GLEIM FLIGHT INSTRUCTOR REFRESHER COURSE
LESSON 1
TEACHING AERODYNAMICS

1.1 CONTROLLING LIFT AND DRAG

I. Lift, Angle of Attack, and Airspeed

A. The amount of lift that a given wing generates at a given altitude is directly related to its angle of attack and airspeed.

1. Angle of attack is defined as the angle between the chord line of the wing and the relative wind.
    a. The chord line of a wing is an imaginary line drawn from the leading edge to the trailing edge.
    b. The relative wind is the direction of airflow seen by the wing in flight; it is defined as parallel to and opposite to the direction of the airplane's flight path.
2. One way to get students to visualize a wing's angle of attack is to describe it as approximately the angle formed by the airflow striking the bottom surface of the wing.

B. As angle of attack or airspeed is increased, lift is increased.

1. Explain to your students that if they wish to change airspeed while maintaining a constant altitude, they must vary the angle of attack in order to maintain constant lift.
    a. If the airspeed is decreased, the angle of attack must be increased in order to keep the total lift constant.
        i. If the angle of attack is not increased, the total lift will decrease momentarily and the airplane will begin a descent.
    b. If airspeed is increased, the angle of attack must be decreased in order to keep the total lift constant.
        i. If the angle of attack is not decreased, the total lift will increase momentarily and the airplane will begin a climb.

C. When the airplane is in steady-state, unaccelerated flight, lift is equal to weight.

1. Since this makes lift a constant in steady-state flight, it can be seen that there is one and only one angle of attack for any given airspeed that will maintain the airplane in steady-state flight.
2. Because lift must equal weight, a heavily loaded airplane must fly at a higher angle of attack for any given airspeed than the same airplane does when lightly loaded.
3. Explain to your students that the term "steady-state, unaccelerated flight" means that the airplane's attitude, airspeed, and flight path remain constant.
    a. This term therefore includes constant airspeed/rate climbs and descents in addition to straight-and-level flight.
        i. This is a concept that is sometimes difficult for students to grasp, because their intuition tells them that lift must be greater than weight if the airplane is climbing, for example.
        ii. Explain that lift does not exceed weight in a climb, but rather that the airplane's flight path is simply inclined upward.
            o In order to maintain a steady-state climb, thrust in excess of that necessary for level flight is required.

iii. An analogy can be drawn between a car going up a hill and an airplane in a climb:

- When a car is going up a steady incline at a constant speed, the load supported by the car's tires is equal to the car's weight.
  - Excess power beyond that required on a level surface is required to maintain a constant speed while going up an incline.
  - If no excess power is available over that required for a given speed on a level surface, the car will be unable to maintain the desired speed (i.e., the car will slow down).
  - Some inclines are too steep for the car to climb with the available power, and the car will come to a stop.
- When an airplane is in a steady-state climb, the load supported by the wings (i.e., lift) is equal to the airplane's weight.
  - Excess power beyond that required in level flight is required to maintain a constant airspeed in the climb.
  - If no excess power is available over that required for a given airspeed in level flight, the airplane will be unable to maintain the desired speed in the climb (i.e., the airspeed would decrease).
  - If no excess power is available over the minimum required to maintain level flight, the airplane will be unable to climb.

II. Drag, Angle of Attack, and Airspeed

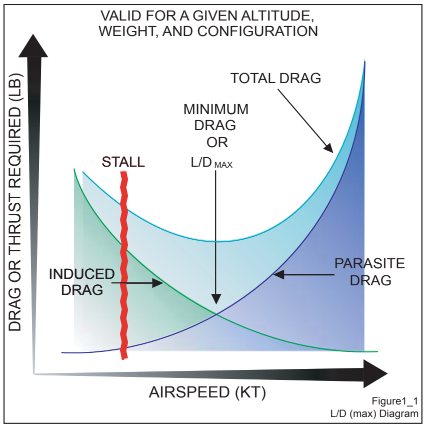
A. As airspeed increases, parasite drag increases.

1. Parasite drag is drag due to air's resistance to flowing around an object. It is greatest at low angles of attack and high airspeeds.
2. Explain to your students that they have felt the effects of parasite drag if they have ever stuck their hand out the window of a moving car and felt the backward "push" caused by the air.

B. As airspeed decreases in level flight, the angle of attack must increase, which causes induced drag to increase.

1. Induced drag is drag due to the generation of lift. It is greatest at high angles of attack and low airspeeds.
2. Explain to your students that one way an airfoil generates lift is by producing a low-pressure area on top of the wing. At all angles of attack, and at high angles of attack in particular, the top surface of the wing is not roughly parallel to the relative wind; it is at an angle. Therefore, lift created by this low pressure area acts not perpendicular to the relative wind (i.e., straight up), but rather upward and slightly rearward.
   a. This rearward component of the lift vector is induced drag.
   b. Explain to your students that they can visualize induced drag by picturing the low pressure area on top of the wing as an area of suction which impedes the airplane's movement through the air.

C. The graph below illustrates the variations in parasite, induced, and total drag with airspeed for a typical airplane in steady, level flight.



D. The amount of drag present at a given airspeed is equal to the amount of thrust required to maintain level flight at that airspeed and angle of attack.

1. If thrust is increased beyond that required for level flight, the airplane will climb unless it is retrimmed to maintain a lower angle of attack and a higher airspeed.
2. If thrust is reduced, the airplane will descend unless it is retrimmed to maintain a higher angle of attack and a lower airspeed.

E. Note on the drag vs. speed chart that the airspeed at which minimum drag occurs is the same airspeed at which the maximum lift/drag ratio (L/D_{MAX}) takes place.

1. At this point, the least amount of thrust is required for level flight.
   a. Flight at airspeeds above and below L/D_{MAX} produces more total drag and requires more thrust to maintain level flight.
   b. Tell your students that, at airspeeds above L/D_{MAX}, the familiar relationship between power and speed that they observe in their car applies; i.e., while maintaining a constant altitude, less power is required to fly at a slower airspeed.
   c. At airspeeds below L/D_{MAX}, however, this familiar relationship does NOT apply; i.e., at airspeeds below L/D_{MAX}, more power, not less, will be required to maintain a constant altitude.
2. Many important items of airplane performance are obtained in flight at L/D_{MAX}. These include
   a. Maximum range
   b. Maximum power-off glide range
      i. L/D_{MAX} is also the airplane's best glide speed, or the speed which will allow the airplane to cover the maximum distance over the ground for each foot of altitude lost in a power-off glide.
      ii. The best glide speed corresponds to L/D_{MAX} because in a glide, thrust comes from the conversion of altitude into sufficient airspeed to maintain lift; at L/D_{MAX}, the least amount of altitude will be required to be converted into airspeed to maintain lift, thus maximizing the amount of time that can be spent aloft and the distance that can be traveled.

III. **Pitch, Power, and Performance**

A. Adjusting the angle of attack varies the amounts of lift and drag being produced by the wing.

B. Adjusting the airplane's power varies the relationship of thrust to drag, allowing the airplane to change airspeed, altitude, or both.

C. Explain to your students that the pilot can achieve a desired performance from the airplane (in terms of airspeed and altitude) through a variety of pitch and power combinations.

1. A climb may be initiated by raising the nose to increase the angle of attack (up to the critical angle of attack), or by increasing power, or by using both.
2. A descent may be initiated by lowering the nose to reduce the angle of attack, or by decreasing power, or by using both.
3. To increase airspeed in level flight, power must be increased and angle of attack reduced to maintain altitude.
4. To decrease airspeed in level flight, power must be reduced and angle of attack increased to maintain altitude.
5. It is evident, then, that level flight can be performed with any angle of attack between the angle for maximum lift (or critical angle of attack) and the relatively small angles found at high speeds, as shown below.

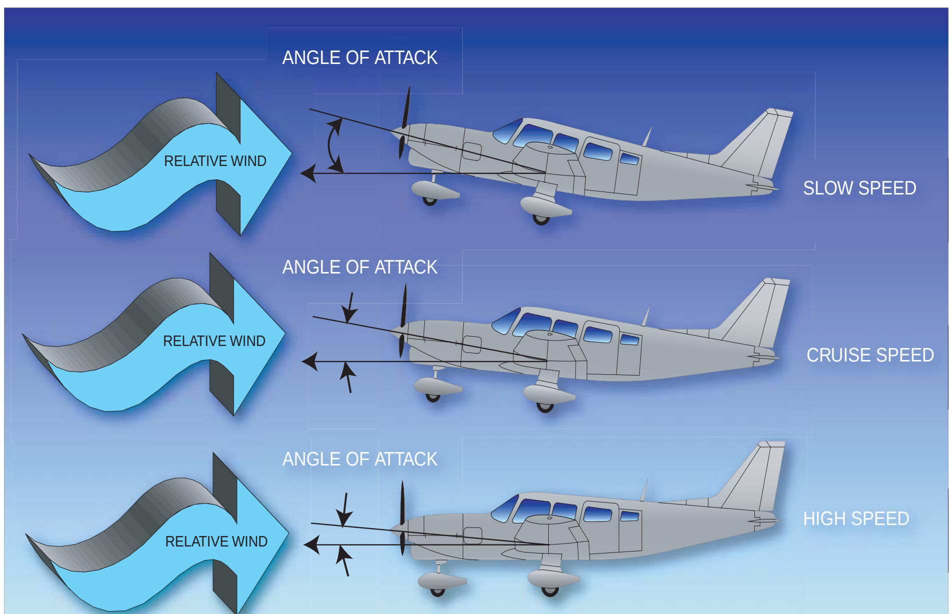


Figure1_2
Angle of Attack and Relative Wind

1.2 FLIGHT AT SLOW AIRSPEEDS

I. Slow flight is any airspeed below normal cruise airspeed to the stall airspeed.

II. Explain to your students that when straight-and-level flight is being maintained at a constant airspeed in slow flight, thrust is still equal in magnitude to drag, and lift is still equal in magnitude to weight, but some of these forces are separated into components.

A. In slow flight, thrust no longer acts parallel and opposite to the flight path and drag, as shown below. Note that thrust has two components:

1. One acting perpendicular to the flight path in the direction of lift
2. One acting along the flight path

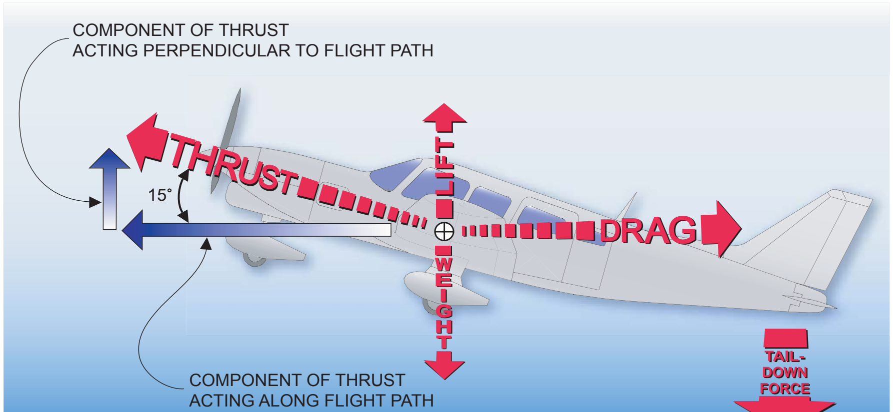


Figure1_3
Lift/Drag Effect on Thrust

3. Explain that because the thrust vector is inclined upward from the flight path, its total magnitude must be greater than total drag in order for the component of thrust that acts along the flight path to be equal to drag.

B. Note that the forces acting upward (wing lift and the component of thrust) equal the forces acting downward (weight and tail-down force).

C. Point out that wing loading (wing lift) is actually less during slow flight because the vertical component of thrust helps support the airplane.

III. Explain that as the airspeed decreases from cruise to L/DMAX, total drag and the amount of thrust required to maintain a constant altitude decrease, as shown in the figure below.

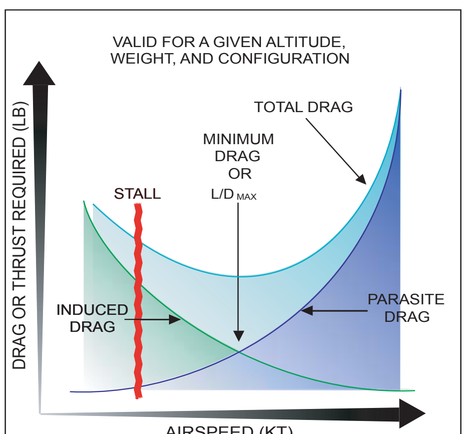


Figure1_4
L/D (max) Diagram [note: same as fig 1_1]

IV. As the airspeed decreases below L/DMAX, additional power (thrust) is required to maintain a constant altitude.

A. At these airspeeds, total drag increases because induced drag increases faster (due to the higher angle of attack) than parasite drag decreases, as shown in the figure above.

B. This flight regime is known as the **back side of the power curve** or the **region of reverse command**.

1. Explain to your students that the term "region of reverse command" means that more power (not less) is required to fly at slower airspeeds while maintaining a constant altitude.

C. You should instruct your students to avoid the natural tendency to pull back on the control yoke in order to climb when flying slower than L/D_{MAX} because increasing the angle of attack will increase drag and may cause the airplane to descend (if thrust remains constant) or stall (if the critical angle of attack is exceeded).

1. Tell your students that they will gain altitude (climb) by increasing power and adjusting pitch to maintain the desired airspeed.

V. For the purposes of the Private and Commercial Pilot Practical Test Standards, the FAA now defines slow flight as the airspeed at which any further increase in angle of attack or load factor, or any further reduction in power (while maintaining a constant altitude), will result in a stall.

A. This definition is essentially the same as the old term **minimum controllable airspeed (MCA)**, though this term is no longer used by the FAA (in either the FARs or PTSs).

1. The old definition of slow flight was flight at 1.2 V_{S1}.

B. Explain to your students that since the airplane is flying near the critical angle of attack, they cannot increase pitch (angle of attack) to gain altitude.

1. To gain altitude, they must increase power and lower the nose.

1.3 STALL AND SPIN CONSIDERATIONS

I. **Stalls**

A. A stall is the loss of lift and the increase in drag that occur when an airplane is flown at an angle of attack greater than the angle for maximum lift. The angle of attack for maximum lift is also called the critical angle of attack.

1. Thus, a stall occurs whenever the critical angle of attack is exceeded.

B. To help your students understand the stall phenomenon, some basic factors affecting aerodynamics and flight should be reviewed with particular emphasis on their relation to stall speeds. Explain that the stall speed is the speed at which the critical angle of attack is exceeded in a given airplane configuration and at a given load factor.

1. When the angle of attack is increased to approximately 18° to 20° on most airfoils, the airstream can no longer follow the upper curvature of the wing because of the excessive change in direction. Explain that this angle is the critical angle of attack.

a. As the critical angle of attack is approached, the airstream begins separating from the rear of the upper wing surface. As the angle of attack is further increased, the airstream is forced to flow straight back, away from the top surface of the wing and from the area of highest camber. See the figure on the next page.

b. This causes a swirling or burbling of the air as it attempts to follow the upper surface of the wing. When the critical angle of attack is reached, the turbulent airflow, which appeared near the trailing edge of the wing at lower angles of attack, quickly spreads forward over the entire upper wing surface.

c. This results in a sudden increase in pressure on the upper wing surface and a considerable loss of lift. Due to both this loss of lift and the increase in form drag (a larger area of the wing and fuselage is exposed to the airstream), the remaining lift is insufficient to support the airplane, and the wing stalls.

d. Emphasize to your students that to recover from a stall, the angle of attack must be decreased so that the airstream can once again flow smoothly over the wing surface.

   i. Remember to stress that the angle of attack is the angle between the chord line and the relative wind, not between the chord line and the horizon.

   ii. Your students should understand that an airplane can be stalled in any attitude of flight with respect to the horizon, at any airspeed, and at any power setting because **exceeding the critical angle of attack is the only requirement for a stall to occur.**

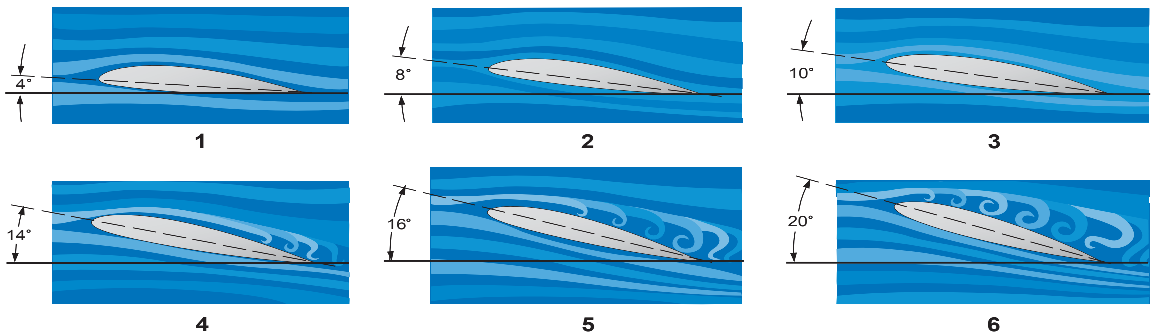


Figure1_5
Airflows Over a Wing

2. Explain that most light airplanes are designed so that the wings will stall progressively outward from the wing roots to the wingtips.

   a. Some wings are designed with washout; i.e., the wingtips have less angle of incidence than the wing roots.

      i. Explain that the **angle of incidence** is the angle between the chord line of the wing and the longitudinal axis of the airplane.

   b. Thus, during flight, the tips of such wings have a smaller angle of attack than the wing roots.

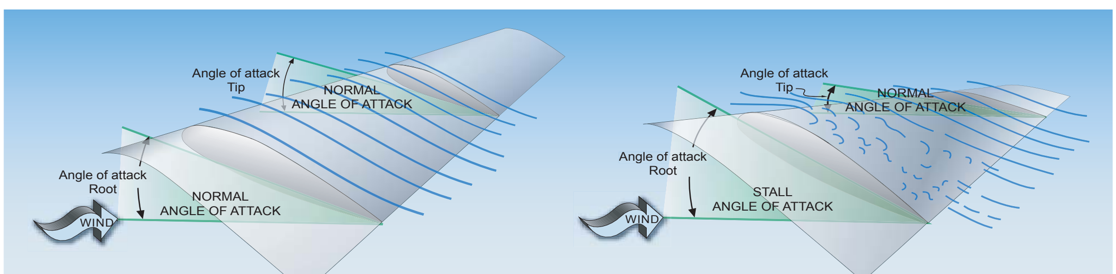


Figure1_6
Angle of Attack: Wing Tip vs. Wing Root

      i. Remind your students that a stall is caused by exceeding the critical angle of attack. Since the wing roots will exceed the critical angle of attack before the wingtips, the roots will stall first.

   c. You may have a particularly observant student who notices that the ailerons on your training airplane appear to be bent upward near the wingtips.

      i. Explain that the bending is not the result of damage, but that it is evidence of washout.

d. Another means of forcing the wing to stall progressively outward from the wing roots to the wingtips is to include stall strips (sometimes called flow strips) at the wing root.
   i. These wedge-shaped metal strips are mounted on the leading edge of the wing near the root.
   ii. Explain that they are designed to cause early airflow separation (with the associated buffeting) near the wing root.

e. Tell your students that the wings are designed to stall outward from the wing root to the wingtip so that control of the ailerons (which are located toward the tips of the wings) will be available at high angles of attack and give the airplane more stable stalling characteristics.

C. Your students need to know how the following variables affect an airplane's stall characteristics and stall speed:

1. **Configuration:** Flaps, landing gear (if retractable), and other configuring devices can affect an airplane's stall speed. Flap extension will generally increase the lifting ability of the wings, thus reducing the stall speed.
   a. Point out that this effect is illustrated by the colored arcs on the airspeed indicator, where the lower airspeed limit of the white arc (V_{S0}, power-off stall speed with gear and flaps in the landing configuration) is less than the lower airspeed limit of the green arc (V_{S1}, power-off stall speed, normally, with the flaps and gear up).

2. **Load factor:** Load factor is the ratio of the lifting force produced by the wings to the actual weight of the airplane and its contents, usually expressed in Gs.
   a. When the airplane is subjected to a load factor that is greater than 1 G (in a level turn, for example), the wings are required to support a load that is greater than the airplane's weight.
      i. The increased load is the result of inertia, sometimes referred to as "centrifugal force."
      ii. Explain that when your students feel pressed downward in their seat during a level turn, they are feeling the effect of increased load factor.
         - This sensation of increased weight is also called "pulling Gs."
   b. An airplane's stall speed increases in proportion to the square root of the load factor.
      i. EXAMPLE: An airplane with a normal unaccelerated stall speed of 45 kt. can be stalled at 90 kt. when subjected to a load factor of 4 Gs. This load might be experienced in a 75° bank level turn.
   c. A stall entered from straight-and-level flight or from an unaccelerated straight climb will not produce additional load factors.
      i. Emphasize, however, that other normal maneuvers will produce additional load factors and the associated higher stalling speeds.
   d. **Why does stall speed increase as load factor increases?** Explain that the stall speed increases above the unaccelerated stall speed at increased load factors because the wing is required to produce lift equal to a load that is greater than the airplane's weight.
      i. Remind your students that the amount of lift generated by a given wing at a given altitude is directly related to its angle of attack and airspeed.
         - Therefore, the stall speed increases when load factor increases because, for any given airspeed, the wing is required to be at a higher angle of attack in order to generate sufficient lift to support the increased load.
         - Accordingly, the critical angle of attack will be reached at a higher airspeed because the margin between the required angle of attack for sufficient lift at any given airspeed and the critical angle of attack (which remains constant) is reduced.

e. On a related note, in a constant altitude turn, increased load factors will cause an airplane's stall speed to increase as the angle of bank increases.

i. **Stall speed increases as bank angle increases** because load factor increases as bank angle increases.

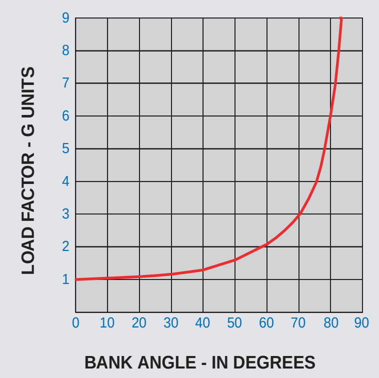


Figure1_9 - Bank Angle vs. Load Factor Graph

ii. For this reason, you must emphasize the importance of using moderate bank angles (no more than 30°) when flying at reduced airspeeds (e.g., in the traffic pattern).

3. **Center of gravity (CG):** Because the CG location affects both the required angle of attack and airplane stability, it has a significant effect on stall speed and ease of recovery.

a. As the CG is moved aft, the airplane flies at a lower angle of attack for a given airspeed because of reduced tail-down force required from the horizontal stabilizer.

i. Explain that tail-down force is necessary to counteract the intentional nose-heaviness of the airplane.

o When nose-heaviness is reduced by moving the CG aft, the tail-down force must also be reduced to achieve equilibrium.

ii. The reduction of tail-down force reduces the total load that must be supported by the wings.

o Thus, the critical angle of attack will be exceeded (causing the airplane to stall) at a lower airspeed because the margin between the required angle of attack for any given airspeed and the critical angle of attack is increased.

o However, the airplane is less stable because the CG is closer to the center of lift.

b. Instruct your students that, with an extremely aft CG (i.e., aft of the center of lift), the airplane loses its natural tendency to pitch nose down, making stall recovery more difficult.

i. Stall recovery is also more difficult because the leverage of the elevators is reduced by the shortened distance from the CG.

ii. If a spin is entered, the balance of forces on the airplane may result in a flat spin, from which recovery may be impossible.

c. A forward CG location will cause the critical angle of attack to be reached (and the airplane to stall) at a higher airspeed.

i. However, stall recovery is easier because the airplane has a greater tendency to pitch nose down and the elevator is a greater distance from the CG.

4. **Weight:** Explain that although the distribution of weight has the most direct effect on stability and stall speed, increased gross weight also affects an airplane's flight characteristics, regardless of the CG location.
   a. A higher angle of attack is required at any given airspeed to produce the additional lift required to support the greater weight.
   b. Thus, the critical angle of attack will be exceeded (causing the airplane to stall) at a higher airspeed because of the reduced margin between the required angle of attack and the critical angle of attack.
5. **Snow, ice, or frost on the wings:** Emphasize that even a small accumulation of snow, ice, or frost on an airplane can cause an increase in the stall speed.
   a. Such accumulation changes the shape and/or texture of the wing, disrupting the smooth airflow over the surface and thus increasing drag and decreasing lift.
6. **Turbulence:** Tell your students that turbulence can cause an airplane to stall at a significantly higher airspeed than in smooth conditions.
   a. Explain that a vertical gust or wind shear can cause a sudden change in the relative wind and result in an abrupt increase in the angle of attack.
      i. Such sudden increases in the angle of attack are most hazardous at low airspeeds and low altitudes, such as during takeoff and landing, because an unintentional stall could result.
   b. When flying in moderate to severe turbulence or strong crosswinds, a higher-than-normal approach speed should be maintained.
      i. In turbulent cruise flight, maintain an airspeed well above the indicated stall speed and below V_A (maneuvering speed).

D. Note that while both the private and commercial pilot PTSs no longer require the pilot to recognize and announce the first aerodynamic indications of an approaching stall (i.e., buffeting or decay of control effectiveness), you should still teach your students to identify these indications to increase their stall awareness.

II. Spins

A. For the purpose of discussing stall/spin awareness with your students (i.e., not necessarily for aerobatic training), a spin, as defined in the FAA's *Airplane Flying Handbook* is an aggravated stall that results in "autorotation," where the airplane follows a downward corkscrew path.
1. When discussing spins with your students, emphasize that there are two prerequisites for a spin to develop, and that if either of these elements are not present, a spin cannot occur. The prerequisites are:
   a. A stall
   b. A yawing motion
2. Explain that if the nose of the airplane is allowed to yaw at the beginning of a stall, the wing will drop in the direction of the yaw.
   a. Unless rudder is applied to keep the nose from yawing, the airplane will begin to slip toward the lowered wing.
   b. The slip will cause the airplane to weathervane into the relative wind, i.e., toward the lowered wing, thus continuing the yaw.
3. At the same time, the airplane will continue rolling toward the lowered wing.
   a. Explain that the lowered wing therefore has an increasingly greater angle of attack, due to the upward motion of the relative wind against its surfaces.
      i. The lowered wing will then be well beyond the critical angle of attack and will suffer an extreme loss of lift and an increase in drag.

b. However, the rising wing, since the relative wind is striking it at a smaller angle, will have a smaller angle of attack than the opposite wing.

i. Explain that the rising wing, in effect, becomes less stalled and thus develops some lift so that the airplane continues to roll.

ii. If one of your students asks how it is possible for a wing to be only partially stalled, remind him/her of design elements such as washout and stall strips, which are designed to cause the wing roots to stall before the wingtips.

c. As the autorotation continues, the aerodynamic and inertial forces will balance and the airplane will settle in a stabilized spin.

4. Summarize that, in order for a spin to develop, both of the airplane's wings must first be stalled; then one wing becomes less stalled than the other.

B. Explain that a spin may be broken down into three phases.

1. The incipient phase is the transient period between a full stall and a fully developed spin, when aerodynamic and inertial forces have not yet achieved equilibrium.

a. The incipient spin usually occurs in approximately 4 to 6 sec. and consists of approximately the first two turns.

2. The steady-state phase is that portion of the spin in which it is fully developed and the aerodynamic forces are in balance.

a. Warn your students that a flat spin can develop during the steady-state phase when the spin axis is located near the airplane's CG. This can happen when the airplane's CG is located aft of the CG's aft limit.

3. The recovery phase begins when controls are applied to stop the spin and ends when level flight is attained.

a. In many airplanes under typical power, trim, configuration, and loading conditions, the recovery phase will begin as soon as pro-spin control inputs are removed (i.e., as soon as elevator back pressure is released to break the stall).

b. Observation of this phenomenon is sometimes incorrectly interpreted to mean that a proper spin recovery procedure involves simply "letting go of the controls."

c. Emphasize to your students that, while such a procedure may result in spin recovery **if sufficient altitude is available**, significantly more altitude will be lost than if proper techniques are used.

i. In addition, there are certain power, trim, configuration, and loading conditions under which positive forward elevator pressure will be required to break the stall and effect recovery.

d. Accordingly, proper spin recovery procedures, as outlined in the airplane's *Pilot's Operating Handbook*, should always be used.

C. You must stress to your students that the intentional spinning of an airplane for which spins are not specifically approved is prohibited and extremely dangerous.

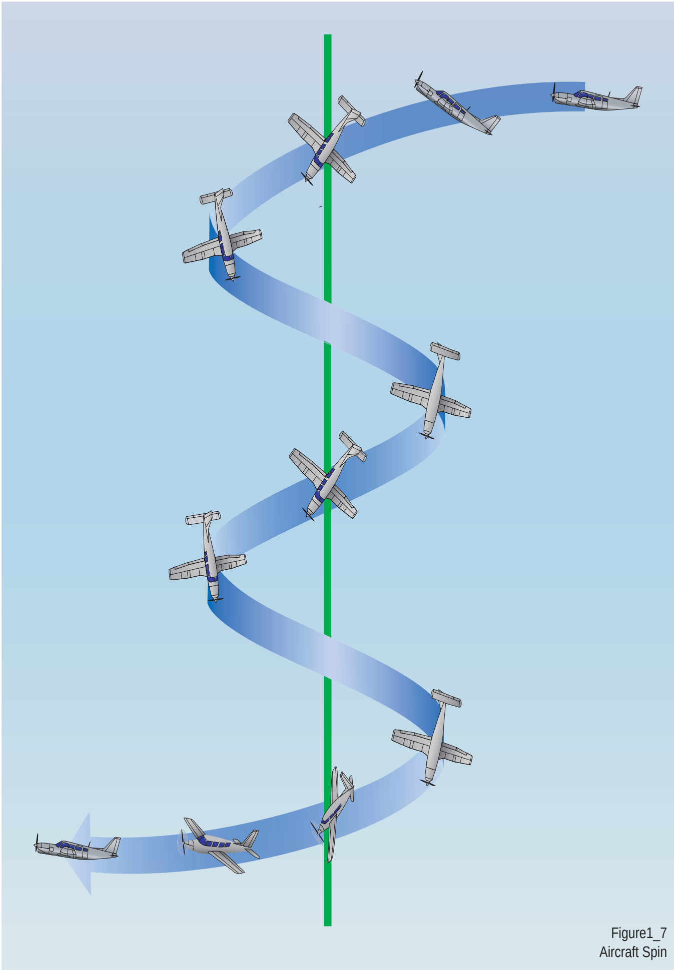
1. Single-engine normal category airplanes are placarded against intentional spins.

a. However, to provide a margin of safety when recovery from a stall is delayed, these airplanes are tested during certification and must be able to recover from a one-turn spin or a 3-sec. spin, whichever takes longer, in not more than one additional turn during recovery.

2. Acrobatic category airplanes must recover from any point in a spin, in not more than one and one-half additional turns during recovery.

a. Prior to normal recovery, the spin test must proceed for six turns or 3 sec., whichever takes longer, with flaps retracted, and one turn or 3 sec., whichever takes longer, with flaps extended.

3. A utility category airplane must meet the requirements for either the normal or acrobatic category.
4. Emphasize to your students that, as the pilot of an airplane placarded against spins, they should assume that the airplane may become uncontrollable in a spin.



1.4 AERODYNAMIC LIMITATIONS OF FLIGHT

I. Explain to your students that any force applied to deflect an airplane from a straight line produces a stress on its structure due to inertia. The amount of this force is called load factor.

A. **Load factor** is the ratio of the total load supported by the airplane's wings (i.e., lift) to the actual weight of the airplane and its contents:

$$\textit{Load factor} = \frac{\textit{Total load supported by the wings}}{\textit{Total weight of the airplane}}$$

1. EXAMPLE: An airplane has a gross weight of 2,000 lb. During flight it is subjected to aerodynamic forces which increase the total load that the wing must support to 4,000 lb. The load factor is thus 2.0 (4,000 ÷ 2,000). The airplane wing is producing lift equal to twice the gross weight of the airplane.

B. Explain that load factor can also be expressed as the ratio of a given load to the pull of gravity, expressed in "Gs." If the weight of the airplane is equal to 1 G, and if a load of three times the actual weight of the airplane were imposed upon the wing due to a curved flight path, the load factor of 3 is expressed as 3 Gs.

C. Tell your students that in unaccelerated flight, the airplane is said to have a load factor of 1; i.e., the total lift that the wings are producing is equal to the gross weight of the airplane.

1. If the angle of attack of the wings is increased while airspeed remains constant, e.g., in a pull-up from a dive, the wings produce more lift and thus a higher load factor.

D. Explain that a positive load occurs when back pressure is applied to the elevator, causing "centrifugal force" (i.e., inertia) to act in the same direction as weight.

1. A negative load occurs when forward pressure is applied to the elevator control, causing "centrifugal force" (i.e., inertia) to act in a direction opposite to that of weight.

II. **Load Factors and Airplane Design.** Tell your students that, in order to be certified by the FAA, airplanes must conform with prescribed structural strength (i.e., maximum allowable load factor) standards set forth by Federal Aviation Regulations. Airplanes are classified as to strength and operational use by means of the category system. Most general aviation trainer-type airplanes are classified in one or more of the following categories:

A. The **normal category** has a maximum limit load factor of 3.8 positive Gs and 1.52 negative Gs.

1. A limit load factor is the highest positive or negative load factor that can be sustained without causing permanent deformation or structural damage to the airplane.

   a. The limit load factors listed for each airplane category represent the maximum load factors (both positive and negative) that can be expected in typical operations for that category of airplane.

2. Permissible maneuvers include

   a. Any maneuver incidental to normal flying
   b. Stalls
   c. Lazy eights, chandelles, and steep turns in which the angle of bank does not exceed 60°

B. The **utility category** has a maximum limit load factor of 4.4 positive Gs and 1.76 negative Gs.

1. Permissible maneuvers include

   a. All operations in the normal category
   b. Spins (if approved for that airplane)
   c. Lazy eights, chandelles, and steep turns in which the angle of bank is more than 60°

C. The **acrobatic category** has a maximum limit load factor of 6.0 positive Gs and 3.0 negative Gs.

1. There are no restrictions except those shown to be necessary as a result of required flight tests.

D. Explain to your students that the category system indicates what operations can be performed in a given airplane without exceeding load factor limits. You must caution your students to operate the airplane within the load factor limits for which it was designed so as to enhance safety while still benefitting from the intended use of the airplane.

E. You should also emphasize that an airplane’s structure is designed to support a certain total load.

1. It is therefore vital for your students to observe maximum gross weight limits as well as load factor limits.

III. **Effect of Turns on Load Factor.** Explain that a turn is made by banking the airplane so that lift from the wings no longer acts straight up, but acts upward at an angle. In this orientation, the horizontal component of lift pulls the airplane from its straight flight path.

A. In a constant altitude coordinated turn, the resultant load is the result of two forces -- weight and the apparent “centrifugal force” caused by inertia, as shown below.

B. Explain that the airplane's wings must produce lift equal to the resultant load in a level, coordinated turn. Remind your students that, as the required lift increases, load factor also increases.

1. Thus, a level, coordinated turn produces a load factor that is greater than 1 G.

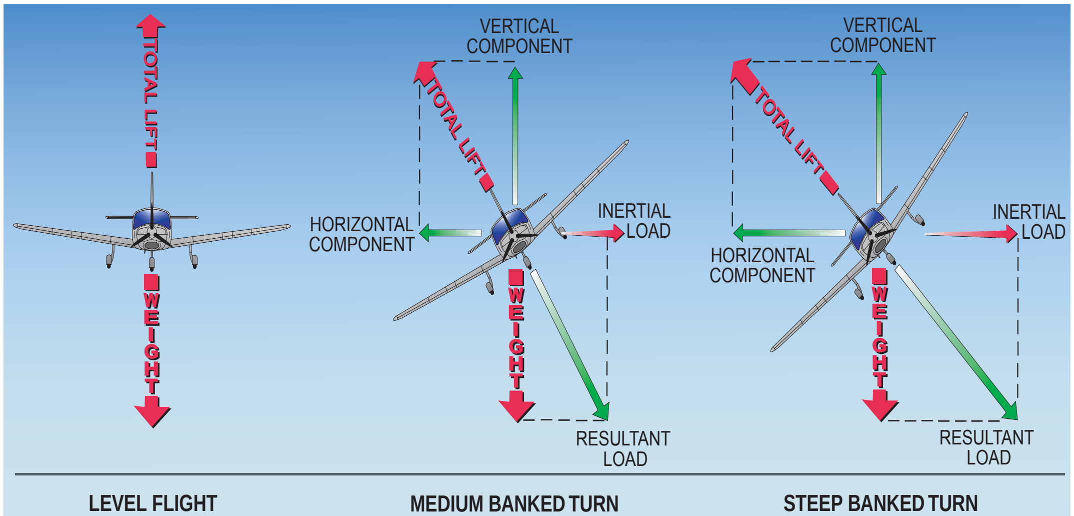


Figure1_8
Airframe Loads During Level Turns

C. Explain to your students that in any airplane, if a constant altitude is maintained during the turn, the load factor for a given degree of bank is the same.

1. This is because the vertical component of lift (which must always equal the airplane’s weight in level flight), and therefore the total lift required, remain the same regardless of the airspeed and rate of turn.

   a. Explain that the horizontal component of lift thus also remains constant for any given bank angle because of the fixed relationship between the vertical component of lift and the total lift required.

2. Because the total lift required in a level turn does not vary for any given bank angle, the load factor remains constant.

D. Using the figure below, show your students that the load factor increases at a rapid rate after the angle of bank reaches 60°. The wing must produce lift equal to this load factor if the airplane is to maintain altitude.

1. The figure below can be used to explain why the maximum bank angle for normal-category airplanes is 60°, which produces a load factor of 2.0.

    a. Point out that the positive limit load factor of 3.8 Gs for normal-category airplanes is exceeded at approximately 75° of bank, an increase of only 15° beyond the maximum-allowable bank angle of 60°.

    b. Tell your students that caution dictates a margin of safety between the maximum-allowable bank angle and the bank angle at which structural damage will occur.

2. Show your students that, at an angle of bank of slightly more than 80° in level flight, the load factor exceeds 6.0, which is the limit load factor of an acrobatic airplane.

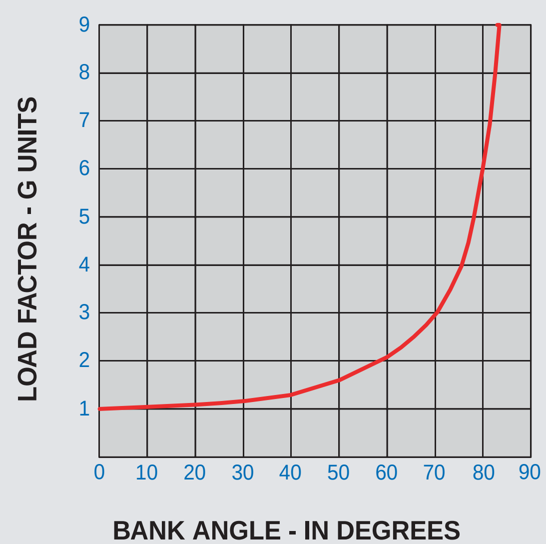


Figure1_9 - Bank Angle vs. Load Factor Graph

IV. **Effect of Load Factor on Stalling Speed.** As a result of your discussion of stalls, your students should understand that any airplane, within the limits of its structure and the strength of the pilot, can be stalled at any airspeed.

A. Remind your students that at any given airspeed, the load factor increases as angle of attack increases, and the wing stalls when the angle of attack has been increased beyond the critical angle.

B. Therefore, there is a direct relationship between the load factor imposed upon the wing and its stalling characteristics.

C. Emphasize that the airplane's stall speed increases in proportion to the square root of the load factor.

1. EXAMPLE: Using the load factor chart above, the load factor produced in a 75° banked, level turn is 4.0. The square root of 4 is 2.

    a. An airplane that has a normal unaccelerated stall speed of 45 kt. will stall at 90 kt. when subjected to a load of 4 Gs.

2. You can also use the load factor chart to demonstrate why 30° is typically considered the maximum safe bank angle in the traffic pattern.

3. Point out how, at bank angles greater than 30°, the load factor (and thus, the stall speed) begins to increase rapidly.

V. **Maneuvering Speed.** Explain that the maximum speed at which an airplane can be stalled without exceeding its structural (or load) limits is the maneuvering speed (V_A).

A. V_A can also be defined as the minimum airspeed at which the wing can produce lift equal to the positive limit load factor.

B. Tell your students that, when operating below V_A, a damaging positive flight load cannot (theoretically) be produced. The airplane should stall before the load becomes excessive. Any combination of flight control usage, including full deflection of the controls or gust loads created by turbulence, should not create an excessive air load if the airplane is operated below V_A.

1. CAUTION: Certain adverse wind shear or gusts may cause excessive loads even at speeds below V_A.

C. Emphasize that V_A is a vital reference point for pilots, but it is not marked on the airspeed indicator since it varies with gross weight.

1. Instead, V_A can be found in the *Pilot's Operating Handbook* (*POH*) for each airplane and/or on a placard within the cockpit.

a. If the *POH* specifies more than one V_A, show your students that V_A varies with weight.

b. Explain that V_A decreases with gross weight because it is effectively an accelerated stall speed.

i. Thus, just as V_{S0} and V_{S1} decrease as gross weight decreases, V_A decreases as gross weight decreases.

D. Older general aviation airplanes may not have a published V_A in their *POHs*. In this case, a general rule for determining the maneuvering speed is approximately 1.7 times the normal stalling speed.

1. Thus, an airplane that normally stalls at 35 kt. should never be stalled when the airspeed is above 60 k (35 kt. x 1.7 = 59.5 kt.).

VI. **Effect of Turbulence on Load Factor.** Tell your students that turbulence in the form of vertical air currents can, under certain conditions, cause severe load stress on the airplane.

A. For example, when an airplane flying at a high airspeed with a low angle of attack suddenly encounters an updraft, the relative wind changes to strike the bottom of the airfoil at a greater angle. This increases the wing's angle of attack.

B. Explain that all certificated airplanes are designed to withstand loads imposed by turbulence of considerable intensity. Nevertheless, gust load factors increase with increasing airspeed.

1. Therefore, it is wise in extremely rough air, as in thunderstorm or frontal conditions, to reduce the speed to below V_A.

2. Tell your students that, as a general rule when severe turbulence is encountered, the airplane should be flown at or below V_A as shown in the *POH* and/or on the placard in the airplane.

a. This speed is the one least likely to result in structural damage to the airplane (even if the control surfaces are fully deflected), yet it allows a sufficient margin of safety above stalling speed in turbulent air.

b. Teach your students to avoid over-stressing the airplane in severe turbulence by maintaining a level attitude and accepting variations in altitude and airspeed.

VII. **V-G Diagram (Velocity versus G Loads)**

A. Explain that a V-G diagram is a graphic representation of the operating limitations of a specific make and model of airplane under specified conditions (e.g., weight and configuration).

1. Airplane manufacturers use numerous V-G diagrams when designing an airplane in order to define its airspeed and load factor limits.

   a. These limits specify that airplane’s flight, or operating, envelope.

B. Use the V-G diagram shown below to illustrate several important operating limitations to your students.

1. Explain that airspeed (V) is shown on the horizontal axis with load factor (G) on the vertical axis.

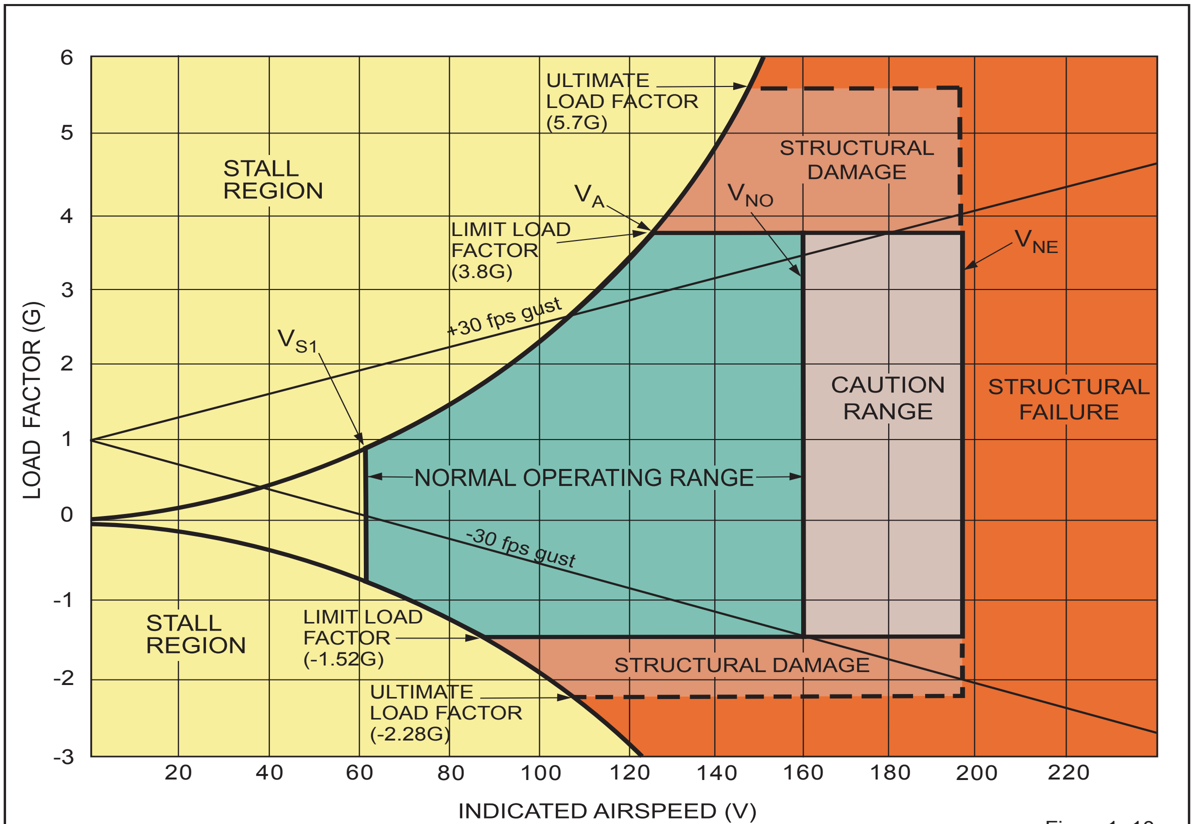


Figure1_10
V-G Diagram

C. Tell your students that the curved lines starting at 0 on the vertical axis represent the positive and negative lines of maximum lift capability.

1. These lines indicate the maximum amount of lift the airplane can generate at a specified speed.

   a. Note that at an indicated airspeed of zero, the wing generates zero lift.

2. The intersection of the maximum lift line and a given airspeed line indicates the maximum load factor that can be placed on the airplane for that speed.

   a. If any load factor greater than the maximum lift line is placed on the airplane at a given airspeed line, a stall will result.

D. Explain that the solid horizontal lines at +3.8 G and –1.52 G represent the positive and negative limit load factors for this airplane, i.e., the limits for a normal category airplane.

1. The dashed lines at +5.7 G and –2.28 G are the ultimate load factors, which are determined by multiplying the limit load factors by the required safety factor of 1.5.
2. Explain that any load placed on the airplane between the limit load factor and ultimate load factor may cause permanent deformation of the airplane's primary structure (e.g., wings). A high rate of fatigue damage may be incurred, but the structure should not fail.
    a. However, the fatigue damage incurred may be of sufficient magnitude to cause structural failure later during completely normal operations.
3. A load placed on the airplane greater than the ultimate load factors will cause the wings to separate from the airplane.

E. Remind your students that in smooth air and with the wings level, the airplane is flying at 1 G. The speed at which the airplane stalls at 1 G is V_{S1}.

1. V_{S1} is marked on the airspeed indicator at the lower limit of the green arc.
    a. V_{S1} is shown on the V-G diagram by a solid vertical line.
2. Explain that any stall that occurs above 1 G is an accelerated stall.

F. Show your students that V_A is the airspeed that is at the intersection of the positive limit load factor and maximum lift lines.

1. Point out that at speeds greater than V_A, the limit load factor will be exceeded (leading to structural damage or failure) before the airplane will stall.

G. Tell your students that certain airspeeds, called design airspeeds, are established when an airplane is designed (e.g., design maneuvering speed). Some important airspeed limitations are established from various design airspeeds and other factors.

1. Explain that V_{NO} is the maximum structural cruising speed, or maximum normal operating speed, and is shown on the airspeed indicator at the upper limit of the green arc. V_{NO} is shown on the V-G diagram by a solid vertical line.
    a. Show your students that V_{NO} is determined by the intersection of the negative limit load factor and the load produced by an instantaneous 30 ft.-per-second downdraft.
    b. Explain that the airspeed range from V_{S1} to V_{NO} is the normal operating range, which is considered safe for moderately bumpy air. Flight above V_{NO} should be conducted only in smooth air and with caution.
2. Remind your students that V_{NE} is the airplane's never-exceed speed and is marked by the red line on the airspeed indicator. V_{NE} is shown on the V-G diagram by a solid vertical line.
    a. If flight is attempted beyond V_{NE}, structural damage or failure may result from a variety of phenomena, even if excessive load factors are not imposed.
    b. The airspeed range from V_{NO} to V_{NE} is the caution range, i.e., the yellow arc on the airspeed indicator.

H. Emphasize to your students that the airplane must be operated within the flight envelope to prevent the airplane's primary structure from being deformed or damaged. Thus, the airplane in flight is limited to a regime of airspeeds and load factors that do not exceed either of the following:

1. The positive or negative limit load factors
2. V_{NE}

GLEIM FLIGHT INSTRUCTOR REFRESHER COURSE
LESSON 2
TEST PRACTICAL TEST STANDARDS

2.1 GENERAL

I. The Flight Standards Service of the Federal Aviation Administration (FAA) has developed a practical test standard (PTS) for each practical test that is required for the issuance of a pilot certificate or rating.

A. Each PTS sets forth the practical test requirements for that pilot certificate or rating.

B. FAA inspectors and designated pilot examiners use the practical test standards as a means of objectively evaluating each applicant seeking a given certificate or rating.

C. Instructors are therefore expected to refer to these standards when preparing applicants for their practical tests.

II. Title 14 of the Code of Federal Regulations (CFR) specifies the areas in which knowledge and skill must be demonstrated by the applicant before a particular certificate or rating will be issued.

A. However, the regulations do not list the specific tasks (knowledge areas, procedures, and/or maneuvers) in which pilot competence must be demonstrated.

1. Specific tasks are found in the appropriate PTS.

B. Because the specific tasks are not contained in the CFR, they can be modified without the need to undergo a time-consuming rule-making process.

1. The FAA can add, delete, or revise tasks whenever it is determined that changes are needed in the interest of safety.

III. Adherence to provisions of the regulations and the practical test standards is mandatory for the evaluation of pilot applicants.

A. The examiner who conducts the practical test is responsible for determining that the applicant meets the standards of knowledge and skill outlined in the objective of each task within the appropriate practical test standard.

B. Because there is no formal division between the “knowledge” and “skill” portions of the practical test, oral questioning is an ongoing process throughout the test.

1. The examiner will use oral questioning judiciously at all times, especially during the flight portion of the practical test, to determine the applicant’s knowledge of the tasks and related safety factors.

C. The examiner will determine that the applicant's knowledge and skill meet the objectives in all required tasks.

IV. The introduction of each PTS contains the prerequisites that the applicant must meet prior to taking the appropriate practical test.

A. The applicant must have obtained the required instruction and aeronautical experience prescribed for the pilot certificate or rating sought.

B. The applicant must possess at least a current third-class medical certificate (with some exceptions).

C. The applicant must meet the age requirement for the issuance of the certificate or rating sought.

D. The applicant must have a written statement from an appropriately certificated flight instructor certifying that (s)he has been given flight instruction in preparation for the practical test within the preceding 60 days, that (s)he is competent to pass the practical test, and that (s)he has satisfactory knowledge of the subject area(s) in which a deficiency was indicated by his/her pilot knowledge test report (14 CFR Sec. 61.39).

E. Most tests require the applicant to have passed an appropriate pilot knowledge test within the previous 2 years.

F. Many tests, e.g., instrument rating and flight instructor certificate, require that the applicant possess a minimum grade of pilot certificate and/or certain ratings.

2.2 PTS FORMAT

I. **Areas of operation** are general subject areas that are arranged in a logical sequence within each standard.

A. Examples include “performance maneuvers” and “takeoffs, landings, and go-arounds.”

B. The examiner is not required to follow the order of areas of operation as shown in the PTS; (s)he may conduct the practical test in any sequence that results in a complete and efficient test.

1. However, the oral portion of the practical test must be completed before the flight portion.

II. **Tasks** are knowledge areas, flight procedures, and/or maneuvers appropriate to an area of operation.

III. The **reference** identifies the publications that describe each task.

A. The practical test standards are intended to provide criteria by which an applicant's performance of each task can be evaluated; descriptions of the tasks themselves are not included in the standards because this information can be found in the listed references for each specific task.

B. Publications other than those listed may be used for references if their content is essentially the same as the referenced publications.

IV. The **objective** lists the important elements that must be satisfactorily performed to demonstrate competency in a task. The objective includes

A. Specifically what the applicant should be able to do,
B. The conditions under which the task is to be performed, and
C. The acceptable performance standards.

V. The following examples illustrate the format of the practical test standards.

A. Below is an example of a "knowledge only" task from the Commercial Pilot PTS.

I.A. TASK: CERTIFICATES AND DOCUMENTS

REFERENCES:14 CFR Parts 43, 61, 91; FAA-H-8083-3; AC 61-23/FAA-H-8083-25; *Pilot's Operating Handbook, FAA-Approved Airplane Flight Manual*

Objective. To determine that the applicant exhibits knowledge of the elements related to certificates and documents by:

1. Explaining --
   a. Commercial pilot certificate privileges, limitations, and recent flight experience requirements.
   b. Medical certificate class and duration.
   c. Pilot logbook or flight records.

2. Locating and explaining --
   a. Airworthiness and registration certificates.
   b. Operating limitations, placards, instrument markings, and Pilot's Operating Handbook/Airplane Flight Manual
   c. Weight and balance data and equipment list

B. Below is an example of a "knowledge and skill" task from the Private Pilot PTS.

IV.E. TASK: SHORT-FIELD TAKEOFF AND MAXIMUM PERFORMANCE CLIMB

REFERENCES: FAA-H-8083-3; *Pilot's Operating Handbook*, *FAA-Approved Airplane Flight Manual*

Objective. To determine that the applicant:

1. Exhibits knowledge of the elements related to a short-field takeoff and maximum performance climb.

2. Positions the flight controls for the existing wind conditions; sets the flaps as recommended.

3. Clears the area; taxies into takeoff positions utilizing maximum available takeoff area and aligns the airplane on the runway centerline.

4. Applies brakes (if appropriate), while advancing the throttle smoothly to takeoff power.

5. Lifts off at the recommended airspeed, and accelerates to the recommended obstacle clearance airspeed or V_X.

6. Establishes a pitch attitude that will maintain the recommended obstacle clearance airspeed, or V_X +10/-5 Kt., until the obstacle is cleared, or until the airplace is 50 ft. (20 meters) above the surface.

7. After clearing the obstacle, establishes the pitch attitude for V_Y, accelerates to V_Y, and maintains V_Y, + 10/-5 kt., during the climb.

8. Retracts the landing gear, if appropriate, and flaps after clear of any obstacles or as recommended by manufacturer.

9. Maintains takeoff power and V_Y +10/-5 kt. to a safe maneuvering altitude.

10. Maintains directional control and proper wind-drift throughout the takeoff and climb.

11. Completes the appropriate checklist.

2.3 HOW TO USE THE PRACTICAL TEST STANDARDS EFFECTIVELY

I. As an appropriately rated flight instructor, you are responsible for training your students to acceptable standards in all knowledge areas, procedures, and maneuvers as outlined in the objective of each task within the appropriate practical test standard.

A. You must certify that your student is able to perform safely as a pilot and is competent to pass the required practical test for the certificate or rating sought.

B. Therefore, you must become thoroughly familiar with the practical test standard that is appropriate to the certificate or rating sought before training begins, and you must refer to it regularly throughout training.

1. As each maneuver or procedure is introduced, you should inform your students of the standards they will ultimately be expected to meet.
2. If your students have been thinking in terms of the PTS from the beginning of their training, what is expected of them during the flight portion of the practical test will be no different from their flights with you.

II. The introduction of each practical test standard defines the overall level of competence required of the applicant and identifies the general skills emphasized by the FAA during the practical test for that certificate or rating.

A. During any practical test, the examiner will place special emphasis upon areas of aircraft operation considered critical to flight safety.

1. Among these areas are positive aircraft control and sound judgment in aeronautical decision making.
2. Although these areas may or may not be listed under each task, they are essential to flight safety and will receive careful evaluation throughout the practical test.
   a. If these areas are listed in the objective, additional emphasis will be placed on them.

B. During the practical test for the private or commercial pilot certificate, the examiner will also emphasize positive exchange of the flight controls, stall/spin awareness, collision avoidance, wake turbulence avoidance, Land and Hold Short Operations (LAHSO), runway incursion avoidance, controlled flight into terrain (CFIT) avoidance, and checklist usage.

1. Because of their professional status, commercial pilots are expected to exhibit a significantly higher level of knowledge and skill than private pilots.
2. The wording used in the commercial pilot standards is intended to reflect this higher level of competency.

C. During the practical test for the instrument rating, the examiner will also emphasize division of attention, control touch, and two-way radio communications.

1. Instrument pilot applicants must demonstrate partial-panel, nonprecision instrument approach procedures and an understanding of the **primary and supporting** or the **control and performance concept** method of instrument flying.

D. During the practical test for the flight instructor certificate, the examiner will also emphasize the ability to teach precise aircraft control, sound judgment in aeronautical decision making, spatial disorientation, wake turbulence avoidance, low level windshear avoidance, checklist usage, positive exchange of the flight controls, Land and Hold Short Operations (LAHSO), and runway incursion avoidance.

III. Unless otherwise noted, all tasks in a practical test standard are required to be incorporated into the practical test for the issuance of the particular certificate or rating.

   A. Thus, it is essential that you incorporate each task, its objectives, and its completion standards into the course syllabus for the certificate or rating sought by your student.

IV. Satisfactory performance on the practical test is based on the applicant's ability to safely

   A. Perform the tasks specified in the areas of operation for the certificate or rating sought within the approved standards
   B. Demonstrate mastery of the aircraft with the successful outcome of each task performed never seriously in doubt
   C. Demonstrate satisfactory proficiency and competency within the approved standards
   D. Demonstrate sound judgment
   E. Demonstrate single-pilot competence if the aircraft is type certificated for single-pilot operations

V. The tolerances shown in each practical test standard represent the performance expected in good flying conditions.

   A. Tell your students that this means that the examiner may allow them additional leeway in the performance of maneuvers in turbulent conditions.

      1. Accordingly, occasionally exceeding tolerances on a turbulent day should not result in failure of the practical test.

   B. If, however, in the judgment of the examiner, the applicant does not meet the standards of performance for any task performed, the associated area of operation is failed, and therefore the practical test is failed.
   C. The examiner or applicant may discontinue the test at any time after the failure of an area of operation makes the applicant ineligible for the certificate or rating sought.

      1. The test may be continued only with the consent of the applicant.

   D. If the test is discontinued, the applicant is entitled to credit for those tasks satisfactorily performed, but the applicant receives credit for those tasks only if (s)he passes the remainder of the practical test within 60 days from the date the test was discontinued.

      1. Inform your students, however, that during the retest and at the discretion of the examiner, any task may be reevaluated, including those previously passed.
      2. Accordingly, it may be appropriate to review more of the appropriate practical test standard prior to the re-test than just the task(s) that were performed unsatisfactorily.

   E. The introduction of each PTS indicates that typical areas of unsatisfactory performance and grounds for disqualification are

      1. Any action or lack of action by the applicant that requires corrective intervention by the examiner to maintain safe flight,
      2. Failure to use proper and effective visual scanning techniques to clear the area before and while performing maneuvers,
      3. Consistently exceeding tolerances stated in the objectives, or
      4. Failure to take prompt corrective action when tolerances are exceeded.

F. Tell your students that the FAA's use of the phrases "*consistently* exceeding tolerances" and "failure to take prompt corrective action *when* tolerances are exceeded" implies that an isolated instance of exceeded tolerances should NOT in itself be grounds for disqualification.

1. Knowing that a single mistake should not lead to failure may help your students to relax during the practical test.

VI. **A Word of Caution**

A. It is tempting for CFIs to use the appropriate PTS to simply "teach the test" when training a student for a particular certificate or rating.

1. CFIs who approach flight training this way are doing their students a disservice.
2. The tasks in the practical test standards are intended to provide a reasonable sampling of the applicant's abilities; they cannot realistically cover every subject that should be included in a comprehensive flight training program for a given certificate or rating

   a. For example, while the "emergency descent" task was recently deleted from the private and commercial pilot practical test standards, all pilots should know how to perform this maneuver.

3. It is therefore up to you as a CFI to incorporate the items that you think are necessary for complete coverage of the subjects you are teaching.

B. It is important to always teach your students first and foremost to be competent and safe pilots; passing the practical test should be regarded as simply a byproduct of thorough instruction.

2.4 RECENT PTS CHANGES

I. The FAA recently revised the Practical Test Standards for the private pilot, commercial pilot, and flight instructor certificates. These revised PTSs became effective in August 2002. We have compiled an overview of the major changes below.

A. For a detailed page-by-page description of the changes, visit Gleim's CFI-Only web site at http://www.gleim.com/Aviation/cfionly/ and click the link titled "Changes to FAA Practical Test Standards."

1. You will be asked to provide your e-mail address and CFI certificate number to access this free site.

B. We also recommend that you view the actual Practical Test Standards documents, available from the FAA web site at http://afs600.faa.gov./AFS630.htm. Under "Related Links," click "Practical Test Standards" to obtain a listing of all current Practical Test Standards documents.

II. **General Changes:** The FAA made the following significant changes that are common to all three of the recently-revised PTSs (private, commercial, and CFI):

A. The introduction specifies that the ground portion of the practical test must take place before the flight portion.

1. Previously, either portion of the test could be conducted first.

B. The introduction clarifies the FAA's position regarding incomplete or marginal performance of a task with the following paragraph:

> If the examiner determines that a TASK is incomplete, or the outcome uncertain, the examiner may require the applicant to repeat that TASK, or portions of that TASK. This provision has been made in the interest of fairness and does not mean that instruction, practice, or the repeating of an unsatisfactory task is permitted during the certification process. When practical, the remaining TASKs of the practical test phase should be completed before repeating the questionable TASK.

C. The introduction also clarifies that the tolerances listed for each task contained in the PTSs represent the performance expected in good flying conditions.

1. While examiners have generally interpreted the PTSs this way in the past, the wording of the current documents should result in less individual variation between examiners/inspectors with regard to satisfactory performance of PTS tasks on turbulent days.

D. All airplane categories (single- and multi-engine, land and sea) are now contained in a single PTS document. The organization of each new PTS is as follows:

1. Each PTS is divided into 2 sections: Section 1, Airplane Single-Engine Land and Sea, and Section 2, Airplane Multi-Engine Land and Sea
   a. Each section is essentially a complete PTS document for single- and multi-engine airplanes, respectively.
   b. Land and sea tasks for single- and multi-engine airplanes are therefore presented in the same PTS document, so it is necessary to determine which airplane class(es) are applicable to each task when using the PTS by looking for identifying letters in parentheses to the right of each task title (e.g., ASEL, ASES).
2. The summaries of changes to each recently-revised PTS presented below are for airplane single-engine land (ASEL) tasks only.

III. **Private Pilot:** The FAA made the following changes to the Private Pilot Practical Test Standards (FAA-S-8081-14A):

A. **Deleted Tasks:**

1. In Area of Operation I, "Preflight Preparation," Task G., "Minimum Equipment List."
   a. Note that knowledge of minimum equipment lists is still required for the new "Airworthiness Requirements" task (see item III.B.1. below).
2. In Area of Operation X, "Emergency Operations," Task A., "Emergency Descent."
3. In Area of Operation XI, "Night Operations," Task B., "Night Flight."

B. **New Tasks:**

1. In Area of Operation I, "Preflight Preparation," new Task B., "Airworthiness Requirements."
   a. This task covers the following elements:
      i. Required instruments and equipment for day/night VFR.
      ii. Procedures and limitations for determining airworthiness of an airplane with inoperative instruments and equipment, with and without a minimum equipment list.
      iii. Requirements and procedures for obtaining a special flight permit.
      iv. Locating and explaining ADs, compliance records, maintenance/inspection requirements, and appropriate record keeping.

C. **Revised Tasks:**

1. In Area of Operation IV, “Takeoffs, Landings, and Go-Arounds," the following tasks were revised:
   a. Task C, “Soft-Field Takeoff and Climb”: The airplane may now be allowed to accelerate to V_X or V_Y in ground effect, as appropriate, and maintain this speed to a safe maneuvering altitude (the old PTS specified V_Y only).
   b. Task L, “Go-Around/Rejected Landing”: The applicant is now required to maneuver to the side of the runway to clear and avoid conflicting traffic (this action, while commonly taught by most CFIs, was not specifically required in the old PTS)
2. In Area of Operation V, “Performance Maneuver,” the only task revised was:
   a. Task A, “Steep Turns”: The applicant is no longer required to complete the maneuver at a minimum of 1,500 ft. AGL.
3. In Area of Operation VI, “Ground Reference Maneuvers,” the examiner is now required to select only one of the three tasks. In addition, the following task was revised:
   a. Task C, “Turns Around a Point”: The applicant is no longer required to complete two turns during the maneuver, and 45° is no longer specified as the approximate bank angle at the steepest point in the turn.
4. In Area of Operation VIII, “Slow Flight and Stalls,” the following tasks were revised:
   a. Task A, “Maneuvering During Slow Flight”:
      i. Slow flight is now defined as an airspeed at which any further increase in angle of attack, increase in load factor, or reduction in power would result in an immediate stall (the old PTS defined slow flight as 1.2 V)
         o This definition of slow flight is similar to the old FAA term “minimum controllable airspeed,” and requires flight at airspeeds considerably lower than 1.2 V_{S1} in some airplanes.
      ii. The airspeed tolerance is now +10/-0 kt., and the bank angle tolerance is now +/-10° (the tolerances in the old PTS were airspeed, +10/-5 kt., and bank angle, +0/-10°).
      iii. The new PTS no longer specifies a maximum bank angle for turns (the old PTS specified 30° in level flight and 20° in climbing or descending flight).
   b. Task B, “Power-Off Stalls”: The applicant is no longer required to announce the indications of an approaching stall. Additionally, the maximum bank angle and tolerance for inducing a turning stall is now 20°, +/-10° (the old PTS specified a maximum bank angle of 30°, +0/-10°), and the applicant may now accelerate to V_X or V_Y before the final flap retraction (the old PTS specified V_Y only).
   c. Task C, “Power-On Stalls”: The applicant is no longer required to announce the indications of an approaching stall. Additionally, the bank angle tolerance is now 20°, +/- 10° (the old PTS specified 20°, +0/-10°), and the applicant may now accelerate to V_X or V_Y before the final flap retraction (the old PTS specified V_Y only).
5. In Area of Operation IX, “Basic Instrument Maneuvers,” the examiner is now required to select Task E, “Recovery From Unusual Flight Attitudes,” and one other task. In addition, the following tasks were revised:
   a. Task B, “Constant Airspeed Climbs”: The applicant may now be required to perform turning climbs (the old PTS specified straight climbs only).
   b. Task C, “Constant Airspeed Descents”: The applicant may now be required to perform turning descents (the old PTS specified straight descents only).
   c. Task D, “Turns to Headings”: The applicant is now required to roll out on the assigned heading, +/- 10° (the old PTS tolerance was +/- 20°).

6. In Area of Operation XII, “Postflight Procedures," the following tasks were revised:
   a. Task A, “After Landing,” and Task B, “Parking and Securing,” have been combined into a single new Task A, “After Landing, Parking, and Securing.” This new task covers essentially the same areas as the two tasks it replaces, while placing additional emphasis on runway incursion avoidance and reaching an appropriate speed during the landing roll-out before attempting to turn off the runway.

IV. **Commercial Pilot:** The FAA made the following changes to the Commercial Pilot Practical Test Standards (FAA-S-8081-12B):

A. **Deleted Tasks**:

1. In Area of Operation I, “Preflight Preparation,” Task H., “Physiological Aspects of Night Flying.”
2. In Area of Operation I, “Preflight Preparation,” Task I., “Lighting and Equipment for Night Flying.”
3. In Area of Operation IX, “Emergency Operations,” Task A., “Emergency Descent.”

B. **New Tasks:**

1. In Area of Operation I, “Preflight Preparation,” new Task B., “Airworthiness Requirements.”
   a. See item III.B.1. in the discussion of new private pilot PTS tasks for a description of the elements of this task.
2. In Area of Operation IV, “Takeoffs, Landings, and Go-Arounds,” new Task K., “Power-Off 180° Accuracy Approach and Landing.”
   a. A power-off 180° accuracy approach and landing is an approach and landing that is made by gliding with the engine idling through a 180° turn to a touchdown that is beyond and within 200 ft. of a specified point on the runway.
      i. The maneuver is begun in the traffic pattern at the pattern altitude by closing the throttle abeam the intended touchdown point, establishing the recommended glide airspeed (presumably the airplane’s best glide speed), and beginning a power-off glide, which is continued all the way to touchdown.
   b. The objective of this maneuver is to develop the ability to accurately judge the airplane’s glide path in a power-off glide and to develop the ability to control the glide path in order to make an accurate touchdown at an appropriate airspeed.
      i. Explain to your students that an example of a practical application of this maneuver is performing a forced landing following an engine failure.
   c. See the *Airplane Flying Handbook* (FAA-H-8083-3) and the Commercial Pilot Practical Test Standards (FAA-S-8081-12B) for more information on how to perform power-off 180° accuracy approaches and landings.
3. In Area of Operation V, “Performance Maneuvers,” new Task B., “Steep Spiral.”
   a. A steep spiral is a series of three 360° gliding turns of constant radius around a reference point on the ground.
      i. A steep spiral is essentially a descending turn around a point.
   b. The maneuver is begun at an altitude sufficient to allow three 360° turns to be completed, with the maneuver ending no lower than 1,000 ft. AGL. The throttle should be closed shortly before the airplane arrives abeam the intended ground reference point, and the recommended glide speed should be established. A gliding spiral of constant radius should be begun once the airplane is abeam the ground reference point.

i. Explain to your students that an example of a practical application of this maneuver is the dissipation of altitude above an emergency landing site following an engine failure at altitude.

c. See the *Airplane Flying Handbook* (FAA-H-8083-3) and the Commercial Pilot Practical Test Standards (FAA-S-8081-12B) for more information on how to perform steep spirals.

C. **Revised Tasks:**

1. In Area of Operation IV, “Takeoffs, Landings, and Go-Arounds," the following tasks were revised:

   a. Task A, “Normal and Crosswind Takeoff and Climb”: The applicant may now be tested on rejected takeoff procedures.

   b. Task B, “Normal and Crosswind Approach and Landing”: In the absence of a recommended approach airspeed, the applicant is required to maintain no more than 1.3 V_{SO}, +/- 5 kt. (the old PTS did not specify an airspeed to be used in the absence of a recommended approach speed).

   c. Task C, “Soft-Field Takeoff and Climb”: The airplane may now be allowed to accelerate to V_X or V_Y in ground effect, as appropriate, and maintain this speed, +/- 5 kt., to a safe maneuvering altitude (the old PTS specified V_Y only).

2. In Area of Operation V, “Performance Maneuvers,” the following changes were made:

   a. In the beginning of the area of operation, it is now specified that the examiner must select at least one task from each of the following groups, for a total of at least 2 tasks:

      i. Task A, “Steep Turns,” or Task B., “Steep Spiral.”

      ii. Task C, “Chandelles,” or Task D., “Lazy Eights.”

   b. Task A, “Steep Turns”: The applicant is no longer required to complete the maneuver at a minimum of 1,500 ft. AGL.

   c. Task C, “Chandelles”:

      i. The maximum entry speed and maximum bank angle are no longer specified (the old PTS specified that the entry airspeed was not to exceed V_A and that the maximum allowable bank was 30°).

      ii. At the completion of the maneuver the applicant must return to straight and level flight with a minimum loss of altitude (the old PTS specified that straight and level flight should be resumed at the final altitude attained, +/-50 ft.).

   d. Task D, “Lazy Eights”:

      i. The applicant is no longer required to select a prominent 90° reference point in the distance, and it is no longer specified that the applicant must complete at least two 180° circuits. Additionally, the PTS now specifies a maximum of approximately 30° of bank at the steepest point (the old PTS did not specify a maximum bank angle).

3. In Area of Operation VI, “Ground Reference Maneuver,” the only task revised was:

   a. “Eights on Pylons”: The applicant is no longer required to maintain straight and level flight for 3-5 seconds between the pylons. Additionally, the maneuver is now required to be completed with a maximum of approximately 30° to 40° of bank at the steepest point (the old PTS did not specify a maximum bank angle).

4. In Area of Operation VIII, “Slow Flight and Stalls,” the following tasks were revised:
    a. Task A, “Maneuvering During Slow Flight”:
        i. Slow flight is now defined as an airspeed at which any further increase in angle of attack, increase in load factor, or reduction in power would result in an immediate stall (the old PTS defined slow flight as 1.2 V_{S1}).
        ii. The airspeed tolerance is now +5/-0 kt., and the bank angle tolerance is now +/- 5° (the tolerances in the old PTS were airspeed, +/-5 kt., and bank angle, +/-10°).
    b. Task B, “Power-Off Stalls”: The applicant is no longer required to announce the indications of an approaching stall. Additionally, the maximum bank angle and tolerance for inducing a turning stall is now 20°, +/- 5° (the old PTS specified a maximum bank angle of 30°,+0/-10°), and the applicant may now accelerate to V_X or V_Y before the final flap retraction (the old PTS specified V_Y only).
    c. Task C, “Power-On Stalls”: The applicant is no longer required to announce the indications of an approaching stall. Additionally, the applicant may now accelerate to V_X or V_Y before the final flap retraction (the old PTS specified V_Y only).
5. In Area of Operation XI, “Postflight Procedures,” the following tasks were revised:
    a. Task A, “After Landing,” and Task B, “Parking and Securing,” have been combined into a single new Task A, “After Landing, Parking, and Securing.” This new task covers essentially the same areas as the two tasks it replaces, while placing additional emphasis on runway incursion avoidance and reaching an appropriate speed during the landing roll-out before attempting to turn off the runway.

V. **Flight Instructor:** The FAA made the following changes to the Flight Instructor Practical Test Standards (FAA-S-8081-6B):

A. **General Information:** The introduction to the Flight Instructor Practical Test Standards specifies that CFI candidates are expected to perform all maneuvers to the commercial pilot skill level.

1. Accordingly, the tolerances for acceptable completion of the maneuvers are not reproduced within the flight instructor PTS because they are found in the appropriate private pilot, commercial pilot, or instrument rating PTS.
2. Because of this organization, you must remember that the recent private and commercial pilot PTS changes also affect the flight instructor PTS without being specifically mentioned in that document. Therefore, you must prepare new CFI candidates accordingly.

B. **Deleted Tasks:**

1. In Area of Operation II, “Technical Subject Areas,” Task C., “Use of Distractions During Flight Training.”
2. In Area of Operation II, “Technical Subject Areas,” Task M., “Use of Minimum Equipment List.”

C. **New Tasks:**

1. In Area of Operation II, "Technical Subject Areas," new task K., "Navigation Aids and Radar Services."
   a. The applicant must be able to explain one ground-based navigational system (VOR/VORTAC, NDB, DME, or LORAN), satellite-based navigation systems, and radar service and procedures.
2. In Area of Operation III, "Preflight Preparation," new Task E., "Airworthiness Requirements."
   a. See item III.B.1. in the discussion of new private pilot PTS tasks for a description of the elements of this task.
3. In Area of Operation VII, now titled "Takeoffs, Landings, and Go-arounds," new Task K., "Power-Off 180° Accuracy Approach and Landing."
   a. See item IV.B.2. in the discussion of new commercial pilot PTS tasks for a description of power-off 180° accuracy approaches and landings.
4. In Area of Operation IX, "Performance Maneuvers," new Task B., "Steep Spirals."
   a. See item IV.B.3. in the discussion of new commercial pilot PTS tasks for a description of steep spirals.

D. **Revised Tasks:**

1. In Area of Operation I, "Fundamentals of Instructing," all tasks have been revised to reflect the new *Aviation Instructor's Handbook* (FAA-H-8083-9), dated 1999.
2. In Area of Operation II, "Technical Subject Areas," the following task was revised:
   a. Task L, "Federal Aviation Regulations," and Task N, "Publications," have been combined into a single new Task, "Federal Aviation Regulations and Publications."
      i. The content of this new task is identical to the old tasks.
3. In Area of Operation VII, tasks from old Area of Operation VII, "Takeoffs and Climbs," and old Area of Operation XIV, "Approaches and Landings," have been combined into a single new Area of Operation VII, "Takeoffs, Landings, and Go-Arounds." The PTS specifies that the examiner is required to select at least two takeoff tasks and two landing tasks from this new area of operation, for a total of at least four tasks. In addition, the following task was revised:
   a. Task G, "Slip to a Landing": The task now refers to both forward and side slips (the old PTS referred to forward slips only).
4. In Area of Operation IX, "Performance Maneuvers," it is now specified that the examiner must select at least one task from each of the following groups, for a total of at least two tasks:
      i. Task A, "Steep Turns," or Task B, "Steep Spiral."
      ii. Task C, "Chandelles," or Task D, "Lazy Eights."

5. In Area of Operation X, “Ground Reference Maneuvers,” it is now specified that the examiner must select Task D, “Eights on Pylons,” and at least one other task, for a total of at least two tasks.
6. In Area of Operation XII, “Basic Instrument Maneuvers,” the following tasks were revised:
    a. Task B, “Constant Airspeed Climbs”: The applicant may now be evaluated on straight and turning climbs (the old PTS specified only straight climbs).
    b. Task C, “Constant Airspeed Descents”: The applicant may now be evaluated on straight and turning descents (the old PTS specified only straight descents).

2.5 FREQUENTLY UNDER-EMPHASIZED AREAS

I. Use of Checklists

A. You must use, and you must instruct your students to use, the appropriate checklist for each phase of flight while on the ground or in the air (e.g., before starting engine, climb, before landing, etc.)
    1. When teaching checklist usage, you must emphasize proper scanning vigilance and division of attention at all times.

B. Explain to your students that there are two different kinds of checklists used for single-pilot operations:
    1. “Read and do” -- e.g., before-takeoff checklist.
    2. “Do and read” -- e.g., in reacting to emergencies, doing everything that comes to mind and then confirming or researching in the *Pilot’s Operating Handbook (POH)*.
    3. Ensure that your students understand when it is appropriate to perform both kinds of checklists.

C. ALL CHECKLISTS should be read aloud at all times.
    1. Requiring your students to call out the items on the checklist as they undertake the action or make the necessary observation will focus their attention on the individual items.
    2. However, be sure to emphasize to your students that checklists are not an end in and of themselves. Checklists are a means of flying safely. Generally, they are to be used as specified in the *POH* and to accomplish safe flight.
        a. Simply “going through the motions” of reading the checklist aloud without actually confirming each item serves no purpose except to create a false sense of security.

D. Many pilots do not refer to a checklist after completing the run-up.
    1. This bad habit can lead to forgetting critical steps, such as setting the power, leaning the mixture, and checking the heading indicator after level-off from a climb, or opening the cowl flaps after landing.

2. Emphasize to your students that checklists must be used for each phase of the flight in order to ensure proper operation of the aircraft.
   a. For example, tell your students that during a cross-country flight in a typical training airplane, if they fail to properly set cruise power and lean the mixture when they level off at cruise altitude (i.e., if they continue flying level with the mixture rich at full throttle), they will burn 30-40% more fuel than the performance information indicated in the *Pilot's Operating Handbook*.
   b. This means that if they are even slightly pushing the manufacturer's endurance figures as listed in the *Pilot's Operating Handbook*, they may suffer fuel exhaustion and a forced landing simply as a result of not completing a cruise checklist.

II. **Night flight**

A. While none of the FAA's practical test standards include tasks that are required to be performed at night, applicants for private and commercial pilot certificates are required to obtain certain aeronautical experience at night:
   1. Private pilot candidates are required to obtain 3 hours of night flight instruction, including at least one cross-country flight of over 100 NM total distance and at least 10 takeoffs and landings to a full stop.
   2. Commercial pilot candidates are required to have at least one dual night cross-country flight of at least 2 hours duration and consisting of a total straight-line distance of more than 100 NM from the original point of departure. In addition, commercial pilot candidates must also log at least 5 hours of solo flight at night, including at least 10 takeoffs and 10 landings (with each landing involving a flight in the traffic pattern) at an airport with an operating control tower.

B. As a flight instructor, you must remember that you will probably be the only person to evaluate your student's night flying abilities before (s)he is certificated.
   1. Most practical tests are conducted entirely in daylight (though there is no restriction against conducting them at night), so the examiner probably will not have an opportunity to test your student's night flying abilities.
   2. Accordingly, you have a responsibility NOT to endorse a pilot candidate for his/her practical test unless (s)he is competent to act as pilot in command at night.
      a. No conscientious flight instructor would knowingly put his/her student and future passengers at risk.
         i. However, that is exactly what you would be doing by endorsing a private or commercial pilot candidate who is not proficient in night operations for his/her practical test, because the candidate will obtain night-flying privileges if (s)he successfully completes the test.
         ii. You cannot rely on your students' assessment of their own night flying abilities to keep them out of trouble until they gain further instruction. YOU are the expert, and it is not unreasonable for your students to take your practical test endorsement as an endorsement of their night flying abilities as well.

C. The following are a few points you should make to your students regarding night flight:

1. At night, visual references are limited (and sometimes nonexistent), and the flight instruments will need to be used to a greater degree in controlling the airplane.
   a. This does not mean that only the flight instruments will be used to control the airplane, but that the flight instruments are used more to cross-check the visual references.
   b. Remind your students that they must also continue to scan for traffic by looking outside the airplane.
2. Emphasize that crossing large bodies of water on night flights can be potentially hazardous, not only from the standpoint of landing (ditching) in the water, should it become necessary, but also because the horizon may blend in with the water, so that control of the airplane may become difficult.
   a. During hazy conditions over open water, the horizon will become obscure, and spatial disorientation becomes a possibility.
   b. Even on clear nights, the stars may be reflected on the water surface, appearing as a continuous array of lights, which makes the horizon difficult to identify.
3. Warn your students that at night, it is difficult to see clouds and restrictions to visibility, particularly on dark nights (i.e., no moonlight) or under an overcast.
   a. Caution must be exercised to avoid flying into weather conditions below VFR (i.e., clouds, fog).
   b. Normally, the first indication of flying into restricted visibility conditions is the gradual disappearance of lights on the ground.
      i. Advise your students that if the lights begin to take on an appearance of being surrounded by a "cotton ball" or glow, they should use extreme caution in attempting to fly farther in that same direction.
   c. Also remind your students that, if a descent must be made through any fog, smoke, or haze in order to land, visibility is considerably less when looking horizontally through the restriction than it is when looking straight down through it from above.
   d. Advise your students never to attempt a VFR flight at night during poor or marginal weather conditions.
4. Traffic patterns
   a. When teaching traffic pattern entries at night, emphasize to your students that it is important to identify the runway lights and other airport lighting as early as possible.
      i. If your student is unfamiliar with the airport layout, sighting of the runway may be difficult until (s)he is very close-in due to other lighting in the area.
      ii. Instruct your students to fly toward the airport rotating beacon until they can identify the runway lights.
      iii. The airplane's landing light should be on to make it more visible to other pilots and ATC.
   b. Inform your students that in order to fly a traffic pattern of the proper size and direction when there is little to see but a group of lights, they must positively identify the runway threshold and runway edge lights.
      i. Your students can confirm that they are entering the pattern for the proper runway by comparing the runway lights to the heading indicator.
      ii. Once this is done, the location of the approach threshold lights should be known at all times throughout the traffic pattern.
      iii. The traffic pattern should be flown as it would be during the day.

III. Instrument Flying

A. Aeronautical experience requirements:

1. A private pilot (airplane) applicant is required to log 3 hours of flight training on the control and maneuvering of an airplane solely by reference to instruments, including straight-and-level flight, constant airspeed climbs and descents, turns to a heading, recovery from unusual flight attitudes, radio communications, and the use of navigation systems/facilities and radar services appropriate to instrument flight.
2. A commercial pilot (airplane) applicant is required to receive at least 10 hours of instrument training, at least 5 hours of which must be in the appropriate class of airplane.

B. This lesson discusses one possible method for teaching a student to perform straight-and-level flight by reference to instruments.

C. **STRAIGHT-AND-LEVEL FLIGHT**

1. Begin by defining straight-and-level attitude instrument flying.
   a. Flying straight means to maintain a constant heading on the heading indicator (HI), which is done by keeping the wings level on the attitude indicator (AI) and the ball centered on the turn coordinator (TC).
   b. Flying level means to maintain a constant altitude on the altimeter (ALT), which is done by holding a level pitch attitude on the AI.
   c. Steady airspeed is maintained by holding a constant power (RPM) setting.
   d. Explain to your students that flying straight-and-level requires a series of constant corrections for unintended deviations in heading, altitude, and airspeed.
2. Next, discuss the **primary/supporting** concept of attitude instrument flying. Explain that there are three parameters to be considered: they are the airplane's **pitch, bank, and power**.
   a. Each of these parameters can be varied by the pilot in order to maintain a particular flight condition at the desired value (e.g., bank can be varied in order to hold a constant heading).
      i. For this discussion, the term "flight condition" refers to an aeronautical value that can be quantified, such as heading, airspeed, altitude, bank angle, climb rate, or descent rate.
   b. For any given maneuver (e.g., straight-and-level flight, turns, or descents) there will be one **primary instrument** designated for each parameter. This instrument is designated as the primary instrument because it is the only instrument that provides the pilot with the following information:
      i. Whether a desired flight condition that is controlled by a given parameter is being maintained (e.g., in level flight, a particular airspeed is maintained by only one power setting), and
      ii. What action is necessary to correct for any observed deviation of the flight condition from the desired value (e.g., if the airspeed is below the desired value in straight-and-level flight, power must be increased).

c. Each parameter will also have at least one **supporting instrument**.
   i. These instruments are designated as supporting instruments because they provide useful information about the trend of each flight condition to deviate from the desired value, the rate at which each condition is deviating, and the approximate extent of any pitch, bank, or power correction required to correct for these deviations.
   ii. Supporting instruments do not, however, provide the pilot with information about the current status of the flight condition.
      o For example, in level cruising flight, pitch controls altitude. Thus, the ALT is the primary pitch instrument because it is the only instrument that tells the pilot which direction (s)he needs to vary the pitch (up or down) if the altitude deviates from the desired value.
      o The supporting pitch instruments for level flight are the airspeed indicator (ASI), the AI, and the vertical speed indicator (VSI). In addition to providing raw pitch information, these instruments all provide clues as to how rapidly the airplane's altitude is changing (if at all), and whether the altitude is increasing or decreasing, but they cannot tell the pilot if the change in altitude is bringing the airplane closer to the desired value, or further from it-this information is **only** available from the primary pitch instrument (the ALT).

d. Emphasize to your students that the terms “primary” and “supporting” can be misleading because they could be interpreted to mean that the primary instruments are more important than the supporting instruments.
   i. The supporting instruments are extremely helpful aids to smooth, precise flying.
   ii. For example, if the VSI shows a 100 fpm climb, the altitude will increase by 100 ft. over the course of 1 min., even though the ALT may show the desired altitude and the pointers may not appear to be moving.
      o The VSI (a supporting pitch instrument) is therefore a very useful aid in maintaining a constant altitude, because if the VSI shows that the climb/descent rate is zero, the altitude will not change.
      o Accordingly, the pilot can make a correction for the slight climb shown on the VSI before any altitude change appears on the ALT.
   iii. The following explanation may be useful in helping your students to understand the primary/supporting concept of instrument flying:
      o **The primary instruments tell the pilot about the airplane’s present condition**; e.g., while attempting to maintain level flight, the ALT always indicates the airplane’s altitude at that instant, regardless of how rapidly the altitude may be changing.
      o **The supporting instruments predict the future of the airplane’s condition**; e.g., even though the ALT may show that the airplane is currently at the desired altitude, the airplane will not remain at that altitude for very long if the VSI shows a 500 fpm climb.

3. Finally, explain straight-and-level flight solely by reference to instruments
   a. The figure below illustrates the instrument indications for straight-and-level flight.

Figure2_3 - Standard Six IFR Instruments

   b. Straight flight is maintained by holding the wings level on the AI and the TC, and maintaining a constant heading on the HI.
      i. Since a specific heading is desired, the HI is primary for bank.
         o The supporting instruments for bank are the AI and the TC.
      ii. If the airplane deviates from the desired heading, the AI is used to level the wings. The pilot must also ensure that the ball of the TC is centered.
         o The pilot must then determine the direction to turn in order to return to the desired heading, and use the AI to establish a bank in the proper direction.
            ■ The pilot should use an angle of bank no greater than the number of degrees to be turned, but the bank angle should be limited to that required for a standard-rate turn.
         o Coordinated aileron and rudder are used to establish the turn.
      iii. The ball of the TC should be centered. If it is not, the pilot may be unintentionally holding rudder pressure, or the airplane may be improperly trimmed (if rudder trim is available).
   c. Level flight is maintained by adjusting pitch as necessary on the AI to maintain altitude.
      i. Since a specific altitude is desired, the ALT is primary for pitch.
         o The supporting instruments for pitch are the AI and the VSI.
         o As a trend instrument, the VSI will show immediately, even before the ALT, the initial vertical movement of the airplane.

   ii. If the airplane changes altitude, the AI is used to return to level flight, and the pilot must determine if a climb or descent is required to return to the desired altitude.
      - The AI is used to make a small pitch adjustment in the proper direction, and the VSI is used to ensure that the airplane is moving in the proper direction.
      - Small altitude deviations (i.e., 100 ft. or less) should be corrected with pitch only, using a rate of approximately 200 fpm on the VSI.
      - Large altitude deviations (i.e., greater than 100 ft.) may be more easily corrected by adjusting both pitch and power, and using a greater rate of return to altitude (approximately double the error in altitude).
   iii. The VSI becomes the primary pitch instrument while returning to altitude after a deviation is noticed during level flight.
      - Pitch should be adjusted on the AI in order to establish and maintain the desired descent rate.
      - For example, if the airplane is 200 ft. below the desired altitude, pitch should be increased to a climb attitude on the AI and fine-tuned in order to maintain approximately a 400 fpm climb (double the altitude error) on the VSI.

d. During straight-and-level flight, a constant airspeed is desired; thus the ASI is the primary power instrument. Power is increased or decreased as necessary in order to maintain the desired airspeed.
   i. The manifold pressure gauge (MP) and/or RPM are supporting power instruments for straight-and-level flight.
      - When changing airspeed in level flight, power can be initially adjusted using the MP/RPM.
      - Once the airspeed has stabilized, power can then be fine-tuned using the ASI in order to maintain the desired airspeed.

e. Advise your students that they will need to learn to overcome a natural tendency to make a large control movement for a pitch change, and learn to apply small control pressures smoothly, cross-checking rapidly for the results of the change and continuing with the pressures as the instruments show the desired results at a rate that they can interpret.
   i. Small attitude changes can be easily controlled, stopped, and corrected.
   ii. Large changes are more difficult to control.

f. Coordination of controls requires that the ball of the TC be kept centered and that the available trim control devices be used whenever a change in flight conditions disturbs the existing trim.
   i. Trim is used to relieve all possible control pressures held after a desired attitude has been attained.
   ii. The pressure felt on the control yoke must be that which is applied while controlling a planned change in airplane attitude, not pressure held because "the pilot is being flown by the airplane."

4. Private pilot PTS completion standards
   a. Maintain altitude, ±200 ft.; heading, ±10; and airspeed, ±10 kt.

5. Instrument rating PTS completion standards
   a. Maintain altitude, ±100 ft.; heading, ±10; and airspeed, 10 kt.

IV. Abnormal and Emergency Procedures

A. Explain to your students that several factors may interfere with a pilot's ability to act promptly and properly when faced with an emergency:

1. Reluctance to accept the emergency situation. Allowing one's mind to become paralyzed by the emergency may lead to failure to maintain flying speed, delay in choosing a suitable landing area, and indecision in general.
2. Desire to save the airplane. If a pilot has been conditioned to expect to find a suitable landing area whenever the instructor has simulated a failed engine, (s)he may be apt to ignore good procedures in order to avoid rough terrain where the airplane may be damaged. There may be times that the airplane will have to be sacrificed so that the pilot and passengers can walk away.
3. Undue concern about getting hurt. Fear is a vital part of self-preservation, but it must not be allowed to lead to panic. Pilots faced with an emergency must maintain their composure and apply the proper concepts and procedures.

B. Emergency operations require that the pilot maintain situational awareness of what is happening. You must help your student to develop an organized process for decision making that can be used in all situations. One method is to use **DECIDE**:

D etect a change: Recognize immediately when indications, whether visual, aural, or intuitive, are different from those expected.

E stimate need to react: Determine whether these different indications constitute an adverse situation and, if so, what sort of action, if any, will be required to deal with it.

C hoose desired outcome: Decide how, specifically, you would like the current situation altered.

I dentify actions to control change: Formulate a definitive plan of action to remedy the situation.

D o something positive: Even if no ideal plan of action presents itself, something can always be done to improve things at least.

E valuate the effects: Have you solved the predicament, or is further action required?

C. Pass on the following ideas about good judgment and sound operating practice as you prepare your students to meet emergencies:

1. All pilots hope to be able to act properly and efficiently when the unexpected occurs. A safe pilot will try to cultivate coolness in an emergency.
2. A pilot must know his/her airplane well enough to interpret the indications of trouble correctly before taking corrective action. This requires regular study of the airplane's *POH*.
3. While difficult, all pilots must make a special effort to remain proficient in emergency procedures they will seldom, if ever, have to use.
4. Emphasize to your students that they must not be reluctant to accept the existence of an emergency. They must take appropriate action immediately without overreacting. The problem should be explained to ATC so that controllers can help them plan alternatives and be in a position to grant them priority.
5. It is good operating practice to assume that an emergency will occur on every takeoff; i.e., expect the unexpected. If nothing unusual happens, the pilot gets a pleasant surprise. If an emergency does occur, (s)he will be in the correct mind-set to recognize the problem and handle it in a safe and efficient manner.
6. Smart pilots avoid putting themselves into situations in which they have no alternatives. Encourage your students to remain continuously alert for suitable emergency landing spots.

V. Determining Airworthiness

A. Your students must be familiar with all airworthiness considerations that apply to their aircraft and to the type of flight operations being conducted.

B. From a safety-of-flight standpoint, an aircraft is considered airworthy when it meets its type design specifications or is in a "properly altered condition" as defined by the FAA, and is in a condition that allows for safe flight.

1. You should carefully instruct your students to determine that the airplane is physically in a condition for safe flight during the preflight inspection.
    a. This instruction should include the location of critical areas for inspection, appropriate tolerances for each area, and the means to identify excessive wear or damage.

C. From an equipment standpoint, an aircraft is considered airworthy when all equipment required for the intended operation is installed and operational.

1. Inform your students that 14 CFR Sec. 91.205 describes the required equipment for each aircraft to conduct day and night operations under IFR or VFR, as appropriate.
    a. Emphasize that all equipment required for the operation must be installed and operational prior to beginning the flight.
    b. These items are outlined in Lesson 3, Federal Regulations.
2. Explain that 14 CFR Sec. 91.213 describes the acceptable methods for the operation of an airplane with inoperative instruments and equipment that are not listed under 14 CFR Sec. 91.205, and that are not otherwise essential for safe flight. These acceptable methods of operation are
    a. Operation with an approved minimum equipment list (MEL)
        1) An MEL is a specific inoperative equipment document for a particular aircraft, identified by that aircraft's serial and registration number.
        2) An MEL is designed to provide owners/operators with the authority to operate an aircraft with certain items or components inoperative, provided the FAA finds an acceptable level of safety can be maintained by
            a) Appropriate operating limitations
            b) A transfer of the function to another operating component
            c) Reference to other instruments or components providing the required information
        3) Note that an MEL is a list of equipment that is NOT required to be operational for safe flight.
            a) MELs are described in more detail in Lesson 3, Federal Regulations
    b. Operation without an MEL (the way most training airplanes are operated)
        1) A pilot may take off in an aircraft with inoperative instruments and equipment, and without an approved MEL, provided that the inoperative instruments and equipment are not
            a) Part of the VFR-day type certification instruments and equipment under which the aircraft was type certificated
            b) Indicated as required on the aircraft's equipment list or on the Kinds of Operations Equipment List for the kind of flight operation being conducted
            c) Required by any FAR
            d) Required by an airworthiness directive

2) The inoperative instruments or equipment must be
   a) Removed from the airplane with the cockpit control placarded and the maintenance properly recorded, or
   b) Deactivated and placarded “inoperative.”
3) A determination must be made by a certificated and appropriately rated pilot or an appropriately certificated mechanic that the inoperative instrument or equipment does not constitute a hazard to the aircraft.
4) By following these procedures, the aircraft is considered to be in a “properly altered condition” acceptable to the FAA.

D. From a legal standpoint, an aircraft is considered airworthy when all required maintenance and inspections have been performed at the appropriate intervals, and when all required documents are present. Specifically, the following requirements must be met:

1. An **annual inspection** must have been performed within the preceding 12 calendar months.
   a. The date of the last annual inspection can be verified in the aircraft's maintenance logbooks.
2. A **100-hr. inspection** must have been performed within the preceding 100 hr. of flight time if the aircraft is operated for compensation or hire, or is used to provide flight instruction for hire.
   a. The 100-hr. interval may be exceeded by no more than 10 hr. to facilitate transport of the aircraft to a maintenance location where the inspection can be performed.
      1) However, if the 100-hr. inspection is overflown, the next inspection will be due after 100 hr. of flight time **less** the amount overflown.
      2) EXAMPLE: If the check is performed at the 105-hr. point, the next 100-hr. check is due at the end of 95 hr., not 100 hr.; thus, it would be due at the 200-hr. point
   b. The date of the last 100-hr. inspection can be verified in the aircraft's maintenance logbooks.
3. An **ATC transponder inspection** must have been performed within the preceding 24 calendar months in order to operate the transponder.
   a. If this inspection has not been performed, the transponder may not be operated, nor may operations that require a transponder (e.g., flight inside Class B airspace) be conducted without prior ATC approval.
   b. The date of the last transponder inspection can be verified in the aircraft's airframe logbook.
4. An **altimeter and static system inspection** must have been performed within the preceding 24 calendar months if the airplane is to be operated under IFR.
   a. The date of the last altimeter and static system inspection can be verified in the aircraft's airframe logbook.
5. A **VOR receiver accuracy check** must have been performed by a pilot or mechanic within the preceding 30 days if the airplane is to be operated under IFR.
   a. The date, place, bearing error, and name of the pilot or mechanic who conducted the last receiver check can be found in the aircraft's airframe logbook or in another appropriate record (many airplane operators keep a separate VOR record inside the airplane).

6. An **emergency locator transmitter (ELT) inspection** must have been performed within the preceding 12 calendar months. The ELT battery must be replaced or recharged after half of its useful life has expired, or following 1 hr. of cumulative use.
   a. Note that an ELT is not required for flight training operations that are conducted within 50 NM of the airport of origin.
   b. The date of the last ELT inspection can be verified in the aircraft's airframe logbook.
      1) The ELT battery's expiration date can be found placarded on the ELT itself, as well as recorded in the aircraft's airframe logbook.
7. All applicable one-time and recurring **airworthiness directives (ADs)** must have been complied with within the appropriate time interval.
   a. The date of compliance with each AD can be verified in the aircraft's maintenance logbooks.
      1) Most operators also maintain a list of all applicable ADs for a particular aircraft and, in the case of recurring ADs, a record of the time and date when the next action is required.
8. Any other **periodic maintenance** required by the manufacturer must have been performed within the appropriate interval.
   a. The date of the last action can be verified in the aircraft's maintenance logbooks.
9. All required **certificates and documents** must be carried aboard the aircraft. These can be easily recalled using the memory aid **ARROW**.

A irworthiness certificate
R egistration
R adio station license
O perating limitations
W eight and balance

GLEIM FLIGHT INSTRUCTOR REFRESHER COURSE
LESSON 3
FEDERAL REGULATIONS

3.1 PART 1: DEFINITIONS AND ABBREVIATIONS

I. Part 1 contains definitions of numerous terms and abbreviations used throughout the regulations.

A. Advise your students to refer to Part 1 anytime they do not understand the meaning of a word or an abbreviation used in a regulation.

B. In addition to Part 1, more specialized definitions can often be found at the beginning of other Parts (e.g., 14 CFR 61.1, Applicability and Definitions, contains definitions of terms specific to the certification of pilots and flight/ground instructors).

II. The following terms are frequently misunderstood, so it may be worth spending some extra time to clarify them to your students.

A. **Category**

1. Category, as used with respect to the certification, ratings, privileges, and limitations of airmen, means a broad classification of aircraft.

a. EXAMPLES: Airplane, rotorcraft, glider, and lighter-than-air.

2. Category, as used with respect to the certification of aircraft, means a grouping of aircraft based upon intended use or operating limitations.

a. EXAMPLES: Transport, normal, utility, acrobatic, limited, restricted, and provisional.

B. **Ceiling** means the height above the Earth's surface of the lowest layer of clouds or obscuring phenomena that is reported as "broken," "overcast," or "obscuration," and not classified as "thin" or "partial."

C. **Class**

1. Class, as used with respect to the certification, ratings, privileges, and limitations of airmen, means a classification of aircraft within a category having similar operating characteristics.

a. EXAMPLES: Single-engine, multi-engine, land, water, gyroplane, helicopter, airship, and free balloon.

2. Class, as used with respect to certification of aircraft, means a broad grouping of aircraft having similar characteristics of propulsion, flight, or landing.

a. EXAMPLES: Airplane, rotorcraft, glider, balloon, landplane, and seaplane.

D. **Commercial operator** means a person who uses an aircraft to transport persons or property for compensation or hire.

1. If it is uncertain whether an operation is for compensation or hire, the test applied is whether the operation is merely incidental to the person's other business or is, in itself,a major enterprise for profit.

E. **Controlled airspace** means an airspace of defined dimensions within which air traffic control is provided to IFR flights and, in some classes of airspace, to VFR flights.

1. Note that controlled airspace is a generic term that covers Class A, Class B, Class C, Class D, and Class E airspace.

F. **Flight time** means pilot time that commences when an aircraft moves under its own power for the purpose of flight and ends when the aircraft comes to a rest after landing.

G. **Night**

1. As used for general purposes, means the time between the end of evening civil twilight and the beginning of morning civil twilight, as published in the *American Air Almanac*, converted to local time.
   a. While not a definition of ‘night,’ you should also inform your students that aircraft position lights must be displayed during the period from sunset to sunrise.
2. As used for the purpose of meeting recency of experience requirements (14 CFR 61.57) and aeronautical experience requirements to obtain a certificate or rating, means the period from 1 hr. after sunset to 1 hr. before sunrise.

H. **Operator** is a person who uses, causes the use of, or authorizes the use of an aircraft for the purpose of air navigation, including the piloting of an aircraft, with or without the right of legal control (i.e., owner, lessee, or otherwise).

1. Remind your students that they are legally considered to be the aircraft operator when they are acting as pilot in command.

I. **Pilot in command (PIC)** means the person who

1. Has final authority and responsibility for the operation and safety of the flight
2. Has been designated as pilot in command before or during the flight
3. Holds the appropriate category, class, and type rating, if appropriate, for the conduct of the flight

J. **Rating** means a statement that, as part of a certificate, sets forth special conditions, privileges, and limitations.

3.2 PART 61: CERTIFICATION RULES FOR PILOTS AND FLIGHT INSTRUCTORS

NOTE: The certification rules presented below are applicable to pilots training for pilot or flight instructor certificates with a single-engine airplane rating only.

I. Part 61 addresses the certification, privileges, and limitations of pilots and flight/ground instructors.

A. Your students should be aware that Part 61 is the official source for information about the specific requirements for obtaining each pilot and instructor certificate and associated ratings, and for information about the privileges and limitations that apply to each certificate and rating.

II. Part 61 Definitions (61.1)

A. **Aeronautical experience** means pilot time obtained in an aircraft, flight simulator, or flight training device for the purpose of meeting appropriate training and flight time requirements for a pilot certificate, a rating, a flight review, or recency of flight experience requirements.

B. **Authorized instructor** means a person who holds

1. A current flight instructor certificate issued under Part 61 when conducting ground training or flight training in accordance with the privileges and limitations of his/her flight instructor certificate
2. A valid ground instructor certificate issued under Part 61 or Part 143 when conducting ground training in accordance with the privileges and limitations of his/her ground instructor certificate

C. **Cross-country time** means

1. Except as provided in 2., 3., and 4. below, time acquired during a flight that
   a. Was conducted by a person who holds a pilot certificate;
   b. Was conducted in an aircraft;
   c. Included a landing at a point other than the point of departure; and
   d. Involved the use of dead reckoning, pilotage, electronic navigation aids, radio aids, or other navigation systems to navigate to the landing point.
2. For the purpose of meeting the aeronautical experience requirements (except for a rotorcraft category rating) for a private pilot certificate, a commercial pilot certificate, or an instrument rating, or for the purpose of exercising recreational pilot privileges (except in a rotorcraft) under Sec. 61.101(c), time acquired during a flight that
   a. Was conducted in an appropriate aircraft;
   b. Included a point of landing that was at least a straight-line distance of more than 50 NM from the original point of departure; and
   c. Involved the use of dead reckoning, pilotage, electronic navigation aids, radio aids, or other navigation systems to navigate to the landing point.
3. For the purpose of meeting the aeronautical experience requirements for an airline transport pilot certificate (except with a rotorcraft category rating), time acquired during a flight that
   a. Was conducted in an appropriate aircraft;
   b. Was at least a straight-line distance of more than 50 NM from the original point of departure; and
   c. Involved the use of dead reckoning, pilotage, electronic navigation aids, radio aids, or other navigation systems.
      i. Note that there is no requirement to make a landing at a point other than the point of departure.
4. For a military pilot who qualifies for a commercial pilot certificate (except with a rotorcraft category rating) under Sec. 61.73, time acquired during a flight that
   a. Was conducted in an appropriate aircraft;
   b. Was at least a straight-line distance of more than 50 NM from the original point of departure; and
   c. Involved the use of dead reckoning, pilotage, electronic navigation aids, radio aids, or other navigation systems.

D. **Flight simulator** means a device that

1. Is a full-size aircraft cockpit replica of a specific type of aircraft, or make, model, and series of aircraft;
2. Includes the hardware and software necessary to represent the aircraft in ground operations and flight operations;
3. Uses a force cueing system that provides cues at least equivalent to those cues provided by a 3° freedom-of-motion system;
4. Uses a visual system that provides at least a 45° horizontal field of view and a 30° vertical field of view simultaneously for each pilot; and
5. Has been evaluated, qualified, and approved by the FAA.

E. **Flight training** means that training, other than ground training, received from an authorized instructor in flight in an aircraft.

1. Note that solo flight is therefore not considered to be “flight training,” even though 14CFR 61.109 refers to “solo flight training.”

F. **Flight training device** means a device that

1. Is a full-size replica of the instruments, equipment, panels, and controls of an aircraft, or set of aircraft, in an open flight deck area or in an enclosed cockpit, including the hardware and software for the systems installed, that is necessary to simulate the aircraft in ground and flight operations;
2. Need not have a force (motion) cueing or visual system; and
3. Has been evaluated, qualified, and approved by the FAA.

G. **Ground training** means training, other than flight training, received from an authorized instructor.

H. **Instrument training** means the time in which instrument training is received from an authorized instructor under actual or simulated instrument conditions.

I. **Knowledge test** means a test on the aeronautical knowledge areas required for an airman certificate or rating that can be administered in written form or by a computer.

J. **Pilot time** means time in which a person

1. Serves as a required pilot flight crewmember;
2. Receives training from an authorized instructor in an aircraft, flight simulator, or flight training device; or
3. Gives training as an authorized instructor in an aircraft, flight simulator, or flight training device.

K. **Practical test** means a test on the areas of operations for an airman certificate, rating, or authorization that is conducted by having the applicant respond to questions and demonstrate maneuvers in flight, in a flight simulator, or in a flight training device.

L. **Set of aircraft** means aircraft that share similar performance characteristics, such as similar airspeed and altitude operating envelopes, similar handling characteristics, and the same number and type of propulsion systems.

M. **Training time** means training received from an authorized instructor

1. In flight
2. On the ground
3. In a flight simulator or flight training device

III. Medical Certificates: Requirement and Duration (61.23)

A. You must hold at least a third-class medical certificate when exercising the privileges of a flight instructor certificate if you are acting as the pilot in command (PIC) or serving as a required pilot flight crewmember.

B. A medical certificate is NOT required if you are exercising the privileges of a flight instructor certificate but are NOT acting as PIC or a required pilot flight crewmember.

1. Thus, the pilot you are flying with must meet the requirements to act as PIC if you do not hold at least a third-class medical certificate.

IV. Student Pilots (61.83)

A. To be eligible for a student pilot certificate, a person must

1. Be at least 16 years of age.
2. Be able to read, speak, write, and understand English.
   a. If the person is unable to meet one of these requirements due to medical reasons, the FAA may place operating limitations on the student pilot certificate as necessary for safety.

V. Requirements to Obtain a Recreational Pilot Certificate (Part 61, Subpart D)

A. The requirements to obtain a recreational pilot certificate are summarized in Part 61, Subpart D.

1. We have not listed the requirements here because of the very small number of individuals who seek recreational pilot certificates.

VI. Requirements to Obtain a Private Pilot Certificate (Part 61, Subpart E)

A. Be at least 17 years of age.

B. Be able to read, write, and converse fluently in English.

C. Hold an airman medical certificate, appropriate to the intended operation.

D. Receive and log ground training from an authorized instructor or complete a home-study course to learn

1. *Applicable Federal Aviation Regulations ... that relate to private pilot privileges, limitations, and flight operations.*
2. *Accident reporting requirements of the National Transportation Safety Board.*
3. *Use of the applicable portions of the Aeronautical Information Manual and FAA ACs (advisory circulars).*
4. *Use of aeronautical charts for VFR navigation using pilotage, dead reckoning, and navigation systems.*
5. *Radio communication procedures.*
6. *Recognition of critical weather situations from the ground and in flight, windshear avoidance, and the procurement and use of aeronautical weather reports and forecasts.*
7. *Safe and efficient operation of aircraft, including collision avoidance, and recognition and avoidance of wake turbulence.*
8. *Effects of density altitude on takeoff and climb performance.*
9. *Weight and balance computations.*
10. *Principles of aerodynamics, powerplants, and aircraft systems.*
11. *Stall awareness, spin entry, spins, and spin recovery techniques for airplane category ratings.*
12. *Aeronautical decision making and judgment.*
13. *Preflight action that includes*
    a. *How to obtain information on runway lengths at airports of intended use, data on takeoff and landing distances, weather reports and forecasts, and fuel requirements.*
    b. *How to plan for alternatives if the flight cannot be completed or delays are encountered.*

E. Pass the FAA private pilot knowledge test with a score of 70% or better.

1. The instructor who conducted the ground training or reviewed the person's home-study in the areas listed in VI.D. on the previous page is required to provide an endorsement certifying that the person is prepared for the knowledge test.

F. Accumulate flight experience. Receive a total of 40 hr. of flight training and solo flight time, including

1. 20 hr. of flight training from a certificated flight instructor (CFI), including at least
   a. 3 hr. of cross-country, i.e., to other airports
   b. 3 hr. at night, including
      i. One cross-country flight of over 100 NM total distance
      ii. 10 takeoffs and 10 landings to a full stop at an airport
   c. 3 hr. of training to control and maneuver an airplane solely by reference to instruments
   d. 3 hr. in a single-engine airplane in preparation for the private pilot practical test within 60 days prior to that test
2. 10 hr. of solo flight time in an airplane, including at least
   a. 5 hr. of cross-country time
   b. One solo cross-country flight of at least 150 NM total distance, with full-stop landings at a minimum of three points and with one segment of the flight consisting of a straight-line distance of at least 50 NM between the takeoff and landing locations
   c. Three solo takeoffs and landings to a full stop at an airport with an operating control tower

G. Receive and log ground and flight training and a logbook endorsement from the CFI who conducted the training in the areas of operation listed below and certifies that the person is prepared for the practical test.

1. *Preflight preparation*
2. *Preflight procedures*
3. *Airport operations*
4. *Takeoffs, landings, and go-arounds*
5. *Performance maneuver*
6. *Ground reference maneuvers*
7. *Navigation*
8. *Slow flight and stalls*
9. *Basic instrument maneuvers*
10. *Emergency operations*
11. *Night operation*
12. *Postflight procedures*

H. Successfully complete the private pilot practical test.

VII. Requirements to Obtain a Commercial Pilot Certificate (Part 61, Subpart F)

A. Be at least 18 years of age.

B. Be able to read, write, and converse fluently in English.

C. Hold an airman medical certificate, appropriate to the intended operation.

D. Receive and log ground training from an instructor or complete a home-study course to learn

1. *Applicable Federal Aviation Regulations...that relate to commercial pilot privileges, limitations, and flight operations*

2. *Accident reporting requirements of the National Transportation Safety Board*
3. *Basic aerodynamics and the principles of flight*
4. *Meteorology to include recognition of critical weather situations, windshear recognition and avoidance, and the use of aeronautical weather reports and forecasts*
5. *Safe and efficient operation of aircraft*
6. *Weight and balance computations*
7. *Use of performance charts*
8. *Significance and effects of exceeding aircraft performance limitations*
9. *Use of aeronautical charts and a magnetic compass for pilotage and dead reckoning*
10. *Use of air navigation facilities*
11. *Aeronautical decision making and judgment*
12. *Principles and functions of aircraft systems*
13. *Maneuvers, procedures, and emergency operations appropriate to the aircraft*
14. *Night and high-altitude operations*
15. *Procedures for operating within the National Airspace System*

E. Pass the FAA commercial pilot knowledge test.

   1. The instructor who conducted the ground training or reviewed the person's home-study in the areas listed in VII.D. beginning on the previous page is required to provide an endorsement certifying that the person is prepared for the knowledge test.

F. Accumulate flight experience consisting of at least 250 hr. of flight time as a pilot, which includes at least

   1. 100 hr. in powered aircraft, of which 50 hr. must be in airplanes
   2. 100 hr. of pilot in command flight time, which includes at least
      a. 50 hr. in airplanes
      b. 50 hr. in cross-country flight of which at least 10 hr. must be in airplanes
   3. 20 hr. of training in the areas of operation listed in VII.H. on the next page, including at least
      a. 10 hr. of instrument training of which at least 5 hr. must be in a single-engine airplane
      b. 10 hr. of training in an airplane that has a retractable landing gear, flaps, and controllable pitch propeller, or is turbine-powered
      c. One cross-country flight of at least 2 hr. in a single-engine airplane in day-VFR conditions, consisting of a total straight-line distance of more than 100 NM from the original point of departure
      d. One cross-country flight of at least 2 hr. in a single-engine airplane in night-VFR conditions, consisting of a straight-line distance of more than 100 NM from the original point of departure
      e. 3 hr. in a single-engine airplane in preparation for the practical test within the 60 days preceding the test

4. 10 hr. of solo flight in a single-engine airplane conducting training in the areas of operation required for a single-engine rating, which includes at least
   a. One cross-country flight of not less than 300 NM total distance, with landings at a minimum of three points, one of which is a straight-line distance of at least 250 NM from the original departure point
      i. In Hawaii, the longest segment need have only a straight-line distance of at least 150 NM.
   b. 5 hr. in night-VFR conditions with 10 takeoffs and 10 landings (with each landing involving a flight in the traffic pattern) at an airport with an operating control tower

G. Hold an instrument rating, or the commercial certificate will be endorsed with a prohibition against carrying passengers for hire on flights beyond 50 NM or at night.

H. Receive and log ground and flight training and a logbook endorsement from the CFI who conducted the training in the areas of operations listed below and certifies that the person is prepared for the practical test.

1. *Preflight preparation*
2. *Preflight procedures*
3. *Airport operations*
4. *Takeoffs, landings, and go-arounds*
5. *Performance maneuvers*
6. *Ground reference maneuver*
7. *Navigation*
8. *Slow flight and stalls*
9. *Emergency operations*
10. *High-altitude operations*
11. *Postflight procedures*

I. Successfully complete the commercial pilot practical test.

VIII. **Requirements to Obtain a Flight Instructor Certificate (Part 61, Subpart H)**

A. Be at least 18 years old.

B. Be able to read, write, and converse fluently in English.

C. Hold a commercial pilot certificate with an instrument rating or an airline transport pilot (ATP) certificate.

D. Hold an airman medical certificate, appropriate to the intended operation.

E. Receive and log ground training to learn

1. Fundamentals of instructing
2. All subject areas in which ground training is required for recreational, private, and commercial pilot certificates

F. Pass the fundamentals of instructing (FOI) and flight instructor knowledge tests.

NOTE: No instructor endorsement is required to take the FOI or any instructor knowledge test. To take the knowledge test, an applicant will need proper identification, containing his/her photograph, signature, actual address, and date of birth.

G. Receive flight instruction from a CFI who has held a flight instructor certificate during the 24 months immediately preceding giving the instruction and who has given at least 200 hr. of flight instruction as a CFI. The CFI will endorse the person's logbook certifying that (s)he is competent in the following areas of operation:

1. *Fundamentals of instructing*
2. *Technical subject areas*
3. *Preflight preparation*
4. *Preflight lesson on a maneuver to be performed in flight*
5. *Preflight procedures*
6. *Airport operations*
7. *Takeoffs, landings, and go-arounds*
8. *Fundamentals of flight*
9. *Performance maneuvers*
10. *Ground reference maneuvers*
11. *Slow flight, stalls, and spins*
12. *Basic instrument maneuvers*
13. *Emergency operations*
14. *Postflight procedures*

H. Obtain a logbook endorsement from a CFI who has provided the person with spin entry, spin, and spin recovery training in an airplane certificated for spins.

I. Successfully complete the flight instructor practical test.

IX. **FAA 14 CFR Parts 61, 63, and 65 Regarding Airman Certificates**

A. The FAA is adding a section to 14 CFR parts 61, 63, and 65 to expressly make individuals who pose a security threat as determined by the Transportation Security Act (TSA) ineligible to hold certificates, ratings, and authorizations issued under those parts.

1. This ineligibility means that the FAA will not issue a certificate, rating, or authorization to any applicant who the TSA advises the FAA poses a security threat.
2. If the TSA issues an Initial Notification of Threat Assessment to an applicant, the FAA will hold the application pending the outcome of the TSA's final threat assessment review.
3. If the individual is issued a Final Notification of Threat Assessment, the FAA will deny an application for any airman certificate, rating, or authorization.

B. With regard to certificates already issued, the FAA will suspend an individual's airman certificates after receiving the Initial Notification of Threat Assessment from the TSA.

1. Suspension is appropriate in the circumstance, because the TSA's initial assessment that an individual poses a security threat is still subject to review by the TSA's Deputy Administrator.
2. If a Final Notification of Threat Assessment is issued, the FAA will revoke the certificates.
3. If an Initial Notification is withdrawn, the FAA will withdraw its certificate suspension.

3.3 PART 91: GENERAL OPERATING AND FLIGHT RULES

I. Part 91 addresses general operating rules, flight rules, aircraft equipment requirements, and maintenance requirements.

A. Your students should be aware that Part 91 is the official source for information about the rules pertaining to flight operations, air traffic control clearances, operations in different airspace classes, aircraft equipment requirements, and certain maintenance and inspection requirements.

1. Additional maintenance and inspection requirements are also found in Part 43

II. Subpart A -- General

91.3 Responsibility and Authority of the Pilot in Command

A. The pilot in command (PIC) of an airplane is directly responsible for, and is the final authority as to, the operation of that airplane.

1. In most circumstances, unless you have specifically made arrangements with your student, you will be PIC while providing flight instruction.
2. However, if your student is an appropriately-rated and certificated pilot, you may both log pilot in command flight time.

B. In emergencies, the PIC may deviate from the FARs to the extent needed to maintain the safety of the airplane and passengers.

1. If the PIC must deviate from the FARs in an emergency, (s)he may be required to file a written report with the FAA.

91.9 Civil Aircraft Flight Manual, Marking, and Placard Requirements

A. No person may operate an aircraft that has an approved flight manual unless that manual is aboard the aircraft.

B. No person may operate contrary to any limitations specified in an approved flight manual.

91.17 Alcohol or Drugs

A. No person may act, or attempt to act, as a crewmember of a civil aircraft

1. While under the influence of drugs or alcohol
2. Within 8 hr. after the consumption of any alcoholic beverage
3. While having .04% by weight or more alcohol in the blood
4. While using any drug that affects the faculties in any way contrary to safety

III. Subpart B -- Flight Rules

91.103 Preflight Action

A. Prior to every flight, the pilot in command is required to familiarize him/herself with all available information concerning that flight and specifically to determine

1. Runway lengths at airports of intended use and the airplane's takeoff and landing requirements
2. On cross-country flights, weather, fuel requirements, alternate airports available, and any known traffic delays

91.109 Flight Instruction: Simulated Instrument Flight and Certain Flight Tests

A. Dual instruction must be given in an airplane with dual controls. Dual instrument instruction may be given in a single-engine airplane with a single throwover control wheel when

1. The person manipulating the controls has at least a private pilot certificate with appropriate category and class ratings, and
2. The instructor determines that it can be done safely.

B. A safety pilot is required while conducting simulated instrument flight.

1. The safety pilot must hold at least a private pilot certificate with appropriate category and class ratings, and
2. The instructor determines that it can be done safely.
    a. Since the safety pilot is required for simulated instrument flight, (s)he is a required flight crewmember who must also have a valid medical certificate.
3. The safety pilot must have adequate sideward and forward flight visibility, or another observer in the aircraft must supplement the safety pilot.
4. Dual controls (except in lighter-than-air aircraft) or a single throwover control that meets the requirements of item A. on the previous page must be present for the safety pilot.

91.113 Right-of-Way Rules: Except Water Operations

A. Converging. When aircraft of the same category are converging at approximately the same altitude (except head-on), the aircraft to the right has the right-of-way.

1. Explain to your students that this rule means that, if they see an aircraft to their right, that aircraft has the right-of-way, but if they see an aircraft to their left, they have the right-of-way.
2. Remind your students that, even if they have the right-of-way, the other pilot may not see them, so they must remain prepared to take evasive action.

B. Converging. When aircraft of the same category are converging at approximately the same altitude (except head-on), the least-maneuverable aircraft has the right-of-way.

1. Balloons, gliders, and airships have the right-of-way over an airplane, but airplanes have right-of-way over rotorcraft.
2. Aircraft towing or refueling other aircraft have the right-of-way over all other engine-driven aircraft.
3. An aircraft in distress has right-of-way over all other aircraft.

C. Approaching head-on. The pilot of each aircraft shall alter course to the right.

D. Overtaking. An aircraft that is being overtaken has the right-of-way.

1. The overtaking aircraft shall alter course to the right.

E. Landing. Aircraft while on final approach to land or while landing have the right-of-way over other aircraft in flight or on the ground.

1. When two or more aircraft are approaching the airport for landing, the aircraft at the lower altitude has the right-of-way.
    a. Pilots should not take advantage of this rule to cut in front of another aircraft that is on final approach or to overtake that aircraft.

91.119 Minimum Safe Altitudes: General

A. Except for takeoff and landing, the following altitudes are required:

1. Anywhere, the airplane must have sufficient altitude to make an emergency landing without undue hazard to persons or property on the surface if an engine fails.

2. Over congested areas of a city, town, or settlement, or over an open-air assembly of persons, the airplane must have 1,000 ft. of clearance over the highest obstacle within a 2,000-ft. radius.
3. Over other than congested areas (e.g., farm land), the airplane must remain 500 ft. above the surface.
4. Over open water or sparsely populated areas, the airplane must remain at least 500 ft. from any person, vessel, vehicle, or structure.

B. Explain to your students that the general rule given in item A.1. overrides the more-specific rules that follow it, particularly item A.2. regarding congested areas.

1. EXAMPLE: If a single-engine airplane experienced an engine failure at exactly 1,000 ft. above the tallest building in a large city, successfully gliding to an emergency landing site would be unlikely.

91.123 Compliance with ATC Clearances and Instructions

A. No one may deviate from ATC instructions or an ATC clearance unless amended instructions or an amended clearance are obtained, an emergency exists, or the deviation is in response to a traffic alert and collision avoidance system (TCAS) resolution advisory.

1. A pilot who deviates from a clearance must notify ATC as soon as possible.
2. Pilots who are given priority by ATC in an emergency must submit a detailed report of the emergency within 48 hr. to the manager of that ATC facility, if requested.
   a. The report may be requested even if the pilot does not deviate from any rule of Part 91.

B. If the meaning of an ATC clearance is uncertain, pilots should immediately ask for clarification from ATC.

91.125 ATC Light Signals

A. ATC light signals have the meaning shown in the following table:

Light Signal	On the Ground	In the Air
Steady green	Cleared for takeoff	Cleared to land
Flashing green	Cleared to taxi	Return for landing *(to be followed by steady green at proper time).*
Steady red	Stop.	Give way to other aircraft and continue circling.
Flashing red	Taxi clear of landing area (runway) in use.	Airport unsafe -- Do not land.
Flashing white	Return to starting point on airport.	Not applicable.
Alternating red and green	General warning signal -- Exercise extreme caution.	General warning signal -- Exercise extreme caution.

91.126 Operating on or in the Vicinity of an Airport in Class G Airspace

A. Airplanes approaching to land at an airport without an operating control tower in Class G airspace must make all turns in the traffic pattern to the left, unless the airport displays light signals or markings indicating right turns.

B. Communications with control towers

1. No person may operate an airplane to, from, through, or on an airport having an operational control tower unless two-way radio communication is established with the control tower.
2. Communications must be established prior to 4 NM from the airport, up to and including 2,500 ft. AGL.
3. Pilots experiencing in-flight radio failure may approach the airport and land if weather conditions are at or above basic VFR weather minimums, visual contact with the tower is maintained, and a clearance to land is received (e.g., a light signal).

91.127 Operating on or in the Vicinity of an Airport in Class E Airspace

A. When approaching to land at an airport in a Class E airspace area, airplanes should make all turns in the traffic pattern to the left unless the airport displays light signals or markings indicating right turns.

1. When departing, pilots must comply with any established traffic pattern for that airport.

B. For a discussion of communications with control towers, see 91.126.

91.129 Operations in Class D Airspace

A. Communications with ATC in Class D airspace

1. Pilots must establish two-way radio communication with the ATC facility providing air traffic services prior to entering the Class D airspace area, and maintain communication while operating within the Class D area.
2. When departing from the primary airport or a satellite airport with an operating control tower, pilots must establish and maintain two-way radio communication with the control tower.
   a. The primary airport is the airport for which the Class D airspace area is designated.
   b. A satellite airport is any other airport within the Class D airspace area.
3. When departing from a satellite airport without an operating control tower, pilots must establish and maintain two-way radio communication with the ATC facility providing air traffic services to the Class D airspace area as soon as practicable after departing.
4. Pilots experiencing in-flight radio failure may enter the Class D airspace and land if weather conditions are at or above basic VFR weather minimums, visual contact with the tower is maintained, and a clearance to land is received (e.g., a light signal).

B. Airplanes approaching to land on a runway served by a visual approach slope indicator must remain at or above the glide slope until a lower altitude is necessary for a safe landing.

1. Advise your students, however, that they are not prohibited from making normal bracketing maneuvers above or below the glide slope for the purpose of remaining on the glide slope.

C. When approaching to land, airplanes should make left turns in the traffic pattern unless directed otherwise by the tower.

D. Departing airplanes must comply with any departure procedures established for that airport by the FAA.

E. A pilot may not, at any airport with an operating control tower, operate his/her airplane on a runway or taxiway, or take off or land, unless an appropriate clearance is received from ATC.

91.130 Operations in Class C Airspace

A. Pilots must establish two-way radio communication with the appropriate ATC facility before entering Class C airspace and maintain communication with that facility while within the Class C airspace area.

B. When departing from the primary airport (the airport for which the Class C airspace area is designated) or a satellite airport (any other airport within the Class C airspace area) with an operating control tower, two-way radio communication must be established and maintained with the tower and as instructed by ATC while in the Class C airspace area.

   1. When departing from a satellite airport without an operating control tower, two-way radio communication must be established with ATC as soon as practicable after departing.

C. Unless otherwise authorized by the ATC facility having jurisdiction over the Class C airspace area, all aircraft must have a transponder with altitude encoding capability while operating in the Class C airspace area and the airspace above the ceiling and within the lateral boundaries of the Class C airspace area.

91.131 Operations in Class B Airspace

A. All aircraft must have an ATC clearance to operate within a Class B airspace area.

B. If it is necessary to conduct training operations within a Class B airspace area, procedures established for these flights within the Class B airspace area must be followed.

C. All pilots operating within any Class B airspace area must be

   1. At least a private pilot, or
   2. A student pilot who has received flight training on the procedures necessary to operate in that specific Class B airspace area and has received a flight instructor endorsement authorizing solo flight privileges within the past 90 days.

D. However, certain Class B airspace area primary airports require the pilot to hold at least a private pilot certificate to land or take off. These are the busiest airports, such as Atlanta Hartsfield and Chicago O'Hare.

E. All aircraft must have operative two-way radio communications and a transponder with altitude encoding capability (Mode C).

Visual Flight Rules

91.151 Fuel Requirements for Flight in VFR Conditions

A. No pilot may fly VFR during the day unless the airplane has enough fuel to fly to the destination and thereafter for at least 30 min. at normal cruising speed.

B. No pilot may fly VFR at night unless the airplane has enough fuel to fly to the destination and thereafter for at least 45 min. at normal cruising speed.

91.155 Basic VFR Weather Minimums

A. Except as provided in this section and 14 CFR 91.157, no pilot may operate an airplane under VFR when the flight visibility is less, or the distance from clouds is less, than prescribed for the corresponding altitude in the following table.

Cloud Clearance and Visibility Required for VFR

Airspace	Flight Visibility	Distance from Clouds
Class A	Not applicable	Not applicable
Class B	3 SM	Clear of clouds
Class C	3 SM	500 ft. below 1,000 ft. above 2,000 ft. horiz.
Class D	3 SM	500 ft. below 1,000 ft. above 2,000 ft. horiz.
Class E:		
Less than 10,000 ft. MSL	3 SM	500 ft. below 1,000 ft. above 2,000 ft. horiz.
At or above 10,000 ft. MSL	5 SM	500 ft. below 1,000 ft. above 1 SM horiz.

Airspace	Flight Visibility	Distance from Clouds
Class G:		
1,200 ft. or less above the surface (regardless of MSL altitude)		
Day	1 SM	Clear of Clouds
Night, except as provided in B. below	3 SM	500 ft. below 1,000 ft. above 2,000 ft. horiz.
More than 1,200 ft. above the surface but less than 10,000 ft. MSL		
Day	1 SM	500 ft. below 1,000 ft. above 2,000 ft. horiz.
Night	3 SM	500 ft. below 1,000 ft. above 2,000 ft. horiz.
More than 1,200 ft. above the surface and at or above 10,000 ft. MSL	5 SM	1,000 ft. below 1,000 ft. above 1 SM horiz.

B. An airplane may be operated clear of clouds in Class G airspace at night below 1,200 ft. AGL when the visibility is less than 3 SM but not less than 1 SM in an airport traffic pattern and within ½ mi. of the runway.

C. Except when operating under a special VFR clearance, you may not operate your airplane under VFR while beneath the ceiling and within the lateral boundaries of the surface areas of Class B, Class C, Class D, or Class E airspace designated for an airport when the ceiling is less than 1,000 ft.

1. You may not take off, land, or enter the traffic pattern of an airport unless ground visibility is at least 3 SM. If ground visibility is not reported, flight visibility must be at least 3 SM.

D. You can help your students remember exceptions to the “typical” VFR visibility and cloud clearance requirements (i.e., 3 SM, 1,000 ft. above, 500 ft. below, and 2,000 ft. horizontally—most airspace areas have these minimums) by explaining why VFR visibility and cloud clearance requirements are established and why they vary with altitude and airspace.

1. VFR visibility and cloud clearance requirements are established for the purpose of preventing collisions between VFR and IFR aircraft.

   a. This goal is achieved by requiring VFR aircraft to maintain spacing from clouds in airspace areas that contain IFR traffic.

   b. Appropriate spacing from clouds will allow adequate time for pilots to see and avoid each other should an IFR aircraft emerge from a cloud in close proximity to another aircraft that is not in contact with ATC.

2. In Class B airspace, the cloud clearance requirements are to remain clear of clouds because all aircraft in Class B airspace are in contact with ATC.
   a. ATC provides radar traffic separation for all aircraft, both IFR and VFR, so there is no need to be concerned about an IFR aircraft emerging from a cloud in close proximity to other aircraft.
3. Likewise, the cloud clearance requirements are to remain clear of clouds in Class G airspace below 1,200 ft. AGL because aircraft do not operate on IFR flight plans in Class G airspace.
   a. The visibility and cloud clearance requirements increase at night and above 1,200 ft. because of the increased risk of inadvertently flying into a cloud under those conditions.
4. The VFR visibility and cloud clearance requirements increase above 10,000 ft. MSL in Class E and Class G airspace because the 250 kt. speed limit (in effect below 10,000 ft. MSL) no longer applies.
   a. With potentially higher closing speeds, more distance between aircraft is required in order to have sufficient time to see and avoid.

91.157 Special VFR Weather Minimums

A. These special minimums apply to VFR traffic operating within the lateral boundaries of the surface areas of Class B, Class C, Class D, or Class E airspace designated for an airport.

B. Special VFR operations may be conducted only
   1. With an ATC clearance
   2. Clear of clouds
   3. With flight visibility of at least 1 SM

C. To take off or land under VFR, ground visibility must be at least 1 SM.
   1. If ground visibility is not reported, then flight visibility must be at least 1 SM.

D. Operation under special VFR at night is prohibited unless both the pilot and the aircraft are IFR rated and equipped.

E. Solo student pilots may not operate under special VFR (FAR 61.89 (6)).

Subpart C -- Equipment, Instrument, and Certificate Requirements

91.205 Powered Civil Aircraft with Standard Category U.S. Airworthiness Certificates: Instrument and Equipment Requirements

A. No person may operate a powered civil aircraft with a standard category U.S. airworthiness certificate without the specified operable instruments and equipment.

B. Required equipment: VFR - day
   1. Airspeed indicator
   2. Altimeter
   3. Magnetic direction indicator (compass)
   4. Tachometer for each engine
   5. Oil pressure gauge for each engine using a pressure system

6. Temperature gauge for each liquid-cooled engine
7. Oil temperature gauge for each air-cooled engine
8. Manifold pressure gauge for each altitude engine
9. Fuel gauge indicating the quantity of fuel in each tank
10. Landing gear position indicator, if the aircraft has a retractable landing gear
11. For small airplanes certificated after March 11, 1996, an approved anticollision light system
12. Approved flotation gear for each occupant and one pyrotechnic signaling device if the aircraft is operated for hire over water beyond power-off gliding distance from shore
13. Approved safety belt with approved metal-to-metal latching device for each occupant who is 2 yr. of age or older
14. For small civil airplanes manufactured after July 18, 1978, an approved shoulder harness for each front seat
15. An emergency locator transmitter (ELT), if required by FAR 91.207
16. For normal, utility, and acrobatic category airplanes with a seating configuration, excluding pilot seats, of nine or less, manufactured after December 12, 1986, a shoulder harness for each seat in the airplane

C. Required equipment: VFR - night

1. All equipment listed in B., above.
2. Approved position (navigation) lights
3. Approved aviation red or white anticollision light system on all U.S.-registered civil aircraft
4. If the aircraft is operated for hire, one electric landing light
5. An adequate source of electricity for all electrical and radio equipment
6. A set of spare fuses or three spare fuses for each kind required that are accessible to the pilot in flight

91.207 Emergency Locator Transmitters

A. ELT batteries must be replaced after 1 cumulative hr. of use or after 50% of their useful life (or charge, if rechargeable) expires.

B. The expiration date for batteries used in an ELT must be legibly marked on the outside of the transmitter.

C. The ELT must be inspected every 12 calendar months for

1. Proper installation
2. Battery corrosion
3. Operation of the controls and crash sensor
4. Sufficient signal radiated from its antenna

91.209 Aircraft Lights

A. During the period from sunset to sunrise, no person may operate an aircraft unless it has lighted position (navigation) lights.

B. A pilot may not park or move an aircraft in, or in dangerous proximity to, a night flight operations area of an airport unless the aircraft

1. Is clearly illuminated,
2. Has lighted position lights, or
3. Is in an area marked by obstruction lights.

C. If an airplane is equipped with an anticollision light system (i.e., rotating beacon and/or strobe lights), the system must be in operation at all times while the airplane is being operated.

1. However, the anticollision light system may be turned off if the pilot in command determines that it would be in the interest of safety to do so, given the operating conditions.
2. For example, atmospheric conditions such as clouds or fog (particularly when they are encountered at night) can scatter the light from the strobe/beacon, leading to disorientation.

91.213 Inoperative Instruments and Equipment

A. No person may take off in an aircraft with inoperative instruments or equipment installed unless

1. An approved minimum equipment list (MEL) exists for that specific aircraft. Note that the MEL is a list of equipment that does NOT have to be operable.
   a. The MEL also lists the different flight limitations placed upon the aircraft when that equipment is inoperative; e.g., you cannot fly at night if the landing light is out.
2. The aircraft has within it a letter of authorization, issued by the FAA FSDO in the area where the operator is based, authorizing operation of the aircraft under the MEL. The MEL and authorization letter constitute an STC (supplemental type certificate) for the aircraft.

B. The approved MEL must

1. Be prepared in accordance with specified limitations
2. Provide how the aircraft is to be operated with the instruments and equipment in an inoperative condition

C. The aircraft records must include an entry describing the inoperative instruments and equipment.

D. The aircraft must be operated under all applicable conditions and limitations contained in the MEL and the letter of authorization.

E. The following instruments and equipment may NOT be included in an MEL:

1. Instruments and equipment that are specifically or otherwise required by the airworthiness requirements under which the aircraft is type-certificated and which are essential to the safe operation of the aircraft
2. Instruments and equipment required by an Airworthiness Directive
3. Instruments and equipment required for operations by the FARs

F. Except as described above, a pilot may take off in a light, piston-driven airplane with inoperative equipment and no MEL under any of the following conditions:

1. An FAA Master MEL (MMEL) has not been developed by the FAA, and the inoperative equipment is not required by the aircraft manufacturer's equipment list, any other FARs, ADs, etc.
2. An FAA MMEL exists, and the inoperative equipment is not required by the MMEL, the aircraft manufacturer’s equipment list, any other FARs, ADs, etc.

3. The inoperative equipment is removed, or deactivated and placarded “inoperative,” and you or an appropriate maintenance person determines that the inoperative equipment does not constitute a hazard to the flight.
   a. Under these conditions, the aircraft is deemed to be in a “properly altered condition” by the FAA.

G. Special flight permits (from the FAA) are possible under FAR 21 when the requirements previously noted cannot be met.

Subpart E -- Maintenance, Preventive Maintenance, and Alterations

91.409 Inspections

A. Annual inspections are good through the last day of the 12th calendar month after the previous annual inspection.
   1. An annual inspection must be performed by a certified mechanic (A & P) who also has an inspection authorization (IA).

B. For commercial operations, an inspection is also required every 100 hr.
   1. The 100 hr. may not be exceeded by more than 10 hr. if necessary to reach a place at which an inspection can be performed.
   2. The next inspection, however, is due 200 hr. from the prior inspection; e.g., if the inspection is done at 105 hr., the next inspection is due in 95 hr.
   3. If you have an inspection done prior to 100 hr., you cannot add the time remaining before 100 hr. to the timetable for the next inspection.

91.417 Maintenance Records

A. Each owner or operator shall keep the following records:
   1. Alteration or rebuilding records
   2. 100-hr. inspections
   3. Annual inspections
   4. Progressive and other required inspections

B. The records must be kept for each aircraft (airframe), engine, propeller, and appliance.

C. Each record shall include a description of the work performed, the date of completion, and the signature and certificate number of the person performing the work.

3.4 PART 141: PILOT SCHOOLS

I. Part 141 addresses the certification, privileges, limitations, and operating rules of FAA-approved pilot schools. Additionally, Part 141 outlines the required curriculum for an approved certification course to obtain each pilot and instructor certificate and rating.

A. If you are an instructor at an FAA-approved school, you should be familiar with Part 141 because it is the official source for information about the specific requirements to obtain each certificate and rating under this part of the regulations.
   1. Tell your students that the advantage of training under Part 141 is that most certificates and ratings can, in theory, be obtained with fewer total flight hours than when training under Part 61.
   2. To help your students make the best choice between these training options, you should also be familiar with the differences between training under Part 61 and Part 141 for the various certificates and ratings that your school offers.

II. 141.79 Flight Training

A. Only a flight instructor who has the ratings and the minimum qualifications specified in the FAA-approved training course outline may give a student flight training that is to be credited in an approved course of training.

1. A training course outline (TCO) is a summary of the elements of an FAA-approved course of training intended for the purpose of obtaining a certificate or rating.
2. Once a pilot school's TCO for a given certificate or rating has been approved, all training conducted within that course must conform to the standards set forth in the TCO.
    a. For example, most TCOs will specify that only a CFII may provide flight instruction for an approved instrument rating course.

B. No student pilot may begin a solo practice flight in a Part 141 course unless that flight has been approved by a flight instructor who is present at the airport.

C. Each chief instructor and assistant chief instructor must complete an approved syllabus of training, or a flight instructor refresher course, at least once every 12 calendar months.

D. Each flight instructor who is assigned to a flight training course must

1. Prior to receiving initial authorization to train students in the course,
    a. Accomplish a review of and receive a briefing on the standards and objectives of the course, and
    b. Accomplish an initial proficiency check in each make and model of aircraft in which the instructor will provide flight training in that training course.
2. Every 12 calendar months following the initial authorization to provide training in the course, accomplish a recurrent proficiency check in one of the aircraft in which that instructor provides flight training.

III. 141.81 Ground Training

A. Except as outlined in item B. below, each instructor who is assigned to a ground training course must hold a flight or ground instructor certificate with the appropriate rating for that course of training (e.g., an instructor must hold either a CFII certificate or an IGI certificate in order to provide ground instruction in an instrument rating certification course).

B. A person who does not hold a flight or ground instructor certificate with the appropriate rating for a course of training may provide ground instruction in that course of training, provided

1. The chief instructor finds the person qualified to give the training, and
2. The training is given while under the supervision of the chief instructor or the assistant chief instructor, who is on the premises while the training is given.

C. An instructor may not provide ground training in an approved course until that instructor has been briefed on the objectives and standards of the course.

IV. 141.85 Chief Instructor Responsibilities

A. The chief instructor is responsible for

1. Certifying each student's training record, graduation certificate, stage checks, and end-of-course test reports; and providing the recommendations for course completion and application for the certificate or rating.
2. Ensuring that each CFI and ground instructor passes an initial proficiency check before that instructor is allowed to provide training in the school's approved courses, and ensuring that each instructor thereafter passes a recurrent proficiency check every 12 calendar months after the month in which the initial test was accomplished.

3. Ensuring that each student accomplishes the required stage checks and end-of-course tests in accordance with the school's approved training course.
4. Maintaining training techniques, procedures, and standards for the school that are acceptable to the FAA.

B. The chief instructor or an assistant chief instructor must be available at the pilot school or available by telephone, radio, or other means during the time that training is being given for an approved course.

C. The chief instructor may delegate authority for conducting stage checks, end-of-course tests, and flight instructor proficiency checks to an assistant chief instructor or a check instructor.

V. **141.101 Training Records**

A. Each pilot school must maintain a current and accurate record of the participation of each student enrolled in an approved course of training that includes the following information:

1. The date of enrollment.
2. A chronological log of the student's course attendance; subjects and flight operations covered in the student's training; and the names and grades of any tests taken by the student.
3. The date on which the student was graduated from the course, terminated training, or transferred to another school.

B. The student's pilot logbook will NOT suffice for the records required to be maintained while conducting training in an approved course.

1. Many commercially-available Part 141 syllabi include a folder or other form of training record that complies with the requirements outlined in item V.A. above.

C. When a student graduates, terminates training, or transfers to another school, the student's record must be certified to that effect by the chief instructor.

D. Pilot schools must retain each student record for at least 1 year following the date of the student's graduation, termination of enrollment, or transfer to another school.

E. Pilot schools must provide a copy of the student's training record upon request by the student.

VI. **Appendix A - Recreational Pilot Certification Course**

A. The requirements to obtain a recreational pilot certificate under Part 141 are summarized in Appendix A to Part 141.

1. We have not listed the requirements here because of the very small number of individuals who seek recreational pilot certificates.

VII. **Appendix B - Private Pilot Certification Course** (Airplane Single Engine Land)

A. Before enrolling in the flight portion of a private pilot certification course, a person must hold a student or recreational pilot certificate.

B. The course must include at least 35 hr. of ground training that covers the aeronautical knowledge areas outlined in FAR 61.105 (b) (listed in Module 3.2, item VI.D.).

C. The course must include at least 35 hr. of flight training on the areas of operation listed in FAR 61.107 (b) (1) (listed in Module 3.2, item VI.G.), which consists of at least

1. 20 hr. of flight training from a certificated flight instructor (CFI), including at least
   a. 3 hr. of cross-country.

   b. 3 hr. at night, including
      i. One cross-country flight of over 100 NM total distance.
      ii. 10 takeoffs and 10 landings to a full stop at an airport.
   c. 3 hr. of instrument training.
   d. 3 hr. of training in preparation for the private pilot practical test within 60 days prior to that test.

2. 5 hr. of solo flight time, including at least
   a. One solo cross-country flight of at least 100 NM total distance, with landings at a minimum of three points and with one segment of the flight consisting of a straight-line distance of at least 50 NM between the takeoff and landing locations.
   b. Three solo takeoffs and landings to a full stop (with each landing involving a flight in the traffic pattern) at an airport with an operating control tower.

D. Each student must demonstrate satisfactory proficiency prior to receiving an endorsement to operate an airplane in solo flight.

E. Each student enrolled in a private pilot certification course must satisfactorily complete the stage checks and end-of-course tests in accordance with the approved training course.

VIII. **Appendix D - Commercial Pilot Certification Course** (Airplane Single Engine Land)

A. Before enrolling in the flight portion of a commercial pilot certification course, a person must hold at least a private pilot certificate and either
   1. Hold an instrument rating, or,
   2. Be concurrently enrolled in an instrument rating course and pass the instrument rating practical test prior to completing the commercial pilot certification course.

B. The course must include at least 35 hr. of ground training that covers the aeronautical knowledge areas outlined in 14 CFR 61.125 (b) (listed in Module 3.2, item VII.D.).

C. The course must include at least 120 hr. of flight training on the areas of operation listed in 14 CFR 61.127 (b) (1) (listed in Module 3.2, item VII.H.), which consists of at least
   1. 55 hr. of flight training from a certificated flight instructor (CFI), including at least
      a. 5 hr. of instrument training.
      b. 10 hr. of training in a single-engine airplane that has retractable landing gear, flaps, and a controllable pitch propeller, or is turbine powered.
      c. One cross-country flight of at least 2 hr. in a single-engine airplane in day-VFR conditions, consisting of a total straight-line distance of more than 100 NM from the original point of departure
      d. One cross-country flight of at least 2 hr. in a single-engine airplane in night-VFR conditions, consisting of a straight-line distance of more than 100 NM from the original point of departure
      e. 3 hr. of training in preparation for the commercial pilot practical test within 60 days prior to that test.
   2. 10 hr. of solo flight time, including at least
      a. One cross-country flight with landings at a minimum of three points, and one segment of the flight consisting of a straight-line distance of at least 250 NM
         i. In Hawaii, the longest segment need have only a straight-line distance of at least 150 NM.
      b. 5 hr. in night-VFR conditions with 10 takeoffs and 10 landings (with each landing involving a flight in the traffic pattern) at an airport with an operating control tower

D. Each student must demonstrate satisfactory proficiency prior to receiving an endorsement to operate an airplane in solo flight.

E. Each student enrolled in a commercial pilot certification course must satisfactorily complete the stage checks and end-of-course tests in accordance with the approved training course.

IX. **Appendix F - Flight Instructor Certification Course** (Airplane Single Engine)

A. Before enrolling in the flight portion of a flight instructor or additional flight instructor rating certification course, a person must hold at least a commercial pilot certificate with an instrument rating or an airline transport pilot certificate.

B. The course must include at least 40 hr. of ground training if it is for the initial issuance of a flight instructor certificate, or 20 hr. of training if the course is for an additional instructor rating.

1. The ground training must cover the aeronautical knowledge areas outlined in 14 CFR 61.185 (a) (listed in Module 3.2, item VIII.E.).
2. A student who has satisfactorily completed 2 years of study on the principles of education at a college or university may be credited with no more than 20 hr. of the required ground training.

C. The course must include at least 25 hr. of flight training on the areas of operation listed in 14 CFR 61.187 (b) (1) (listed in Module 3.2, item VIII.G.).

D. Each student enrolled in a flight instructor certification course must satisfactorily complete the stage checks and end-of-course tests in accordance with the approved training course.

E. Each student must also receive a logbook endorsement from a flight instructor who certifies that the student received ground and flight training on stall awareness, spin entry, spins, and spin recovery procedures, and that the student has demonstrated instructional proficiency in these subjects.

GLEIM FLIGHT INSTRUCTOR REFRESHER COURSE
LESSON 4
THE NATIONAL AIRSPACE SYSTEM AND AIRPORT OPERATIONS

4.1 AIRSPACE CLASSIFICATIONS: GENERAL

I. The federal airspace system is divided into six class designations.

A. Explain to your students that the objectives of this airspace classification are to

1. Simplify the airspace designations
2. Increase standardization of equipment and pilot requirements for operations in various classes of airspace
3. Promote pilot understanding of ATC services available
4. Achieve international commonality and satisfy our responsibilities as a member state of the International Civil Aviation Organization (ICAO)

B. This airspace classification conforms with the ICAO airspace system.

1. Note that the airspace designated as Class F in the ICAO system is not used in the U.S.

C. The diagram below and the table on the next page show the airspace classification and summarize the classifications with regard to the requirements and services available in each class of airspace.

1. Use a similar diagram with your students when discussing airspace classifications and how they relate to the corresponding chart symbols.

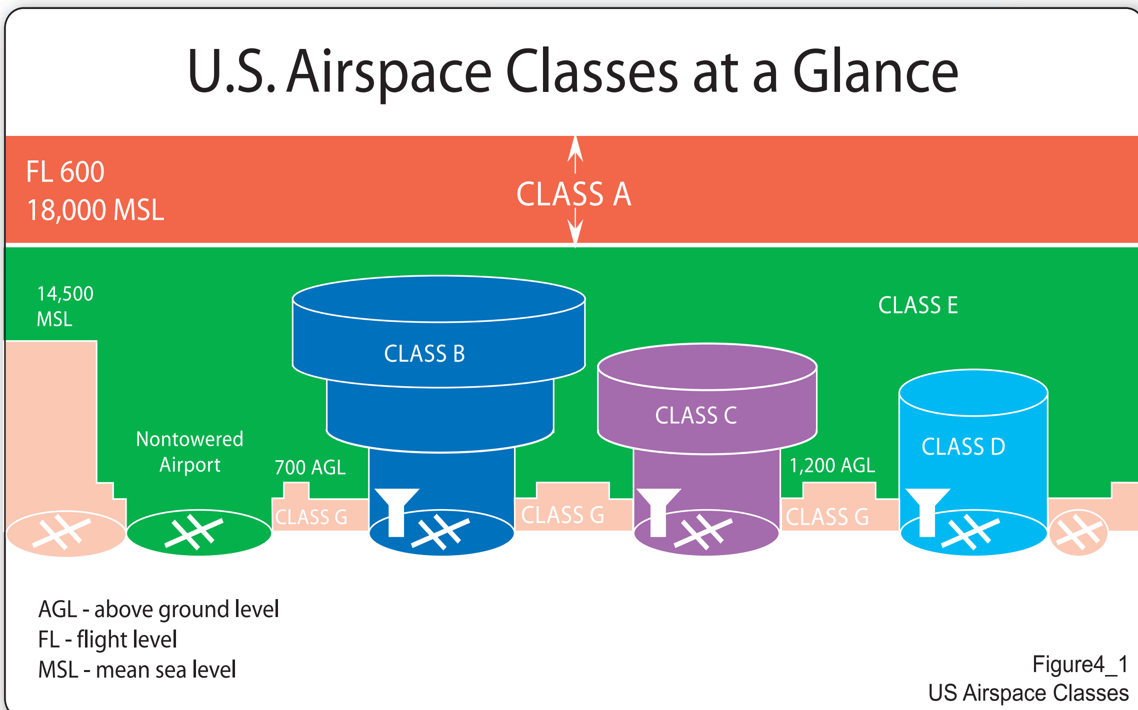


Figure4_1
US Airspace Classes

Airspace Features	Class A	Class B	Class C	Class D	Class E	Class G
Operations Permitted	IFR	IFR and VFR	IFR and VFR	IFR and VFR	IFR and VFR	IFR and VFR
Entry Requirements	ATC clearance	ATC clearance	ATC clearance for IFR All require radio contact.	ATC clearance for IFR All require radio contact.	ATC clearance for IFR All IFR require radio contact.	None
Minimum Pilot Qualifications	Instrument rating	Private or student certificate	Student certificate	Student certificate	Student certificate	Student certificate
Two-way Radio Communications	Yes	Yes	Yes	Yes	Yes for IFR	No
VFR Minimum Visibility	N/A	3 statute miles	3 statute miles	3 statute miles	3 statute miles[1]	1 statute mile[2]
VFR Minimum Distance from Clouds	N/A	Clear of clouds	500 ft. below, 1,000 ft. above, and 2,000 ft. horizontal	500 ft. below, 1,000 ft. above, and 2,000 ft. horizontal	500 ft. below,[1] 1,000 ft. above, and 2,000 ft. horizontal	Clear of clouds
Aircraft Separation	All	All	IFR, SVFR, and runway operations	IFR, SVFR, and runway operations	IFR and SVFR	None
Conflict Resolution	N/A	N/A	Between IFR and VFR ops	No	No	No
Traffic Advisories	N/A	N/A	Yes	Workload permitting	Workload permitting	Workload permitting
Safety Advisories	Yes	Yes	Yes	Yes	Yes	Yes
Differs from ICAO	No	Yes[3]	Yes[4]	Yes for VFR[4]	No	Yes for VFR[5]

[1]Different visibility minima and distance from cloud requirements exist for operations above 10,000 ft. MSL.

[2]Different visibility minima and distance from cloud requirements exist for night operations, operations above 10,000 ft. MSL, and operations below 1,200 ft. AGL.

[3]ICAO does not have speed restrictions in this class -- U.S. speed limit is 250 KIAS.

[4]ICAO requires an ATC clearance for VFR.

[5]ICAO requires 3 statute miles visibility.

4.2 DISCUSSION OF AIRSPACE

I. The following discussion of airspace classes (Modules 4.3 through 4.9) will focus on teaching techniques that are appropriate for student pilots.

   A. These modules therefore focus on VFR flight operations.

II. Below is a brief summary of pilot and equipment requirements for IFR operations:

   A. For IFR operations in all airspace classes, the pilot in command must hold an instrument rating or an airline transport pilot certificate.

   B. For IFR operations in controlled airspace (i.e., airspace other than Class G airspace), including special-use airspace, all aircraft must be operated on an IFR flight plan and have two-way radio communications.

   C. For IFR operations in Class A, B, and C airspace, all aircraft must have an operable Mode C transponder.

4.3 CLASS A AIRSPACE

I. **Definition**. Class A airspace exists from 18,000 ft. MSL up to and including flight level (FL) 600, including the airspace over the waters within 12 NM of the coast of the 48 contiguous states and Alaska.

II. **Operating Rules and Pilot/Equipment Requirements**. Explain to your students that all pilots must operate their aircraft under IFR in Class A airspace.

A. Thus, the pilot in command (PIC) of an airplane operating in Class A airspace must have an instrument rating.

B. VFR flights are prohibited in Class A airspace.

4.4 CLASS B AIRSPACE

I. **Definition**. Class B airspace exists from the surface to 10,000 ft. MSL surrounding the nation's busiest airports in terms of IFR operations or number of passengers.

A. Explain that the configuration of each Class B airspace area is individually tailored and consists of a surface area and two or more layers.

1. Most students grasp the analogy if you explain that Class B airspace areas resemble upside-down wedding cakes.

II. **Operating Rules and Pilot/Equipment Requirements for VFR Operations**

A. Explain that the VFR visibility and cloud clearance requirements for operations in Class B airspace are 3 SM and "clear of clouds."

1. Additional cloud clearance is not needed because ATC provides radar separation for all traffic, both VFR and IFR.

B. You must emphasize to your students that, regardless of weather conditions, an ATC clearance is required prior to operating within Class B airspace.

1. All aircraft that are cleared to operate in Class B airspace receive radar separation services within that Class B airspace.

C. A student pilot may not operate within Class B airspace unless (s)he has received training (ground and flight) specific to that Class B area and has also received an instructor endorsement authorizing solo operations within that Class B area within the past 90 days.

1. In order to land at a Class B primary airport, a student pilot must have received instruction at that airport and been given an instructor endorsement authorizing solo operations at that airport.
2. Note that there are some Class B primary airports (listed in Appendix D to Part 91) at which student pilot solo operations are prohibited.

D. To enter Class B airspace, an airplane must be equipped with

1. An operable two-way radio capable of communicating with ATC on appropriate frequencies for that area.
2. An operable Mode C transponder.

E. Explain to your students that the airspace within 30 NM of the primary airport for which the Class B airspace was established, from the surface to 10,000 ft. MSL, is commonly called the **Mode C veil**. An operable Mode C transponder is required within the Mode C veil, even in those areas that are not actually within Class B airspace due to variations in the lateral and vertical boundaries.

1. However, an airplane that was not originally certificated with an engine-driven electrical system, or which has not been certificated with such a system installed, may conduct operations within a Mode C veil, provided the pilot remains outside of Class A, B, or C airspace and below the ceiling of Class B or C airspace designated for an airport or 10,000 ft. MSL, whichever is lower.

III. **VFR Flight Procedures**

A. Teach your students to obtain a **clearance** from ATC prior to entering Class B airspace by using the appropriate frequency shown on the chart, which is selected based on their position.

1. Emphasize that obtaining a clearance is distinctly different from merely establishing radio communications.
2. A clearance has been received when ATC uses the phrase, "(aircraft call sign) is cleared to enter the (name of airport/facility) Class Bravo airspace."
3. Your students must understand that a clearance is required whether they are landing at the primary airport of the Class B airspace, they are landing at a satellite airport, or they intend to transition through the airspace without landing.

B. When departing from the primary airport of the Class B airspace, pilots should inform clearance delivery that they are departing under VFR and provide their intended route of flight and requested cruising altitude.

C. If your students plan to transition through a Class B airspace area, you should encourage them, to the extent possible, to transition through established VFR corridors or VFR transition routes.

1. These routes are shown on VFR Terminal Area Charts.

4.5 CLASS C AIRSPACE

I. **Definition.** Class C airspace exists from the surface to 4,000 ft. above the airport elevation (charted in MSL) surrounding airports that have an operating control tower, are serviced by a radar approach control, and handle a certain number of IFR operations or passengers.

A. Explain that the configuration of each Class C airspace area is individually tailored and consists of a surface area and a shelf area.

1. The **surface area** is normally circular, has a 5 NM radius, and extends from the surface to 4,000 ft. above the airport elevation.
2. The **shelf area** is normally circular, has a 10 NM radius, and extends from 1,200 ft. to 4,000 ft. above the airport elevation.

B. Generally, the airspace between 10 and 20 NM from the airport for which the Class C airspace was established is designated as the **outer area**.

1. Explain that the outer area extends from the lower limits of radar/radio coverage up to the ceiling of the approach control's airspace.
2. Pilots are encouraged, but not required, to contact ATC and participate in radar services when within the outer area.

   a. Make sure that your students understand that the outer area is not part of the Class C airspace.

II. Operating Rules and Equipment Requirements for VFR Operations

A. The VFR visibility and cloud clearance requirements for operations in Class C airspace are 3 SM and a distance from clouds of 1,000 ft. above, 500 ft. below, and 2,000 ft. horizontally.

B. Explain that two-way radio communications must be established and maintained with ATC prior to entering Class C airspace.

1. No clearance is required for VFR operations.
2. Radar separation services are provided to aircraft within the Class C airspace and the outer area after two-way radio communications and radar contact are established.

C. To enter Class C airspace, an airplane must be equipped with

1. An operable two-way radio capable of communicating with ATC on appropriate frequencies for that area.
2. An operable Mode C transponder.
   a. A Mode C transponder is also required within the lateral limits of Class C airspace up to 10,000 ft. MSL.

III. VFR Flight Procedures

A. Explain that pilots must establish and maintain two-way radio communications with ATC prior to entering Class C airspace by using the appropriate frequency shown on the chart, which is selected based on their position.

1. Emphasize to your students that, while a clearance is not required to enter Class C airspace, merely calling ATC does not constitute establishment of two-way radio communications.
   a. The controller must respond using the aircraft's call sign.
      i. If the response received is, "(aircraft call sign), standby," or, "(aircraft call sign), proceed with request," radio communications have been established and your student may enter the Class C airspace.
      ii. If the response received is, "Aircraft calling (facility name), standby," radio communications have **not** been established, and your student must remain outside the Class C airspace.
2. Explain that ATC also has the option of requiring aircraft to remain clear of the Class C airspace if the workload prevents immediate provision of Class C services.
   a. Tell your students that if ATC's response is, "(aircraft call sign), remain outside the Class Charlie airspace and standby," communications have been established, but they may **not** enter the Class C airspace.
      i. ATC will normally contact them again as soon as Class C services can be provided.

B. Teach your students to establish and maintain communications with ATC when departing from an airport situated within a Class C surface area as follows:

1. When departing from the primary airport of the Class C airspace, pilots should inform clearance delivery that they are departing under VFR and provide their intended route of flight and requested cruising altitude.
   a. They must then change to the tower and approach/departure control frequencies as directed by ATC and maintain two-way radio communications until leaving the Class C airspace.

2. When departing from a satellite airport with an operating control tower, pilots must establish and maintain two-way radio communications initially with that airport's control tower.
   a. Thereafter, they must maintain communications as instructed by ATC until leaving the Class C airspace.
3. When departing from a satellite airport without an operating control tower, pilots must establish two-way radio communications with ATC as soon as practical after departure.
   a. Communications must be maintained until leaving the Class C airspace.

C. Explain to your students that if they plan to transition through a Class C airspace area without landing, they may wish to climb above the ceiling of the airspace if weather conditions permit.
   1. Operating above the airspace makes communication with ATC unnecessary.
   2. The airplane will still need to have an operable Mode C transponder, however.

4.6 CLASS D AIRSPACE

I. **Definition.** Class D airspace exists from the surface to 2,500 ft. above the airport elevation (charted in MSL) surrounding airports that have an operating control tower and weather reporting capability.

A. Explain that the configuration of each Class D airspace area is individually tailored and consists of a surface area only.
   1. The surface area is normally circular, has a 4 NM radius, and extends from the surface to 2,500 ft. above the airport elevation.

B. For airports with part-time towers, the airspace is classified as Class D only when the tower is in operation.

II. **Operating Rules and Equipment Requirements for VFR Operations**

A. The VFR visibility and cloud clearance requirements for operations in Class D airspace are 3 SM and a distance from clouds of 1,000 ft. above, 500 ft. below, and 2,000 ft. horizontally.

B. Explain that two-way radio communications must be established and maintained with ATC prior to entering Class D airspace.
   1. No clearance is required for VFR operations.

C. To enter Class D airspace, an airplane must be equipped with
   1. An operable two-way radio capable of communicating with ATC on the appropriate frequency.

III. **VFR Flight Procedures**

A. Pilots must establish and maintain two-way radio communications with ATC prior to entering Class D airspace.
   1. Explain to your students that communications must be established with ATC whether they are landing at the primary airport of the Class D airspace, they are landing at a satellite airport, or they intend to transition through the airspace without landing.
      a. Pilots should contact the control tower on the published frequency and give their position, altitude, destination, and any requests.
   2. Emphasize that, while a clearance is not required to enter Class D airspace, merely calling ATC does not constitute establishment of two-way radio communications.
      a. See Module 4.5, item III.A., for a discussion of establishing radio communications.

B. When departing from an airport situated within a Class D surface area, pilots must establish and maintain communications with ATC as follows:

1. When departing from the primary airport of the Class D airspace, pilots must establish two-way radio communications with the tower and maintain them until leaving the Class D airspace.
2. When departing from a satellite airport with an operating control tower, pilots must establish and maintain two-way radio communications initially with that airport's control tower.
   a. Thereafter, they must maintain communications as instructed by ATC until leaving the Class D airspace.
3. When departing from a satellite airport without an operating control tower, pilots must establish two-way radio communications with the primary airport's control tower as soon as practical after departure.
   a. Communications must be maintained until leaving the Class D airspace.

C. Explain to your students that if they plan to transition through a Class D airspace area without landing, they may wish to climb above the ceiling of the airspace if weather conditions permit.

1. Operating above the airspace makes communication with ATC unnecessary.

4.7 CLASS E AIRSPACE

I. **Definition.** Class E airspace is controlled airspace that is not Class A, Class B, Class C, or Class D airspace.

A. Explain that Class E airspace extends upward from the surface or the designated floor to the overlying controlled airspace.

1. Therefore, Class E airspace will not exist above 17,999 ft. MSL because Class A airspace begins at 18,000 ft. MSL.

B. Your students will be more comfortable with the concept of Class E airspace if you explain that its purpose is to provide separation for IFR traffic.

1. Therefore, its effect on normal VFR operations (i.e., not special VFR operations) is restricted to visibility and cloud clearance requirements.

II. **Operating Rules and Equipment Requirements for VFR Operations**

A. The minimum VFR visibility and cloud clearance requirements for operations in Class E airspace vary depending on the aircraft's altitude.

1. Below 10,000 ft. MSL: 3 SM visibility and a distance from clouds of 1,000 ft. above, 500 ft. below, and 2,000 ft. horizontally.
2. At or above 10,000 ft. MSL: 5 SM visibility and a distance from clouds of 1,000 ft. above and below, and 1 SM horizontally.
   a. Explain that the VFR visibility and cloud clearance requirements increase above 10,000 ft. MSL because the 250-kt. speed limit for aircraft below 10,000 ft. MSL no longer applies.
   b. Therefore, more space is required between aircraft with higher closing speeds in order to avoid a collision in the same amount of time.

B. There are no communications or clearance requirements for VFR operations in Class E airspace.

C. There are no specific equipment requirements for VFR operations in Class E airspace.

III. **VFR Flight Procedures**

A. No special communications or clearance requirements exist for VFR operations in Class E airspace.

B. Emphasize to your students that, unless they request VFR Flight Following from a radar facility, they will not be in contact with ATC when operating in Class E airspace.

1. Therefore, they must be extra vigilant in scanning for other traffic.

4.8 CLASS G AIRSPACE

I. **Definition.** Class G airspace is all airspace which has not been designated as Class A, Class B, Class C, Class D, or Class E airspace (i.e., airspace that has not been designated as controlled airspace).

A. Explain that Class G airspace is commonly called “uncontrolled” airspace.

II. **Operating Rules and Equipment Requirements for VFR Operations**

A. The VFR visibility and cloud clearance requirements for operations in Class G airspace vary depending on the aircraft’s altitude and the time of day.

1. At or below 1,200 ft. AGL:

a. Day: 1 SM visibility and “clear of clouds.”

b. Night: 3 SM visibility and a distance from clouds of 1,000 ft. above, 500 ft. below, and 2,000 ft. horizontally.

i. When in an airport traffic pattern in Class G airspace at night below 1,200 ft. AGL, airplanes may operate “clear of clouds” with at least 1 SM visibility, provided they remain within 1/2 mile of the runway.

2. Below 10,000 ft. MSL but above 1,200 ft. AGL:

a. Day: 1 SM visibility and a distance from clouds of 1,000 ft. above, 500 ft. below, and 2,000 ft. horizontally.

b. Night: 3 SM visibility and a distance from clouds of 1,000 ft. above, 500 ft. below, and 2,000 ft. horizontally.

3. At or above 10,000 ft. MSL and above 1,200 ft. AGL:

a. Day or Night: 5 SM visibility and a distance from clouds of 1,000 ft. above and below, and 1 SM horizontally.

b. As with Class E airspace, the VFR visibility and cloud clearance requirements increase above 10,000 ft. MSL because the 250-kt. speed limit no longer applies.

B. Explain that the VFR visibility and cloud clearance requirements in Class G airspace increase at night and at altitudes above 1,200 ft. AGL because of the increased possibility of inadvertently entering a cloud under those conditions.

1. At night, it is difficult to detect clouds against a darkened background.

a. Accordingly, it is prudent to remain a greater distance from clouds in order to avoid accidentally drifting into them.

2. At higher altitudes (i.e., greater than traffic pattern altitude), marginal visibility conditions seem "worse" than at lower altitudes.
    a. With visibility less than 5 SM, a pilot can get the sensation of being in a "hole," where it is possible to see the ground beneath the airplane, but not ahead of it.
        i. This sensation increases as altitude increases.
    b. Under these conditions, there is little contrast between clouds and the background.
        i. For this reason, it is more likely for a pilot to inadvertently enter a cloud at higher altitudes; therefore, greater distances from clouds are required.

C. There are no communications or clearance requirements for VFR operations in Class G airspace.

D. There are no specific equipment requirements for VFR operations in Class G airspace.

E. If a control tower is operating at an airport in Class G airspace, a pilot must establish two-way radio communications with the controller prior to 4 NM from the airport, up to and including 2,500 AGL.

III. **VFR Flight Procedures**

A. No special communications or clearance requirements exist for VFR operations in Class G airspace.

B. Explain to your students that, because it is uncontrolled, they will not be in contact with ATC when operating in Class G airspace.

1. Therefore, they must be extra vigilant in scanning for other traffic, particularly when the visibility is less than 3 SM.

4.9 SPECIAL USE AIRSPACE

I. **Definition.** Special use airspace areas contain activities which must be confined due to their nature.

A. Explain that each special use airspace area has defined lateral and vertical dimensions, and is individually tailored to the activities for which it was designated.

1. The lateral dimensions of each area are depicted directly on VFR charts, while the vertical dimensions are found in the special use airspace table located on the edge of the chart.

B. The operations of non-participating aircraft may be prohibited or restricted within these areas.

II. **Operating Rules and Equipment Requirements for VFR Operations**

A. Standard Class E VFR visibility and cloud clearance minimum requirements, depending on altitude, apply to operations in special use airspace.

B. There are no specific equipment requirements for VFR operations in special use airspace areas.

C. Explain to your students that there are 5 major types of special use airspace. Each has different operating rules.

1. **Prohibited areas** consist of defined lateral dimensions and extend upward from the surface to a specified vertical limit. They are designed to keep aircraft out of areas that are important to national security.
    a. The flight of aircraft is prohibited within prohibited areas.

2. **Restricted areas** consist of defined lateral and vertical dimensions. They are designed to contain unusual, often invisible, hazards to aircraft, such as aerial gunnery or guided missiles.
   a. The flight of aircraft, while not wholly prohibited, is subject to restrictions.
      i. Emphasize to your students that they must obtain authorization from the controlling agency in order to enter an active restricted area.

3. **Warning areas** consist of defined lateral and vertical dimensions extending from 3 NM outward from the coast of the United States. They contain activities that are similar to those found in restricted areas, and are intended to warn non-participating aircraft of the hazards.
   a. The flight of aircraft is neither prohibited nor restricted because warning areas are typically located in international airspace.
      i. Explain that the FAA cannot regulate the flight of aircraft in international airspace, so no **legal** restrictions on flying in a warning area exist.
         o Warning areas are still very hazardous, however, and must be avoided when they are active.

4. **Military operations areas (MOAs)** consist of defined lateral and vertical dimensions. They are designed to separate certain military training activities from IFR traffic.
   a. Because VFR flight is neither prohibited nor restricted, no special communications or clearance requirements exist.
   b. However, MOAs contain a high volume of military activities which require acrobatic or abrupt flight maneuvers, so pilots must be especially vigilant in scanning for other traffic.

5. **Alert areas** consist of defined lateral and vertical dimensions. They are intended to inform non-participating pilots to a high volume of pilot-training or an unusual type of aerial activity (e.g., skydiving) in a concentrated area.
   a. Because the flight of aircraft is neither prohibited nor restricted, no special communications or clearance requirements exist.
   b. However, alert areas contain a high volume of flight activity, so pilots must be especially vigilant in scanning for other traffic.

III. VFR Flight Procedures

A. Emphasize to your students that VFR flight procedures for special use airspace vary depending on the type of airspace.
   1. Flight of any kind is prohibited within a prohibited area.
   2. Pilots must obtain an ATC clearance to fly through an active restricted area.
      a. A clearance is obtained by contacting the appropriate controlling agency, which is listed in the special use airspace table found on the edge of the chart.
      b. A clearance has been received when ATC uses the phrase, “(aircraft call sign) is cleared to enter the (restricted area restricted area name).”
      c. No clearance is required to fly through an inactive restricted area.
         i. However, the only way to be sure of the status of a restricted area is to contact the controlling agency.
            o Pilots should not rely on the special use airspace table.
         ii. Therefore, recommend to your students that they always contact the controlling agency before entering a restricted area.

3. No special communications or clearance requirements exist to fly through a warning area, an MOA, or an alert area.
   a. Each of these special use airspace areas has its own unique hazards, however, and care must be taken when operating within them.
      i. Active warning areas should be avoided altogether.
      ii. MOAs and alert areas require pilots to be extra vigilant in scanning for other traffic.

4.10 AIRPORT SIGNS

I. Emphasize to your students that a thorough understanding of airport signs is very important to safe ground operations.

A. Familiarity with airport signs helps pilots to maintain positional awareness while taxiing, allows pilots to use airport diagrams more effectively, and helps to prevent runway incursion incidents.

II. The figures below illustrate some of the more important airport signs. Explain each of them to your students, and point out examples of each sign at your airport.

A. **Runway holding position sign** (illustration A). These signs are located at the holding position on taxiways that intersect a runway and on runways that intersect another runway. They are placed adjacent to the **runway holding position markings** (four yellow lines, two solid, and two broken) which are painted on the taxiway or runway.

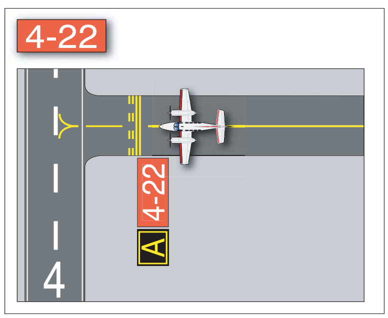


Illustration A

1. Explain that the numbers on the sign correspond to the locations of the runway's thresholds.
   a. Illustration A indicates that the threshold for runway 4 is to the left, and the threshold for runway 22 is to the right.

B. **Runway approach area holding position sign** (illustration B). At some airports, it is necessary for aircraft to hold at a point on a taxiway which is not immediately adjacent to the runway so as to prevent them from interfering with takeoff and landing operations on that runway.

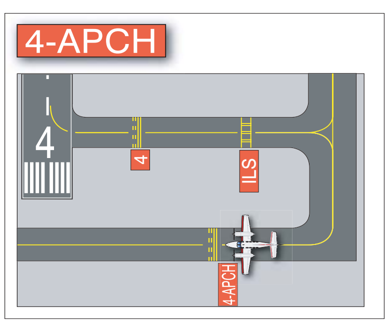


Illustration B

1. Explain that illustration B indicates that aircraft must hold at this point in order to protect the approach path to runway 4 or the departure path from runway 22.

C. **ILS critical area holding position sign** (illustration C). At some airports, when the instrument landing system (ILS) is being used, it is necessary for aircraft to hold at a point on a taxiway that is different from the standard holding position. This point is usually farther from the runway than the standard holding position.

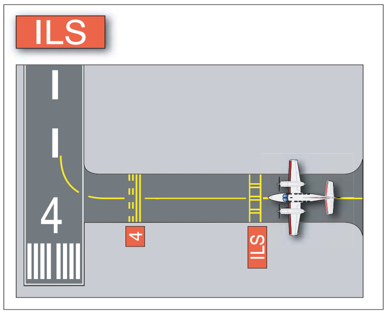


Illustration C

1. Explain that holding at this point is necessary to prevent aircraft on the ground from interfering with the ILS signal.

D. **No entry sign** (illustration D). These signs are used to prohibit aircraft from entering an area. They may be found on a taxiway that is intended to be used in only one direction, at an intersection of a vehicle roadway with a runway or taxiway, or adjacent to areas not intended for aircraft which may easily be mistaken for aircraft movement areas.

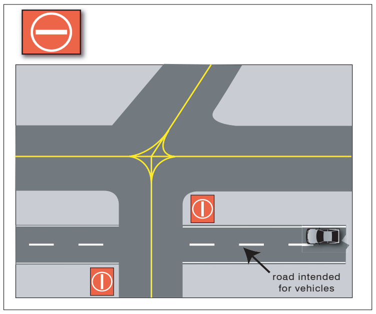


Illustration D

E. **Taxiway location sign** (illustration E). These signs identify the taxiway on which an aircraft is currently located.

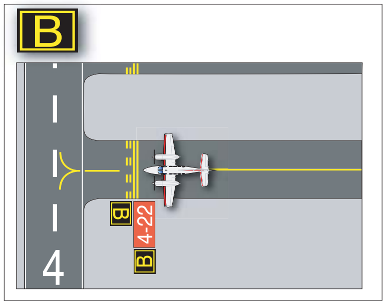


Illustration E

1. Explain that illustration E indicates that the aircraft is located on taxiway bravo.

F. **Runway location sign** (illustration F). These signs identify the runway on which an aircraft is currently located.

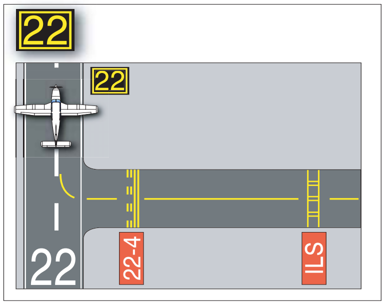


Illustration F

1. Explain that illustration F indicates that the aircraft is currently located on runway 22.

G. **Runway boundary sign** (illustration G). These signs are visible to aircraft leaving a runway. They are intended to provide another visual cue as to when the aircraft is clear of the runway.

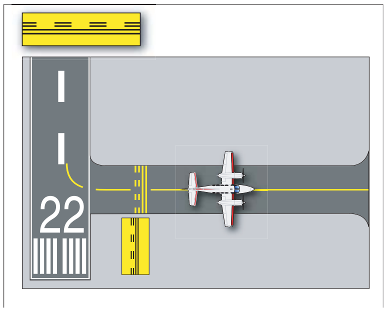


Illustration G

1. Explain that these signs are placed adjacent to the **runway holding position markings** which are painted on the taxiway, and consist of a graphic representation of these markings.

H. **ILS critical area boundary sign** (illustration H). These signs are visible to aircraft leaving an ILS critical area. They are intended to provide another visual cue as to when the aircraft is clear of the critical area.

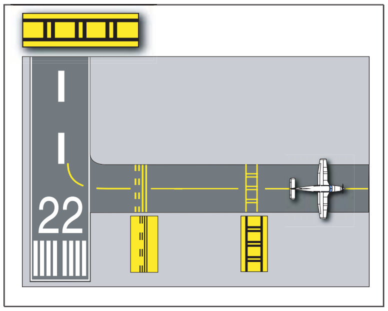


Illustration H

1. Explain that these signs are placed adjacent to the **ILS critical area holding position markings** which are painted on the taxiway, and consist of a graphic representation of these markings.

I. **Destination sign** (illustration I). These signs show the taxi route to a particular destination on the airport surface. They may provide directions to runways, ramps, terminals, military areas, FBOs, etc.

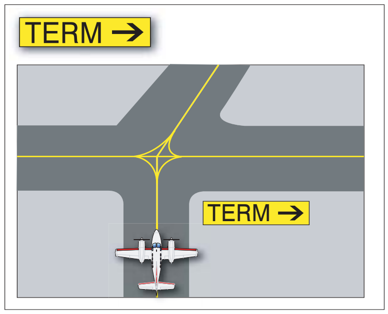


Illustration I

1. Explain that illustration I indicates that aircraft following the taxi route to the terminal should turn right.

J. **Direction signs** (illustrations J and K). These signs identify the intersecting runways or taxiways leading out of an intersection on the airport surface.

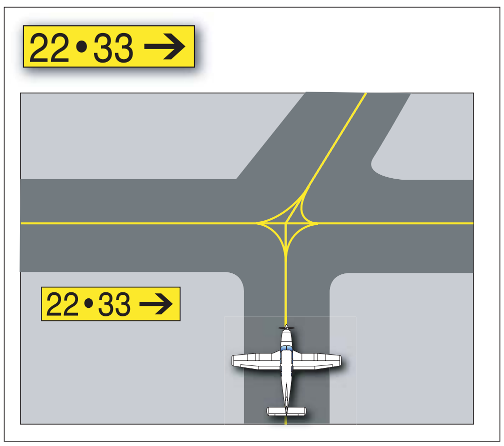


Illustration J

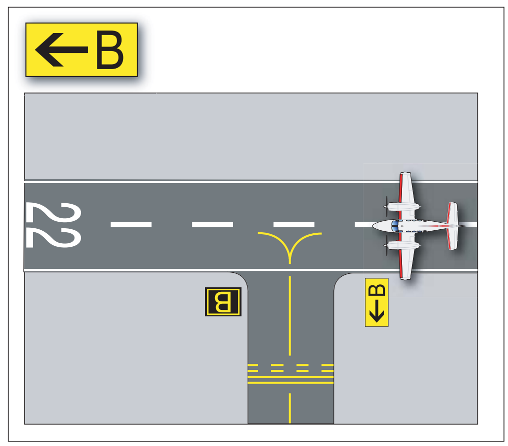


Illustration K

1. Explain that illustration J indicates that runways 22 and 23 are to the right, and that illustration K indicates that taxiway bravo is to the left.

K. **Runway distance remaining sign** (illustration L). These signs indicate how much runway distance remains in thousands of feet. This information is relevant to LAHSO as well as to normal operations.

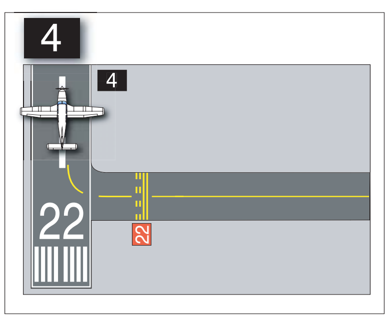


Illustration L

1. Explain that illustration L indicates that 4,000 feet of runway remain.

L. **Land and hold short point sign** (illustration M). These signs indicate a land and hold short point that is at a location other than an intersecting runway. Explain that aircraft may be instructed to hold short of these points during LAHSO.

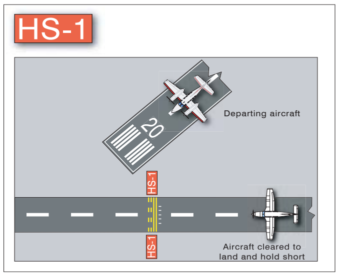


Illustration M

M. **Taxiway ending sign** (illustration N). These signs indicate that a taxiway ends at that point (i.e., there is a "dead end").

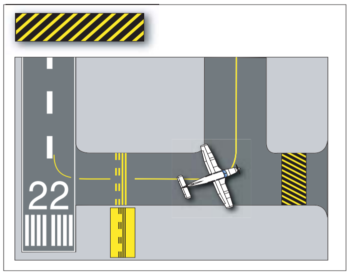


Illustration N

III. Refer your students to chapter 2 in the *Aeronautical Information Manual* or to Chapter 3 in Gleim's *Pilot Handbook* for more information about airport signs and markings.

4.11 RUNWAY AND TAXIWAY MARKINGS

I. Runway Markings

A. Point out to your students that most runway markings are white.

1. Explain that a runway is marked in accordance with its present usage as a visual runway, nonprecision instrument runway, or precision instrument runway. Pilots can use any of these runways for takeoff and landing.

B. Discuss the following runway markings with your students.

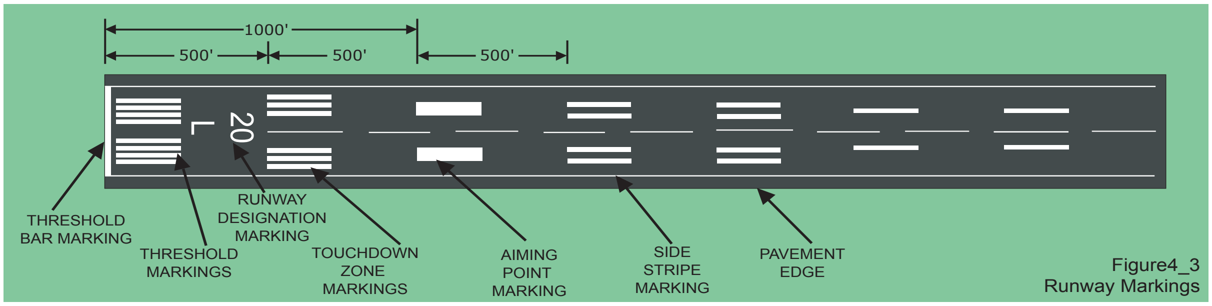


Figure4_3
Runway Markings

1. **Designation marking**. Runway numbers are determined based on the magnetic heading of an aircraft taking off or landing on that runway, and letters differentiate between left (L), right (R), or center (C) parallel runways, if applicable.

2. **Centerline marking**. The runway centerline is a dashed line.
3. **Threshold bar marking**. A threshold bar marking is a solid white line that is used to mark the beginning of the runway surface that is available for landing.
   a. A **displaced threshold** is a threshold that is not at the beginning of the paved runway.

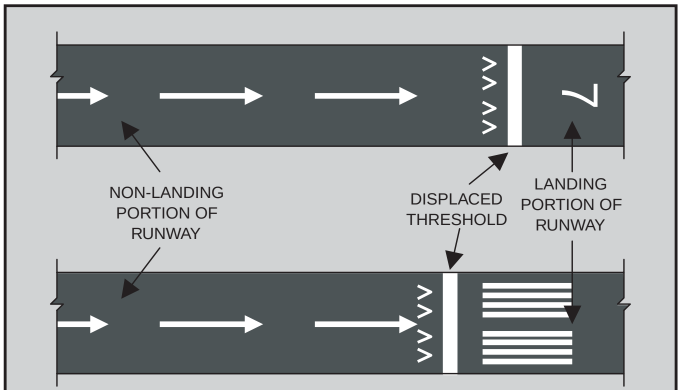
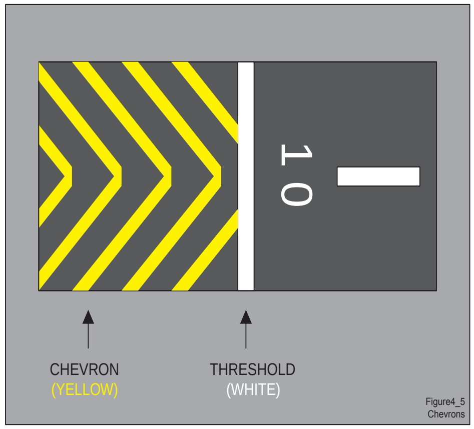


Figure4_4 - Displaced Threshold

      i. The paved area before the displaced runway threshold (marked by arrows) is available for taxiing, the takeoff of aircraft, and a landing rollout from the opposite direction, but not for landing in the direction of the runway in question.
      ii. White arrows are located along the centerline in the area between the beginning of the runway and the displaced threshold.
      iii. White arrow heads are located across the width of the runway just prior to the threshold bar.

4. **Threshold markings**. Threshold markings consist of several longitudinal stripes grouped on either side of the runway centerline prior to the designation marking. These stripes help pilots to identify the runway threshold area.
5. **Aiming point markings**. Aiming point markings serve as a visual aiming point during landing. Aiming point markings are two broad white stripes located on each side of the runway centerline approximately 1,000 ft. from the landing threshold.
6. **Touchdown zone markings**. Touchdown zone markings help pilots to identify the touchdown zone for landing operations and are coded to provide distance information in 500-ft. increments.
7. **Side stripe marking**. Runway side stripes are continuous white stripes located on each side of the runway to provide a visual contrast between the runway and the abutting terrain or shoulders.
8. **Chevrons**. Chevrons are used to show pavement areas (e.g., blast pads, stopways, etc.) aligned with the runway that are unusable for landing, takeoff, and taxiing. Chevrons are yellow.



9. **Closed or temporarily closed runway**.
   a. A permanently closed runway has all runway lighting disconnected, all runway markings obliterated, and yellow crosses placed at each end of the runway and at 1,000-ft. intervals.
   b. A temporarily closed runway is marked by yellow crosses placed only at each end of the runway.
      i. Alternatively, raised lighted yellow crosses are placed at each end of the runway.
      ii. A visual indication may not be present depending on the reason for the closure, the duration of the closure, the airport configuration, and the existence (and operating hours) of a control tower.

II. Taxiway Markings

A. Point out to your students that most taxiway markings are yellow. You should discuss the following taxiway markings with your students.

1. **Taxiway centerline marking**. The taxiway centerline is a single continuous yellow line that indicates the desired taxi path.
   a. Explain that, ideally, the airplane should be kept centered over this line during taxiing to ensure wingtip clearance.
2. **Taxiway edge markings**. These markings are used to define the edge of the taxiway when the taxiway edge does not correspond with the edge of the pavement. There are two types of taxiway edge markings:
   a. A continuous double yellow line should not be crossed.
   b. A dashed double yellow line indicates the edge of the taxiway where the adjoining pavement is also intended for use by aircraft, i.e., a parking ramp.
3. **Closed or temporarily closed taxiway**
   a. A permanently closed taxiway has all lighting disconnected and yellow crosses placed at each entrance of the taxiway and possibly at 1,000-ft. intervals.
   b. A temporarily closed taxiway is usually treated as a hazardous area that no part of the airplane may enter and is blocked with barricades.
      i. Alternatively, a yellow cross may be installed at each entrance to the taxiway.

III. Holding Position Markings

A. Point out to your students that holding position markings are yellow and typically have red-and-white holding position signs mounted next to them.

1. **Runway holding position markings**. These markings indicate where an aircraft should stop. They consist of four yellow lines, two solid and two dashed, extending across the width of the taxiway or runway. See detail 1 in the next figure.
   a. Explain that the solid lines are always on the side where the aircraft is to hold.
   b. On taxiways, these markings identify the location where aircraft are to stop when they do not have clearance to proceed onto the runway at a controlled airport or when there is not adequate separation from other aircraft at an uncontrolled airport.
      i. Emphasize that, when exiting the runway, an aircraft is not clear of the runway until all parts of the airplane have crossed the holding position marking.

2. **Holding position markings for ILS critical areas**. These markings consist of two solid yellow lines extended across the width of the taxiway that are spaced 2 ft. apart and connected by pairs of perpendicular lines, as shown in the next figure (see detail 2).
   a. Explain to your students that, when the ILS critical area is being protected, they must stop at the ILS holding position unless they have a clearance from ATC to proceed.

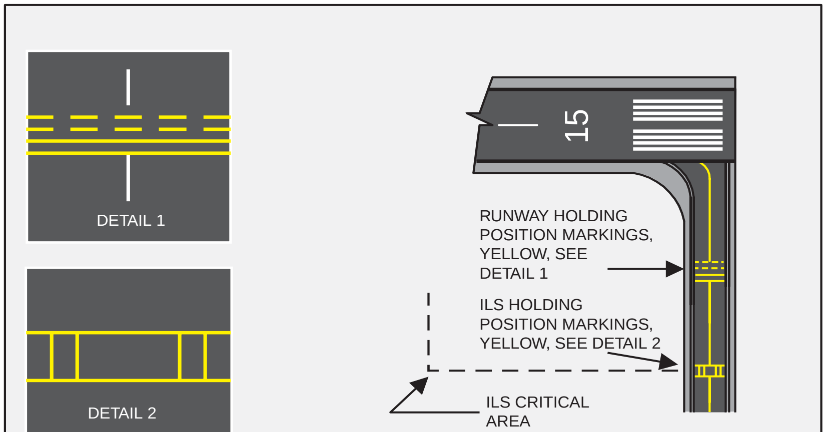


Figure4_6
Holding Position Marking

3. **Holding position markings for taxiway/taxiway intersections**. These markings consist of one dashed line extending across the width of the taxiway.

B. **Other Markings**

1. **Vehicle roadway markings**. These markings are used to define a pathway for vehicle operations in areas that are also intended for aircraft.
   a. Vehicle roadway markings consist of a white solid line to delineate each edge of the roadway and a dashed line to separate lanes within the edges of the roadway.
      i. An alternative to solid edge lines is the use of zipper markings (staggered lines).

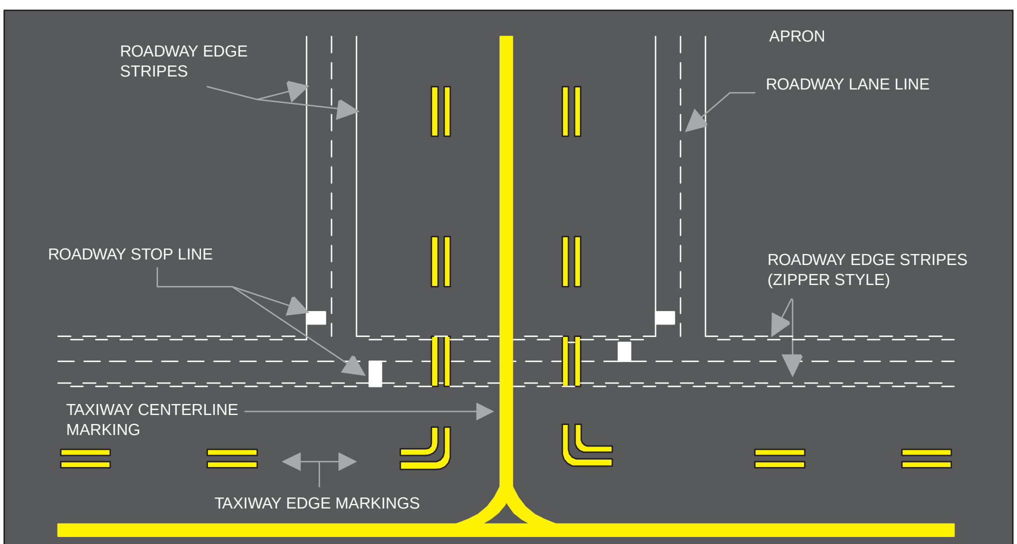
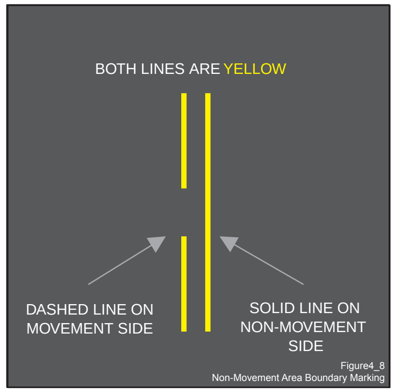


Figure4_7 - Vehicle Roadway Marking

2. **Non-movement area boundary markings**. These markings delineate movement areas, i.e., areas on the airport surface that are under air traffic control.
    a. Non-movement area boundary markings consist of two yellow lines, one solid and one dashed.
        i. Explain that the solid line is located on the non-movement area side, while the dashed line is located on the movement area side.



4.12 AIRPORT LIGHTING

I. **Runway Lights**.

A. Point out to your students that runway lights are primarily white. You should discuss the following runway lights with your students:

1. **Runway edge lights**. These lights are used to outline the edges of the runway during periods of darkness or restricted visibility.
    a. Emphasize that runway edge lights are white, except on instrument runways, where yellow replaces white on the last 2,000 ft. or half the runway length, whichever is less, to form a caution zone for landings.
2. **Runway threshold lights**. These lights (sometimes called runway end lights) mark the ends of the runway. Explain that they appear
    a. Green to aircraft on approach (i.e., they indicate the landing threshold)
    b. Red to aircraft taking off or on the landing rollout (i.e., they indicate the end of the runway)
3. **In-runway lighting**. This lighting is installed on some precision approach runways to facilitate landing under adverse visibility conditions.
    a. **Touchdown zone lighting** consists of two rows of flush white lights on either side of the centerline in the runway touchdown zone.
    b. **Runway centerline lighting** consists of semi-flush centerline lights spaced at 50-ft. intervals along the runway centerline.
        i. When viewed from the landing threshold, the runway centerline lights are white until the last 3,000 ft. of the runway.
            o Then they alternate red and white until 1,000 ft. from the end of the runway.
            o For the last 1,000 ft. of the runway, all lights are red.

c. **Taxiway lead-off lights** are semi-flush lights defining the curved path of travel from the runway centerline to a point on an exit taxiway to expedite movement of aircraft from the runway.

i. These lights alternate green and yellow from the runway centerline to the runway holding position or ILS critical area boundary, as appropriate.

4. **Runway end identifier lights (REILs)**. These lights are installed at many airports to provide rapid and positive identification of the approach end of a particular runway.

a. The REIL system consists of a pair of synchronized flashing lights located laterally on each side of the runway threshold.

II. Taxiway Lights

A. Point out to your students that taxiway lights are primarily blue and green. Discuss the following taxiway lights with your students:

1. **Taxiway edge lights**. These lights are blue and outline the edges of taxiways during periods of darkness or restricted visibility conditions.
2. **Taxiway centerline lights**. These green lights are used on some airports to mark the taxiway centerline during low visibility conditions.
3. **Clearance bar lights**. These lights consist of three in-pavement steady-burning yellow lights located at holding positions on taxiways to help pilots identify the holding position in low visibility conditions.
4. **Runway guard lights**. These lights are installed at taxiway/runway intersections and are primarily used to help pilots identify taxiway/runway intersections during low visibility conditions.

a. Runway guard lights consist of either a pair of elevated flashing yellow lights installed on either side of the taxiway or a row of in-pavement yellow lights installed across the entire taxiway at the runway holding position marking.

5. **Stop bar lights**. When installed, these lights are used to confirm the ATC clearance to enter or cross the active runway in low visibility conditions.

a. Stop bars consist of a row of red, unidirectional, steady-burning in-pavement lights installed across the entire taxiway at the runway holding position, and elevated steady-burning red lights on each side.

b. A controlled stop bar is operated in conjunction with the taxiway centerline lead-on lights, which extend from the stop bar toward the runway.

c. Following an ATC clearance to proceed, the stop bar is turned off and the lead-on lights are turned on. These lights are automatically reset by a sensor or timer.

i. Impress upon your students that they should never cross a red illuminated stop bar, even if an ATC clearance has been given to proceed onto or across the runway.

ii. If, after crossing the stop bar, the lead-on lights are inadvertently extinguished, pilots should stop, hold their position, and contact ATC for further instructions.

III. **Pilot-controlled lighting (PCL)**

A. Explain to your students that PCL is available at many airports where there is no operating control tower or FSS. PCL is normally activated on the airport's CTAF.

B. The control system consists of a three-step control responsive to seven, five, and/or three microphone clicks.

1. Suggest to your students that they always initially key the microphone seven times to assure that all controlled lights are at maximum available intensity.
2. They may then lower the intensity (if applicable) by keying five or three times.

C. Explain that, due to the close proximity of airports using the same frequency, radio-controlled lighting receivers may be set at a low sensitivity requiring the airplane to be relatively close. The lights will usually remain on for a period of 15 min. unless they are reset by re-keying the microphone.

IV. **Airport Rotating Beacons**

A. Explain that the primary purpose of rotating beacons is to identify the location of airports at night.

1. Rotating beacons usually flash 24 to 30 times per minute.
2. White and green alternating flashes indicate a lighted land airport for civil use.
3. Two whites and a green indicate a military airport.

B. Inform your students that operation of the green and white rotating beacon in Class B, C, D, and E surface areas during the day often indicates that the weather is below basic VFR weather minimums, meaning that conditions are

1. Less than 3 SM visibility, and/or
2. Ceiling less than 1,000 ft.

a. Emphasize, however, that there is no regulatory requirement for daylight operation of the rotating beacon.

4.13 SIGNIFICANCE OF NOTICES TO AIRMEN (NOTAMS) TO AIRPORT OPERATIONS

I. Explain to your students that the National Notice to Airmen (NOTAM) System disseminates time-critical aeronautical information which is either of a temporary nature or not sufficiently known in advance to permit publication on aeronautical charts or in other operational publications.

A. Emphasize that NOTAM information is aeronautical information that could affect the decision to make a flight.

II. Explain that, of the three types of NOTAMs, local NOTAMs and distant NOTAMs are the most likely to contain information relevant to airport operations. Flight Data Center (FDC) NOTAMs may also impact airport operations.

A. Information regarding runway closures, airport closures, and changes in the status of navigational aids is found in distant NOTAMs.

1. These NOTAMs can be obtained from any flight service station briefer.

B. Information regarding taxiway closures, rotating beacon outages, and airport lighting that does not affect instrument approach criteria will be found in local NOTAMs.

1. These NOTAMs can be obtained from ATC or from the flight service station in whose area the airport is located.

C. FDC NOTAMs are regulatory in nature and include information such as amendments to published Instrument Approach Procedures and other current aeronautical charts.

1. FDC NOTAMs are also used to advertise temporary flight restrictions, which sometimes impact airport operations.

4.14 LAND AND HOLD SHORT OPERATIONS (LAHSO)

I. Explain that LAHSO is an acronym for “Land And Hold Short Operations.” These operations, in which a landing aircraft is required to hold short of an intersecting runway, taxiway, or other point on the landing runway, take place at some large, busy airports in order to increase capacity.

II. LAHSO is an ATC procedure that requires pilot participation in order to balance the needs for increased airport capacity and system efficiency with the requirement for safety. LAHSO can be done safely provided pilots and controllers are knowledgeable and understand their responsibilities.

III. Explain to your students that, at an airport with an operating control tower, ATC may clear them to land and hold short.

A. Pilots may accept such a clearance provided they have determined that their aircraft can safely land and stop within the Available Landing Distance (ALD).

1. ALD data are published in the special notices section of the *Airport/Facility Directory* (*A/FD*).
2. Controllers will also provide ALD data upon request.
3. Pilots who are not familiar with LAHSO should not participate in the program.

IV. **Emphasize that, as pilot-in-command, your students have the final authority to accept or decline any land and hold short clearance. The safety and operation of the aircraft remain their responsibility. Pilots are expected to decline a LAHSO clearance if they determine that it will compromise safety.**

A. A LAHSO clearance, just as with any other ATC clearance, must be adhered to once accepted, unless an amended clearance is obtained or an emergency occurs.

B. A LAHSO clearance does not eliminate the possibility of a rejected landing (go-around).

4.15 AVOIDING RUNWAY INCURSION

I. Tell your students that the FAA defines **runway incursion** as any occurrence at an airport involving an aircraft, vehicle, person, or object on the ground that creates a collision hazard or results in a loss of separation with an aircraft taking off, intending to take off, landing, or intending to land. Some examples of runway incursions are:

A. At an airport without an operating control tower, a departing aircraft may taxi into position for takeoff without first checking for landing traffic. If an aircraft is on short final when this happens, a go-around will be necessary, or a collision could result.

B. While taxiing at an airport with a complex taxiway layout, a pilot may become confused as to his/her location and inadvertently cross or turn onto a runway that is being used by another aircraft. Depending on the timing of the incursion, the other aircraft may have to abort a takeoff or perform a go-around. **A collision may be unavoidable.**

C. At an airport with an operating control tower, a pilot may misunderstand a clearance (or fail to obtain the correct clearance due to inattention) and cross a runway of which (s)he was instructed to hold short. The pilot could also turn onto the wrong runway when cleared for takeoff. Any aircraft using these runways may have to abort a takeoff or perform a go-around. **Again, a collision may be unavoidable.**

II. Emphasize that runway incursions that are most likely to cause accidents are common at high-volume airports with complex taxiway layouts and multiple parallel or intersecting runways.

A. The vast majority are caused by general aviation pilots who are confused or disoriented, do not understand a controller's instructions, or are not paying attention to their surroundings.

B. The likelihood of an accident increases when the visibility is low.

III. Impress upon your students that the following practices will help them to avoid a runway incursion incident:

A. Read back all runway crossing and/or hold short instructions.

B. Review airport layouts as part of preflight planning, before descending to land, and while taxiing as needed.

C. Know airport signage.

D. Review Notices to Airmen (NOTAMs) for information on runway/taxiway closures and construction areas.

E. Do not hesitate to request progressive taxi instructions from ATC when unsure of the taxi route.

F. Check for traffic before crossing any runway or entering a taxiway.

G. Turn on the aircraft's lights and rotating beacon or strobe lights while taxiing.

H. When landing, clear the active runway as quickly as possible; then wait for taxi instructions before further movement.

I. Study and use proper radio phraseology as described in the *Aeronautical Information Manual*, Chapter 4, or Gleim's ***Pilot Handbook***, Chapter 3, in order to respond to and understand ground control instructions.

J. Write down complex taxi instructions at unfamiliar airports.

GLEIM FLIGHT INSTRUCTOR REFRESHER COURSE
LESSON 5
AVIATION WEATHER AND WEATHER-RELATED DECISION MAKING

5.1 GENERAL

I. You should emphasize to your students that weather is relevant to each flight they make. A pilot should never begin a flight without considering weather.

A. 14 CFR Sec. 91.103 states that, for any flight conducted under IFR or not in the vicinity of an airport, the pilot is required to become familiar with appropriate weather reports and forecasts.

1. The FAA expects each pilot to obtain an official weather briefing from an appropriate source (e.g., a Flight Service Station or DUATS) prior to such flights.

B. Even for local flights, it is appropriate to consider local weather reports and forecasts, because even a session of touch and goes can be significantly affected by rapidly changing weather.

1. For example, on a day with widely scattered thunderstorms, use a series of radar images or METAR observations to show your students that a local airport can rapidly alternate several times between clear skies and heavy rain over the course of a few hours.

a. Explain to your students that if they fail to consider the possibility of rapidly changing weather and closely monitor the weather during each circuit around the traffic pattern, they could be caught beneath or inside a thunderstorm.

II. This lesson will help you to explain sources of weather information, aviation weather products, special weather hazards, and weather-related decision-making.

5.2 WEATHER INFORMATION

I. **Sources of Weather Information:** Aviation weather services are a joint effort of the National Weather Service (NWS), the Federal Aviation Administration (FAA), the Department of Defense (DOD) Weather Service, and other aviation-oriented groups and individuals.

To help your students better-understand aviation weather services, it is useful for you as a CFI to know how weather products are created and distributed. The following organizations are responsible for collecting weather data and creating the weather reports and forecasts that are distributed to pilots:

A. **National Oceanic and Atmospheric Administration (NOAA).** NOAA is an agency of the Department of Commerce. Among its six major divisions are the National Environmental Satellite Data and Information Service and the National Weather Service.

1. The **National Environmental Satellite Data and Information Service (NESDIS)** is located in Washington, D.C., and directs the weather satellite program.

2. The **National Weather Service (NWS)** collects and analyzes weather data and uses this data to prepare forecasts on a national, hemispheric, and global scale. The following are descriptions of the NWS facilities tasked with these duties:

a. The **National Center Operations (NCO)** is located in Washington, D.C., and is the focal point of the NWS's weather processing center. Using worldwide weather reports, the NCO prepares weather analysis charts and guidance forecasts for use by NWS offices and others. The majority of the charts are computer generated, but a few are still manually prepared by meteorologists. The winds and temperatures aloft forecast is one example of an NCO product.

b. The **Storm Prediction Center (SPC)**, located in Norman, Oklahoma, is responsible for monitoring and forecasting severe weather over the 48 contiguous states and for developing severe weather forecasting techniques in addition to conducting research. Its products include severe weather (convective) outlooks and severe weather watches.

i. For more information about the Storm Prediction Center, visit their web site at http://www.spc.noaa.gov/

c. The **Aviation Weather Center (AWC)**, located in Kansas City, Missouri, identifies existing or imminent weather hazards, issues warnings and forecasts, and analyzes hazardous weather. The AWC also produces 2-day operational forecasts, aviation area forecasts (FA), and in-flight aviation weather advisories for the 48 contiguous states.

i. Visit the Aviation Weather Center web site at http://www.aviationweather.noaa.gov/

d. The **Tropical Prediction Center (TPC)**, located in Miami, Florida, issues hurricane advisories for the Atlantic, the Caribbean, the Gulf of Mexico, the eastern Pacific, and adjacent land areas. It also conducts hurricane research and develops hurricane forecasting techniques. A similar facility, the Joint Typhoon Warning Center in Honolulu, Hawaii, issues advisories for the central Pacific.

i. Visit the Tropical Prediction Center web site at http://www.nhc.noaa.gov/

B. A **Weather Forecast Office (WFO)**prepares and issues various public, marine, and aviation forecasts and weather warnings for its area of responsibility. These products include terminal aerodrome forecasts (TAF) and transcribed weather broadcasts (TWEB). The Honolulu WFO also issues aviation area forecasts (FA) and in-flight advisories.

C. Because of international flights and a need for worldwide weather forecasts, foreign weather services also have a vital role as sources of weather information.

II. **Preflight and En Route Weather Acquisition:** Your students should be aware that the Federal Aviation Administration (FAA) provides a wide range of weather services at no charge to them as pilots. The following are descriptions of those FAA facilities from which pilots may obtain weather information prior to and during a flight:

A. **Automated Flight Service Station (AFSS).** All Flight Service Stations in the contiguous 48 states are now automated. With about one AFSS per state, these “hub” facilities use improved technology to enhance the pilot weather briefing services that were previously available at non-automated facilities. In addition to other services such as processing flight plans and relaying ATC clearances, AFSSs provide the following preflight/in-flight briefings, transcribed weather briefings, and weather broadcasts:

1. Three types of **In-person and Live Voice Telephone Weather Briefings** are provided:

a. A **standard** weather briefing is normally obtained a few hours prior to a flight and contains all applicable planning information that the AFSS can provide concerning weather and aeronautical information (such as Notices to Airmen [NOTAMs]) that will affect the flight.

b. An **outlook** weather briefing is normally obtained 6 hr. or more prior to a flight and contains general information useful for advance planning only.

c. An **abbreviated** weather briefing is normally limited to some specific information and is obtained to supplement weather information obtained from another source or to update a prior briefing.

2. The **En Route Flight Advisory Service (EFAS)**, or Flight Watch, is a weather information service offered by selected AFSSs on a common low-altitude frequency of 122.0 MHz. Above 18,000 ft., discrete frequencies are used for the service, which is extremely useful for obtaining in-flight weather updates.

3. The **Telephone Information Briefing Service (TIBS)** offers continuous telephone recordings of aviation weather information and special announcements covering at least four areas or routes in the AFSS's service area.
4. The **Transcribed Weather Broadcast (TWEB)** provides continuous aeronautical and meteorological information in a route format over selected VOR and NDB frequencies. At selected locations, telephone access to the TWEB has been provided (TEL-TWEB).
5. The **Hazardous Inflight Weather Advisory Service (HIWAS)** is a continuous broadcast service over selected VORs of in-flight aviation weather advisories, i.e., AIRMETs, SIGMETs, convective SIGMETs, severe weather forecast alerts (AWW), center weather advisories (CWA), and urgent PIREPs (UUA).

B. The following **Air Traffic Control Facilities and Services** provide en route weather services to pilots:

1. The **Air Traffic Control System Command Center (ATCSCC)**, also known as "central flow control," is located in Herndon, Virginia. ATCSCC has the mission of balancing air traffic demand with system capacity. Since weather is the most common reason for air traffic delays and re-routings, the ATCSCC is supported full-time by Air Traffic Control System Command Center Weather Unit Specialists, who disseminate weather information that pertains to national air traffic flow management.
2. An **Air Route Traffic Control Center (ARTCC)** is an en route radar facility that provides air traffic control services to en route aircraft operating under IFR and, as workload permits, under VFR. Center controllers have access to weather information, either from their radar equipment directly or from other sources.
   a. The **Center Weather Service Unit (CWSU)** is a joint agency aviation weather support team located at each ARTCC that provides weather consultation and advice to managers and staff within the ARTCC and other supported FAA facilities. The CWSU, composed of NWS meteorologists and FAA traffic management personnel, provides FAA traffic managers with accurate and timely weather information.
3. **Air Traffic Control Tower (ATCT)** personnel share the responsibility for official weather observations with the NWS at some airports. All ATCTs have access to aviation weather information that they can provide to pilots.
   a. **Automatic Terminal Information Service (ATIS)** is a continuous loop voice recording of current airport weather and other information made by tower personnel that is broadcast over a discrete frequency by some ATCTs. The ATIS frequency is listed on navigation charts and in the *Airport/Facility Directory* (*A/FD*).
      i. ATIS broadcasts normally contain the following:
         - The time of the latest weather observation
         - Ceiling
         - Visibility and obstructions to visibility
         - Temperature and dew point
         - Wind direction (magnetic) and velocity
         - Altimeter setting
         - Remarks, including instrument approach and runway in use

         NOTE: The ceiling and sky condition, visibility, and obstructions may be omitted from the ATIS broadcast if the ceiling is above 5,000 ft. and the visibility is more than 5 mi.

ii. The ATIS information is updated upon receipt of any official weather information, which normally occurs hourly.
   - Advise your students that this means that the information contained in an ATIS broadcast may be up to 1 hour old.
   - Therefore, they should be prepared for the actual wind speed/direction, cloud heights, and runway information to be different from the information contained in the broadcast.

iii. The system is designed so that arriving or departing VFR or IFR traffic can copy the ATIS information, prior to contacting ATC, in order to reduce ATC frequency congestion.
   - Each broadcast is identified by a letter of the alphabet, i.e., "Information Alpha," "Information Bravo," etc.
   - Advise your students that they should indicate to controllers that they have the latest information by using the current ATIS code in their initial transmission (e.g., "...five miles north, landing with Bravo").

C. The **Direct User Access Terminal System (DUATS)** is an FAA-funded, computer-based information system that enables certificated pilots (including student pilots) to obtain their own weather briefings and to file flight plans directly without going through an AFSS. DUATS products also include free color weather graphics.

1. The Data Transformation Corporation (DTC) DUATS web site is at http://www.duat.com. Information and free software for non-Internet access to its service is available at (800) 243-3828. The direct dial number for text-only products not requiring special software is (800) 245-3828.
2. The GTE DUATS web site is at http://www.duats.com. Information and free software for non-Internet access to its service is available at (800) 345-3828. The direct dial number for text-only products not requiring special software is(800) 767-9989.

5.3 AVIATION WEATHER PRODUCTS

I. Aviation Routine Weather Report (METAR)

A. An **aviation routine weather report (METAR)** is a weather observer's (human or automated) interpretation of the weather conditions at a given site and time. The METAR is used by the aviation community and the NWS to determine the weather conditions (VFR, MVFR, or IFR) at an airport, as well as to produce a terminal aerodrome forecast (TAF), if appropriate.

1. Although the METAR code is being adopted worldwide, each country is allowed to make modifications or exceptions to the code for use in that particular country; e.g., the U.S. will report prevailing visibility in statute miles, runway visual range (RVR) values in feet, wind speed in knots, and altimeter setting in inches of mercury. However, temperature and dew point will be reported in degrees Celsius.

B. **Elements**. A METAR report contains the following sequence of elements in the following order:

1. Type of report
2. ICAO station identifier
3. Date and time of report
4. Modifier (as required)
5. Wind
6. Visibility
7. Runway visual range (RVR) (as required)

8. Weather
9. Sky condition
   a. Vertical visibility is reported when the sky is obscured by a surface-based phenomenon.
10. Temperature/dew point
11. Altimeter
12. Remarks (RMK) (as required)

NOTE: The elements in the body of a METAR report are separated by a space, except temperature and dew point, which are separated with a solidus, /. When an element does not occur or cannot be observed, that element is omitted from that particular report.

C. **Example of a METAR report**

METAR KGNV 201953Z 24015KT 3/4SM R28/2400FT +TSRA BKN008 OVC015CB
26/25 A2985 RMK TSB32RAB32

To aid in the discussion, we have divided the report into the 12 elements:

METAR	KGNV	201953Z	________	24015KT	3/4SM	R28/2400FT	+TSRA
1	2	3	4	5	6	7	8

BKN008 OVC015CB	26/25	A2985	RMK TSB32RAB32
9	10	11	12

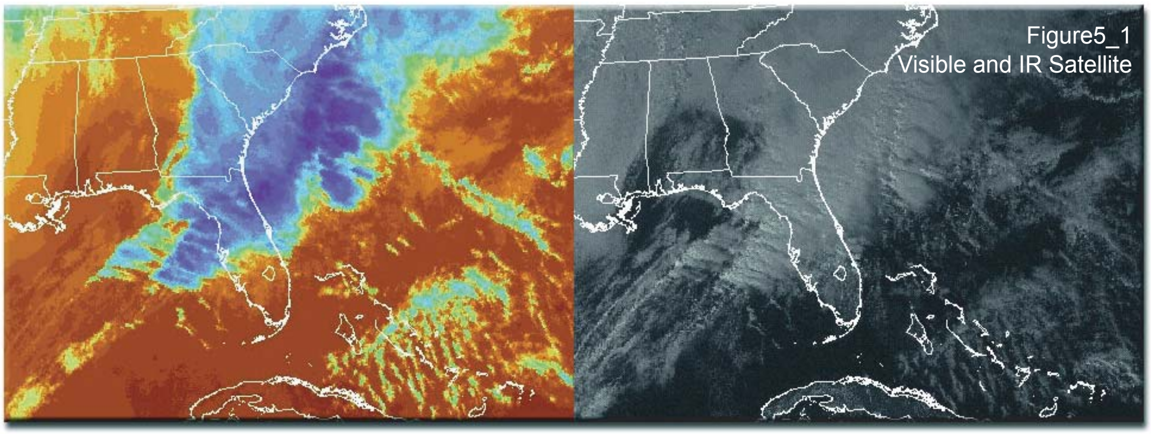
1. Aviation routine weather report
2. Gainesville, FL
3. Observation taken on the 20th day of the month at 1953 UTC (or Zulu)
4. Modifier omitted; i.e., not required for this report
5. Wind 240 true at 15 kt.
6. Visibility 3/4 SM
7. Runway 28, runway visual range 2,400 ft.
8. Thunderstorm with heavy rain
9. Ceiling 800 ft. broken, 1,500 ft. overcast, cumulonimbus clouds
10. Temperature 26C, dew point 25C
11. Altimeter 29.85
12. Remarks: Thunderstorm began at 32 min. past the hour; rain began at 32 min. past the hour.

D. Advise your students that a good way to become proficient at reading METARs is to practice decoding them.

1. The NWS Internet Weather Source provides the most recently observed weather conditions for locations in the U.S. and worldwide.
   a. For U.S. locations, go to http://www.nws.noaa.gov/
   b. On the left side of the page, under the heading “Observations,” select “Surface Weather.”
   c. When the next page opens, select a state. This will display the observing locations in that state.
   d. Next, select a location (town, airport name) to view the latest observation.

2. The observations will include the time, “plain English” data, the coded METAR, maximum and minimum temperatures, precipitation accumulation, and a 24-hour summary.
   a. Your students can practice decoding the coded METARs for several locations and then confirm their interpretations using the “plain English” data shown above the METAR.

II. Satellite Weather Pictures



A. Satellite weather pictures are of either visible or infrared (IR) imagery. They are useful in assessing the development and dissipation of weather over the entire country and coastal regions.

1. A visible picture shows the reflection of sunlight from clouds and the Earth to the satellite sensor.
   a. The greater the reflected sunlight reaching the sensor, the whiter the object is on the picture.
      i. The amount of reflectivity reaching the sensor depends upon the height, thickness, and ability of the object to reflect sunlight.
      ii. Since clouds are much more reflective than the Earth, clouds will usually show up white on the picture, especially thick clouds.
      iii. Thus, the visible picture is primarily used to determine the presence of clouds and the type of cloud from shape and texture.
   b. Useful visible images are only available during the day because sunlight is necessary for illumination.
2. An IR picture shows heat radiation being emitted by the Earth and clouds.
   a. The images show temperature differences between cloud tops and the ground, as well as temperature gradations of cloud tops and along the Earth’s surface.
      i. Ordinarily, cold temperatures are displayed light gray or white.
      ii. High clouds appear whitest.
      iii. However, various computer-generated enhancements are sometimes used to sharply illustrate important temperature contrasts.
   b. IR images are used to determine cloud-top temperatures, which can approximate the height of the cloud.
      i. These images can be useful at night because visible satellite images are only available with sunlight.

B. Two kinds of weather satellites are in use today by the U.S.

1. Geostationary Operational Environmental Satellite (GOES) in geostationary equatorial orbit
2. National Oceanic and Atmospheric Administration (NOAA) satellite in polar orbit

C. NWS satellite pictures are available on the Internet from the following sites:

1. The Aviation Weather Center has various satellite pictures (images) available on its product page at http://aviationweather.gov/awc/aviation_weather_center.html#satellite
   a. Scroll down the page to “CURRENT CONDITIONS.”
   b. The first heading is “Satellite” followed by subheadings for “Infra Red,” “Visible/Fog,” and “Water Vapor” images.
2. The Tropical Prediction Center also has various satellite images at http://www.nhc.noaa.gov/graphics.html
3. GOES imagery and products available at http://www.goes.noaa.gov/

III. Radar Summary Chart

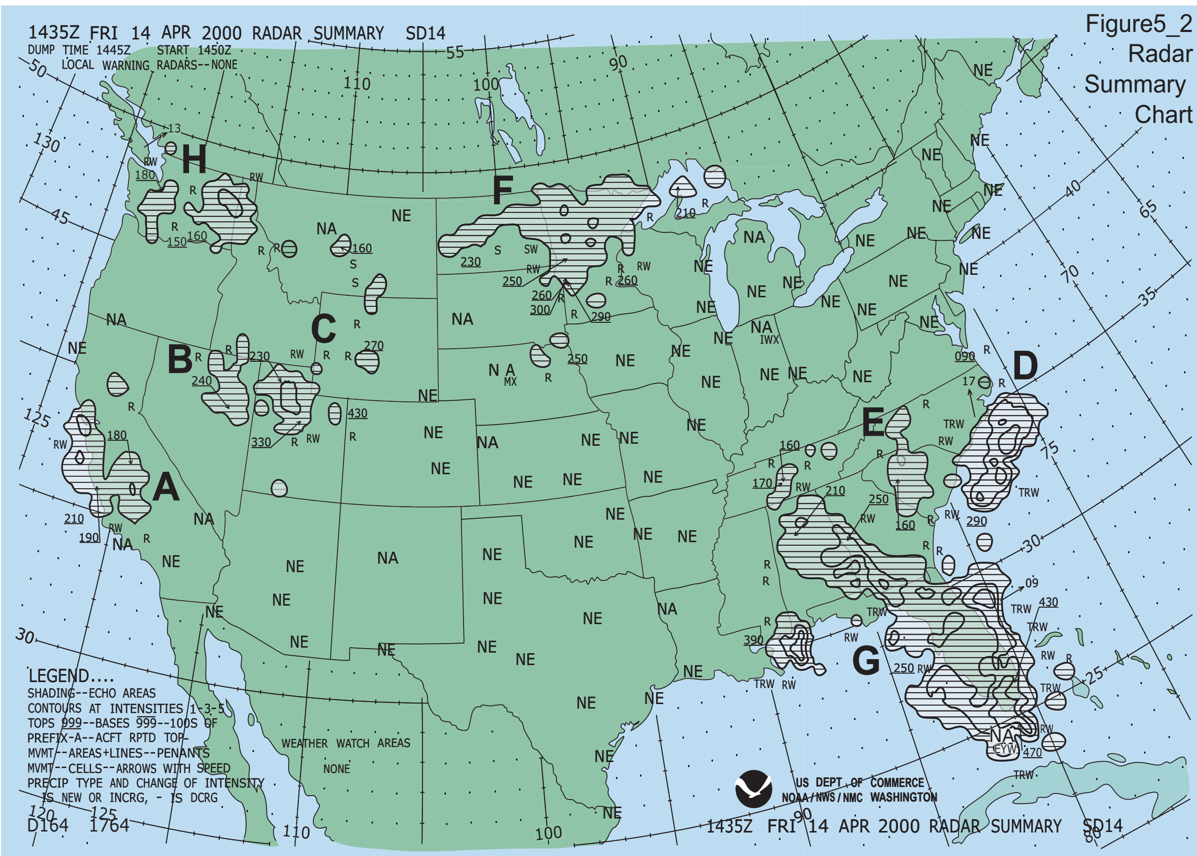


Figure5_2 Radar Summary Chart

A. The radar summary chart is a computer-generated graphical display of a collection of automated radar weather reports (SDs). It displays areas of precipitation; information about precipitation type, intensity, configuration, and coverage; echo tops; and cell movement.

1. The radar summary chart is available hourly at 35 minutes past the hour.

B. The radar summary chart helps preflight planning by identifying general areas and movement of precipitation and/or thunderstorms.

1. Radar detects **only** drops or ice particles of precipitation size; it **does not** detect clouds and fog.

   a. You should emphasize to your students that the absence of echoes does not guarantee clear weather, and cloud tops will most likely be higher than the precipitation tops detected by radar.

2. The chart must be used in conjunction with other charts, reports, and forecasts.

C. A national radar image is available on the Internet at http://www.aviationweather.gov/awc/aviation_weather_center.html

1. Scroll down to the heading titled "CURRENT CONDITIONS."
2. Under the side subheading of "Radar," click on National Radar Comp withTops/Conv SIGMETs.

IV. Terminal Aerodrome Forecast (TAF)

A. The terminal aerodrome forecast (TAF) is a concise statement of the expected weather at a specific airport during a 24-hour period. It covers an area within a 5-SM radius of the center of the airport and is prepared four times daily at 0000Z, 0600Z, 1200Z, and 1800Z. Many of the weather codes used in the METAR are also used in the TAF.

B. **Elements**. A TAF contains the following sequence of elements in the following order (items a-i). Forecast change indicators (items j-l) and probability forecast (item m) are used as appropriate.

Communications Header	Forecast of Meteorological Conditions	Time Elements
a. Type of report	e. Wind	j. Temporary (TEMPO)
b. ICAO station identifier	f. Visibility	k. From (FM)
c. Date and time of origin	g. Weather	l. Becoming (BECMG)
d. Valid period date and time	h. Sky condition	m. Probability (PROB)
	i. Wind shear (optional)	

C. **Example of a TAF**.

TAF
KOKC 051130Z 051212 14008KT 5SM BR BKN030 WS018/32030KT TEMPO 1316 1 1/2SM BR FM1600 16010KT P6SM SKC BECMG 2224 20013G20KT 4SM SHRA OVC020 PROB40 0006 2SM TSRA OVC008CB=

To aid in the discussion, we have divided the TAF above into elements a.-m. as follows:

TAF	KOKC	051130Z	051212	14008KT	5SM	BR	BKN030
a.	b.	c.	d.	e.	f.	g.	h.

WS018/32030KT	TEMPO 1316 1 1/2SM BR	FM1600 16010KT P6SM SKC
i.	j.	k.

BECMG 2224 20013G20KT 4SM SHRA OVC020
l.

PROB40 0006 2SM TSRA OVC008CB=
m.

a. Routine terminal aerodrome forecast
b. Oklahoma City, OK
c. Forecast prepared on the 5th day at 1130 UTC (or Z)
d. Forecast valid from the 5th day at 1200 UTC until 1200 UTC on the 6th
e. Wind 140° true at 8 kt.
f. Visibility 5 SM
g. Visibility obscured by mist
h. Ceiling 3,000 ft. broken
    i. A vertical visibility (VV) may also be forecast as a sky condition when the sky is expected to be obscured by a surface-based phenomena.
i. Low-level wind shear at 1,800 ft., wind 320° true at 30 kt.
j. Temporary (spoken as occasional) visibility 1½ SM in mist between 1300 UTC and 1600 UTC
k. From (or after) 1600 UTC, wind 160° true at 10 kt., visibility more than 6 SM, sky clear
l. Becoming (gradual change) wind 200° true at 13 kt., gusts to 20 kt., visibility 4 SM in moderate rain showers, ceiling 2,000 ft. overcast between 2200 UTC and 2400 UTC
m. Probability (40% chance) between 0000 UTC and 0600 UTC of visibility 2 SM, thunderstorm, moderate rain, ceiling 800 ft. overcast, cumulonimbus clouds (The = sign indicates end of forecast.)

V. **Aviation Area Forecast (FA)**

A. An area forecast (FA) is a forecast of visual meteorological conditions (VMC), clouds, and general weather conditions over an area the size of several states. They are issued three times a day for each of the six areas in the contiguous states, plus Alaska and Hawaii. The FA is comprised of four sections:

1. Communication and product header section. This section identifies the office for which the FA is issued (e.g., MIA for Miami), the date and time of issue, the product name, the valid times, and the states and/or areas covered by the FA.
2. Precautionary statements section. Three statements are in all FAs:
    a. SEE AIRMET SIERRA FOR IFR CONDS AND MTN OBSCN.
    b. TS IMPLY SEV OR GTR TURB SEV ICE LLWS AND IFR CONDS.
    c. NON MSL HGTS ARE DENOTED BY AGL OR CIG.
3. Synopsis section. The synopsis is a brief summary of the location and movements of fronts, pressure systems, and circulation patterns for an 18-hr. period.
4. VFR clouds/weather section. This section contains a 12-hr. specific forecast, followed by a 6-hr. (18-hr. in Alaska) categorical outlook giving a total forecast period of 18 hr. (30 hr. in Alaska).
    a. The forecast is of clouds and weather that are significant to VFR operations.

B. Example of a partial FA

```
MIAC FA 060945
SYNOPSIS AND VFR CLDS/WX
SYNOPSIS VALID UNTIL 070400
CLDS/WX VALID UNTIL 062200 . . .  OTLK VALID 062200-070400
NC SC GA FL AND CSTL WTRS
.
SEE AIRMET SIERRA FOR IFR CONDS AND MTN OBSCN.
TS IMPLY SEV OR GTR TURB SEV ICE LLWS AND IFR CONDS.
NON MSL HGTS DENOTED BY AGL OR CIG.
.
SYNOPSIS . . .  LOW PRES SYS OVR S CNTRL GLFMEX WITH QSTNRY FNTL
SYS EXTDG EWD FROM LOW ACRS SRN FL PENINSULA.  BY 04Z . . . LOW
PRES SYS WILL BE OVR ATLC E OF SRN FL PENINSULA . . .  MOVG EWD.
.
NC
CIGS BKN-OVC015-025.  TOPS 060-080.  CHC —DZ.  OTLK . . .  MVFR CIGS.
.
GA
NW OF AND-ABY LN . . .  CIGS OVC015-025.  TOPS 060-080.  OTLK . . . MVFR
      CIGS.
NE OF AND-ABY-SAV LN . . .  SCT CI.  BECMG 1622 SCT030-050 SCT-BKN100.
      TOPS TO FL200.  BKN CI.  OTLK . . .  VFR BECMG 0104 MVFR CIGS.
S OF ABY-SAV LN . . .  SCT030-050 SCT-BKN100.  TOPS TO FL200.  BKN CI.
      BECMG 1622 CIGS BKN-OVC030-050.  CHC —RA LWRG VIS 3-5SM.
      OTLK . . .  MVFR CIGS.
```

C. Your students can view the FA on the Internet by starting at the Aviation Weather Center's product page: http://aviationweather.gov/awc/aviation_weather_center.html

D. Under the heading of "AVIATION PRODUCTS," they should click Area Aviation Forecast (description).

1. Next, they should choose and click the FA they would like to see. If they are not sure, the states that are covered by each FA are listed next to the FA.

VI. **Pilot Weather Report (PIREP):** PIREPs are textual reports of actual conditions aloft observed by pilots.

A. Explain that a PIREP will include some or all of the following elements: the weather reporting station nearest to the reported conditions, the location of the reporting aircraft, the time of the report, the aircraft's altitude, the aircraft type, the sky condition, the weather conditions (including flight visibility), the temperature, the wind speed and direction, any turbulence, any icing, and any necessary remarks.

B. Emphasize to your students that PIREPs are the only source for direct pilot observations of cloud tops, icing, and turbulence.

1. Therefore, pilots are encouraged to make frequent reports.

a. Advise your students that they are not required to provide all of the elements listed in item F.1. above when giving a PIREP.

VII. For a one-stop Internet site for METAR, TAF, PIREPs, AIRMETs, SIGMETs, winds, and satellite and radar images (but not the FA), direct your students to the Aviation Digital Data Service web site at http://adds.aviationweather.noaa.gov/

A. On the left side of the screen, they will see several "tabs."

1. Your students can click the topic they want to view and follow the on-screen instructions.

B. If your students need help or information, tell them to click the box in the upper right corner of the screen, titled "FYI/Help."

5.4 ANALYZING SPECIAL WEATHER PHENOMENA AND HAZARDS

I. **Wind Shear**

A. Wind shear is defined as the rate of change of wind velocity.

1. Any change in wind speed or direction over a given distance constitutes wind shear.

B. Explain to your students that, as a practical consideration for pilots, the term "wind shear" usually refers to a rapid change in wind speed or direction that occurs over a relatively short distance.

1. Your students must be aware that a report or forecast of wind shear at an airport should be regarded as a significant hazard to flight.

C. The effects of wind shear on an aircraft can be felt as turbulence and can be seen in fluctuations of airspeed, altitude, vertical speed, and pitch attitude.

D. Wind shear can be critical when it occurs close to the ground, such as immediately after takeoff or during an approach to landing. Explain to your students that hazardous wind shear encounters usually involve a decreasing headwind or an increasing tailwind.

1. Hazardous wind shear effects:

a. When a headwind component shears to a calm wind or a tailwind component, OR a calm wind shears to a tailwind component:

i. **Airspeed** will decrease
ii. **Pitch attitude** will decrease (i.e., the nose will pitch down)
iii. **Vertical speed/Altitude:**

- **If climbing:** Rate of climb will decrease, possibly becoming a descent
- **If level:** Altitude will decrease
- **If descending:** Rate of descent will increase

b. When an updraft shears to a calm wind or a downdraft, OR a calm wind shears to a downdraft:

i. **Airspeed** and **pitch attitude** should remain initially unaffected
ii. **Vertical speed/Altitude:**

- **If climbing:** Rate of climb will decrease, possibly becoming a descent
- **If level:** Altitude will decrease
- **If descending:** Rate of descent will increase

E. Severe wind shear (defined as a change in airspeed of more than 15 kt. or a change in vertical speed of more than 500 fpm) is a hazard that is closely associated with thunderstorms and microbursts, which are explained in the following sections.

II. Thunderstorms

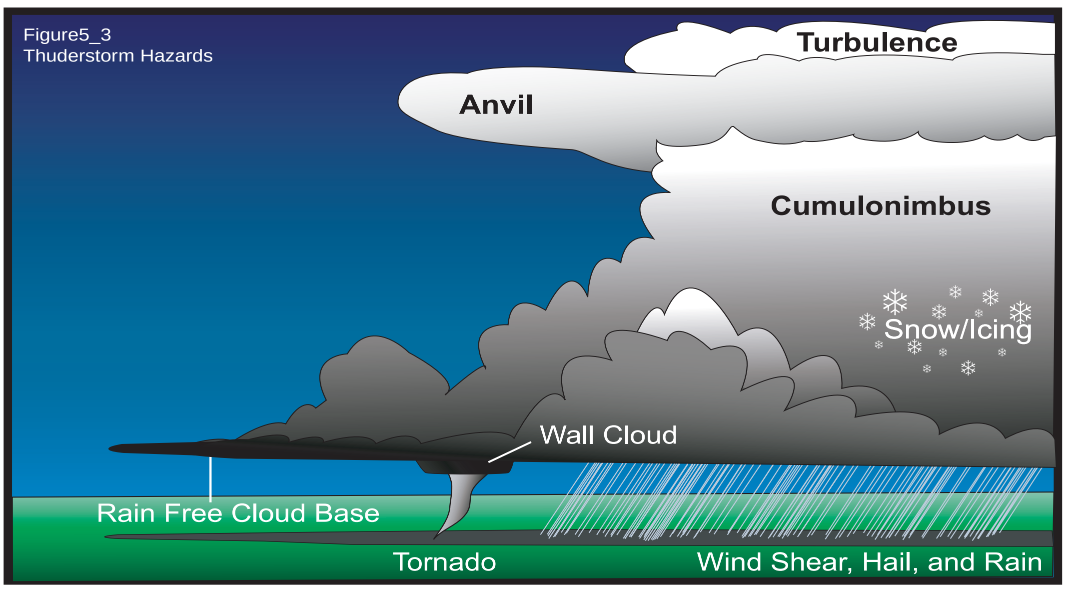
A. **Formation of Thunderstorms:** Tell your students that the air must have the following 3 qualities for a thunderstorm to form:

1. Sufficient water vapor.
2. An unstable lapse rate (i.e., temperature variation with altitude).
3. An initial upward boost (lifting) to start the storm process in motion.
    a. This upward boost can come from surface heating, converging winds, sloping terrain, a frontal surface, or any combination of these factors.

B. A thunderstorm's life cycle progresses through three stages: cumulus, mature, and dissipating.

1. The cumulus stage begins as a cumulus cloud and is characterized by continuous updrafts.
2. The mature stage is characterized by both updrafts and downdrafts. This stage is associated with the most severe turbulence due to wind shear between the updrafts and downdrafts.
    a. The beginning of the mature stage is signaled by precipitation falling from the cloud base.
3. The dissipating stage is characterized by continuous downdrafts as the storm "rains itself out."

C. **Hazards Associated With Thunderstorms:** Tell your students that any of the following hazards may be associated with thunderstorms:



1. **Tornadoes.** The most violent thunderstorms draw air into their bases with great vigor. If the incoming air has any tendency toward rotation, a concentrated vortex may form from the surface well into the structure of the cloud. If this vortex touches the ground, it is called a tornado (if the vortex touches water, it is called a "water spout").
    a. Winds within a tornado may exceed 200 kt.
    b. Any aircraft that penetrates a tornado will almost certainly suffer structural damage.

2. **Squall Lines.** A squall line is a non-frontal, narrow band of active thunderstorms. Squall lines are often too dense to be safely penetrated and too long to be easily circumnavigated.
   a. They often develop ahead of a cold front in moist, unstable air, but they may also develop in unstable air far removed from any front.
   b. Squall lines often contain severe steady-state thunderstorms and present the single most intense weather hazard to aircraft.
3. **Turbulence**
   a. Hazardous turbulence is present in *all* thunderstorms, and in a severe thunderstorm it can seriously damage an airframe.
   b. The strongest turbulence within the cloud occurs as the result of wind shear between updrafts and downdrafts.
      i. Outside the cloud, shear turbulence has been encountered several thousand feet above and 20 mi. laterally from a severe storm.
   c. It is almost impossible to hold a constant altitude in a thunderstorm, and maneuvering in an attempt to do so greatly increases stresses on the aircraft.
      i. Advise your students that stresses will be least if a power setting is selected that should keep the airspeed below the maneuvering speed and the aircraft is held in a constant *attitude* while being allowed to “ride the waves.”
4. **Hail** competes with turbulence as the greatest thunderstorm hazard to aircraft.
   a. Hail forms when supercooled raindrops that are lifted above the freezing level by updrafts begin to freeze.
      i. If the updrafts are strong enough, the hailstones will remain aloft long enough for other drops to attach and freeze to them. Sometimes the hailstones grow into huge ice balls.
   b. Eventually, the updraft cannot support the weight of the hailstones, so they fall, possibly some distance from the storm core.
      i. Hail has been observed in clear air several miles from the parent thunderstorm.
   c. As hailstones fall below the freezing level, they begin to melt, and precipitation may reach the ground as either hail or rain.
      i. Advise your students that rain at the surface does not mean the absence of hail aloft.
      ii. They should anticipate possible hail with *any* thunderstorm, especially beneath the anvil of a large cumulonimbus cloud.
5. **Icing**
   a. There are two kinds of icing.
      i. **Structural icing** is the accumulation of ice on the exterior of the aircraft. Types of structural ice are clear ice, rime ice, and mixed ice.
      ii. **Induction icing** is icing on the air intakes and the carburetor that affects the powerplant operation.
   b. Remind your students that two conditions are necessary for structural icing to form: the presence of visible moisture and a temperature at the collecting surface that is at or below freezing.
      i. Updrafts in a thunderstorm can carry liquid water above the freezing level, where it becomes supercooled (i.e., it remains in a liquid state, but is cooled below freezing temperature).
      ii. This supercooled water freezes instantly upon contact with an aircraft, resulting in a rapid accumulation of ice which may cause a stall and loss of control

before the aircraft can escape the thunderstorm.

c. Tell your students that aerodynamic cooling can lower the temperature of an airfoil to 0° Celsius even though the ambient temperature is above freezing.

d. Emphasize that ice is extremely difficult to forecast accurately, so a forecast that does not include icing should not be relied on when atmospheric conditions of cold temperatures and high humidity exist.

   i. PIREPS provide the best information about the presence of ice on a real-time basis.

e. Explain that in-flight structural icing affects aircraft performance negatively in four ways:

   i. Ice, especially clear ice, can change the shape of an airfoil, thereby reducing lift.
   ii. Ice of any type increases the weight of an aircraft.
   iii. Ice on aircraft surfaces increases drag.
   iv. Ice on the propeller blades reduces blade efficiency, thereby reducing thrust.

6. **Effect on Altimeters**

a. Atmospheric pressure usually falls rapidly with the approach of a thunderstorm, then rises sharply with the arrival of the cold downdraft and heavy rain showers, falling back to normal as the storm moves on.

   i. This cycle of pressure change may occur in as little as 15 min.

b. Advise your instrument students that if the altimeter setting is not corrected for changes in atmospheric pressure, the indicated altitude may be in error by over 100 ft in the vicinity of a thunderstorm.

7. **Lightning**

a. While a lightning strike can puncture the skin of an aircraft and can damage communication and electronic navigational equipment, the danger of fire or an explosion is extremely small.

b. Nearby lightning can temporarily blind the pilot, rendering him/her momentarily unable to navigate either by instrument or by visual reference.

   i. Nearby lightning can also induce permanent errors in the magnetic compass.

c. Lightning discharges, even distant ones, can disrupt radio communications on low and medium frequencies.

d. Give your students the following useful tips about lightning:

   i. The more frequent the lightning, the more severe the thunderstorm.
   ii. Increasing frequency of lightning indicates a growing thunderstorm.
   iii. Decreasing frequency of lightning indicates a storm nearing the dissipating stage.
   iv. At night, frequent distant flashes playing along a large sector of the horizon suggest a probable squall line.

III. **Microbursts** are an especially hazardous weather phenomenon because they can occur with little or no warning. They are small-scale intense downdrafts that, on reaching the surface, spread outward in all directions from the downdraft center. This outward spread causes the presence of both vertical and horizontal wind shears that can be extremely hazardous to all aircraft, especially at low altitudes where there might not be sufficient altitude for recovery from a microburst downdraft that is stronger than the aircraft's ability to climb. Characteristics of microbursts include the following:

A. **Size.** The microburst downdraft is typically less than one mile in diameter as it descends from the cloud base to about 1,000 to 3,000 ft. above the ground.

1. In the transition zone near the ground (i.e., below 3,000 ft. AGL), the downdraft changes to a horizontal outflow that can extend to approximately 2½ miles in diameter.

B. **Intensity.** The downdrafts can be as strong as 6,000 feet per minute, with horizontal winds near the surface of 45 kt. These strong horizontal winds can result in a 90-kt. shear across the microburst.

C. **Visual signs.** Microbursts can be found almost anywhere there is convective activity.

1. They may be embedded in heavy rain associated with a thunderstorm or in light rain in benign-appearing virga.
2. When there is little or no precipitation at the surface accompanying the microburst, a ring of blowing dust may be the only visual clue of its existence.

D. **Duration.** An individual microburst will seldom last longer than 15 min. from the time it strikes the ground until dissipation.

1. An important consideration for pilots is that the microburst intensifies for about 5 min. after it strikes the ground, with the maximum intensity winds lasting approximately 2 to 4 min.
2. Once microburst activity starts, multiple microbursts in the same general area are not uncommon and should be expected.
3. Sometimes microbursts are concentrated into a line structure, and under these conditions, microburst activity may continue for as long as an hour.

E. Microburst wind shear may create a severe hazard for aircraft within 1,000 ft. of the ground, particularly during the approach to landing and landing and takeoff phases.

1. The aircraft may encounter a headwind (performance increasing) followed by a downdraft and tailwind (both performance decreasing), possibly resulting in terrain impact, as shown in the figure below.

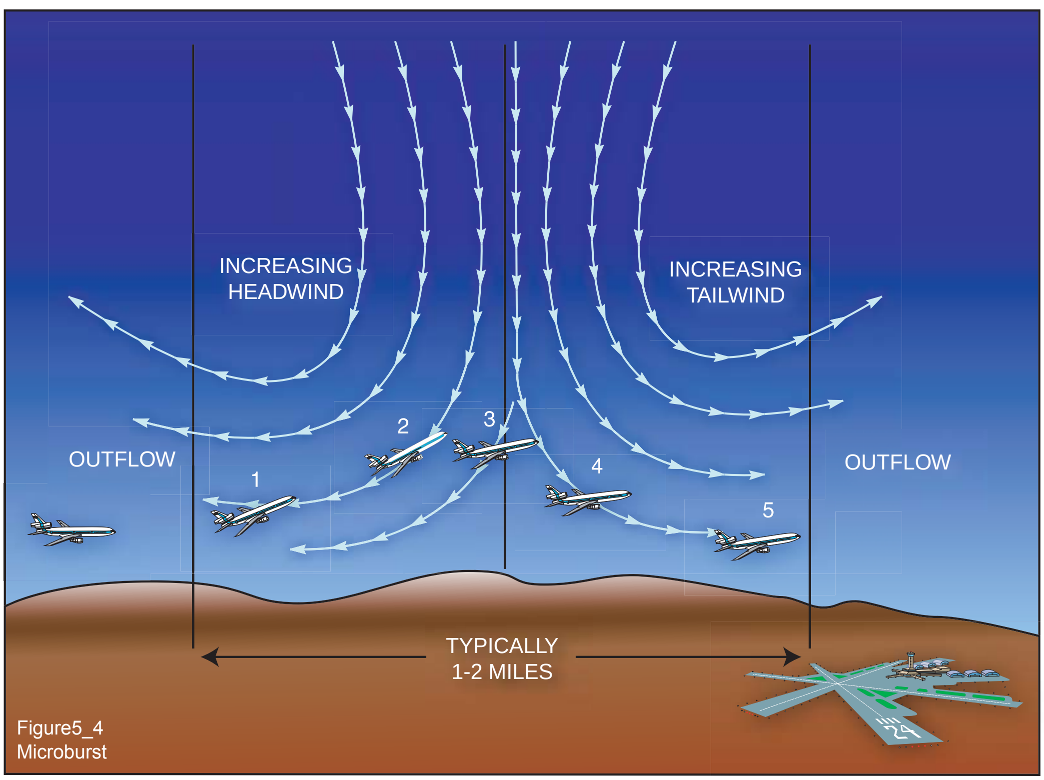


Figure5_4
Microburst

5.5 WEATHER-RELATED DECISION MAKING

I. Explain to your students that the go/no-go decision-making process as it relates to weather conditions is a continuation of the decision-making process you will study in Lesson 6: Human Factors.

A. Advise your students that the decision-making process is facilitated when they have their personal minimums checklist filled out. A personal minimums checklist is used by a pilot to preflight him/herself in much the same manner as (s)he uses an aircraft checklist to preflight his/her airplane. An example of a personal minimums checklist is available below:

PILOT

Experience/Recency
Takeoff/landings........................ ____ In the last ____ days
Hours in make/model................ ____ In the last ____ days
Instrument approaches............. ____ In the last ____ days
(simulated or actual)
Instrument flight hours.............. ____ In the last ____ days
(simulated or actual)
Terrain and airspace................ familiar

Physical Condition
Sleep....................................... ____ In the last 24 hours
Food and water......................... In the last ____ hours
Alcohol...................................... None in the last ____ hours
Drugs or medication................. None in the last ____ hours
Stressful events........................ None in the last ____ days
Illnesses................................... None in the last ____ days

AIRCRAFT

Fuel Reserves (Cross-Country)
VFR Day.................. ____ hours
Night.................. ____ hours
IFR Day................... ____ hours
Night.................. ____ hours

Experience in Type
Takeoffs/landings in aircraft type........... ____ in the last ____ days

Aircraft Performance
Establish that you have additional performance available over that required. Consider the following:

* Gross weight
* Load distribution
* Density altitude
* Performance charts

Aircraft Equipment
Avionics................... familiar with equipment (including autopilot and GPS systems)
COM/NAV................. equipment appropriate to flight
Charts...................... current
Clothing................... suitable for preflight and flight
Survival gear........... appropriate for flight and terrain

ENVIRONMENT

Airport Conditions
Crosswind........................... ______ % of max POH
Runway length.................... ______ % more than POH

Weather
Reports and forecasts.................... not more than ____ hours old
Icing conditions.............................. within aircraft/pilot capabilities

Weather for VFR
Ceiling Day...................... ______ feet
Night..................... ______ feet
Visibility Day..................... ______ miles
Night..................... ______ miles

Weather for IFR
Precision Approaches
Ceiling............................. ______ feet above min.
Visibility........................... ______ mile(s) above min.
Non-Precision Approaches
Ceiling............................. ______ feet above min.
Visibility........................... ______ mile(s) above min.
Missed Approaches
No more than.................. ______ before diverting
Takeoff Minimums
Ceiling............................. ______ feet
Visibility........................... ______ mile(s)

EXTERNAL PRESSURES

Trip Planning
Allowance for delays............................. ____ minutes

Diversion or Cancellation Alternate Plans
Notification of person(s) you are meeting

Passengers briefed on diversion or cancellation plans and alternatives

Modification or cancellation of car rental, restaurant, or hotel reservations

Arrangement of alternative transportation (Airline, car, etc.)

Personal Equipment
Credit card and telephone numbers available for alternate plans

Appropriate clothing or personal needs (eye wear, medication...) in the event of an unexpected stay

1. Explain that they should compare the current and forecast weather to their personal minimums. If the weather is better than their minimums, they are a “go” for weather reasons.
2. If the weather is below their minimums, they are a “no-go” for weather reasons.

II. **Use scenarios similar to the following to discuss personal weather minimums, e.g., go/no-go decisions, with your students.**

A. After discussing the concept of personal weather minimums with your student, agree on a set of minimums to use in your discussion. For example, your student's personal minimums might be a ceiling of 2,000 ft. and 5 SM visibility. Discuss several METARs with your student to see if (s)he should depart on a flight under the reported weather conditions. For example,

1. METAR KXYZ 101853Z 16005KT 4SM HZ BKN018 24/19 A2992.
   a. At this airport, the visibility is 4 SM in haze (HZ), and the ceiling is a broken layer of clouds at 1,800 ft. (BKN018).
   b. While these conditions are above the regulatory VFR weather minimums requirement, they are below your student's personal minimums. Thus, (s)he should either delay or reschedule the flight.
2. METAR KXYZ 201253Z 21010KT 8SM SCT020 OVC080 30/20 A2992
   a. At this airport, the visibility is 8 SM with a scattered cloud layer at 2,000 ft. (SCT020) and the ceiling is an overcast layer at 8,000 ft. (OVC080).
   b. You bet! Your student can go and enjoy his/her flight.
3. METAR KXYZ 301955Z 02008KT 4SM BR SCT100 27/25 A2992
   a. At this airport, the visibility is 4 SM in mist (BR) with a scattered cloud layer at 10,000 ft. (SCT 100).
   b. Since visibility is below your student's minimums, (s)he should delay the flight until the visibility is at least 5 SM.

B. Explain to your students that they cannot make an informed weather-related go/no-go decision by only considering reports of current conditions; they will also need to apply their minimums to the forecast conditions at the time of arrival. Using the same personal minimums, look at several TAFs to determine if your student should depart on a flight under the forecast weather conditions. For these examples, assume that your student is headed to KXYZ with an ETA of 2300Z:

1. TAF

   KXYZ 291720Z 291818 04014KT P6SM VCSH SCT025 BKN050
   TEMPO 2024 3SM SHRA BKN020
   FM 2400 P6SM BKN050
   FM0600 03015G20KT P6SM SCT020 SCT050 TEMPO 0812 BKN050
   BECMG 1618 04020G25KT=

   a. This forecast calls for the following temporary (spoken as "occasional") conditions between 2000Z and 2400Z (TEMPO 2024): 3 SM visibility, rain showers (SHRA), and a broken ceiling at 2,000 ft.

b. Advise your student that (s)he should treat any forecast occasional or temporary conditions as though they will occur.

c. Because the forecast visibility at the planned ETA is below your student's personal minimums, (s)he should cancel the flight or postpone it until (s)he can arrive when better visibility is forecast.

i. One option would be to wait for an hour or so in order to arrive after 2400Z, when the forecast calls for better than 6 SM visibility (P6SM) and a broken ceiling at 5,000 ft.

2. TAF

KXYZ 291130Z 291212 00000KT P6SM SCT150 OVC250
FM1400 01004KT P6SM SCT150 BKN250
FM1800 35005KT P6SM FEW250
FM2300 VRB03KT P6SM SKC
BECMG 0709 33008KT=

a. This forecast calls for the following conditions from (spoken as "after") 2300Z (FM2300): wind variable at 3 kt., better than 6 SM visibility, and clear skies.

b. Looks good! Your student should have a nice trip.

C. Emphasize to your students that, in addition to looking at the weather at their departure and arrival airports, they must determine the conditions that will be encountered en route and apply their personal minimums to those conditions as well.

1. It is important for your students to understand that the conditions at their departure and/or arrival airports may meet or exceed their minimums, but conditions en route may be below those minimums.

a. Stress to your students that if they begin a flight into deteriorating weather, regardless of the conditions at the point of departure, it is likely that the flight will not be completed as planned. They may need to return to the departure point or land at another airport. Worse, an accident could result due to spatial disorientation or collision with obstacles.

2. An alternative possibility that you should address is that conditions could improve along the route.

a. Even if the weather at the departure airport is right at your student's personal minimums, it may be reasonable to begin a cross-country flight if conditions are quickly improving along the route.

3. Some things your students (and you!) should do in making a go/no-go decision for a cross-country flight are:

a. Determine what weather conditions will be encountered by referring to METARs and TAFs for several airports along the route, area forecasts, surface analysis charts, low-level significant weather prognostic charts, and other weather products.

i. A flight service specialist can help by combining these sources into a meaningful briefing.

b. Determine if the conditions are improving, getting worse, or remaining stable.

c. Based on this determination, make a decision about beginning the flight.

4. Impress on your instrument students that, while en route weather conditions are less restrictive for instrument-rated pilots, who do not need to worry about visibility or ceilings until they are ready to land, an instrument rating does not guarantee a safe flight in all weather conditions (e.g., icing, thunderstorms, turbulence, etc.).

III. Below are some weather judgment tips for everyone (including CFIs):

A. Do NOT fly in or near thunderstorms. You can fly safely around scattered thunderstorms, but do not try to fly through or under a thunderstorm.

B. Do NOT continue your VFR flight into IFR weather conditions, even if you are instrument-rated.

1. If you are on the ground, wait it out or file an IFR flight plan and obtain a proper clearance.
2. If you are in the air, turn around.

C. Do NOT proceed "on top" of a ceiling, hoping to find a hole at the other end or getting ATC to "talk you down" if you get caught on top.

D. Do allow more margin for weather at night. It is harder to see that the weather is getting worse, especially on a dark night (no moon).

GLEIM FLIGHT INSTRUCTOR REFRESHER COURSE
LESSON 6
HUMAN FACTORS

6.1 AERONAUTICAL DECISION MAKING (ADM)

I. Discuss the following terms and definitions with your students when you present the concept of aeronautical decision making.

A. **Aeronautical Decision Making (ADM)** is a systematic approach to the mental process used by aircraft pilots to consistently determine the best course of action in response to a given set of circumstances.

B. **Attitude** is a personal motivational predisposition to respond to persons, situations, or events in a given manner that can, nevertheless, be changed or modified through training.

1. Explain that a pilot's attitude serves as a sort of "mental shortcut" to decision making.

C. **Attitude management** is the ability to recognize hazardous attitudes in oneself and the willingness to modify them as necessary through the application of an appropriate antidote thought.

D. **Cockpit resource management (CRM)**, in single-pilot or multiperson crew configurations, is the effective use of all personnel and material assets available to a pilot or a flight crew.

1. Explain that CRM emphasizes good communication and other interpersonal relationship skills, not just in the cockpit, but also with ATC, ground control, etc.

E. **Headwork** is required to accomplish a conscious, rational thought process when making decisions.

1. Emphasize that good decision making involves risk identification and assessment, information processing, and problem solving.

F. **Judgment** is the mental process of recognizing and analyzing all pertinent information in a particular situation, rationally evaluating alternative actions in response to it, and making a timely decision on which action to take.

G. **Personality** is the embodiment of personal traits and characteristics of an individual that are set at a very early age and are extremely resistant to change.

H. **Poor judgment (PJ) chain** is a series of mistakes that may lead to an accident or incident.

1. Explain that two basic principles generally associated with the creation of a PJ chain are

   a. One bad decision often leads to another, and

   b. As a string of bad decisions grows, it reduces the number of subsequent alternatives for continued safe flight.

2. Emphasize that ADM is intended to break the PJ chain before it can cause an accident or incident.

I. **Risk management** is the part of the decision-making process which relies on situational awareness, problem recognition, and good judgment to reduce risks associated with each flight.

J. **Risk elements** in ADM take into consideration the four fundamental risk elements:

1. The pilot
2. The aircraft
3. The environment
4. The type of operation that comprises any given aviation situation

K. **Situational awareness** is the accurate perception and understanding of all the factors and conditions within the four fundamental risk elements that affect safety before, during, and after the flight.

L. **Skills and procedures** are the procedural, psychomotor, and perceptual skills used to control a specific aircraft or its systems.

1. Explain that skills and procedures are the “stick and rudder” or airmanship abilities that are gained and perfected through conventional training, and become almost automatic through experience.

M. **Stress management** is the personal analysis of the kinds of stress experienced while flying and the application of appropriate stress assessment tools and coping mechanisms.

II. ADM Process

A. Conventional training programs tend to focus on skills and procedures (how to perform a maneuver, how to operate equipment, etc.) with only a minimal emphasis on headwork (how to make rational, systematic decisions based on situational conditions, called decision making).

1. Unfortunately, a student’s decision-making ability is often developed informally by listening to other pilots around the airport (hangar-flying sessions) and many times through experience.
2. It is your job as an instructor to help your students learn to make sound decisions during the training process, rather than developing their approach to decision-making after receiving their pilot certificates through hearsay and trial-and-error.

B. ADM provides a structured, systematic approach to analyzing changes that occur during a flight and the effect these changes might have on a flight’s safe outcome.

1. Starting with the recognition of change and following with an assessment of alternatives, a decision to act or not to act is made, and the results are monitored.

C. ADM enhances the conventional decision-making process with an awareness of the importance of attitudes in decision making, a learned ability to search for and establish the relevance of all information, and the motivation to choose and execute the actions that assure safety in a time frame permitted by the situation. Therefore, ADM decreases the probability of pilot error.

D. The ADM process addresses all aspects of decision making in the cockpit and identifies the steps involved in good decision making. Explain that these steps are

1. Identifying personal attitudes hazardous to safe flight
2. Learning behavior modification
3. Learning how to recognize and cope with stress
4. Developing risk assessment skills
5. Using all resources in a single-pilot or multicrew situation
6. Evaluating the effectiveness of one’s ADM skills

III. THE DECIDE MODEL

A. Teach your students that a good tool to use in making good aeronautical decisions is the **DECIDE** Model shown below.

1. **D**etect. The decision maker detects that a change has occurred.
2. **E**stimate. The decision maker estimates the need to counter or react to the change.
3. **C**hoose. The decision maker chooses a desirable outcome (in terms of success) for the flight.
4. **I**dentify. The decision maker identifies actions which could successfully control the change.
5. **D**o. The decision maker takes the necessary action.
6. **E**valuate. The decision maker evaluates the effect(s) of his action countering the change.

B. Explain that the six elements of the Decide Model represent a continuous loop decision process that can be used to assist a pilot in the decision-making process when (s)he is faced with a change in a situation that requires a judgment to be made.

1. Emphasize to your students that if they practice the Decide Model in all decision making, its use can become very natural and result in better decisions under all kinds of situations.

IV. Operational Pitfalls

A. Tell your students that pilots, particularly those with considerable experience, have strong tendencies to try to complete a flight as planned, please passengers, meet schedules, and generally demonstrate that they have the “right stuff.”

1. Emphasize that this drive to demonstrate the “right stuff” can have an adverse effect on safety and can lead to an unrealistic assessment of their piloting skills under stressful conditions.

B. These tendencies ultimately may lead to practices that are dangerous and often illegal, and may lead to a mishap.

1. Several of these practices have been identified and grouped into the following **operational pitfalls** listed below. Point out to your students that all experienced pilots have fallen prey to, or have been tempted by, one or more of the following operational pitfalls in their flying careers. Emphasize that these dangerous tendencies or behavior patterns must be identified and eliminated.

   a. **Peer pressure**. Poor decision making may be based upon an emotional response to peers rather than an objective evaluation of a situation.

   b. **Mind set** may produce an inability to recognize and cope with changes in a situation if the outcome is different from that anticipated or planned.

   c. **Get-there-itis**. This tendency, common among pilots, clouds the vision and impairs judgment by causing a fixation on the original goal or destination combined with a total disregard for any alternative course of action.

   d. **Duck-under-syndrome** is the tendency to sneak a peek by descending below minimums during an approach, based on a belief that there is always a built-in “fudge” factor that can be used or on an unwillingness to admit defeat and shoot a missed approach.

      i. Emphasize to your students that relying on such a “fudge” factor can be extremely hazardous because certain circumstances (an altimeter error on the high end of what is considered acceptable, use of the alternate static source, unusually low temperatures, etc.) can reduce any altitude buffer for the approach to zero.

e. **Scud running** refers to pushing the capabilities of the pilot and the aircraft to the limits by trying to maintain visual contact with the terrain while trying to avoid physical contact with it.

   i. Explain that this attitude is characterized by the old pilot's joke: "If it's too bad to go IFR, we'll go VFR."

f. **Continuing VFR** into instrument meteorological conditions (IMC) often leads to spatial disorientation or collision with ground/obstacles.

   i. Emphasize that, while this practice is especially dangerous if the pilot is not instrument qualified or current, even instrument-rated pilots can experience spatial disorientation or controlled flight into terrain (CFIT) if they are not mentally prepared for flight in IMC and aware of their position.

g. **Getting behind the aircraft** means that a pilot allows events or the situation to control his/her actions rather than the other way around. This dangerous tendency is characterized by a constant state of surprise at what happens next.

h. **Loss of positional or situational awareness** is an extreme case of getting behind the aircraft, which results in a pilot not knowing his/her location, being unable to recognize deteriorating circumstances, and/or misjudging the rate of deterioration.

i. **Operating without adequate fuel reserves**. Ignoring minimum fuel reserve requirements, while either VFR or IFR, is generally the result of overconfidence, lack of flight planning, or ignoring the regulations.

j. **Descent below the minimum en route altitude** is typically the result of poor altitude control due to inattentiveness, distraction, or a poor instrument scan.

k. **Flying outside the envelope** results from an unjustified reliance on the (usually mistaken) belief that the aircraft's high performance capability meets the demands imposed by the pilot's (usually overestimated) flying skills.

l. **Neglect of flight planning, preflight inspections, checklists, etc.** , indicates a pilot's unjustified reliance on his/her short- and long-term memory, regular flying skills, repetitive and familiar routes, etc.

V. Hazardous Attitudes and Antidotes to Hazardous Attitudes

A. Discuss the following hazardous attitudes and their antidotes with your students:

1. **Antiauthority *(Don't tell me!)***. This attitude is found in people who do not like anyone telling them what to do. In a sense, they are saying, "No one can tell me what to do." They may be resentful of having someone tell them what to do or may regard rules, regulations, and procedures as silly or unnecessary. Emphasize to your students, however, that they should always question authority (e.g., ATC) if they feel it is in error.
2. **Impulsivity *(Do something quickly!)*** is the attitude of people who frequently feel the need to do something-anything-immediately. They do not stop to think about what they are about to do or determine the best alternative. Instead, they do the first thing that comes to mind.
3. **Invulnerability *(It won't happen to me.)***. Many people believe that accidents happen to others, but never to them. They know accidents can happen, and they know that anyone can be affected. However, they never really believe that they will be personally involved. Emphasize that pilots who think this way are more likely to take chances and increase risk.
4. **Macho *(I can do it.)***. Pilots who are always trying to prove that they are better than anyone else are thinking *I can do it -- I'll show them*. Pilots with this kind of attitude will try to prove themselves by taking risks in order to impress others. Point out that, while this pattern is thought to be a male characteristic, women are equally susceptible.

5. **Resignation *(What's the use?)***. Pilots who think *What's the use?*do not see themselves as being able to make a great deal of difference in what happens to them. They are apt to think that things go well due to good luck. When things go badly, they may feel that someone is out to get them, or they may attribute the situation to bad luck. The pilot will leave the action to others, for better or worse. Point out that, sometimes, such pilots will even go along with unreasonable requests just to be nice.

VI. Antidotes for Hazardous Attitudes

A. Explain that hazardous attitudes that contribute to poor pilot judgment can be effectively counteracted by redirecting them so that appropriate action can be taken.

1. Recognition of hazardous thoughts is the first step in neutralizing them in the ADM process.

B. After recognizing and labeling a thought as hazardous, the pilot should correct the hazardous thought by stating the corresponding antidote.

1. Tell your students that antidotes should be memorized for each of the hazardous attitudes so that they automatically come to mind when needed.

C. The hazardous attitude antidotes, shown below, should be learned thoroughly and practiced by all pilots.

Hazardous Attitude	Antidote
Antiauthority: *Don't tell me!*	Follow the rules. They are usually right.
Impulsivity: *Do something quickly!*	Not so fast. Think first.
Invulnerability: *It won't happen to me.*	It could happen to me.
Macho: *I can do it.*	Taking chances is foolish.
Resignation: *What's the use?*	I'm not helpless. I can make a difference.

6.2 TEACHING ADM

I. Reference Publications

A. There are six manuals oriented to the ADM needs of variously rated pilots available from the National Technical Information Service (NTIS).

1. These manuals provide multifaceted materials designed to reduce the number of decision-related accidents.

B. The following manuals are available from NTIS:

Report Number	Title	NTIS Number
DOT/FAA/PM-86/41	Aeronautical Decision Making for Student and Private Pilots	ADA182549
DOT/FAA/PM-86/42	Aeronautical Decision Making for Commercial Pilots	ADA198772
DOT/FAA/PM-86/43	Aeronautical Decision Making for Instrument Pilots	N8724880
DOT/FAA/PM-86/44	Aeronautical Decision Making for Instructor Pilots (how to teach ADM)	ADA182611
DOT/FAA/PM-86/45	Aeronautical Decision Making for Helicopter Pilots	ADA180325
DOT/FAA/PM-86/46	Aeronautical Decision Making -- Cockpit Resource Management	ADA205115

C. These manuals provide the framework for teaching ADM.

1. You may wish to consider adding a copy of each manual to your aviation library and making them or selected excerpts available to your students after you have introduced the concept of ADM in each course of training.

D. Any of the series of ADM training manuals may be obtained by writing or calling NTIS.

National Technical Information Service
5285 Port Royal Road
Springfield, VA 22161
(800) 553-NTIS (6847)
E-mail: orders@ntis.fedworld.gov
Fax: (703) 321-8547

E. The ADM manual for instructor pilots contains all of the necessary background information for effectively teaching the subject material of the ADM manual for student and private pilots.

1. The instructor pilot manual supplements the student and private pilot manual and is not designed to be used on its own.

II. Principles of ADM Training

A. The ADM manual for student and private pilots is simple and repetitive for two reasons.

1. Simplicity provides frequent positive reinforcement.
2. Repetition builds good judgment habits and refreshes memory so that information can be

readily recalled in a variety of circumstances, even when under stress.

B. The scenarios in the student and private pilot ADM manual should stimulate the student's interest and appreciation of the need for good pilot judgment and decision making.

   1. Discussion of these stories and similar ones from your own personal experiences is important for developing the student's judgment and decision-making skills.

C. You, the instructor, as a role model and an opinion shaper, profoundly affect the student.

   1. Your attitudes toward safe flying and toward teaching ADM concepts may influence the student's judgment much more than actual flight training.
   2. Additionally, instruction is greatly improved when you act as a coach and consistently use effective instructional principles.

D. Use of decision-making concepts to guide conversations with the student focuses the instruction on judgment-related training and increases the student's ability to provide self-generated feedback upon which good judgment depends.

E. Knowing how to recognize and respond to hazardous attitudes and high stress is very important in exercising good pilot judgment.

   1. You should encourage your student to develop these skills but, in doing so, you should never attempt to analyze or modify the student's personality.

F. The student learns concepts and behavioral techniques, then repeatedly applies this learning to relevant flight situations during ground and flight training.

   1. Through repeated reinforcement and continued student involvement, ADM training builds new intellectual and behavioral habits.
   2. Spaced practice which includes repetition, feedback, and positive reinforcement is essential.

III. The Instructor's Role in Training

A. Although ADM training is designed to help pilots overcome a variety of circumstances which may result in poor pilot judgment, flight instructors are the key element of this training.

   1. By always setting a good example and by giving your students support and encouragement throughout this training, you help them develop good judgment and sound flying practices.

B. To help prepare yourself for this role, think about the difference between the instructor as evaluator and the instructor as coach.

   1. The evaluator sees his/her role as one of telling the student what to do, then monitoring the student's performance.
      a. Most of the time is spent making assignments, watching performance, answering questions, measuring performance, and making positive or negative evaluation.
      b. The amount of learning is actually up to the student.
   2. In contrast, the coach sees his/her role as someone who actively stimulates learning.
      a. The instructor not only makes assignments and observes the results but also helps the student learn through demonstration and personalized instruction.
      b. The instructor-coach does more than answer questions and point out errors. (S)he also asks pertinent questions to stimulate the student's thought process and encourages correct ways of doing things by helping the student analyze mistakes.

IV. **When to Begin ADM Training**

A. Ground instruction

1. Students must be exposed to the ADM concepts early in their pilot training, i.e., during the first quarter of the course.
2. This training will provide the foundation for practical exercises during flight training.

B. Flight instruction

1. You should begin ADM training during flight lessons once the student has the ability to control the aircraft confidently during the most basic maneuvers.
    a. Use your own judgment, but a suggested starting point is about three flight lessons before you expect the student to solo.
2. You should provide your students actual preflight or in-flight hands-on experience, in the form of an ADM lesson.
    a. Each lesson should take no more than 5 minutes and should be integrated into the flight lesson.

C. Items needed for ground and flight instruction are covered in the appropriate ADM manual available from NTIS as discussed previously.

6.3 PILOT SELF-ASSESSMENT

I. Remind your students that, when they are pilot in command of an aircraft, they are directly responsible for, and are the final authority as to, the operation of that aircraft.

A. To effectively exercise that responsibility and to make effective decisions regarding the outcome of the flight, a pilot must have an understanding of his/her own limitations.

B. Emphasize that a pilot’s performance during a flight is affected by many factors, such as health, recency of experience, knowledge, skill level, and attitude.

II. Personal Minimums Checklist

A. Explain that, just as a checklist is used to thoroughly preflight an aircraft, a personal checklist can help a pilot determine if (s)he is prepared for a particular flight. This determination is the first decision point of a flight.

B. Introduce the concept of a **personal minimums checklist** to all of your students shortly before you expect them to solo. You should also discuss this concept with your advanced students, some of whom may not have been exposed to the idea during their previous training. An example of a personal minimums checklist is on the next page.

1. This checklist is designed to make pilots think about four categories of risk by using the acronym PAVE (**P**ilot, **A**ircraft, en**V**ironment, and **E**xternal pressures).
    a. This checklist is an easy-to-use, personal tool that can be tailored to any individual’s level of skill, knowledge, and ability.
    b. This checklist helps pilots to control and manage risk by identifying even the subtle risk factors.
    c. You can print out an 8 1/2 x 11 version of the PAVE checklist by visiting http://flysafe.faa.gov/Flysafe/training/PCL.htm or you can make copies of the PAVE checklist we have provided and distribute them to your students.

PILOT	AIRCRAFT
Experience/Recency	**Fuel Reserves (Cross-Country)**
Takeoff/landings........ ___ In the last ____ days	VFR Day........ ___ hours
Hours in make/model........ ___ In the last ____ days	Night........ ___ hours
Instrument approaches........ ___ In the last ____ days (simulated or actual)	IFR Day........ ___ hours
Instrument flight hours........ ___ In the last ____ days (simulated or actual)	Night........ ___ hours
Terrain and airspace........ familiar	**Experience in Type**
	Takeoffs/landings in aircraft type........ ___ in the last ___ days
Physical Condition	**Aircraft Performance**
Sleep........ ___ In the last 24 hours	Establish that you have additional performance available over that required. Consider the following:
Food and water........ In the last ____ hours	* Gross weight
Alcohol........ None in the last ____ hours	* Load distribution
Drugs or medication........ None in the last ____ hours	* Density altitude
Stressful events........ None in the last ____ days	* Performance charts
Illnesses........ None in the last ____ days	**Aircraft Equipment**
	Avionics........ familiar with equipment (including autopilot and GPS systems)
	COM/NAV........ equipment appropriate to flight
	Charts........ current
	Clothing........ suitable for preflight and flight
	Survival gear........ appropriate for flight and terrain

ENVIRONMENT	EXTERNAL PRESSURES
Airport Conditions	**Trip Planning**
Crosswind...................... ______ % of max POH	Allowance for delays....................... ___ minutes
Runway length................ ______ % more than POH	**Diversion or Cancellation Alternate Plans**
Weather	Notification of person(s) you are meeting
Reports and forecasts................ not more than ___ hours old	Passengers briefed on diversion or cancellation plans and alternatives
Icing conditions.........................within aircraft/pilot capabilities	Modification or cancellation of car rental, restaurant, or hotel reservations
Weather for VFR	Arrangement of alternative transportation (Airline, car, etc.)
Ceiling Day.................. ______ feet	**Personal Equipment**
Night................. ______ feet	Credit card and telephone numbers available for alternate plans
Visibility Day................. ______ miles	Appropriate clothing or personal needs (eye wear, medication...) in the event of an unexpected stay
Night................. ______ miles	
Weather for IFR	
Precision Approaches	
Ceiling........................ ______ feet above min.	
Visibility...................... ______ mile(s) above min.	
Non-Precision Approaches	
Ceiling........................ ______ feet above min.	
Visibility...................... ______ mile(s) above min.	
Missed Approaches	
No more than............... ______ before diverting	
Takeoff Minimums	
Ceiling........................ ______ feet	
Visibility...................... ______ mile(s)	

III. Explain to your students that each item on the PAVE checklist provides them with either a space to complete a personal minimum or a checklist item to think about.

A. Encourage your students to spend some time completing each blank and considering other items that apply to their personal minimums.

B. Tell your students that they have permission to choose higher minimums than those specified in the regulations, aircraft flight manuals, or other rules.

C. Explain how to use the checklist.

1. Tell your students to use it at home as they start planning a flight and again just before making the final decision to fly.

a. Emphasize that they, as the pilots, are responsible for determining whether they are fit to fly for a particular flight, even though they hold a current medical certificate.

2. Advise your students to be wary if they have an item that is marginal in any single risk factor category.

3. Tell your students that they should not make the flight if there are marginal items in two or more risk factor categories--DON’T GO!

D. Explain to your students that they should periodically review and revise their checklist as personal circumstances change, such as their proficiency, recent experience, or training.

1. Be very clear that pilots should never make their minimums less restrictive unless a significant positive development has taken place with their flying.

a. However, a pilot may make his/her minimums more restrictive at any time.

E. Emphasize to your students that they should **never** make their minimums less restrictive when they are planning a specific flight, or else external pressures will become an influence.

IV. Another personal minimums checklist that can be easily committed to memory is the I'M SAFE checklist.

A. This checklist contains all of the most common categories of pilot impairment.

Illness.	Do **I** have any symptoms?
Medication.	Have **I** been taking prescription or over-the-counter drugs?
Stress.	Am **I** under psychological pressure from the job? Do **I** have money, health, or family problems?
Alcohol.	Have **I** been drinking within the last 8 hours? Within 24 hours?
Fatique.	Am **I** tired or not adequately rested?
Eating.	Have **I** eaten enough of the proper foods to keep adequately nourished during the entire flight?

6.4 STRESS AND FLYING

I. What Is Stress?

A. Explain that stress is a term used to describe the body's nonspecific response to demands placed on it, whether pleasant or unpleasant, by physical, physiological, or psychological factors known as stressors.

1. Physical stressors include conditions associated with the environment, such as temperature and humidity extremes, noise, vibration, and lack of oxygen.
2. Physiological stressors include fatigue, lack of physical fitness, sleep loss, missed meals (leading to low blood sugar levels), and illness.
3. Psychological stressors are related to social or emotional factors, such as a death in the family, birth of a baby, a divorce, etc.
   a. Also, they may be related to mental workload, such as analyzing a problem, navigating an aircraft, or making decisions.

B. Tell your students that stress is a response to a set of circumstances that induces a change in a pilot's current physiological and/or psychological patterns of functioning, thereby forcing the pilot to adapt to these circumstances.

1. Stress is an inevitable and necessary part of life that adds motivation to life and heightens a pilot's response to meet any challenge.

C. Point out that even those things in life that we find pleasurable can be stressors since they represent changes in our environment that we have to deal with.

1. Everyone is stressed to some degree all the time, and a certain amount of stress is good.
   a. It keeps pilots alert and prevents complacency, thus helping to prevent accidents.

II. Handling Stress in Flying

A. Emphasize to your students that, while some amount of stress is desirable, higher stress levels, particularly when experienced over long periods of time, can adversely affect performance.

1. Thus, performance will generally increase with the onset of stress but will peak and then begin to fall off rapidly as stress levels exceed a pilot's adaptive abilities to handle the situation.

B. Boredom is seen at the lower stress levels, followed by optimal performance at the moderate stress levels, followed by overload and panic at the highest stress levels, as shown below.

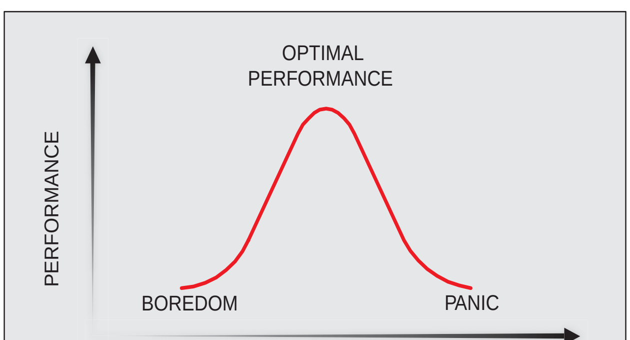


Figure6_2
Stress vs. Performance Graph

1. Complex or unfamiliar tasks require higher levels of performance than simple or overlearned tasks.
   a. Thus, complex or unfamiliar tasks are also more subject to the adverse effects of increasing stress than tasks that are simple or familiar.

C. Explain to your students that accidents often occur when flying task requirements exceed a pilot's capability to meet those requirements.

1. The difference between pilot capabilities and task requirements is called the margin of safety.
2. In the example below, the margin of safety is minimal during the approach under ideal conditions.

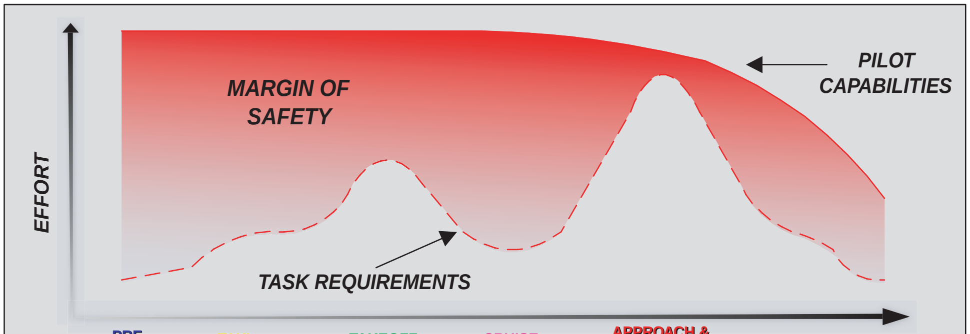


Figure6_3
Margin of Saftey Graph

a. In this example, an accident may have occurred during approach if there were any emergencies, distractions, or anything else degrading pilot capabilities (e.g., fatigue, illness, etc.).

D. Explain to your students that stress has a gradual and cumulative effect that develops so slowly that stress can be well established before its effects become apparent. Emphasize that there is a limit to a pilot's adaptive ability.

1. This limit, referred to as the stress tolerance level, is based on a pilot's ability to cope with the situation.
2. Explain that, if the number or intensity of the stressors becomes too great, the pilot is susceptible to an environmental overload.

   a. At this point, a pilot's performance will begin to decline, and judgment will deteriorate.

III. Signs of Inadequate Coping

A. Individuals who are overstressed (not coping adequately) often show symptoms in three ways:

1. Emotional
2. Physical
3. Behavioral

B. These symptoms differ depending on whether the aggression is focused inward or outward.

1. Individuals who turn their aggression inward demonstrate the following characteristics:

   a. Emotional symptoms include depression, preoccupation, sadness, and withdrawal.
   b. Physical symptoms include headaches, insomnia, appetite changes, weight gain or loss, indigestion, nausea, vomiting, diarrhea, and constipation.
   c. Behavior symptoms include a morbid preoccupation with illness (hypochondria), self-medication, a reluctance to accept responsibility, tardiness, absenteeism, and poor personal appearance and hygiene.

2. Individuals who turn their aggression on other people or objects show few physical symptoms.
    a. Emotional symptoms may show up as overcompensation, denial, suspicion, paranoia, agitation, restlessness, defensiveness, excessive sensitivity to criticism, argumentativeness, arrogance, and hostility.
    b. Behavioral symptoms include episodes of desperate "acting out" or temper tantrums.
        i. These individuals tend to be accident prone.
        ii. Be especially wary of authorizing student pilots who exhibit these tendencies for solo flight.

IV. **Life Stress Management**

A. Life stress is the stress incurred due to the demands of daily life.
    1. It is different from the situational stress that is created by the demands of the cockpit.

B. Explain to your students that there are many techniques available that can help them reduce their life stress, or help them cope with it better. Not all of the following ideas may be the solution, but some of them should be effective for most individuals.
    1. Become knowledgeable about stress.
    2. Take a realistic assessment of oneself.
    3. Take a systematic approach to problem solving.
    4. Develop a lifestyle that will buffer against the effects of stress.
    5. Practice behavioral management techniques.
    6. Establish and maintain a strong support network.

V. **Cockpit Stress Management**

A. Emphasize that good cockpit stress management begins with good life stress management.
    1. Explain that a pilot who begins a flight with minimal stress will have additional reserves available to deal with the demands of the cockpit.
        a. Conversely, a pilot who is already stressed by problems at home or at work may become overwhelmed by what would otherwise be reasonable demands in the cockpit.
    2. Point out that, because many of the stress coping techniques used for life stress management are not usually practical in flight, pilots must condition themselves to relax and think rationally when stress appears.

B. The following is a list of techniques for cockpit stress management. Discuss each item with your students.
    1. Avoid situations that distract you from flying the aircraft.
        a. EXAMPLE: You should not fly when preoccupied with a bad day at work or a fight with your spouse.
    2. Reduce your workload in order to reduce stress levels. A manageable workload will create a proper environment in which to make good decisions.
    3. If an emergency occurs, be calm. Think for a moment, weigh the alternatives, and then act.

4. Maintain proficiency in your aircraft because proficiency builds confidence. Be thoroughly familiar with the aircraft, its systems, and emergency procedures.
5. Know and respect your personal limitations.
6. Do not let little mistakes bother you until they build into a big distraction from flying the aircraft. Wait until after landing; then “debrief” and analyze past actions.
7. If flying is adding to your stress, either stop flying or seek professional help to manage your stress within acceptable limits.

6.5 EXERCISING GOOD JUDGMENT AS A FLIGHT INSTRUCTOR

I. Your flying habits, as observed by students during flight instruction or when conducting other pilot operations, have a vital impact on safety.

A. Students use their flight instructor as a role model whose flying habits they attempt to imitate, consciously or unconsciously.

1. Thus, the instructor’s advocacy and description of safety practices mean little to a student if the instructor does not demonstrate them consistently.

B. For this reason, you must carefully observe the safety practices taught to your students.

1. EXAMPLE: If a student sees the instructor start an airplane and take off without referring to a checklist, no amount of instruction in the use of the checklist will convince that student to faithfully use one during solo flight operations.

II. To maintain a professional image as a flight instructor, you must carefully observe all regulations and recognized safety practices during all flight operations.

A. An instructor who is observed to fly with apparent disregard for loading limitations or weather minimums, for example, creates an impression of irresponsibility that many hours of conscientious flight instruction cannot correct.

III. Habitual observance of regulations, safety precautions, and the precepts of courtesy will enhance your image of professionalism. More importantly, such habits make your instruction more effective by developing the same habits in your students.

A. The most important decision a pilot will make (and that you will influence) is to learn and adhere to published rules, procedures, and recommendations.

1. Emphasize that, by learning and adhering to these rules and procedures, your students can take most hazards out of flying.

IV. As a flight instructor, you must go beyond the requirements of developing technically proficient students who are knowledgeable in the areas of their aircraft, flight procedures, and maneuvers.

A. You must teach your students not only to know and understand their own and their equipment's strengths and limitations, but also to understand how these factors interact with the environment in which they are operating.

B. Thus, you must teach and develop good pilot judgment in your students.

6.6 COCKPIT RESOURCE MANAGEMENT (CRM)

I. CRM means the effective use of all resources (people and materials) to achieve safe and efficient flight operations.

A. While CRM is typically thought of in terms of a multi-person flight crew, the concept applies to solo operations as well, because CRM refers to the use of all resources available in the cockpit (e.g., official publications, navigation equipment, ATC, flight service stations, etc.), not just interactions between crew members.

II. **CRM as applied to your students' solo operations and personal flying**

A. Explain to your students that, to make informed decisions during flight operations, they must be aware of the resources found both inside and outside the cockpit. This is the essence of CRM.

1. Your students must not only identify the resources available to them, but they must also evaluate whether there is time to use a particular resource, and the impact that the use of that resource will have upon the safety of the flight.
2. EXAMPLE: The assistance of ATC may be useful to a pilot who gets lost. However, in an emergency situation when action needs to be taken quickly, time may not be available to contact ATC before the situation must be dealt with.

B. **Internal resources** are found in the cockpit during flight.

1. Emphasize that some of the most valuable internal resources are ingenuity, knowledge, and skill. Pilots can expand their internal (cockpit) resources immensely by improving their capabilities.
   a. This can be done by frequently reviewing flight information publications, such as federal regulations and the *Aeronautical Information Manual* (*AIM*), as well as by pursuing additional training.
2. A thorough understanding of all the equipment and systems in the aircraft is necessary to fully utilize all resources.
   a. Point out that, while GPS and autopilot systems are valuable resources, if a pilot does not fully understand how to use the equipment, or (s)he relies on them so much that (s)he becomes complacent, the equipment can become a detriment to safe flight.
   b. Remind your students of the importance of monitoring the flight instruments and the aircraft's position by other means while using a GPS or an autopilot.
3. Teach your students that checklists are essential cockpit resources for verifying that the aircraft instruments and systems are checked, set, and operating properly, as well as ensuring that the proper procedures are performed if there is a system malfunction or in-flight emergency.
   a. Additionally, the *Pilot's Operating Handbook* (*POH*), which is required to be carried onboard the aircraft, is essential for accurate flight planning and for resolving in-flight equipment malfunctions.
   b. Other valuable cockpit resources include current aeronautical charts and publications, such as the *Airport/Facility Directory*.
4. Point out that passengers can also be a valuable resource.
   a. Passengers can help watch for traffic and may be able to provide information in an irregular situation, especially if they are familiar with flying.
   b. A strange smell or sound may alert a passenger to a potential problem.
   c. You should advise your students, as pilot in command, to brief their passengers before the flight to make sure that they are comfortable voicing any concerns.

C. **External resources**

1. Possibly the greatest external resources available during flight are ATC and flight service station (FSS) specialists.
   a. ATC can help reduce pilot workload by providing traffic advisories, radar vectors, and assistance in emergency situations.
   b. FSSs can provide updates on weather, answer questions about airport conditions, and may offer direction-finding assistance.
2. Emphasize to your students that the services provided by ATC and FSS specialists can be invaluable in enabling them to make informed in-flight decisions.

III. **CRM as applied to the instructor-student relationship**

A. It is often tempting for flight instructors to regard flight training operations essentially as single-pilot operations.

1. With primary students, especially pre-solo students, the tendency may be to treat the student almost as a passenger who simply happens to touch the controls, even to the point of disregarding his/her input about subjects that are not directly related to the lesson.
   a. As your primary students become more capable, you should delegate progressively more responsibility to them for handling the flight operations that take place between the ramp and the practice area.
2. With advanced students, including post-solo student pilots working on cross-country procedures, the tendency may be to regard **yourself** almost as a passenger, whose only job is to direct the student's practice and evaluate his/her performance while (s)he handles the other aspects of the flight.
   a. With advanced students, you must keep yourself mentally involved in the flight, even if you specifically wish to observe the student's abilities to perform as pilot in command.

B. As a flight instructor, you need to regard yourself and your student as the crew of your training aircraft.

1. You must also make your student aware of this fact.
2. Ensure that you have briefed your student on exactly what each of your responsibilities will be during normal operations (i.e., back and forth between the practice area and the airport), training operations, and emergency situations.
3. Ask your student to help you look for traffic, listen for radio calls, etc.
   a. Note that anything you ask the student to assist you with would be required of him/her during solo operations; therefore, it is a good instructional practice to involve your students not just for reasons of safety, but also to enhance learning.

C. Ensuring that a positive exchange of flight controls takes place during training operations is also related to CRM in a flight training situation.

1. Once you get comfortable with a student, particularly an advanced student, it is easy to get complacent about making a positive exchange of the flight controls.
2. Regardless of the student's experience level, you and your student must always be completely clear about who is flying the airplane. One recommended method is to use the sequence below:
   a. Pilot relinquishing control: "You have the flight controls."
   b. Pilot taking control: "I have the flight controls."
   c. Pilot relinquishing control (repeats): "You have the flight controls."

6.7 AVOIDING HAZARDOUS OPERATIONS

I. Explain to your students that most preventable accidents have one common factor -- **the human factor** -- rather than a mechanical malfunction.

A. Very often, the pilot was aware of the possible hazards when (s)he made the decision that led to the wrong course of action.

1. In the interest of expediency, cost savings, self-gratification, or other often irrelevant factors, a series of decisions were made that led to an accident.

B. Explain that this cycle of decisions began at the flight planning desk with decisions made on how much fuel to carry, the route, the alternate route, and adequate weather conditions.

1. This cycle continued throughout the flight with decisions made about speed, altitude, and when to descend.
2. Emphasize that each flight is a sequence of choices with certain milestones in the sequence that require particular attention and discretion.

C. Impress upon your students that, while simple errors of equipment operation are seldom serious, mistakes in judgment can be fatal.

1. One essential decision point before beginning any flight is the pilot's personal minimums checklist (see Module 6.3).

II. Emphasize to your students that the following **hazardous operations** contribute significantly to unsafe flight:

A. Flight while under the influence of alcohol or drugs, including applicable prescription drugs, is never acceptable.

B. Flight with a known medical deficiency is never expedient or legal.

C. Flight outside the certified flight envelope is never safe.

1. Weight, balance, speed, maneuvers, G-loading, and flight in known icing should be limited to flight manual parameters.
2. When pilots venture beyond the limits of known performance data, they are in the wilderness, and all discoveries could be unhappy experiences.

D. Flight with less than the required minimum fuel is never reasonable.

E. VFR flight into IMC is never justified.

F. Descent below the applicable minimum en route altitude anywhere is never justified.

G. Casual neglect of any applicable checklist is never justified.

1. A checklist may be made larger or smaller; however, certain standards should be established for all flights so that the first decision point is whether to begin the flight. This can be the toughest decision.

III. **How to Be a Safe Pilot**

A. Explain to your students that a pilot does not have to be a genius to be a safe pilot.

1. However, pilots should accept the fact that they are not in possession of all facts or skills for all situations, and therefore be willing to accept the recommendations of those who specialize in evaluating, assessing, and administering aviation procedures.

B. Reaching a consensus on all matters within the aviation community can prove difficult, if not impossible.

1. Even though the rules and procedures are designed to serve most of the people most of the time, a pilot can always argue for different ways of doing things.
2. Impress upon your students that an experienced, mature pilot will accept and follow the rules and procedures which have been established to benefit the aviation community.
   a. The immature, emotionally unbalanced pilot has strong tendencies to satisfy a personal need regardless of the consequences.

C. When a pilot exhibits one or more of the five hazardous attitudes or irrational behavior, that pilot may also be exposing an emotional weakness in his/her personality.

IV. **Development of Good Decision-Making Skills**

A. Explain to your students that the development of good decision-making skills is far more difficult than developing good flying skills.

1. Good judgment may mean not flying while under the influence of any medication or when it is too windy, or refusing a revenue flight when it would require flying in marginal weather.

B. Warn your students that many pilots fail to make proper decisions, sometimes due to a lack of knowledge, but too often as the result of a human tendency to rationalize a situation until it appears justifiable.

1. Remind your students that, when a pilot really wants to do something (e.g., loading that one last passenger when close to maximum gross weight), the pilot can generally make himself/herself believe that it is all right to do it.
   a. A pilot can be his/her own worst enemy.

C. Emphasize to your students that, when they operate an aircraft, human lives are held in the balance. Thus, they have a moral responsibility to operate in the safest possible manner.

1. Successful decision making is measured by a pilot's consistent ability to keep himself/herself, any passengers, and the aircraft in good condition regardless of the conditions of any given flight.

GLEIM FLIGHT INSTRUCTOR REFRESHER COURSE
LESSON 7
FUNDAMENTALS OF INSTRUCTING

7.1 THE LEARNING PROCESS

I. In order to successfully meet the challenges of teaching a complex task to multiple individuals with widely varied personalities, backgrounds, and aptitudes, it is essential for flight instructors to have an understanding of the ways that people learn.

II. **Learning** can be defined as a change in behavior as a result of experience.

  A. The behavior change can be physical and overt (an improved ability to maintain a glide path, for instance) or it may involve complex intellectual or attitudinal changes, which affect behavior in more subtle ways (the development of stronger motivation or more acute perceptions and insights, for instance).

III. **Characteristics of Learning**

  A. **Learning is purposeful.**

    1. Most people have fairly definite ideas about what they want to do and achieve; i.e., most students have goals both for the short term (a given learning situation) and the long term (a career). Students learn from any activity that tends to further their goals.

    2. Thus, in the process of learning, the student's goals are of great significance. A student's goals will affect how and what (s)he learns.

  B. **Learning is a result of experience.**

    1. Knowledge cannot be poured into the student's head. The student can learn only from personal experiences. What one student learns from a given situation (e.g., a lecture) will be different from what another student learns from the same situation because of the personal differences that color their experiences.

    2. Learning a physical skill requires actual experience in performing that skill.

      a. Student pilots learn to fly an airplane only if their experience includes flying.

  C. **Learning is multifaceted.**

    1. Psychologists classify learning by many types, including verbal, conceptual, perceptual, motor skills, emotional, and problem solving.

    2. Learning is multifaceted in another sense. While learning the subject at hand, the student may be learning other things as well. They may be developing attitudes about aviation (good or bad) or a sense of self-reliance, based on their unique experience.

      a. Though sometimes called "incidental," this kind of learning can have a significant impact on a student's total development.

  D. **Learning is an active process.**

    1. Students do not automatically soak up knowledge like a sponge absorbs water.

    2. An instructor cannot assume that a student remembers something simply because (s)he attended the lesson.

    3. For students to learn, they must react and respond to the material -- either outwardly or inwardly, intellectually or emotionally.

    4. If learning is a process of changing behavior, clearly that process must be an active one.

IV. **The Principles of Learning**

A. **Principle of readiness**

1. Individuals learn best when they are ready to learn.
    a. Getting students ready to learn is the instructor's job.
    b. Readiness implies a degree of single-mindedness and eagerness toward the subject.
2. If a student has a strong purpose, a clear objective, and a definite reason for learning something, (s)he will make more progress than if (s)he lacks motivation.
    a. When students are ready to learn, they will meet the instructor at least halfway, and this simplifies the instructor's job.
3. There are factors that the instructor will not be able to control (e.g., a student's personal problem), which may render the instructor unable to inspire a readiness to learn and cause the student to have little interest in learning.

B. **Principle of exercise**

1. This principle states that those things most often repeated are best remembered.
    a. This principle is the basis of practice and drill.
2. A student will not learn to perform crosswind landings on a single instructional flight.
    a. Students learn by applying what they have been told and shown.
    b. Every time practice occurs, learning continues.
3. The instructor must provide opportunities for students to practice and must make sure that this process is directed toward a goal.

C. **Principle of effect**

1. Learning is strengthened when accompanied by a pleasant or satisfying feeling, and learning is weakened when associated with an unpleasant feeling.
2. An experience that produces feelings of defeat, frustration, anger, confusion, or futility is unpleasant for the student.
    a. EXAMPLE: If an instructor attempts to teach landings during the first flight lesson, the student is likely to feel inferior and be dissatisfied.
3. Impressing students with the difficulty of a flight maneuver can make the teaching task difficult.
    a. Usually it is better to tell a student that a maneuver, although challenging, is within his/her capability to understand or perform.
4. Whatever the learning situation, it should contain elements that affect the students positively and give them feelings of satisfaction.

D. **Principle of primacy**

1. Primacy, the state of being first, often creates a strong, almost unshakable, impression.
    a. For an instructor, this means that what is taught must be right the first time.
2. For example, if a student does not learn the proper use of the rudder, the instructor will have a difficult task of unteaching the bad habits and reteaching the correct ones.
3. The first experience should be positive and functional and lay the foundation for all that is to follow.

E. **Principle of intensity**

1. A vivid, dramatic, or exciting learning experience teaches more than a routine or boring experience.
    a. A student is likely to gain greater understanding of stalls by performing them than from merely reading about them.
2. A student will learn more from the real thing than from a substitute.

F. **Principle of recency**

1. Things most recently learned are best remembered.
    a. Conversely, the further a student is removed temporally from a new fact or understanding (i.e., the more time that passes between learning a fact and attempting to recall it), the more difficult it is to remember it.
2. The instructor recognizes the law of recency when planning a summary for a ground lesson or a postflight critique.
    a. The instructor repeats, restates, or reemphasizes important points at the end of a lesson to make sure a student remembers them.

V. **Factors Involved in How People Learn**

A. Initially, all learning comes from perceptions that are directed to the brain by one or more of the five senses (i.e., sight, hearing, touch, smell, and taste).

1. Perceiving involves more than the reception of stimuli from the five senses. Perceptions result when a person gives meaning to the sensations. Thus, perceptions are the basis of all learning.
2. It is therefore very important for the instructor to have knowledge of the factors that affect the perceptual process. Some factors are internal to each individual, and some are external. These factors include:
    a. The perceiver's physical organism
    b. The perceiver's basic needs
    c. The perceiver's goals and values
    d. The perceiver's self-concept
    e. The availability or lack of sufficient time and opportunity to turn sensations into meaningful perceptions
    f. The presence of any element of threat

B. The element of threat does not promote effective learning because fear adversely affects a person's perceptions by narrowing the perceptual field.

1. Confronted with a threat, students tend to limit their attention to the threatening object or condition.
2. Anything threatening, whether it is something the instructor says or does or an unsettling feeling of being out of control in a maneuver, adversely affects all of a student's physical, mental, and emotional faculties.

C. Insight involves the grouping of perceptions into meaningful wholes (i.e., getting the whole picture).

1. Creating insight is one of the instructor's major responsibilities.
2. Instruction, as opposed to the trial-and-error method of learning, speeds the learning process by teaching the relationship of perceptions as they occur, thus promoting the development of insights by students.

3. Instructors can help students develop insights by
   a. Pointing out the relationship of perceptions as they occur.
   b. Providing a safe and non-threatening environment in which to learn.
   c. Helping the student acquire and maintain a favorable self-concept.

D. Motivation is the dominant force in a student's progress and ability to learn.

1. Negative motivations are those that may produce fear and be accepted by the student as threats. They may be useful in certain situations, but they are not as effective in promoting efficient learning as positive motivations.
2. Positive motivations are essential to true learning. Positive motivations are provided by the promise or achievement of rewards, whether financial, personal, or societal.

VI. **Levels of Learning**

A. **Rote**

1. Rote learning, the lowest level of learning, is the ability to repeat something that has been taught without understanding or being able to apply what has been learned.
2. EXAMPLE: A flight instructor tells a student pilot to enter a turn by banking the airplane with aileron control and applying sufficient rudder pressure in the same direction to prevent slipping or skidding.
   a. A student who can repeat this instruction, but does not know what it means, has learned by rote.

B. **Understanding**

1. At this level, the student cannot only repeat what has been taught, but also understands the principles and theory behind the knowledge.
2. EXAMPLE: With proper instruction on the effect and use of the flight controls, and experience in their use in straight flight, the student can develop old and new perceptions of the flight controls and their use into an insight about how to make a turn; i.e., the student develops an understanding of how to turn the airplane.

C. **Application**

1. At this level, the student not only understands the theory but can apply what has been learned and perform it correctly.
2. EXAMPLE: When a student understands the procedures for entering a turn, has had turns demonstrated to him/her, and has practiced turn entries until consistency has been achieved at an acceptable skill level, the student has developed the ability to apply what has been taught.
3. Application is a major level of learning, and one at which an instructor is too often willing to stop.
   a. Discontinuing instruction on one element of piloting performance once the application level has been reached, and directing further instruction exclusively to other elements, violates the building block concept of instruction (in which new learning and habit patterns are based on a solid foundation of experience and/or old learning) by failing to apply what has been learned to future lessons.

D. **Correlation**

1. At this level, the student is able to associate an element which has been learned with other segments or blocks of learning.
    a. This level of learning should be the objective of all instruction.
2. EXAMPLE: The student who has achieved this level of learning in turn entries has developed the ability to correlate the elements of turn entries with the performance of combined piloting operations (i.e., operations requiring more of the pilot than a simple turn entry), such as ground reference maneuvers or eights-on-pylons.

VII. **Principles Applied in Learning a Physical Skill**

A. **Physical skills involve more than muscles.**

1. The perception of a skill changes as it becomes easier. Concepts of how to perform the skill are developed, and attitudes toward it are changed.

B. **Desire to learn**

1. A student who has a desire to learn a skill will initially learn it more quickly, and will show more rapid improvement. Students have a desire to learn skills that appear to bring them closer to intended goals or that meet their needs (the principle of readiness).
2. The instructor should build on the student's natural enthusiasm about his/her goals or needs by relating the lesson objective to those goals or needs.

C. **Patterns to follow**

1. The best way to prepare a student to perform a task is to provide a clear, step-by-step example. A good example provides a clear picture of each step necessary to perform a task, thereby allowing students to understand what is necessary to complete the task and how to perform it.
2. In flight, the instructor provides a demonstration of each maneuver, emphasizing the steps and techniques used in order to provide the student with a clear impression of what to do.

D. **Performance of the skill**

1. Physical skills cannot be learned from an explanation or by watching a demonstration. The student must practice the new skill in order to develop coordination between the muscles and the visual and tactile senses.
2. As a student gains proficiency in a skill, verbal instructions become more meaningful.
    a. A long, detailed explanation is confusing if it is given before the student begins performing a skill or maneuver. Specific comments are more meaningful and useful after the skill has been partially mastered.

E. **Knowledge of results**

1. The instructor provides a helpful and often critical function in making certain that students are aware of their progress.
    a. A student should know when his/her performance is right and when it is wrong.
        i. A student may already know that something is wrong with his/her performance, but may not know how to correct it. An instructor's guidance is critical in this situation.
2. Students should be told of their progress as soon after the performance of a maneuver or task as possible, because they should not be allowed to practice mistakes.
3. One way to make students aware of their progress is to repeat a demonstration, showing the students the standard that must ultimately be met.

F. The pattern of progress

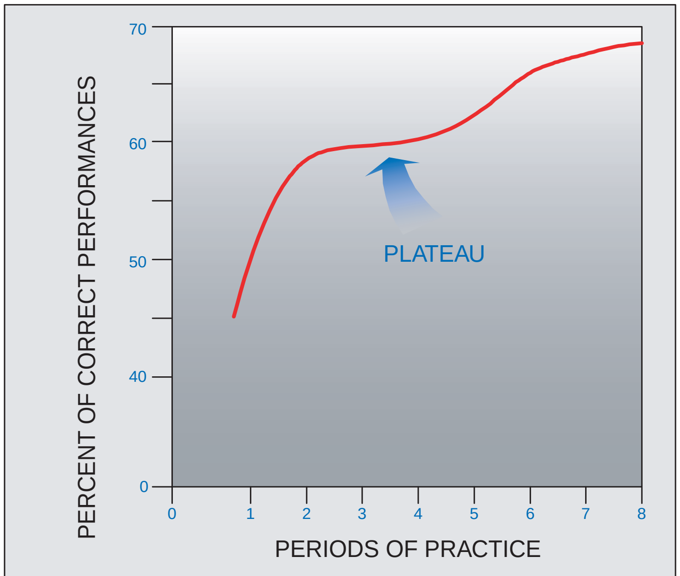


Figure7_1
The Pattern of Progress

1. Learning typically follows a pattern which is called the learning curve, shown above.
   a. There is normally rapid improvement in the performance of a skill during the early stages of learning.
   b. After these initial stages, improvement slows significantly (or stops altogether) for a significant period of time. This slowing of the rate of improvement is called a learning plateau.
   c. A learning plateau is normal and should be expected after a period of rapid improvement. You should prepare your students for this plateau to prevent discouragement and minimize frustration.

G. Duration and organization of a lesson

1. A primary consideration in planning for student performance of a skill is the length of time devoted to practice.
   a. A beginning student will reach a point at which additional practice is not only unproductive, but may even be harmful.
      i. When that point is reached, errors increase and motivation declines.
2. As a student gains experience, longer periods of practice are profitable.
3. Depending on the skill being learned, the practice period (and perhaps the instructional period as well) may need to be divided into segments rather than taking place all at one time. In other cases, it may be beneficial to integrate the instruction and practice of a skill into one continuous sequence.

H. Evaluation vs. critique

1. In the initial stages of learning a skill, practical suggestions are more valuable to the student than a grade.
2. Early evaluation is usually instructor-oriented. It provides a check on the effectiveness of the instruction, can be used to predict eventual student proficiency, and can help in identifying special problem areas.
3. The observations on which the evaluations are based can also identify the student's strengths and weaknesses, which the instructor must understand in order to make constructive criticism.

I. **Application of skill**

1. In order to prevent a newly learned skill from going unused, two things are needed:
   a. The student must learn the skill so well that it becomes easy, even habitual, to perform it.
   b. The student must recognize the types of situations in which it is appropriate to use the skill.

VIII. **Memory**

A. Memory is an integral part of the learning process. It is composed of three parts: the sensory register, the short-term or working memory, and the long-term memory.

1. The **sensory register** receives input from the environment and quickly processes it according to the individual's preconceived concept of what is important. This occurs on a subconscious level.
   a. **Precoding** is the selective process by which the sensory register recognizes certain stimuli and immediately transmits them to the working memory for action.
      i. Irrelevant stimuli are discarded by the sensory register
2. The **short-term memory** (or working memory) is the receptacle of the information deemed important by the sensory register.
   a. The information may temporarily remain in the short-term memory, or it may rapidly fade.
3. The **long-term memory** is where information is stored for future use.
   a. For the stored information to be useful, some special effort must have been expended during the recoding process.

IX. **Factors Related to Forgetting and Retention**

A. The following are three theories of forgetting:

1. The theory of **disuse** states that a person forgets those things which are not used. For example, high school and college graduates are often saddened by the small amount of actual data retained several years after graduation.
2. The theory of **interference** states that people forget something because a new experience has overshadowed it, or the learning of similar things has intervened. In other words, new or similar events can displace things that have been previously learned.
3. The theory of **repression** states that some forgetting is due to the submersion of ideas into the subconscious mind. Material that is unpleasant or produces anxiety is forgotten by the individual, although not intentionally. It is a subconscious and protective response. Repression is unlikely to be a cause of forgetting flying skills and facts in all but a few cases.

B. Each of the preceding theories implies that knowledge is not lost when it is forgotten; it is made unavailable for recall. The instructor's task is to ensure that the knowledge is available for ready recall. To do this, instructors should teach thoroughly and with meaning. Material thoroughly learned is highly resistant to forgetting.

C. The following five principles are generally accepted as having a direct application to retention (remembering):

1. Praise stimulates remembering.
   a. A student's action that results in a pleasurable return (e.g., praise) tends to be repeated. Actions that are met without praise or with a negative response do not tend to be repeated.

2. Recall is promoted by association.
    a. Each bit of information or action that is associated with something to be learned tends to facilitate later recall by the student of that fact or skill. Unique or disassociated facts tend to be forgotten.
3. Favorable attitudes aid retention.
    a. People learn and remember only what they wish to know. Without the motivation to do so, there is little chance for recall.
    b. The most effective motivation is based on positive or rewarding objectives.
4. Learning is most effective when all the senses are used.
    a. Although we generally receive what we learn through the eyes and ears, other senses also contribute to most perceptions.
    b. When several senses respond together, a fuller understanding and a greater chance of recall are achieved.
5. Meaningful repetition aids recall.
    a. Each repetition gives the student an opportunity to gain a clearer and more accurate perception of the subject to be learned, but repetition alone does not guarantee retention.
        i. Practice provides an opportunity for learning but does not cause learning.
    b. Research indicates that three or four repetitions provide the maximum benefit, after which the rate of learning and probability of retention fall off rapidly.

X. How Transfer of Learning Affects the Learning Process

A. The student may be either aided or hindered by things previously learned. This process is called **transfer of learning**.

B. Positive transfer occurs when the learning of one skill aids in learning another skill.

1. EXAMPLE: Flying rectangular courses aids in flying traffic patterns.

C. Negative transfer occurs when a previously learned skill interferes with learning a new skill.

1. EXAMPLE: A student may try to steer a taxiing plane with the control yoke in the same manner as (s)he drives a car.
2. Negative transfer thus substantiates the interference theory of forgetting.

D. By making certain that the student understands that what is learned can be applied to many other training and operational situations, the instructor helps facilitate a positive transfer of learned skills to future training.

1. This is the basis for the building-block technique of instruction, in which each simple task is performed acceptably and correctly before the next learning task is introduced, because that task builds on what came before it.
2. Beginning instruction in more advanced and complex operations before basic skills have been mastered leads to the development of poor habit patterns in the performance of the more complex skills.

XI. **How the Formation of Habit Patterns Affects the Learning Process**

A. The formation of correct habit patterns from the beginning of any learning process is essential to further learning and for correct performance after the completion of training.

1. It is much easier to foster proper habits from the beginning of training than to correct faulty ones later.
2. Faulty performance of the elements of a task are inevitably carried through to all future learning that incorporates that task.

7.2 THE TEACHING PROCESS

I. The presentation of new material by an instructor involves the following four steps:

A. Preparation
B. Presentation
C. Application
D. Review and Evaluation

II. These four steps are discussed in detail in the following section.

A. **Preparation for a Lesson or an Instructional Period**

1. For each lesson or instructional period, the instructor must determine the material to be covered, the objectives of the lesson, and the goals to be attained.
2. The preparation for a lesson also includes an instructor's requirements for home study or other special preparation by the student.
3. As part of the preparation, the instructor should make certain that all necessary supplies, materials, and equipment required for the lesson are readily available and that the equipment is operating properly.
4. The instructor's preparation for a lesson should include reference to the syllabus or PTS involved and a review of the general objectives that are to be accomplished.
5. The instructor must develop a detailed written lesson plan if the instructional period is to be effective.
   a. A lesson plan includes a statement of the lesson's objectives, the procedures and facilities to be used in presenting it, the specific goals to be attained, and the means to be used for evaluating the results that are achieved.

B. **Presentation of Knowledge and Skills**

1. Instructors have several methods of lesson presentation to choose from, including the lecture method, the guided discussion method, and the demonstration/performance method. The choice of method is determined by the nature of the subject matter and the objective of teaching it.
2. The lecture method is used primarily to introduce students to new subject material. It is also valuable for
   a. Summarizing ideas
   b. Showing relationships between theory and practice
3. The guided discussion method is used in a classroom situation to teach subjects about which students may have some intuition. The instructor draws out what the students know by encouraging discussion through the skillful use of questions.

4. The demonstration/performance method is used extensively for flight and ground training.
   a. The demonstration/performance method is composed of four steps:
      i. Instructor explanation
      ii. Instructor demonstration
      iii. Student performance and instructor supervision
      iv. Instructor evaluation
   b. In developing a lesson, the instructor should organize explanations and demonstrations to help the student achieve the desired learning outcome.
   c. The telling-and-doing technique of flight instruction is a variation on the demonstration/performance method and will be discussed further in Lesson 9. It is composed of the following four steps:
      i. Instructor tells; instructor does.
      ii. Student tells; instructor does.
      iii. Student tells; student does.
      iv. Student does; instructor evaluates.

C. Application, by the Student, of the Knowledge and Skills Presented by the Instructor

1. The student may be asked to explain the new material after a classroom presentation, or to perform a procedure or operation after a demonstration.
   a. EXAMPLE: At the end of a classroom period on the flight computer, the student may be asked to work a flight planning problem involving the computation of groundspeed, drift correction, and estimated time en route.
2. The application step is where the student uses what the instructor has presented.
3. During most flight instruction, the instructor's explanation and demonstration activities are alternated with the student's performance efforts.
   a. Usually, the instructor will have to interrupt the student's efforts for corrections and further demonstrations.
   b. This is necessary because it is very important that the student perform the maneuver the right way the first few times. This is when habits are established.
      i. Faulty habits are difficult to correct and must be addressed as soon as possible.

D. Review and Evaluation of Student Performance

1. Review and evaluation are integral parts of each ground or flight lesson. Before the end of the instructional session, the instructor should review what has been covered during the lesson and require students to demonstrate how well the lesson objectives have been met.
   a. The instructor's evaluation may be informal and noted only for use in planning the next lesson for the students, or it may be formally recorded to certify the students' progress in the course.
   b. Students should be made aware of their progress. Any advances or deficiencies should be noted at the conclusion of the lesson.
      i. The failure of the instructor to make students aware of their progress, or the lack of it, may create a barrier that could impede further instruction.

2. In flight training, the instructor must remember that it is difficult for students to obtain a clear picture of their progress, because they seldom have a chance to compare their performance with that of other students.
    a. Students are normally only able to compare their performance with that of their instructor.
        i. Students may become discouraged when their only visible competition (the instructor) is doing well and they are not.
        ii. It is therefore important that the instructor's feedback adequately compares a student's performance to the completion standards of the lesson plan so (s)he has a realistic picture of how (s)he is doing.
3. Each lesson should include a selective review and evaluation of things previously learned.
    a. If the evaluation reveals a deficiency or fault in the knowledge or performance of the present lesson, it must be corrected before new material can be presented.
    b. If deficiencies or faults not associated with the present lesson are revealed, they should be carefully noted and pointed out to the student.
        i. Corrective measures that are practicable within the limitations of the current lesson should be taken immediately.
        ii. More thorough remedial actions that are beyond the scope of the present lesson must be included in future lesson plans.
4. The evaluation of student performance and accomplishment during a lesson should be based on the objectives and goals that were established in the instructor's lesson plan.

7.3 LESSON PLAN

I. A lesson plan is an organized outline for a single instructional period. Lesson plans should be prepared in writing for each instructional period, regardless of the instructor's experience or the student's level.

A. A lesson plan should be developed to show specific knowledge and/or skills to be taught.
1. The lesson plan is a guide for the instructor in that it tells him/her what to do, in what order to do it, and what procedure to use in teaching the material of the lesson.

B. A so-called "mental outline" is not a lesson plan.

C. To be effective, the lesson plan must be in writing.
1. Another instructor should be able to take the lesson plan and know what to do in conducting the period of instruction.
2. When the lesson plan is in written form, it can be analyzed for adequacy and completeness.

II. **Purpose of the Lesson Plan**

A. Lesson plans are designed to ensure that each student receives the best possible instruction under the existing conditions.

B. Lesson plans help instructors keep a constant check on their own activity, as well as that of their students.

C. The development of lesson plans by instructors signifies, in effect, that they have taught the lessons to themselves prior to attempting to teach the lessons to students.

D. An adequate lesson plan, when properly used, should

1. Ensure a wise selection of material and the elimination of unimportant details
2. Make certain that due consideration is given to each part of the lesson
3. Aid the instructor in presenting the material in a suitable sequence for efficient learning
4. Provide an outline of the teaching procedure to be used in a single instructional period
5. Serve as a means of relating the lesson to the objectives of the course of training
6. Give the inexperienced instructor confidence
7. Promote uniformity of instruction regardless of the instructor or the date on which the lesson is given

III. Characteristics of a Well-Planned Lesson

A. Unity. Each lesson should be a unified segment of instruction. A lesson is concerned with certain limited objectives that are stated in terms of desired student learning outcomes. Teaching procedures and materials should be selected to attain these objectives.

B. Content. Each lesson should contain new material. However, the new facts, principles, procedures, or skills should be related to material previously presented.

1. A short review of earlier lessons is usually necessary, particularly in flight training.

C. Scope. Each lesson should be reasonable in scope. A person can master only a few principles or skills at a time, depending on complexity.

1. Presenting too much material in a lesson results in confusion; presenting too little material results in inefficiency.

D. Practicality. Each lesson should be planned in terms of the conditions under which the training is to be conducted.

1. Lesson plans conducted in an airplane or ground trainer will differ from those conducted in a classroom.

E. Flexibility. While the lesson plan provides an outline and a sequence for the training to be conducted, a degree of flexibility should be incorporated.

F. Relation to course of training. Each lesson should be planned and taught so that its relation to the course objectives are clear to each student.

G. Instructional steps. Every lesson, when adequately developed, falls logically into the four steps of the teaching process: preparation, presentation, application, and review and evaluation.

IV. How to Use a Lesson Plan Properly

A. Be familiar with the lesson plan. The instructor should study each step of the plan and should be thoroughly familiar with as much information related to the subject as possible.

B. Use the lesson plan as a guide. The lesson plan is an outline for conducting an instructional period. It assures that pertinent materials are at hand and that the presentation is accomplished with order and unity.

1. Having a plan prevents the instructor from getting off of the topic, omitting essential points, and introducing irrelevant material.

C. Adapt the lesson plan to the class or student. In teaching a lesson, the instructor may find that the procedures outlined in the lesson plan are not leading to the desired results. In this situation, the instructor should change the approach; the use of standard lesson plans may not be effective for students requiring a different approach.

D. Revise the lesson plan periodically. After a lesson plan has been prepared for a training period, a continuous revision may be necessary due to changes in regulations, textbooks, or instructional equipment (including the training aircraft).

V. Lesson Plan Formats

A. The format and style of a lesson plan depend on several factors.

1. The subject matter is directly related to how a lesson is presented and what teaching method is used.
2. Ground lessons will be structured differently for one-on-one training vs. a classroom setting.
3. Preferably, each lesson should have somewhat limited objectives that are achievable within a reasonable period of time. The number and organization of objectives will depend on their characteristics and complexity.

B. Most aviation lesson plans have the following common characteristics: objectives, content that supports the objectives, and completion standards.

C. These characteristics may be incorporated into a lesson in a variety of ways, and may be given different names. An example of one approach is given below:

1. Lesson objective. The objective of the lesson should be clearly stated in terms of desired student learning outcomes.
   a. The objective is the reason for the lesson, i.e., what the instructor expects the student to know or be able to do at the completion of the lesson.
2. Content. This section lists the items that must be covered in order to achieve the lesson objective.
3. Schedule. The instructor should estimate the total amount of time to be spent on a particular lesson as well as the approximate time to be devoted to each part of the lesson.
4. Equipment. The equipment list includes all instructional materials and training aids required to teach the lesson.
5. Instructor's actions. This section outlines the instructor's proposed procedures for presenting the content of the lesson.
6. Student's actions. This section outlines the desired student responses to instruction.
7. Completion standards. These standards supply the basis for determining how well the student has met the lesson objective.

VI. A sample lesson plan for a flight instruction period on stalls is shown below.

LESSON Stalls **STUDENT** Larry **DATE** 7-20

OBJECTIVE

- To familiarize the student with the stall warnings and handling characteristics of the airplane as it approaches a stall. To develop the student's skill in recognition and recovery from stalls.

CONTENT

- Configuration of airplane for power-on and power-off stalls.
- Observation of airplane attitude, stall warnings, and handling characteristics as it approaches a stall.
- Control of airplane attitude, altitude, and heading.
- Initiation of stall recovery procedures.

SCHEDULE

- Preflight Discussion :10
- Instructor Demonstrations :25
- Student Practice :45
- Postflight Critique :10

EQUIPMENT

- Chalkboard or notebook for preflight discussion.

INSTRUCTOR'S ACTIONS

- Preflight — Discuss lesson objective
- Inflight — Demonstrate elements. Demonstrate power-on and power-off stalls and recovery procedures. Coach student practice.
- Postflight — Critque student performance and assign study material.

STUDEBT'S ACTIONS

- Preflight — Discuss lesson objective and resolve questions.
- Inflight — Review previous maneuvers including slow flight. Perform each new maneuver as directed.
- Postflight — Ask pertinent questions.

COMPLETION STANDARDS

- Student should demonstrate competency in controlling the airplane at airspeeds approaching a stall. Student should recognize and take prompt corrective action to recover from power-on and power-off stalls.

7.4 EFFECTIVE COMMUNICATION

I. Communication takes place when one person transmits ideas or feelings to another person or to a group of people.

A. Its effectiveness is measured by the similarity between the idea transmitted and the idea received.

II. Elements of the Communication Process

A. **Source** (sender, speaker, transmitter, or instructor). The instructor's effectiveness as a communicator is related to at least three basic factors.

1. First, successful communicators have an ability to select and use symbols (words, figures) that are meaningful to the listener.

2. Second, communicators, consciously or unconsciously, reveal attitudes toward themselves, toward the ideas they are trying to transmit, and toward the listener.
   a. These attitudes must be positive if the communication is to be effective.
   b. The presentation should show that the instructor is confident in the subject, that the message is important, and that students need to know the information.
3. Third, successful communicators speak from a background of accurate, up-to-date, stimulating material.
   a. Instructors should exercise great care to ensure that ideas and feelings used in the presentation are meaningful to students.
      i. Reliance on technical language (which is often meaningful only to those with technical backgrounds) to express ideas to beginning students usually impedes effective communication.

B. **Symbols**

1. Ideas are communicated only when symbols (e.g., words, gestures) are combined into units (e.g., sentences, paragraphs, lectures, or chapters) that mean something to the student.
   a. When symbols are combined into these units, each becomes important for effective communication.
2. The parts of the total idea must be selected carefully if they are to convey messages that the listener can react to and understand.
   a. The parts of the idea must be analyzed to determine which are best suited to starting and ending the communication, and which are best for the process of explaining, clarifying, or emphasizing.
      i. All of these functions are required for effective transmission of ideas.
3. The process of communicating ideas via simple symbols culminates with the determination of the medium best suited for their transmission.
   a. Many channels (media) are available for transmission, but most communicators select the channels of hearing and seeing.
      i. Flight instructors should also use the channel of touch, i.e., touching or manipulating the flight controls.
   b. The instructor will be more successful in gaining and retaining the student’s attention by using a variety of channels to convey an idea.

C. **Receiver** (student)

1. When students react with understanding and change their behavior according to the intent of the instructor, effective communication has taken place.
2. In order for an instructor to change the behavior of students, some of the students' abilities, attitudes, and experiences need to be understood.
   a. Students begin aviation training with widely varied abilities and backgrounds.
      i. Some students may already be familiar with aviation and/or have well-developed motor skills, while others may have no background knowledge or skills.
         o The instructor needs to determine the student's existing abilities and tailor the presentation to them.
      ii. Students' viewpoints and cultural backgrounds may vary greatly.
         o An instructor should be aware of these differences, but efforts to accommodate them should not be taken too far.
   b. The student's attitude may indicate resistance, willingness, or passive neutrality.
      i. To gain and hold a student's attention, attitudes should be molded into forms that promote reception of information.
   c. The student's background, experience, and educational level will determine the approach an instructor should take.
      i. What the student knows, along with the student's abilities and attitudes, will guide the instructor in communicating.
      ii. The major barriers to effective communication are usually found in this particular area.

III. Barriers to Effective Communication

A. Lack of common experience

1. Probably the greatest single barrier to effective communication is the lack of common experience between instructor and student.
2. Words rarely carry precisely the same meaning from the mind of the instructor to the mind of the student. Words, in themselves, do not transfer meaning at all.
   a. Words, whether spoken or written, are merely stimuli used to arouse a response in the student.
      i. The nature of this response is determined by the student's past experiences with the words and the things they refer to.
      ii. A communicator's words cannot communicate the desired meaning to another person unless the listener has had some experience with the objects or concepts to which these words refer.
         o Therefore, if technical language must be used in presenting an idea, it is essential that all terms be fully understood by the student.

B. Confusion between the symbol and the symbolized object

1. Languages have many words that mean different things to different people.
   a. Confusion between the symbol and the symbolized object results when a word is not correctly associated with what it is meant to represent.
2. Instructors should carefully choose words or symbols to represent exactly what they intend.

C. **Overuse of abstractions**

1. Concrete words refer to objects that people can relate directly to their experiences.
   a. EXAMPLE: If you are discussing a particular general aviation trainer-type airplane and refer to it as a Cessna 172, your student will have a mental image of this airplane.
      i. The name Cessna 172 represents a concrete reality. It can be touched, seen, and heard.
2. Abstract words stand for ideas that cannot be directly experienced, things that do not provide mental images in the minds of students.
   a. EXAMPLE: If you say, “I saw a general aviation airplane,” your student will not form a mental image of a Cessna 172 because the term is abstract.
3. Abstract words are necessary and can be useful. Their purpose is not to bring forth specific items of experience in the minds of the receivers, but rather to serve as shorthand symbols that sum up vast areas of experience.
   a. EXAMPLE: “Aerodynamics” is a term that encompasses many specific subjects that are applicable to all types of aircraft.
4. Although abstractions are useful, they can lead to misunderstanding.
   a. The danger in using abstractions is that they will not evoke the same specific items of experience in the minds of the students that the instructor intends.
      i. The student has no way of knowing what experiences the instructor intends an abstraction to include.
5. When abstractions are used, they should be linked with specific experiences through examples and illustrations.
   a. Even better, the level of abstraction should be reduced by using concrete and specific words as much as possible.
   b. By using concrete words, the instructor narrows, and gains better control of, the image produced in the minds of the students.

D. **Interference**

1. Factors outside the direct control of the instructor can also influence the communication process.
2. Physiological interference is any biological problem that may inhibit symbol recognition, such as hearing loss, injury, or physical illness.
3. Environmental interference is caused by external physical conditions, such as noise or temperature.
4. Psychological interference is a product of how the instructor and the student feel at the time the communication process is occurring.
   a. If either the student or the instructor are not committed to the communication process, communication is impaired.
   b. Fear of the situation or mistrust between the instructor and the student could severely inhibit the flow of information.

7.5 CRITIQUE AND EVALUATION

I. **Critique**

A. **The instructor's critique**

1. No instructor skill is more important than the ability to analyze, appraise, and judge student performance.
   a. A student looks to the instructor for guidance, suggestions for improvement, and encouragement.
   b. To enhance a student's acceptance of further instruction, the instructor should keep the student informed of the progress made.
      i. This will help to minimize student frustrations, which will keep the student motivated to learn.
2. A critique should always be conducted immediately after the student's performance, while the details are easy to recall.
   a. The instructor may critique any activity which a student performs or practices to improve skill, proficiency, and learning.
3. A critique is a step in the learning process, not the grading process.
4. A critique is not necessarily negative in content. It considers the good along with the bad, the whole in terms of its parts, and the parts in relation to each other.

B. **The purpose of a critique**

1. The purpose of a critique is to improve the student's performance and to provide him/her with something constructive to work with and build upon.
   a. The critique should provide direction and guidance to improve performance.

C. **Characteristics of an effective critique**

1. A critique should be **objective**.
   a. The effective critique is focused on student performance, and should not reflect the personal opinions, likes, dislikes, and biases of the instructor.
   b. The critique must be based on the performance as it was, not as it could have been.
2. A critique should be **flexible**.
   a. The instructor must fit the tone, technique, and content of the critique to the occasion and the student.
   b. An effective critique is flexible enough to satisfy the requirements of the moment.
3. A critique should be **acceptable**.
   a. Before students willingly accept their instructor's criticism, they must first accept the instructor.
   b. The students must have confidence in the instructor's qualifications, teaching ability, sincerity, competence, and authority.
   c. Instructors cannot rely solely on their position to make a critique acceptable to their students.
4. A critique should be **comprehensive**.
   a. A comprehensive critique is not necessarily long, nor must it treat every aspect of the performance in detail.
   b. The instructor must decide whether the greater benefit will come from a discussion of a few major points or a number of minor points.
   c. An effective critique covers strengths as well as weaknesses.

5. A critique should be **constructive**.
    a. A critique is pointless unless a student profits from it.
    b. Praise for praise's sake is of no value if a student is not taught how to capitalize on things that are done well and to use them to compensate for lesser accomplishments.
    c. Also, it is not enough to identify a fault or weakness.
        i. To tell students that their work is unsatisfactory with no explanation will most likely result in the students becoming frustrated.
        ii. Students must be briefed on the errors made and told how to correct them so progress and accomplishment can be made.

6. A critique should be **thoughtful**.
    a. An effective critique reflects an instructor's thoughtfulness toward the student's need for self-esteem, recognition, and approval from others.
        i. The critique should never minimize the inherent dignity and importance of the individual.
    b. Ridicule, anger, or teasing at the expense of the student has no place in the critique.

7. A critique should be **specific**.
    a. The instructor's comments and recommendations should be specific, i.e., they should not be so general that the student can find nothing to hold on to.
    b. Express ideas with firmness and authority in terms that cannot be misunderstood.
        i. Students should have no doubt about what they did well and what they did poorly, and should know specifically how they can improve.

II. Evaluation

A. Whenever learning takes place, the result is a definable, observable, measurable change in behavior and/or knowledge.
    1. Evaluations are used to define, observe, and measure or judge this new behavior.

B. The purpose of an evaluation is to determine how a student is progressing in a course of instruction.
    1. During instruction, some sort of evaluation is essential to determine what the student is learning and how well (s)he is learning it.

C. **Types of evaluation**
    1. **Oral quizzing**
        a. The most practical means of evaluation is oral quizzing of students by the instructor. Questions may be loosely classified as fact and thought questions.
            i. The answer to a fact question is based on memory or recall.
            ii. Thought questions require the student to combine a knowledge of facts with an ability to analyze situations, solve problems, and arrive at conclusions.
        b. Proper quizzing by the instructor can have a number of desirable results. It can
            i. Reveal the effectiveness of training procedures,
            ii. Check student retention and comprehension of what has been learned,
            iii. Review material already covered,
            iv. Help retain student interest and stimulate thinking,
            v. Emphasize the important points of training,
            vi. Identify points that need more emphasis, and
            vii. Promote active student participation.

c. Characteristics of effective questions:
   i. Each question must have only one correct answer.
      - This is a characteristic of good objective-type (fact) questions and generally true of all good questions.
      - Each question should call for a specific answer that can be readily evaluated by the instructor, though the answer to thought questions may be expressed in a variety of ways.
   ii. Each question must apply to the subject being taught.
   iii. Each question should be brief and concise, but must be clear and definite.
   iv. Each question should center on only one idea, limited to who, what, where, when, how, or why, not a combination.
   v. Each question should present a challenge.
      - A question must be of suitable difficulty for the students at that particular stage of training.

2. **Written tests**

a. A written test is a set of questions, problems, or exercises used to determine whether a person has obtained a particular knowledge or skill.
   i. As evaluation devices, written tests are only as good as the knowledge and proficiency of the test writer.

b. **Characteristics of a good written test**
   i. **Reliability** is the degree to which test results are consistent with repeated measurements.
      - A written test that has reliability yields consistent results when applied to different groups.
   ii. **Validity** is the extent to which a test measures what it is supposed to measure.
      - A written test has validity when it measures only the achievement of the objectives of the instruction given, and nothing else.
   iii. **Usability** refers to the functionality of tests.
      - A written test is usable when it is easy to administer by the instructor, easy for the student to understand, the wording is clear and concise, the figures are appropriate to the test items and clearly drawn, and the test is easily graded.
   iv. **Comprehensiveness** is the degree to which a test measures the overall objectives of the evaluation.
      - A written test is comprehensive when it liberally samples whatever is being measured.
   v. **Discrimination** is the degree to which a test distinguishes the difference between students.
      - A written test having the characteristic of discrimination will measure small differences in achievement between students.
      - It will also distinguish between students whose achievement of the course objectives is both high and low.

3. **Performance tests**

   a. Performance tests are useful for evaluating the results of training that involves an operation, a procedure, or a process.

   b. An FAA practical test is an example of a performance test.

      i. While flight instructors do not administer the practical test for a certificate or rating, they are responsible for preparing their students for this test and determining their students' readiness for the applicable test.

      ii. Accordingly, flight instructors must be thoroughly familiar with the standards against which the students' performance will be evaluated (i.e., the appropriate PTS).

   c. Flight instructors must administer performance tests, either formally or informally, because performance tests are the only reliable means to determine that a student is ready for a practical test or a new operating privilege (e.g., student solo).

      i. When determining readiness for a practical test, instructors should use the appropriate PTS as the standard for successful completion.

      ii. When determining readiness for a new operating privilege for which official standards have not been designated, instructors should use their best judgment to establish standards of acceptable performance. Instructors should then adhere to those standards.

GLEIM FLIGHT INSTRUCTOR REFRESHER COURSE
LESSON 8
FLIGHT INSTRUCTOR PROFESSIONAL RESPONSIBILITIES AND INSTRUCTOR ENDORSEMENTS

8.1 FLIGHT INSTRUCTOR PROFESSIONALISM

I. Although the term **professionalism** is widely used, it is rarely defined. In fact, no single definition can encompass all of the qualifications and considerations that must be present for true professionalism to exist. The following are some of the major considerations and qualifications of any professional:

- A. Professionalism exists only when a service is performed for someone, or for the common good.
- B. Professionalism is achieved only after extended training and preparation.
- C. Performance as a professional is based on study and research.
- D. Professionals must be able to reason logically and accurately.
- E. Professionalism requires good decision-making ability. Professionals cannot limit their actions and decisions to standard patterns and practice.
- F. Professionalism demands a code of ethics. Professionals must be true to themselves and to those they serve. Anything less than a sincere performance is quickly detected and immediately destroys a professional's effectiveness.

II. Several basic elements of professionalism should concern you as a flight instructor.

- A. **Sincerity**
  1. As a professional flight instructor, you must be straightforward and honest. Attempting to hide an inadequacy will make it impossible for you to command the respect and full attention of your students.
     - a. Student confidence tends to be destroyed if instructors bluff when they are in doubt about some point.
  2. Teaching a student pilot is based upon the student's acceptance of the flight instructor as a competent, qualified instructor and an expert pilot.
  3. Any appearance of instructor pretentiousness, whether real or imagined by the student, will cause the student to lose confidence in the instructor, and learning will be adversely affected.
- B. **Acceptance of the student**
  1. A professional flight instructor must accept students as they are, including all of their faults and problems.
  2. The student is a person who wants to learn to fly, and the instructor is a person who has an interest (financial or otherwise) in helping the student learn.
     - a. With this understanding, the professional relationship between the instructor and the student should be based on a mutual acknowledgment that the student and the instructor are important to each other and that both are working toward the same objective.

C. **Personal appearance and habits**

1. Your personal appearance has an important effect on your professional image. Instructors are expected to be neat, clean, and appropriately dressed.
2. Personal habits also have a significant effect on a flight instructor's professional image.The exercise of common courtesy is perhaps the most important of these habits.
    a. A rude, thoughtless, or inattentive instructor cannot hold the respect of students.

D. **Demeanor**

1. Your attitude and behavior contribute significantly to a professional image.
2. You should avoid
    a. Erratic movements, distracting speech habits, and unpredictable changes in mood
    b. Any tendency toward frequently countermanding directions, reacting differently to similar or identical errors at different times, demanding unreasonable performances or progress, or criticizing a student unfairly
3. Effective instruction is best fostered by a calm, pleasant, thoughtful demeanor that puts the student at ease, and portrays both competence in the subject matter and genuine interest in the student's well being.

E. **Self-improvement**

1. You should never become complacent or satisfied with your own qualifications and abilities.
    a. Flight instructors should constantly seek ways to improve their qualifications, their effectiveness, and the services they provide to students.
2. Flight instructors are considered authorities on aeronautical matters and are the experts to whom many pilots refer questions concerning regulations, requirements, and new operating techniques.
    a. Therefore, you have the opportunity and responsibility of introducing new procedures and techniques through your students and through certificated pilots with whom you come in contact.

F. **Safety practices and accident prevention**

1. To maintain a professional image, you must carefully observe all regulations and recognized safety practices during all flight operations.
2. Habitual observance of regulations, safety precautions, and courtesy will enhance an instructor's image of professionalism.
    a. Such habits will make the instructor more effective by encouraging the same habits in his/her students.

8.2 TEACHING BY EXAMPLE

I. Your flying habits, both during flight instruction and as observed by students when you are conducting other pilot operations, have a vital impact on safety.

A. Students consider their flight instructor to be a model of perfection whose flying habits they attempt to imitate, consciously or unconsciously.

B. Thus, your advocacy and description of safety practices mean little to your students if you do not demonstrate them consistently.

1. EXAMPLE: If your student sees that you start the airplane and take off without referring to a checklist, no amount of instruction in the use of a checklist will convince the student to faithfully use one during solo flight operations.

II. As a flight instructor, you must carefully observe all regulations and recognized safety practices during all flight operations.

A. An instructor who is observed flying with apparent disregard for regulations and safety practices (e.g., load limitations or weather minimums) by his/her students creates an impression of irresponsibility that many hours of conscientious flight instruction cannot correct.

B. Habitual observance of regulations, safety practices, and the precepts of courtesy will make you more effective in developing the same habits in your students.

1. EXAMPLE: All pilots are required by law to dispose of drained/sumped fuel properly. The old method of simply throwing sumped fuel onto the tarmac to evaporate is unacceptable and illegal.

a. Inform your students that this practice causes air pollution, as well as possible water and soil contamination due to the runoff of leaded gasoline.

b. Demonstrate your concern for the environment by always using (and teaching your students to use) a **Gasoline Analysis Test Separator (GATS)** jar to sump your airplane's fuel tanks. This device allows you to sump all of the airplane's tanks, inspect the fuel sample, and filter out water and other contaminants while returning the fuel sample back to your airplane's tanks; contaminated fuel can then be taken to a disposal unit on the ramp.

c. You must consistently use approved fuel sampling practices if you expect your students to do the same.

III. You must go beyond the requirements of developing technically proficient students who are knowledgeable in the areas of their airplane, flight procedures, and maneuvers.

A. You must teach your students not only to know their own limitations and the limitations of their equipment but also to be guided by those limitations.

B. You must teach and develop your students' aeronautical decision-making processes.

8.3 INSTRUCTOR RESPONSIBILITIES

I. **Student pilot supervision**

A. Your evaluation of a student's demonstrated ability during flight instruction must be based upon established standards of performance, suitably modified to apply to the student's experience level and stage of development as a pilot.

1. In evaluating student demonstrations of piloting ability, it is important for you to keep the student informed of his/her progress.

a. This may be done as each procedure/maneuver is completed, or summarized during post-flight critiques.

B. Flight instructors have a moral and ethical obligation to provide guidance and restraint with respect to the solo operations of their students.

1. Before receiving an instructor endorsement for solo flight,
   a. A student should be required to demonstrate the consistent ability to perform all of the fundamental maneuvers.
   b. The student should also be capable of handling ordinary problems that might occur, such as traffic pattern congestion, a change in the active runway, or unexpected crosswinds.
2. In the case of an observed unsatisfactory performance during a student's solo operations, it is your responsibility to try to correct the problem by the most reasonable and effective means.

II. Answering student questions

A. When answering student questions, you should clearly understand the question before attempting an answer.

1. An instructor should display interest in student questions and give as direct and accurate an answer as possible.
2. If a student's question is too advanced for the particular lesson such that confusion may result from a complete answer, you may
   a. Carefully explain that the question was good and pertinent;
   b. Explain that to answer would unnecessarily complicate the learning task at hand; and
   c. Advise the student to reintroduce the question later at the appropriate point in training, or (in the case of a classroom setting) meet outside class for a more complete discussion.
3. Occasionally, a student will ask a question that you cannot answer. The best course is to freely admit not knowing the answer.
   a. You should then promise to research the answer or offer to help the student look it up in appropriate references.

III. Observation of other pilots' actions

A. When instructors witness unsafe or inept operations by pilots who are not aware they are being observed, they have a moral responsibility to try to correct the behavior, if possible.

1. This responsibility also applies to pilots who have requested an instructor's evaluation or guidance.

B. If an instructor is unable to correct the situation by personal contacts and good advice, (s)he should report the situation to an FAA aviation safety counselor.

IV. Practical test recommendations

A. You, as a flight instructor, are a far better judge of your students' flying abilities than the examiner who conducts the practical test.

1. This is because you have flown with the student for many more hours than the examiner will fly with them during the practical test.

B. Accordingly, you have a responsibility NOT to endorse a pilot candidate for his/her practical test unless you believe that (s)he is competent to exercise ALL of the privileges of that certificate or rating on an average day.

1. You cannot count on the examiner who conducts the practical test to serve as a "pilot filter" because the examiner may catch a marginal student on a good day, or, due to weather or time constraints, the examiner may elect to omit certain tasks with which your student has had difficulty.

C. No conscientious flight instructor would knowingly put his/her student and future passengers at risk.

1. Therefore, you should not endorse a pilot candidate who is not proficient in all operations authorized by a certificate or rating for the corresponding practical test. Obtaining a certificate or rating bestows all the privileges of that certificate or rating on the student pilot, including those in which the student lacks proficiency.

   a. EXAMPLE: If you endorse an instrument student who is unable to consistently perform an NDB approach for his/her instrument rating practical test, that student's examiner may not expose the student's weakness by asking him/her to perform an NDB approach during the test, thereby allowing the student to successfully complete the test.
   b. As a result, the student will obtain all instrument flying privileges, and may eventually be required to perform an NDB approach on his/her own in actual conditions, the outcome of which may not be a success.

2. You cannot rely on your student's assessment of his/her own flying abilities to keep them out of trouble until they gain further instruction-YOU are the expert, and it is not unreasonable for your students to interpret your practical test endorsement as an endorsement of their ability to fully exercise the privileges of the new certificate/rating.

D. Exercising restraint with regard to practical test recommendations is particularly critical in the case of flight instructor candidates.

1. Incompetent flight instructors endanger not only themselves and their passengers; they endanger their students and their students' future passengers as well.

V. Aircraft checkouts

A. Before authorizing an unfamiliar pilot to rent an aircraft, or a familiar pilot to rent a new aircraft type, you should ensure that (s)he is thoroughly familiar with all aspects of that aircraft's operation.

1. This is necessary regardless of whether your instructional session is the pilot's first exposure to the aircraft, or (s)he has logged many hours in the type.

B. An aircraft checkout should address at least the following items:

1. The major aircraft systems, including
   a. Flight controls
   b. Engine and propeller
   c. Fuel system
   d. Electrical system
   e. Pressurization system, if applicable
   f. Environmental system
   g. Retractable landing gear, if applicable
   h. Anti- and de-icing system
2. Engine, airspeed, and airframe limitations
3. Preflight procedures
4. Avionics operation
5. Takeoff and landing characteristics
6. Slow-speed and stall characteristics
7. Normal operating procedures

8. Abnormal and emergency procedures
9. Anything unusual or unique about the aircraft type or the specific aircraft in which the checkout is performed

C. The degree of detail and the length of time required for an aircraft checkout will depend on the pilot's experience level and his/her level of familiarity with that aircraft type or similar types.

1. For example, an exhaustive ground session covering each element listed in item V.B. on the previous page is not required for a pilot who is transitioning from a Cessna 152 into a Cessna 172, or for a pilot who has logged many hours in the aircraft type.
   a. However, you should address each element at some point in the checkout, either through direct questions or by noting indirect indications of the pilot's knowledge of those areas.
2. Conversely, a pilot who is transitioning for the first time into a complex, high-performance, pressurized, or tailwheel aircraft will probably require substantial amounts of ground and flight instruction before (s)he can safely operate as pilot in command.
   a. Note also that instructor endorsements are required prior to acting as pilot in command of a complex, high-performance, or tailwheel aircraft, and before acting as pilot in command of a pressurized aircraft capable of high-altitude operations (defined as an aircraft with a service ceiling above 25,000 ft. MSL).

8.4 REGULATORY REQUIREMENTS AND AUTHORIZATIONS

I. Flight Instructor Records

A. As a CFI, you are required to sign the logbook of each person to whom you have given flight training or ground training.

B. You are required to maintain a record (in a logbook or some other document) of the following:

1. The name of each person whose logbook or student pilot certificate you have endorsed for solo flight privileges, and the date of the endorsement
2. The name of each person you have endorsed for a knowledge or practical test, along with the kind of test, the date, and the results

C. You are required to retain these records for at least 3 years.

II. Flight Instructor Privileges

A. You are authorized, within the limitations of your flight instructor certificate and ratings, to give training and endorsements that are required for, and relate to, the following:

1. A student pilot certificate
2. A pilot certificate
3. A flight instructor certificate
4. A ground instructor certificate
5. An aircraft rating
6. An instrument rating
7. A flight review, operating privilege, or recency-of-experience requirement
8. A practical test
9. A knowledge test

III. Flight Instructor Limitations and Qualifications

A. As a CFI, you are subject to the following limitations:

1. You may not conduct more than 8 hr. of flight training in any 24-consecutive-hour period.
2. You may not conduct flight training in any aircraft for which you do not hold a pilot certificate and a flight instructor certificate with the applicable category and class rating, and type rating (if appropriate).
3. You may not conduct instrument flight training for the issuance of an instrument rating or a type rating not limited to VFR unless you hold an instrument rating on your flight instructor certificate and pilot certificate that is appropriate to the category and class of aircraft in which the instrument training is being provided.

B. To endorse a student pilot's certificate or logbook for solo flight privileges, you must have

1. Given that student the flight training required for solo flight privileges, and
2. Determined that the student is prepared to conduct the flight safely under known circumstances, subject to any limitations listed in the student's logbook that you consider necessary for the safety of the flight.

C. To endorse a student pilot's logbook for a solo cross-country flight, you must have determined that the student's flight preparation, planning, equipment, and proposed procedures are adequate for the proposed flight under the existing conditions and within any limitations listed in the logbook that you consider necessary for the safety of the flight.

D. To endorse a student pilot's logbook for solo flight in a Class B airspace area or at an airport within Class B airspace, you must have

1. Given the student ground and flight training in that specific Class B airspace or at that specific airport, and
2. Determined that the student is proficient to operate the aircraft safely.

E. To endorse the logbook of a recreational pilot, you must have

1. Given that pilot the ground and flight training required by 14 CFR 61.101, and
2. Determined that the recreational pilot is proficient to operate the aircraft safely.

F. To endorse the logbook of a pilot for a flight review, you must have conducted a review of that pilot in accordance with the requirements of 14 CFR 61.56(a).

G. To endorse the logbook of a pilot for an instrument proficiency check, you must have tested that pilot in accordance with the requirements of 14 CFR 61.57(d).

1. To conduct an instrument proficiency check, you must have an instrument rating on your flight instructor certificate.
2. The tasks required to be performed on the instrument proficiency check are specified in the FAA's Instrument Rating Practical Test Standards.

H. If you hold a multiengine rating on your flight instructor certificate, you may not give the training required for the issuance of a certificate or rating in a multiengine airplane unless you have at least 5 hr. of pilot-in-command time in the specific make and model of multiengine airplane.

I. You cannot make any self-endorsement for a certificate, rating, flight review, authorization, operating privilege, practical test, or knowledge test that is required under Part 61.

8.5 FAA FORM 8710-1: AIRMAN CERTIFICATE OR RATING APPLICATION

I. Your student must present a completed FAA Form 8710-1, Airman Certificate or Rating Application, to his/her examiner on the day of a practical test.

A. It is strongly encouraged that you assist your student in completing the application before the day of the practical test.

1. Take the time to methodically complete each item on the form with your student, and write legibly.
2. Remember to complete the Practical Test Recommendation block on the back side of the form, as your student will not be able to take the practical test without this evidence of your official recommendation.

B. Any errors on the form that are not detected by the examiner, such as an incorrect address or birth date, may cause problems when the FAA attempts to issue the permanent certificate.

C. The FAA also requires much of the information contained in the form to be presented in a specific format**.**

1. While these formats are described in the itemized instructions for completing the form, most students do not realize that the FAA wants certain items to be expressed in one format only.

a. The FAA requires dates to be presented as three groups of digits separated by hyphens. The groups of digits represent the month, day, and year. Years should be shown with four digits. EXAMPLE: The date **December 13, 2003** should be expressed as **12-13-2003**, NOT 12/13/03 or some other variation.

D. A student who arrives for a practical test with an incomplete or incorrectly filled out 8710-1 form will waste the examiner's time and set a negative tone for the practical test.

1. In some cases, the examiner may not conduct practical test at all.
2. Therefore, both you and your student should be motivated to take the time and effort to fill out your student's Form 8710-1 correctly.

8.6 INSTRUCTOR ENDORSEMENTS

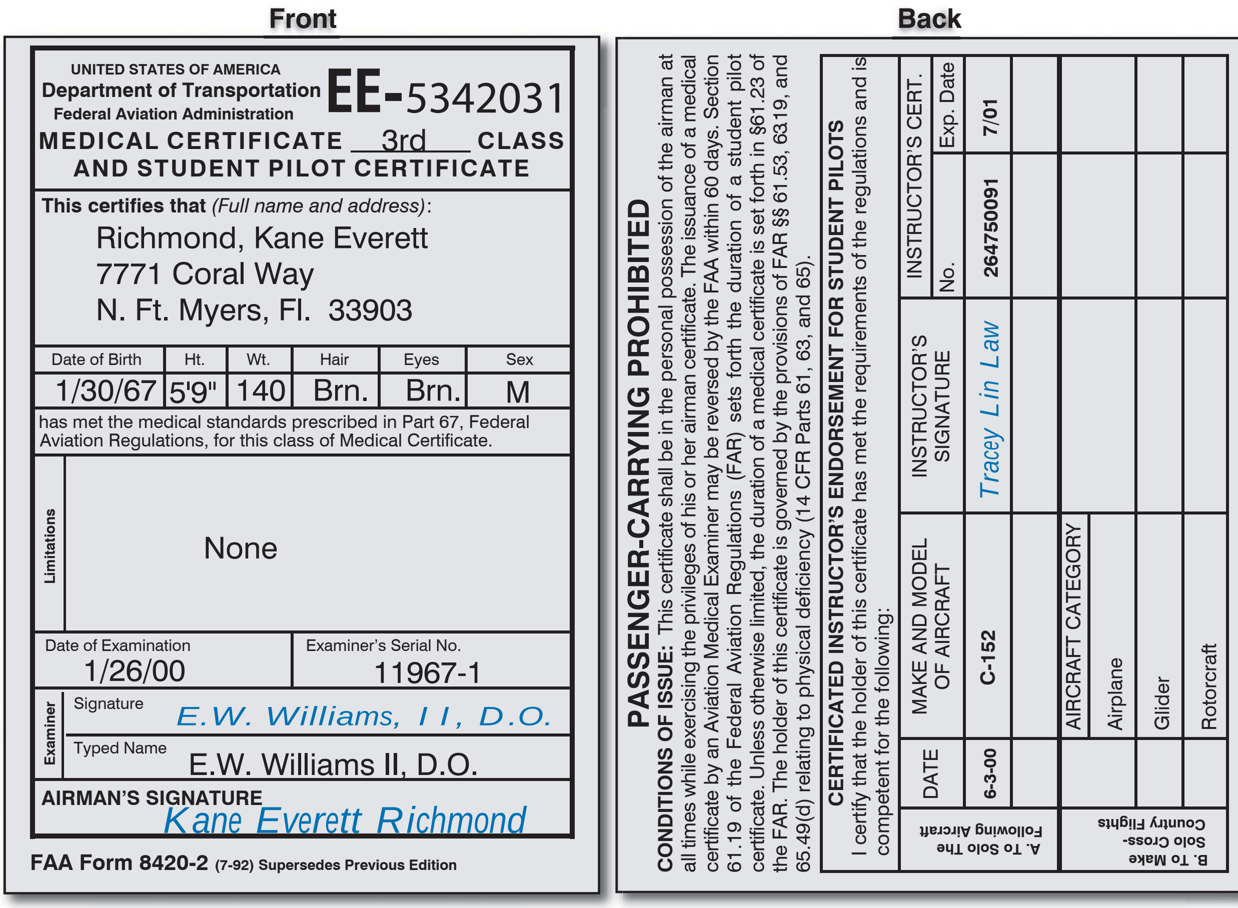
I. **Student pilot endorsements**

A. Student pilot certificates provide spaces for CFI endorsements on the back for solo flight and solo cross-country flight.

1. The student pilot certificate must be endorsed prior to the student's first solo flight in each make and model of airplane.
2. The student pilot certificate must be endorsed prior to the student's first solo cross-country flight.

a. This endorsement is for aircraft category (e.g., airplane), not make and model of aircraft (e.g., Cessna 152).

3. Shown below is an example student pilot certificate endorsed.



Front

UNITED STATES OF AMERICA
Department of Transportation
Federal Aviation Administration
EE-5342031
MEDICAL CERTIFICATE 3rd CLASS
AND STUDENT PILOT CERTIFICATE

This certifies that *(Full name and address)*:
Richmond, Kane Everett
7771 Coral Way
N. Ft. Myers, Fl. 33903

Date of Birth	Ht.	Wt.	Hair	Eyes	Sex
1/30/67	5'9"	140	Brn.	Brn.	M

has met the medical standards prescribed in Part 67, Federal Aviation Regulations, for this class of Medical Certificate.

Limitations: None

Date of Examination: 1/26/00
Examiner's Serial No.: 11967-1

Examiner Signature: E.W. Williams, I I, D.O.
Typed Name: E.W. Williams II, D.O.

AIRMAN'S SIGNATURE: Kane Everett Richmond

FAA Form 8420-2 (7-92) Supersedes Previous Edition

Back

PASSENGER-CARRYING PROHIBITED

CONDITIONS OF ISSUE: This certificate shall be in the personal possession of the airman at all times while exercising the privileges of his or her airman certificate. The issuance of a medical certificate by an Aviation Medical Examiner may be reversed by the FAA within 60 days. Section 61.19 of the Federal Aviation Regulations (FAR) sets forth the duration of a student pilot certificate. Unless otherwise limited, the duration of a medical certificate is set forth in §61.23 of the FAR. The holder of this certificate is governed by the provisions of FAR §§ 61.53, 63.19, and 65.49(d) relating to physical deficiency (14 CFR Parts 61, 63, and 65).

CERTIFICATED INSTRUCTOR'S ENDORSEMENT FOR STUDENT PILOTS

I certify that the holder of this certificate has met the requirements of the regulations and is competent for the following:

	DATE	MAKE AND MODEL OF AIRCRAFT	INSTRUCTOR'S SIGNATURE	INSTRUCTOR'S CERT. No.	Exp. Date
A. To Solo The Following Aircraft	6-3-00	C-152	Tracey Lin Law	264750091	7/01
B. To Make Solo Cross-Country Flights		AIRCRAFT CATEGORY			
		Airplane			
		Glider			
		Rotorcraft			

Figure8_1
FAA Medical - front

B. **Endorsement for presolo aeronautical knowledge: 14 CFR 61.87(b)**

I certify that <u>(First name, MI, Last name)</u> has satisfactorily completed the presolo knowledge exam of § 61.87(b) for the<u>(make and model aircraft)</u>.

S/S [date] J.J. Jones 987654321CFI Exp. 12-31-05

1. This endorsement is required for each make and model of airplane that the student will fly solo.

C. **Endorsement for presolo flight training: § 61.87(c)**

I certify that <u>(First name, MI, Last name)</u> has received the required presolo training in a <u>(make and model aircraft)</u>. I have determined (s)he has demonstrated the proficiency of § 61.87(d) and is proficient to make solo flights in <u>(make and model aircraft)</u>.

S/S [date] J.J. Jones 987654321CFI Exp. 12-31-05

1. This endorsement is required for each make and model of airplane that the student will fly solo.

D. **Endorsement for presolo flight training at night: § 61.87(c) and (m)**

I certify that (First name, MI, Last name) has received the required presolo training in a (make and model aircraft). I have determined (s)he has demonstrated the proficiency of § 61.87(m) and is proficient to make solo flights at night in a (make and model aircraft).

S/S [date] J.J. Jones 987654321CFI Exp. 12-31-05

1. A student pilot may not operate an aircraft in solo flight at night unless (s)he has received
   a. Flight training at night on night flying procedures that includes takeoffs, approaches, landings, and go-arounds at night at the airport where the solo flight will be conducted;
   b. Navigation training at night in the vicinity of the airport where the solo flight will be conducted; and
   c. The endorsement shown in D. above.
2. This logbook endorsement is valid for only 90 days.

E. **Endorsement for solo flight (each additional 90-day period): § 61.87(n)**

I certify that (First name, MI, Last name) has received the required training to qualify for solo flying. I have determined (s)he meets the applicable requirements of § 61.87(n) and is proficient to make solo flights in (make and model).

S/S [date] J.J. Jones 987654321CFI Exp. 12-31-05

F. **Endorsement for solo takeoffs and landings at another airport within 25 NM: § 61.93(b)(1)**

I certify that (First name, MI, Last name) has received the required training of § 61.93(b)(1). I have determined that (s)he is proficient to practice solo takeoffs and landings at (airport name). The takeoffs and landings at (airport name) are subject to the following conditions: (List any applicable conditions or limitations.)

S/S [date] J.J. Jones 987654321CFI Exp. 12-31-05

1. The purpose of this endorsement is to allow a student to practice takeoffs and landings at another airport within 25 NM from the airport where the pilot normally receives training.

G. **Endorsement for initial solo cross-country flight: § 61.93(c)(1)**

I certify that (First name, MI, Last name) has received the required solo cross-country training. I find (s)he has met the applicable requirements of § 61.93, and is proficient to make solo cross-country flights in a (make and model aircraft).

S/S [date] J.J. Jones 987654321CFI Exp. 12-31-05

1. This endorsement should be made in the student pilot's logbook at the same time the student's pilot certificate is endorsed for cross-country flight.
2. Unlike the student pilot certificate endorsement, which is for the specific category of aircraft, this logbook endorsement is for the specific make and model of aircraft to be flown.
   a. Thus, this endorsement is required for each make and model of aircraft to be flown on solo cross-country flights.

H. **Endorsement for each solo cross-country flight: § 61.93(c)(2)**

I have reviewed the cross country planning of (First name, MI, Last name). I find the planning and preparation to be correct to make the solo flight from (location) to (destination) via (route of flight) with landings at (name the airports) in a (make and model aircraft) on (date). (List any applicable conditions or limitations.)

S/S [date] J.J. Jones 987654321CFI Exp. 12-31-05

1. The instructor may want to stipulate additional conditions in the above endorsement.
2. This logbook endorsement is required prior to a student pilot's solo cross-country flight.

I. **Endorsement for repeated solo cross-country flights not more than 50 NM from the pointof departure: § 61.93(b)(2)**

I certify that (First name, MI, Last name) has received the required training in both directions between and at both (airport names). I have determined that (s)he is proficient of § 61.93(b)(2) to conduct repeated solo cross-country flights over that route, subject to the following conditions:(List any applicable conditions or limitations.)

S/S [date] J.J. Jones 987654321CFI Exp. 12-31-05

1. This endorsement is for repeated solo cross-country flights to an airport that is within 50 NM from the airport at which the flight originated.
2. The student must also have his/her student pilot certificate endorsed for cross-country flight and the logbook endorsed for initial solo cross-country flight (see H. above).
   a. Separate endorsements (as shown in I. above) are not required to be made for each flight.

J. **Endorsement for solo flight in Class B airspace: § 61.95(a)**

I certify that (First name, MI, Last name) has received the required training of § 61.95(a). I have determined (s)he is proficient to conduct solo flights in (name of Class B) airspace. (List any applicable conditions or limitations.)

S/S [date] J.J. Jones 987654321CFI Exp. 12-31-05

1. The ground and flight training must be for the specific Class B airspace area in which the student will solo.
2. This logbook endorsement is valid for 90 days.

K. **Endorsement for solo flight to, from, or at an airport located in Class B airspace: §§ 61.95(a) and 91.131(b)(1)**

I certify that (First name, MI, Last name) has received the required training of § 61.95(a)(1). I have determined that (s)he is proficient to conduct solo flight operations at (name of airport). (List any applicable conditions or limitations.)

S/S [date] J.J. Jones 987654321CFI Exp. 12-31-05

1. The ground and flight training must be for the specific airport at which the solo operations will be conducted.
2. This logbook endorsement is valid for 90 days.

II. Recreational pilot endorsements

A. Endorsement for aeronautical knowledge test: §§ 61.35(a)(1) and 61.96(b)(3)

I certify that (First name, MI, Last name) has received the required training of § 61.97(b). I have determined that (s)he is prepared for the (name the knowledge test).

S/S [date] J.J. Jones 987654321CFI Exp. 12-31-05

B. Endorsement for flight proficiency/practical test: §§ 61.96(b)(5), 61.98(a) and (b), and 61.99

I certify that (First name, MI, Last name) has received the required training of §§ 61.98(b) and 61.99. I have determined that (s)he is prepared for the (name the practical test).

S/S [date] J.J. Jones 987654321CFI Exp. 12-31-05

C. Endorsement for recreational pilot to operate within 50 NM of the airport where training was received: § 61.101(b)

I certify that (First name, MI, Last name) has received the required training of § 61.101(b). I have determined (s)he is competent to operate at the (name of airport).

S/S [date] J.J. Jones 987654321CFI Exp. 12-31-05

1. This endorsement is required for each airport that a recreational pilot intends to use as a home base.

D. Endorsement for recreational pilot to act as PIC on a flight that exceeds 50 NM of the departure airport: § 61.101(c)

I certify that (First name, MI, Last name) has received the required cross-country training of § 61.101(c). I have determined that (s)he is proficient in cross-country flying of part 61, subpart E.

S/S [date] J.J. Jones 987654321CFI Exp. 12-31-05

1. The recreational pilot must have received ground and flight training on the cross-country requirements of Subpart E, Private Pilots, of Part 61.

E. Endorsement for recreational pilot with less than 400 flight hours and not logged PIC time within the preceding 180 days: § 61.101(f)

I certify that (First name, MI, Last name) has received the required 180-day recurrent training of § 61.101(f) in a (make and model aircraft). I have determined him/her proficient to act as PIC of that aircraft.

S/S [date] J.J. Jones 987654321CFI Exp. 12-31-05

F. **Endorsement for a recreational pilot to conduct solo flights for the purpose of obtaining an additional certificate or rating while under the supervision of an authorized flight instructor: § 61.101(i)**

I certify that (First name, MI, Last name) has received the required training of § 61.87 in a (make and model aircraft). I have determined (s)he is prepared to conduct a solo flight on (date) under the following conditions: (List all conditions which require endorsement, e.g., flight which requires communication with ATC, flight in an aircraft for which the pilot does not hold a category/class rating, etc.).

S/S [date] J.J. Jones 987654321CFI Exp. 12-31-05

III. **Private pilot endorsements**

A. **Endorsement for aeronautical knowledge test: §§ 61.35(a)(1), 61.103(d), and 61.105**

I certify that (First name, MI, Last name) has received the required training of § 61.105. I have determined (s)he is prepared for the (name the knowledge test).

S/S [date] J.J. Jones 987654321CFI Exp. 12-31-05

B. **Endorsement for flight proficiency/practical test: §§ 61.103(f), 61.107(b), and 61.109**

I certify that (First name, MI, Last name) has received the required training of §§ 61.107 and 61.109. I have determined (s)he is prepared for the (name the practical test).

S/S [date] J.J. Jones 987654321CFI Exp. 12-31-05

IV. **Instrument rating endorsements**

A. **Endorsement for aeronautical knowledge test: §§ 61.35(a)(1) and 61.65(a) and (b)**

I certify that (First name, MI, Last name) has received the required training of § 61.65(b). I have determined that (s)he is prepared for the(name the knowledge test).

S/S [date] J.J. Jones 987654321CFI Exp. 12-31-05

B. **Endorsement for flight proficiency/practical test: § 61.65(a)(6)**

I certify that (First name, MI, Last name) has received the required training of § 61.65(c) and (d). I have determined (s)he is prepared for the Instrument - *(Airplane, Helicopter, or Powered-lift)* practical test.

S/S [date] J. J. Jones 987654321CFI Exp. 12-31-05

V. **Commercial pilot endorsements**

A. **Endorsement for aeronautical knowledge test: §§ 61.35(a)(1) and 61.123(c)**

I certify that (First name, MI, Last name) has received the required training of § 61.125. I have determined that (s)he is prepared for the (name the knowledge test).

S/S [date] J.J. Jones 987654321CFI Exp. 12-31-05

B. **Endorsement for flight proficiency/practical test: §§ 61.123(e) and 61.127**

I certify that (First name, MI, Last name) has received the required training of §§ 61.127 and 61.129. I have determined (s)he is prepared for the (name the practical test).

S/S [date] J.J. Jones 987654321CFI Exp. 12-31-05

VI. **Flight instructor endorsements**

A. **Endorsement for fundamentals of instructing training received: §§ 61.183(d) and 61.185(a)(1)**

I certify that (First name, MI, Last name) has received the required fundamentals of instruction training of § 61.185(a)(1).

S/S [date] J.J. Jones 987654321CFI Exp. 12-31-05

1. Note that CFI candidates are not required to have this endorsement prior to taking the fundamentals of instructing knowledge test.
   a. The endorsement is only required prior to taking the flight instructor practical test.

B. **Endorsement for flight instructor ground and flight proficiency/practical test: §§ 61.183(g) and 61.187(a) and (b)**

I certify that (First name, MI, Last name) has received the required training of § 61.187(b). I have determined (s)he is prepared for the CFI - *(aircraft category and class)* practical test.

S/S [date] J.J. Jones 987654321CFI Exp. 12-31-05

C. **Endorsement for flight instructor certificate with instrument - (category/class) rating/practical test: §§ 61.183(g) and 61.187(a) and (b)(7)**

I certify that (First name, MI, Last name) has received the required CFII training of § 61.187(b)(7). I have determined (s)he is prepared for the CFII - *(airplane, helicopter, or powered-lift)* practical test.

S/S [date] J.J. Jones 987654321CFI Exp. 12-31-05

D. **Endorsement for spin training: § 61.183(i)(1)**

I certify that (First name, MI, Last name) has received the required training of § 61.183(i). I have determined that (s)he is competent and proficient in instructional skills for training stall awareness, spin entry, spins, and spin recovery procedures.

S/S [date] J.J. Jones 987654321CFI Exp. 12-31-05

1. The above spin training endorsement is required of flight instructor-airplane and flight instructor-glider applicants only.

VII. Ground instructor endorsements

A. Endorsement for a ground instructor who does not meet the recent experience requirements: § 61.217(b)

I certify that (First name, MI, Last name) has demonstrated satisfactory proficiency on the appropriate ground instructor knowledge and training subjects of § 61.213(a)(3) and (a)(4).

S/S [date] J.J. Jones 987654321CFI Exp. 12-31-05 [*or CGI, as appropriate]
(The expiration date would apply only to a CFI.)

1. Note that the expiration date applies only if the above endorsement is given by a CFI. Ground instructor certificates do not expire.

VIII. Additional endorsements

A. Endorsement for completion of a flight review: § 61.56(a) and (c)

I certify that (First name, MI, Last name) , (pilot certificate) , (certificate number) , has satisfactorily completed a flight review of § 61.56(a) on (date) .

S/S [date] J.J. Jones 987654321CFI Exp. 12-31-05

1. No logbook entry reflecting unsatisfactory performance on a flight review is required.

B. Endorsement for completion of an instrument proficiency check: § 61.57(d)

I certify that (First name, MI, Last name), (pilot certificate), (certificate number), has satisfactorily completed the instrument proficiency check of § 61.57(d) in a (list make and model of aircraft) on (date).

S/S [date] J.J. Jones 987654321CFI Exp. 12-31-05

1. No logbook entry reflecting unsatisfactory performance on an instrument proficiency check is required.

C. Endorsement for a pilot to act as PIC in a complex airplane: § 61.31(e)

I certify that (First name, MI, Last name), (pilot certificate), (certificate number), has received the required training of § 61.31(e) in a (make and model of complex airplane). I have determined that (s)he is proficient in the operation and systems of a complex airplane.

S/S [date] J.J. Jones 987654321CFI Exp. 12-31-05

D. Endorsement for a pilot to act as PIC in a high performance airplane: § 61.31(f)

I certify that (First name, MI, Last name), (pilot certificate), (certificate number), has received the required training of § 61.31(f) in a (make and model of high performance airplane). I have determined that (s)he is proficient in the operation and systems of a high performance airplane.

S/S [date] J.J. Jones 987654321CFI Exp. 12-31-05

E. **Endorsement to act as PIC in a pressurized aircraft capable of high altitude operations: § 61.31(g)**

I certify that (First name, MI, Last name), (pilot certificate), (certificate number), has received the required training of § 61.31(g) in a (make and model of pressurized aircraft). I have determined that (s)he is proficient in the operation and systems of a pressurized aircraft.

S/S [date] J.J. Jones 987654321CFI Exp. 12-31-05

1. This endorsement is required prior to acting as pilot in command of a pressurized aircraft with a service ceiling greater than 25,000 ft.

F. **Endorsement for a pilot to act as PIC in a tailwheel airplane: § 61.31(i)**

I certify that (First name, MI, Last name), (pilot certificate), (certificate number), has received the required training of § 61.31(i) in a (make and model of tailwheel airplane). I have determined that (s)he is proficient in the operation of a tailwheel airplane.

S/S [date] J.J. Jones 987654321CFI Exp. 12-31-05

G. **Endorsement to act as PIC of an aircraft in solo operations when the pilot does not hold an appropriate category/class rating: § 61.31(d)(3)**

I certify that (First name, MI, Last name) has received the training as required by § 61.31(d)(3) to serve as a PIC in a (category and class of aircraft). I have determined that (s)he is prepared to serve as PIC in that (make and model of aircraft).

S/S [date] J.J. Jones 987654321CFI Exp. 12-31-05

H. **Endorsement to certify completion of prerequisites for a practical test: FAR 61.39(a)(6)**

I have given (First name, MI, last name) flight training in preparation for a (type of practical test) practical test within the preceding 60 days and find him/her prepared for the required practical test and to have demonstrated satisfactory knowledge of the subject areas in which the applicant was shown to be deficient by his/her airman knowledge test.

S/S [date] J.J. Jones 987654321CFI Exp. 12-31-05

I. **Endorsement for retesting after failure of a knowledge or practical test: § 61.49.**

I certify that (First name, MI, Last name) has received the additional (flight and/or ground) training as required by § 61.49. I have determined that he/she is prepared for the (name the knowledge/practical test).

S/S [date] J.J. Jones 987654321CFI Exp. 12-31-05

1. You may also complete the endorsement in the space provided at the bottom of the applicant's airman knowledge test report in the case of a failure on a knowledge test.
2. You must sign the block provided for the instructor’s endorsement on the reverse side of FAA Form 8710-1 for each retake of a practical test.
3. An applicant may retake either a knowledge or practical test if (s)he has received additional training and an instructor’s endorsement.

J. **Endorsement for review of a home study curriculum: § 61.35(a)(1)**

I certify I have reviewed the home study curriculum of (First name, MI, Last name). I have determined (s)he is prepared for the (name the knowledge test).

S/S [date] J.J. Jones 987654321CFI Exp. 12-31-05

K. **Endorsement for an airman seeking an additional aircraft category or class rating (other than ATP): § 61.63(b) or (c)**

I certify that (First name, MI, Last name), (pilot certificate), (certificate number), has received the required training for an additional (name the aircraft category/class rating). I have determined that (s)he is prepared for the (name the practical test) for the addition of a (name the aircraft category/class rating).

S/S [date] J.J. Jones 987654321CFI Exp. 12-31-05

L. **Endorsement for an airman seeking a type rating concurrently with an additional category or class rating (other than ATP): § 61.63(d)(2) and (3)**

I certify that (First name, MI, Last name) has received the required training of § 61.63(d)(2) and (3) for an addition of a (name the category/class/type rating). I have determined that (s)he is prepared for the (name the practical test) for the addition of a (name the aircraft category/class/type rating).

S/S [date] J.J. Jones 987654321CFI Exp. 12-31-05

GLEIM FLIGHT INSTRUCTOR REFRESHER COURSE
LESSON 9
TEACHING FLIGHT MANEUVERS AND PROCEDURES

9.1 AIRCRAFT FAMILIARIZATION

I. Encourage new students to take a few minutes to acquaint themselves with the cockpit before getting ready to start the engine on their first few flights, and whenever preparing to fly an unfamiliar airplane.

A. Suggest that your students sit in the cockpit for a few minutes after performing the preflight inspection to familiarize themselves with the location of all controls and switches, and to think of any questions to ask.

B. The aircraft's *POH* should have a control panel diagram, similar to that of the Cessna illustrated below, that can be studied at home.

C. You may suggest that students take a blank sheet of paper and, without the aid of a diagram or photo, sketch the airplane's control panel and review normal control positions and normal gauge indications.

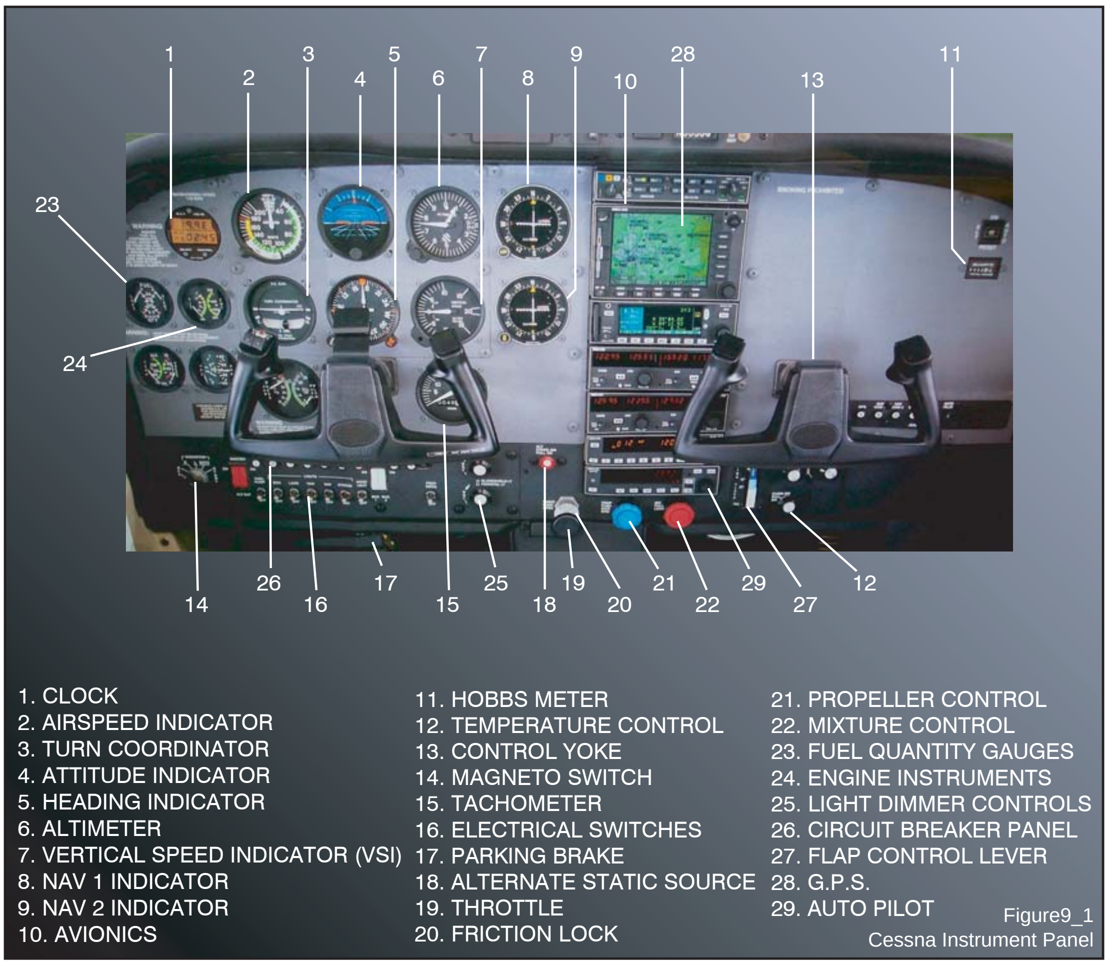


Figure9_1
Cessna Instrument Panel

II. After the first few lessons, when a new student is able to confidently control the airplane in basic maneuvers, spend some time on the ground discussing the airplane's performance, systems, V-speeds, and general limitations.

A. It is important for student pilots to become familiar with these items early in their training so that they learn to regard them as integral elements of the flying process that must always be considered.

B. However, be careful that you do not introduce too much information at once. The student may allow small details to distract him/her from mastery of the fundamental elements of a skill if (s)he is presented with too many of the finer points at an early stage.

1. EXAMPLE: A detailed explanation of takeoff performance considerations, such as runway surface, runway slope, and wind direction, could be extremely confusing and distracting to a student who is still attempting to learn basic aircraft control and become familiar with the flight environment.

9.2 BASIC PRINCIPLES OF FLIGHT

I. You may wish to discuss some of the basic principles of flight with a new student before his/her first flight, or you may wish to wait until that student has flown with you a few times, allowing him/her an opportunity to observe these principles on his/her own.

A. As an alternative to having a ground discussion, you may wish to point out some or all of these principles while in flight.

B. This technique is often the best way to approach a prospective student's introductory flight, as it allows you to make the flight interesting and enjoyable while simultaneously presenting information that will be used in all future lessons.

1. A suggested sequence follows:

a. Perform the takeoff and get the airplane to a safe maneuvering altitude and practice area.

b. Demonstrate the effects of each of the primary flight controls: rudder, elevator, and ailerons (in that order).

c. Demonstrate how to use rudder and aileron together to prevent adverse yaw.

d. Demonstrate that, if constant elevator pressure is maintained, the airplane's nose will drop and the airplane will descend when the wings are banked.

i. This demonstration may be used to introduce coordinated level turns.

e. Demonstrate the relationship of power changes to pitch changes.

f. Demonstrate the use of elevator trim by having the student hold the nose on the horizon while you gradually apply nose-up or nose-down trim. Then, have the student trim away the pressure until none remains.

g. Demonstrate how to initiate and maintain a climb, including how to keep the airplane coordinated by "stepping on the ball."

h. Demonstrate how to initiate and maintain a descent.

i. You can use the descent demonstration as a way to return to the airport.

ii. If traffic conditions allow and the student is able to make a controlled descent, you can let him/her continue to fly the airplane until you are almost ready to land.

i. Note that you should allow the student to repeat your actions after each demonstration.

II. Your discussion of the basic principles of flight should address the following elements:

A. **Flight instruments**

1. When your students have an understanding of the flight instruments and their individual limitations, you will gain a valuable tool that can be used to point out the relationships between variables such as pitch and airspeed, to quantify areas that are deficient, and to provide helpful suggestions for making improvements.

2. Explain each of the six primary flight instruments as follows:
   a. The airspeed indicator (ASI) displays the speed at which the airplane is moving through the air.
   b. The attitude indicator (AI) displays the attitude of the airplane (nose up, nose down, wings banked) in relation to the horizon.
   c. The altimeter (ALT) displays the height of the airplane above mean sea level (MSL) when properly adjusted to the current pressure setting.
   d. The turn coordinator (TC) displays the rate at which a turn is being made. The miniature airplane in the TC display banks in the direction of the turn.
      i. At the bottom of the instrument is a ball in a glass tube called an inclinometer. The inclinometer indicates whether the airplane is in coordinated flight (ball centered) or uncoordinated flight.
      ii. "Step on the ball" in order to center it by applying rudder pressure on the side where the ball is deflected
   e. The heading indicator (HI) displays the heading (direction) the airplane is pointed.
      i. The HI must be set to match the compass before takeoff in order to provide reliable heading information.
   f. The vertical speed indicator (VSI) displays whether the airplane is in level flight, climbing, or descending. The rate of climb or descent is indicated in hundreds of feet per minute.

B. **Airplane control**

1. Explain that airplane control is composed of three components: pitch control, bank control, and power control.
   a. **Pitch control** is the control of the airplane about its lateral axis (i.e., wingtip to wingtip) by applying elevator pressure to raise or lower the nose in relation to the horizon.
   b. **Bank control** is the control of the airplane about its longitudinal axis (i.e., nose to tail) by use of the ailerons to attain the desired angle of bank in relation to the horizon.
   c. **Power control** is the control of power or thrust by use of the throttle to establish or maintain a desired airspeed, climb rate, or descent rate in coordination with attitude changes.

C. **Straight-and-level flight**

1. Explain that straight-and-level flight means that the airplane maintains a constant heading and a constant altitude.
   a. This is accomplished by making constant small corrections for unintended deviations in heading and altitude.
2. Point out that the pitch attitude for level flight is obtained by selecting some portion of the airplane's nose or instrument glare shield as a reference point and then keeping that point in a fixed position relative to the horizon.
   a. That position should then be cross-checked against the altimeter to determine whether the pitch attitude is correct for the power setting being used.
      i. If altitude is being lost or gained, the pitch attitude should be readjusted in relation to the horizon, and then the altimeter should be checked to determine if altitude is being maintained.
   b. Mention that the pitch information obtained from the attitude indicator will also show the position of the nose relative to the horizon if the miniature airplane is properly adjusted.

3. Explain that, to achieve straight flight, your student should select two or more outside visual reference points directly ahead of the airplane (e.g., roads, section lines, towns, lakes, etc.) to form an imaginary line and then keep the airplane headed along that line.
   a. Both wingtips should also be equidistant above or below the horizon (depending on whether the airplane is a high-wing or low-wing type).
   b. While using these references, remind your student to occasionally check the heading indicator (HI) to determine that the airplane is maintaining a constant heading, and to return to the desired heading if necessary.
4. Emphasize that straight-and-level flight requires almost no application of control pressure if the airplane is properly trimmed and the air is smooth.
   a. Teach your students to trim the airplane so it will fly straight and level without constant assistance.
      i. This is called “hands-off flight.”
      ii. Improper trim technique usually results in flying that is physically tiring, particularly in prolonged straight-and-level flight.
   b. Explain that the airplane should be trimmed by first applying control pressure to establish the desired attitude, and then adjusting the trim so that the airplane will maintain that attitude without control pressure in hands-off flight.
5. The airspeed will remain constant in straight-and-level flight with a constant power setting.
   a. Emphasize that significant power changes will result in significant airspeed changes, which will require considerable changes in pitch attitude to maintain altitude.
   b. Pronounced changes in pitch attitude will also be necessary as the flaps and landing gear (if retractable) are operated.

D. **Turns**

1. Explain that a turn is a basic flight maneuver used to change from, or return to, a desired heading. This maneuver involves the coordinated use of the ailerons, rudder, and elevator.
2. To enter a turn, teach your student to simultaneously apply aileron pressure and rudder pressure in the desired direction.
   a. Explain that the rate at which the airplane rolls into a bank depends on the rate and amount of control pressure applied.
      i. Relatedly, the amount of bank depends on how long the ailerons are deflected.
   b. Point out that rudder pressure must be enough to keep the ball of the inclinometer centered.
      i. If the ball is not centered, teach your student to “step on the ball” to recenter it.
   c. Explain that the best outside reference for establishing the degree of bank is the angle made by the top of the engine cowling or the instrument panel with respect to the horizon.
   d. Point out that the attitude indicator (AI) will also show the angle of the wings in relation to the horizon. Referring to the AI will help your student learn to judge the degree of bank based on outside references.
3. Explain that some of the lift produced by the wings is used to turn the airplane.
   a. Thus, to maintain a constant altitude, your student will need to apply enough back elevator pressure to prevent a descent.

4. The roll-out from a turn to straight flight is similar to the roll-in to the turn from straight flight except that control pressures are used in the opposite direction. Explain that aileron and rudder pressures are applied in the direction of the roll-out.
    a. Teach your student that, as the angle of bank decreases, the elevator pressure should be released smoothly as necessary to maintain altitude. Remind your student that the vertical component of lift increases when the airplane is no longer banked.
    b. Point out that the airplane will continue turning as long as it is banked, so the roll-out must be started before reaching the desired heading.

E. **Climbs**

1. Explain that climbs and climbing turns are basic flight maneuvers in which the pitch attitude and power setting result in a gain in altitude. In a straight climb, the airplane gains altitude while traveling straight ahead. In climbing turns, the airplane gains altitude while turning.
2. Teach your student to enter the climb by simultaneously advancing the throttle and applying back elevator pressure.
    a. Point out that, as the power is increased to the climb setting, the airplane's nose will tend to rise toward the climb attitude on its own.
    b. Also point out that, as the pitch attitude increases and the airspeed decreases, progressively more right-rudder pressure must be used to compensate for torque effects and to maintain heading.
        i. Explain that, because the angle of attack and power setting are relatively high and the airspeed is relatively slow, the airplane will have a tendency to roll and yaw to the left due to turning tendencies created by the rotating propeller.
            o While right-rudder pressure will correct for the yaw, some aileron pressure may also be required to keep the wings level.
3. To maintain the climb, back elevator pressure must be maintained to keep the pitch attitude constant.
    a. Explain that, as the airspeed decreases, the elevators may try to return to their streamlined or neutral position, which will cause the nose to lower.
        i. Nose-up trim will therefore be required.
    b. Teach your student to cross-check the airspeed indicator (ASI) because the airplane gives certain degrees of climb performance at certain airspeeds, and because the ASI will provide an indirect indication of the pitch attitude.
        i. If the airspeed is higher than desired, your student must raise the nose.
        ii. If the airspeed is lower than desired, your student must lower the nose.
4. Explain that, to return to straight-and-level flight from a climbing attitude, your student should start the level-off below the desired altitude in order to avoid climbing through it.
    a. To level off, the nose should be lowered gradually, because a loss of altitude will result if the pitch attitude is decreased too abruptly before allowing the airspeed to increase adequately.
        i. Explain that, as the nose is lowered, the airplane will need to be retrimmed to eliminate control pressures.
        ii. Teach your student to reduce the throttle setting to appropriate cruise power setting and to trim the airplane when the airspeed reaches the desired cruise speed.

F. Descents

1. A descent is a basic maneuver in which the airplane loses altitude in a controlled manner. Explain that descents can be made
   a. With partial power, as used during an approach to a landing
   b. Without power, i.e., a glide
   c. At cruise airspeeds, during en route descents
      i. The following discussion applies to en route descents, which are the simplest to introduce.
2. Teach your student that, to enter a descent, (s)he should first apply carburetor heat (if recommended by the manufacturer) and then reduce power to the desired setting.
   a. The power reduction will simultaneously cause the nose to pitch down and the airplane to begin a descent.
   b. Teach your student to adjust the pitch attitude in order to establish the desired rate of descent and to adjust the power setting in order to maintain the desired airspeed.
3. Explain that, when the descent is established, your student should cross-check the airspeed indicator (ASI) and vertical speed indicator (VSI) to ensure that the desired airspeed and descent rate are being maintained.
   a. If the airspeed is higher than desired, teach your student to make a slight power reduction, and then allow the airspeed to stabilize in order to confirm the adjustment.
      i. If the airspeed is lower than desired, teach your student to slightly increase power and allow the airspeed to stabilize.
   b. If the descent rate is higher than desired, teach your student to slightly increase the pitch attitude, and then allow the descent rate to stabilize to confirm the adjustment.
      i. If the descent rate is lower than desired, teach your student to slightly decrease the pitch attitude and allow the descent rate to stabilize.
   c. Once the desired airspeed and descent rate are established, teach your student to note the position of the airplane's nose relative to the horizon and the indications of the attitude indicator (AI).
      i. The airplane should be trimmed to relieve all control pressures.
4. Explain that the level-off from a descent must be started before reaching the desired altitude in order to avoid descending through it.
   a. To level off, teach your student to simultaneously raise the nose to a level attitude and increase power to the desired cruise setting.
      i. Remind your student that the addition of power will tend to raise the nose.
   b. Teach your student to apply appropriate elevator control pressure to resume level flight and retrim to relieve the control pressures.

9.3 ANALYSIS AND PERFORMANCE OF MANEUVERS

I. Ground Training

A. Ground training is extremely important and necessary to facilitate flight training. Each preflight and postflight discussion is as important as the actual flight instruction of each flight training lesson.

1. Unfortunately, most students and many CFIs incorrectly overemphasize the in-airplane portion of a flight lesson.
    a. The airplane and its operating systems, ATC, other traffic, etc., are major distractions from the actual flight maneuver being practiced and the aerodynamic theory/factors underlying the maneuver.
    b. When you discuss these elements with your student on the ground, (s)he will have the necessary background knowledge to make use of your comments and suggestions in the cockpit, despite all of the distractions.
        i. Attempting to introduce a complex flight maneuver or procedure for the first time while in flight is very difficult, if not impossible.

B. When learning a new maneuver or procedure, the effort and results belong to your student. As an instructor, you are responsible for directing your student's effort to obtain optimum results.

1. Impress upon your students that they must prepare for each flight lesson so they will know what is going to happen and why.

C. Before each flight, you should sit down with your student for a preflight briefing.

1. First, go over any questions that your student may have from the previous lesson.
2. Then, go over each maneuver that is to be performed during the lesson and answer any questions.
    a. During this part of the preflight briefing, you will discover how much your student prepared for the lesson.
    b. You can then tailor the rest of the briefing based on your assessment of the student's preparation.

D. After the flight, sit down with your student for a postflight briefing.

1. Begin by asking your student to critique his/her performance, and follow with your own critique.
2. Answer any questions your student may have.
3. Preview the next lesson with your student, and assign work to be done in preparation for the lesson.

II. Flight Maneuver Analysis Sheet (FMAS)

A. We have developed a method of analyzing and studying flight maneuvers that incorporates 10 variables:

1. Maneuver
2. Objective
3. Flight path
4. Power setting(s)
5. Altitude(s)
6. Airspeed(s)
7. Control forces
8. Time(s)
9. Traffic considerations
10. Completion standards

B. A copy of an FMAS (front and back) appears below for your convenience. When you reproduce the forms for your students, photocopy them on the front and back of a single sheet of paper to make the forms more convenient. The front side contains space for analysis of the above variables. The back side contains space for

1. Make- and model-specific information
   a. Weight
   b. Airspeeds
   c. Fuel
   d. Center of gravity
   e. Performance data
2. Flight instrument review of maneuver
   a. Attitude indicator ....AI
   b. Airspeed indicator ....ASI
   c. Turn coordinator ....TC
   d. Heading indicator ....HI
   e. Vertical speed indicator ....VSI
   f. Altimeter ....ALT
3. Common errors

C. A major benefit of the FMAS is preflight lesson preparation. It serves to facilitate discussion of flight maneuvers with your student before and after each flight. The FMAS emphasizes preflight planning, airplane make and model knowledge, flight instruments, and common errors.

1. Also, the FMAS helps you, your students, and pilots in general to focus on the operating characteristics of the airplane, including weight and balance. Weight and balance, which includes fuel, should be carefully reviewed prior to each flight.

CFI ____________________

Student____________________

Date____________________

GLEIM'S

FLIGHT MANEUVER ANALYSIS SHEET

1. MANEUVER ______________________________

2. OBJECTIVES/PURPOSE ______________________________

____

3. FLIGHT PATH (visual maneuvers) ______________________________

4. POWER SETTINGS 5. ALT 6. A/S

MP	RPM	SEGMENT OF MANEUVER		
______	______	a. ______________________________	______	______
______	______	b. ______________________________	______	______
______	______	c. ______________________________	______	______

Pencil in expected indication on each of 6 flight instruments on reverse side.

7. CONTROL FORCES

a. ______________________________

____

b. ______________________________

____

c. ______________________________

____

8. TIME(S), TIMING ______________________________

____

9. TRAFFIC CONSIDERATIONS CLEARING TURNS REQUIRED ______________

____

10. COMPLETION STANDARDS/ATC CONSIDERATIONS ______________________________

____

____

AIRPLANE MAKE/MODEL____

WEIGHT

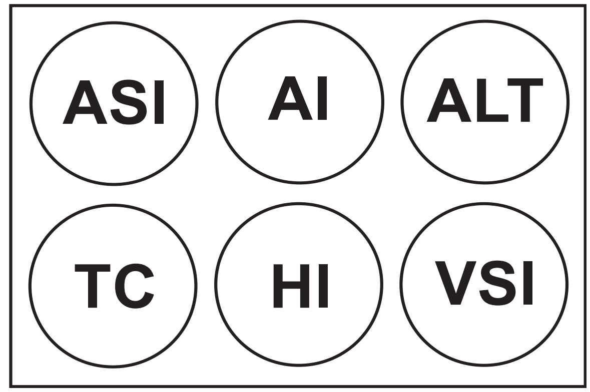
Gross	__________
Empty	__________
Pilot/Pasngrs	__________
Baggage	__________
Fuel (gal x 6)	__________

CENTER OF GRAVITY

Fore Limit	__________
Aft Limit	__________
Current CG	__________

AIRSPEEDS

V_{SO}	__________
V_{S1}	__________
V_X	__________
V_Y	__________
V_A	__________
V_{NO}	__________
V_{NE}	__________
V_{FE}	__________
V_{LO}	__________
V_R	__________



PRIMARY vs. SUPPORTING INSTRUMENTS

(IFR maneuvers) -- instruments: AI, ASI, ALT, TC, HI, VSI, RPM and/or MP
(most relevant to instrument instruction)

	PITCH	BANK	POWER
ENTRY			
primary	______	______	______
supporting	______	______	______
ESTABLISHED			
primary	______	______	______
supporting	______	______	______

FUEL

Capacity L ____gal R ____gal

Current Estimate L ____gal R ____gal

Endurance ____

Fuel-Flow -- Cruise (GPH) ____

PERFORMANCE DATA

	Airspeed	Power*	
		MP	RPM
Takeoff Rotation	______	______	______
Climbout	______	______	______
Cruise Climb	______	______	______
Cruise Level	______	______	______
Cruise Descent	______	______	______
Approach**	______	______	______
Approach to Land (Visual)	______	______	______
Landing Flare	______	______	______

** If you do not have a constant-speed propeller, ignore manifold pressure (MP).*
***Approach speed is for holding and performing instrument approaches.*

COMMON ERRORS

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III. Flight Training

A. After you complete your preflight briefing, including a review and critique of your student's FMAS, you should move out to the airplane and observe your student performing the preflight inspection, engine start, taxi, etc. Critique his/her performance, including flight maneuvers on the way to your practice area.

1. For example, if you observe poor radio technique or inadequate attention to traffic, explain both the deficiency and corrective action.
2. Vary takeoffs and landings (normal, soft-field, short-field) and other maneuvers as a cumulative review process throughout the curriculum; e.g., do S-turns across a road after execution of a surprise emergency approach and landing.

B. As you approach the practice area, implement the **telling-and-doing technique** of flight instruction. It is similar to the demonstration/performance method of teaching and is also used for ground instruction. The telling-and-doing technique is very effective in teaching skills.

1. **Instructor tells, instructor does.** This is a continuation of preparing your student to practice the maneuver, which began during the preflight discussion. It is important that your demonstration conform to the explanation as closely as possible. If a deviation occurs, you should point it out and immediately explain why it occurred.
2. **Student tells, instructor does.** This step assures you that the explanation and demonstration have been adequate and are thoroughly understood by the student. This is a transition to the next step. Frequently this step is changed to **instructor tells, student does**, which may fit the learning/teaching style of the student/instructor.
3. **Student tells, student does.** This step is where learning takes place and where performance habits are formed. You must be alert during this step to detect any errors in technique and to prevent the formation of bad habits.
4. **Student does, instructor evaluates.** During this step, you review what has been covered during the flight and determine to what extent your student has met the objectives outlined during the preflight discussion.

C. During the first step (instructor tells, instructor does) and second step (student tells, instructor does), you will demonstrate one complete circuit of the maneuver that you are introducing to your student.

1. Point out the pattern that (s)he is supposed to fly, noting the visual references to be used.
   a. As you correct for any wind, mention the wind direction and how you are correcting for this condition.
   b. Keep your explanation simple and to the point.
2. This step is a transition from the preflight discussion to your student's actual performance of the maneuver.

D. During the third step (student tells, student does), you should instruct and correct your student's errors as each part of the maneuver is being performed.

1. During this step, you will concentrate on specific items as they are encountered (e.g., wind drift correction errors).

E. The fourth step (student does, instructor evaluates) is when you take an overall look at your student's performance of the maneuver.

1. Your student may have a specific problem (e.g., altitude control) which prevents him/her from seeing the whole maneuver.
   a. While concentrating to maintain altitude, (s)he fails to plan for the next part of the maneuver.

2. You should redirect your student to the basic elements of the maneuver, i.e., planning, orientation, and airplane control.
3. Stress that all of the parts are required to complete the maneuver successfully.

F. Note that in the demonstration/performance method of instruction, student performance and instructor supervision of a maneuver are performed concurrently.

1. Again, the telling-and-doing technique of flight instruction is a variation on the demonstration/performance method.

G. Note that each maneuver should be taught based on both outside visual references and reference to flight instruments. This is known as integrated flight instruction.

9.4 OPERATIONS AT AIRPORTS WITHOUT OPERATING CONTROL TOWERS

I. General Operating Practices

A. The use of standard traffic patterns and the use of common traffic advisory frequency (CTAF) procedures (by radio-equipped aircraft) are recommended at all airports without operating control towers.

1. Instruct your students in the proper use of self-announce procedures when operating at an airport without an operating control tower. Generally, where there is no tower, FSS, or UNICOM CTAFs in operation on the airport, use of the MULTICOM frequency 122.9 is recommended for self-announce procedures. Such airports will be identified in appropriate aeronautical information publications (i.e., *A/FD*).

B. Teach your students that, as part of their preflight familiarization with all available information concerning a flight, they should review all appropriate publications (*A/FD*, *AIM*, *NOTAM*, etc.) for pertinent information about current traffic patterns at the departure and arrival airports.

1. It is recommended that pilots also use visual indicators, such as the segmented circle, wind direction indicator, landing direction indicator, and traffic pattern indicators, to determine or verify traffic pattern information.

C. Explain that the FAA encourages (but does not require) pilots to use a standard traffic pattern.

1. Point out that other traffic patterns may already be in common use at some airports, or that special circumstances or conditions may exist that prevent the use of a standard traffic pattern.
   a. For example, pilots inbound on an instrument approach procedure or performing straight-in VFR approaches will not adhere to a standard “downwind, base, and final” type of pattern.
2. Accordingly, pilots must remain alert for traffic that is not established in a leg of a standard traffic pattern.
   a. The use of any traffic pattern procedure does not alter the responsibility of each pilot to see and avoid other aircraft.
   b. Emphasize to your students that they should be alert at all times for aircraft executing straight-in approaches.

D. Explain that pilots of inbound non-radio-equipped aircraft will determine the runway in use by observing the landing direction indicator or by other means.

1. Impress upon your students that procedures at airports without operating control towers do not require the use of two-way radios; therefore, they must be especially vigilant for other aircraft while operating in the traffic pattern.

E. If you wish to conduct practice instrument approaches with a student, you must be particularly alert for other aircraft in the pattern so as to avoid interrupting the flow of traffic.

1. Position reports on the CTAF should include your distance and direction from the airport, as well as your intentions upon completion of the approach.

II. Recommended Standard Traffic Pattern

A. Explain that, prior to entering the traffic pattern at an airport without an operating control tower, aircraft should avoid the flow of traffic until established on the entry leg.

1. For example, wind and landing direction indicators can be checked while at an altitude of 500 to 1,000 ft. above the traffic pattern altitude.
2. Teach your students that, when the proper traffic pattern direction has been determined, they should then proceed to a point well clear of the pattern before descending to the pattern altitude.

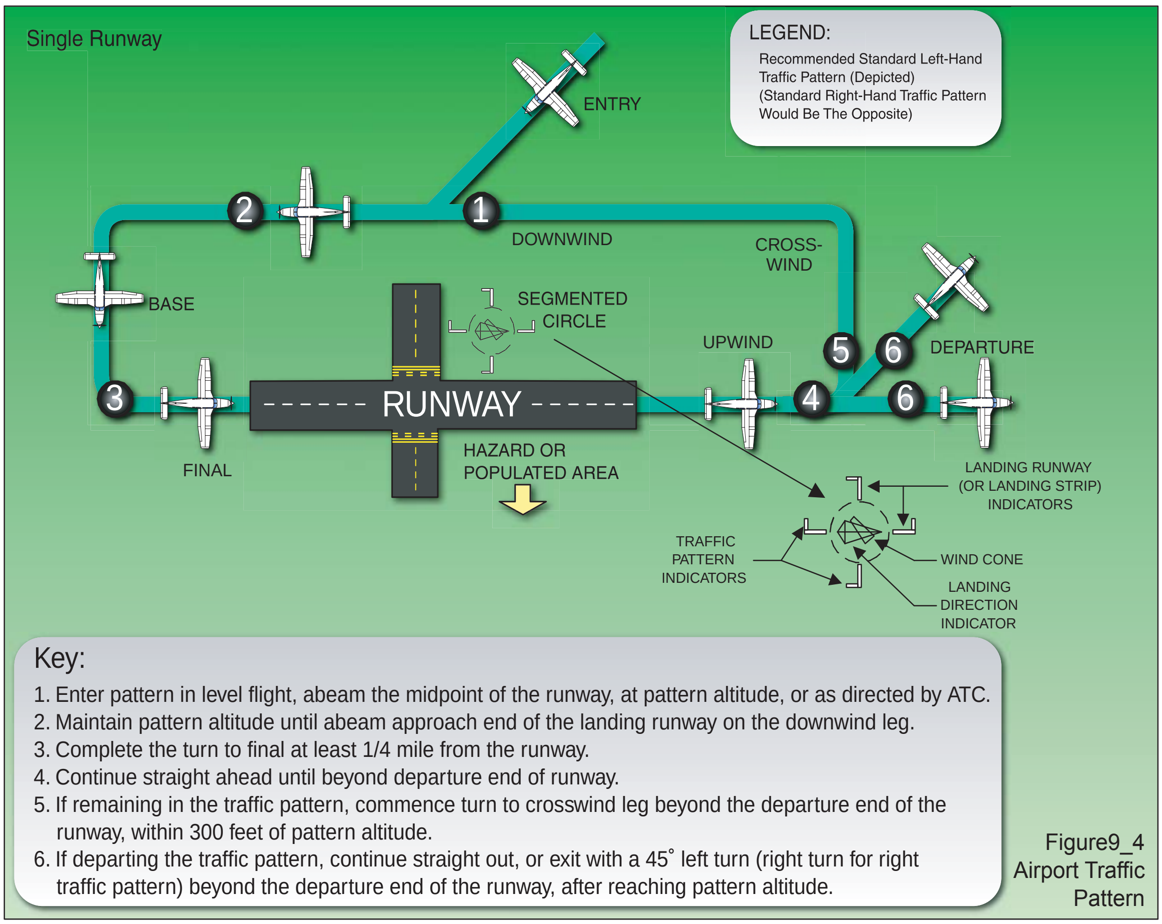


Figure9_4 Airport Traffic Pattern

B. Emphasize that arriving aircraft should be at the appropriate traffic pattern altitude before entering the traffic pattern.

1. Explain that descending into the traffic pattern greatly increases the chances of a midair collision in which the descending airplane descends into another airplane already established in the traffic pattern.
   a. This scenario is especially likely when the descending airplane is of the low-wing type and the airplane in the pattern is of the high-wing type.

C. Teach your students that entry to the downwind leg should be made at a 45° angle, abeam the midpoint of the runway.

1. Explain that one method to enter the traffic pattern at an airport without an operating control tower is to fly in the landing direction parallel to, and slightly to one side of, the runway at

an altitude 500 to 1000 ft. above the traffic pattern altitude.

a. Once the airplane is about 15 sec. past the departure end of the runway, a 45° turn should be made in the same direction as the traffic pattern direction (i.e., turn left if the runway is using left traffic; turn right if the runway is using right traffic).

b. This heading should be maintained for approximately 1 min.; then a descent to traffic pattern altitude and a 180° turn in the direction of the traffic pattern should be simultaneously begun.

c. At the completion of the 180° turn, the airplane should be at the traffic pattern altitude and established on the 45° entry leg to the downwind.

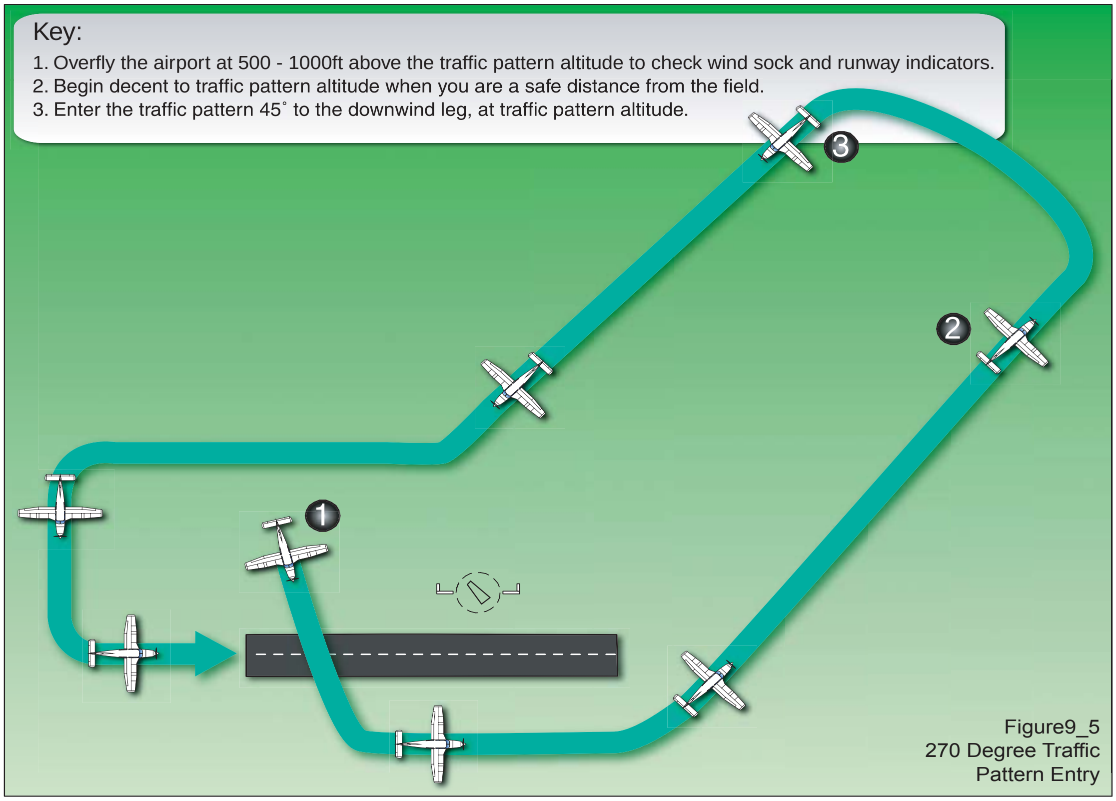


Figure9_5
270 Degree Traffic
Pattern Entry

D. Explain that the recommended traffic pattern altitude for airplanes is 1000-ft. above ground level (AGL).

1. However, large and turbine-powered airplanes should enter the traffic pattern at an altitude of 1,500 ft. AGL or 500 ft. above the established pattern altitude.

2. Tell your students that pilots may vary the size of the traffic pattern depending on their aircraft's performance characteristics.

a. Help your students find a reference on the airframe that can be used to help establish the appropriate distance from the runway while on the downwind leg.

i. EXAMPLE: On many airplanes, the airplane is a good distance from the runway on downwind when the runway appears approximately halfway down the wing on the pilot's side.

E. Teach your students to maintain the traffic pattern altitude until the aircraft is at least abeam the approach end of the landing runway on the downwind leg.

1. The base leg turn should then commence when the aircraft is at a point approximately 45 degrees relative bearing from the runway threshold.

2. On many small training airplanes, this is the point when the touchdown area (i.e., the numbers) appears to be approximately halfway between the wing and the tail.

F. Emphasize that landing and takeoff should be accomplished on the operating runway that is most nearly aligned into the wind.

1. Explain that, if a secondary runway is also being used, pilots using that runway are expected to avoid the flow of traffic to the primary runway.
2. However, this fact does not relieve pilots using the primary runway of the responsibility of looking for traffic.

G. Teach your students that, after takeoff, they should continue straight ahead until the airplane is beyond the departure end of the runway.

1. Additionally, when executing a go-around maneuver, teach your students to continue straight ahead, beyond the departure end of the runway, while maintaining awareness of other traffic, so as not to conflict with aircraft established in the pattern.
   a. Point out that, in cases in which a go-around was caused by an aircraft on the runway, your student may be required to maneuver parallel to the runway in order to maintain visual contact with the conflicting aircraft.
   b. Explain that this procedure is necessary only to maintain visual contact with a conflicting aircraft, however, and should not necessarily be a part of every go-around.

H. Explain that the FAA recommends that a pilot remaining in the traffic pattern should not commence a turn to the crosswind leg until beyond the departure end of the runway and within 300 ft. below traffic pattern altitude, while ensuring that the turn to downwind leg will be made at the traffic pattern altitude.

1. Point out, however, that factors such as marginal airplane performance, obstacles, conflicting traffic, or nearby restricted airspace may require the turn to crosswind to occur at a lower altitude.

I. When departing the traffic pattern, teach your students to continue straight out or exit with a 45° turn in the direction of the traffic pattern.

1. This turn should commence only when the airplane is beyond the departure end of the runway, and after reaching pattern altitude.
2. Remind your students that they need to be aware of any traffic entering the traffic pattern before commencing the turn.

J. Though a moot point for most training aircraft, explain that airplanes should not be operated in the traffic pattern at an indicated airspeed of more than 200 kt.

K. Teach your students that, throughout the traffic pattern, right-of-way rules apply as stated in 14 CFR Part 91.113.

1. Any aircraft in distress has the right-of-way over all other aircraft.
2. When converging aircraft are of different categories, a balloon has the right-of-way over any other category of aircraft.
3. A glider has the right-of-way over an airship, airplane, or rotorcraft.
4. An airship has the right-of-way over an airplane or rotorcraft.
5. An airplane has the right-of-way over a rotorcraft.

GLEIM FLIGHT INSTRUCTOR REFRESHER COURSE
LESSON 10
FLIGHT SAFETY

10.1 ANALYSIS OF ACCIDENTS AND INCIDENTS

I. **National Transportation Safety Board (NTSB) Definitions**

A. Explain to your students that an **aircraft accident** is an occurrence associated with the operation of an aircraft that takes place between the time any person boards an aircraft with the intention of flight and the time all such persons have disembarked, and in which one of the following results:

1. Any person suffers death or serious injury.
2. The aircraft sustains substantial damage.

B. A **serious injury** is any injury that

1. Requires hospitalization for more than 48 hr., commencing within 7 days from the date the injury was sustained;
2. Results in a fracture of any bone (except simple fractures of fingers, toes, or nose);
3. Causes severe hemorrhages or nerve, muscle, or tendon damage;
4. Involves injury to any internal organ; or
5. Involves second- or third-degree burns, or any burns affecting more than 5% of the body surface.

C. **Substantial damage** is damage or failure that adversely affects the structural strength, performance, or flight characteristics of the aircraft and that would normally require major repair or replacement of the affected component.

1. Engine failure; damage limited to an engine; bent fairings or cowling; dented skin; small punctured holes in the skin or fabric; ground damage to rotor or propeller blades; damage to landing gear, wheels, tires, flaps, engine accessories, brakes, or wingtips are not considered "substantial damage."

D. An **incident** is an occurrence, other than an accident, associated with the operation of an aircraft that affects or could affect the safety of operations.

II. The NTSB is an independent Federal agency charged by Congress with the task of investigating every civil aviation accident in the United States and significant accidents in the other modes of transportation – railroad, highway, marine and pipeline – and issuing safety recommendations aimed at preventing future accidents. The NTSB does not produce or enforce legislation in any form.

A. The NTSB determines the probable cause of all U.S. civil aviation accidents and publishes detailed accident reports outlining its findings.

B. There are two types of NTSB accident reports:

1. **Preliminary reports** are issued following a preliminary investigation of an accident, but before any final conclusions are made.

a. These reports consist of a description of the observed events of the accident and a summary of all known information regarding the accident (e.g., reported weather conditions, excerpts of radio transmissions, etc.).

i. They do not list a probable cause for the accident.

b. Information contained in preliminary reports may be in error and is subject to change.

2. **Final reports** are issued following the NTSB's full investigation and determination of a probable cause for the accident. Final reports can be subdivided into 2 types based on the nature of the accident:
   a. Reports for accidents that did not result in fatalities consist of a summary of the events of the accident and all relevant information, followed by the NTSB's determination of the probable cause of the accident.
   b. Reports for accidents that resulted in fatalities are considerably more extensive than reports for non-fatal accidents. They typically consist of several sections, including the following:
      i. **History of the Flight:** This section outlines the circumstances of the flight, including the reasons the flight was being conducted, the applicable regulations.
      ii. **Personnel/Pilot Information:** This section provides background information about the flight crew and any relevant passengers, including certificates and ratings held, flight experience, character descriptions, etc.
      iii. **Aircraft Information:** This section describes the accident aircraft, including airframe and engine times, maintenance history, typical types of operations, etc.
      iv. **Meteorological Information:** This section describes the reported and forecast weather conditions at the time of the accident, including wind velocity, ceilings, visibility, relevant pilot reports, etc.
      v. **Wreckage and Impact Information:** This section describes the condition and location of any aircraft wreckage associated with the accident, including whether the engine(s) were developing power at the time of impact, any instrument indications that can be determined, any engine or flight control positions that can be determined, whether damage to significant aircraft components occurred before or after impact, etc.
      vi. **Medical and Pathological Information:** This section describes the physiological condition of the crew and any relevant passengers, including the presence of drugs or alcohol in the blood, relevant past medical history, official cause(s) of death, etc.
      vii. **Additional Information:** This section contains any other information relevant to the accident.
      viii. **Probable Cause:** This section explains the probable cause determined by the NTSB, including any actions recommended to prevent future accidents of the same type.
         o This section sometimes also lists any **contributing factors** to the accident which, while not considered to be direct causes, increased the likelihood of the accident's occurrence.

C. The NTSB web site includes a database of accident reports that have been produced since the agency's formation, available at www.ntsb.gov/ntsb/query.asp
   1. As a flight instructor, you may wish to use this searchable database to find and analyze relevant aircraft accidents with your students at certain key points in their training.
      a. EXAMPLE: When teaching a student pilot flight by reference to instruments and recovery from unusual attitudes, find and analyze several accident reports involving spatial disorientation and continued VFR flight into IMC in order to underscore the importance of being able to control the airplane by reference to instruments in an emergency.

2. The web site presents each accident report first as a synopsis of the full report, including the probable cause of the accident if the report is a final report.
   a. For more detail about the accident, click on the “narrative” link at the bottom of the synopsis to see the full report.

10.2 FLIGHT SAFETY PUBLICATIONS

I. The majority of aviation magazines contain a column that highlights an NTSB accident/incident report, with an analysis of what to learn from the mishap. Many magazines also regularly feature an account of an accident or near-accident that is submitted by a reader who describes his/her personal experiences.

A. These articles often provide more analysis of an accident than a typical NTSB report, and they may be better organized for the purpose of clearly explaining the events of the accident and making key points about its cause.

1. The reader-submitted accounts of their own experiences are also beneficial because they often reveal, in the pilot’s own words, the thought process that accompanied the chain of decisions that culminated in the accident.
2. Such articles often illustrate points about aeronautical decision making very well because it is possible to see theoretical concepts, such as operational pitfalls or a poor judgment chain, played out in reality.

B. As an instructor, you may find it helpful to save relevant articles and provide them to your students at key points in their training.

1. EXAMPLE: An article that discusses a controlled flight into terrain (CFIT) accident might be appropriate for an instrument student who is beginning the cross-country portion of his/her flight training.

II. The FAA’s National Aviation Safety Data Analysis Center (NASDAC) has a web page that contains NTSB and FAA accident/incident databases with excellent search devices. The address ishttp://nasdac.faa.gov/

A. The following searchable databases that may be useful to you as a CFI are available:

1. **Aviation Safety Reporting System (ASRS):** The Aviation Safety Reporting System (ASRS) receives, processes, and analyzes reports of unsafe occurrences and hazardous situations that are voluntarily submitted by pilots, air traffic controllers, and others.
   a. Information collected by the ASRS is used to identify hazards and safety discrepancies in the National Airspace System. It is also used to formulate policy and to strengthen the foundation of aviation human factors safety research.
2. **Near Midair Collision System (NMACS):** The Near Midair Collision System (NMACS) database is used to record reports of in-flight incidents where two aircraft have closed to an unsafe distance, but avoided an actual collision.
3. **FAA Accident/Incident Data System (AIDS):** The Accident/Incident Data System (AIDS) database contains data records for general aviation and commercial air carrier incidents since 1978.
   a. The NASDAC database for AIDS contains incidents only because NASDAC uses the NTSB accident database as the primary source for accident information.
4. **NTSB Aviation Accident and Incident Data System (NTSB):** The NTSB Aviation Accident and Incident Data System contains preliminary and final NTSB accident and incident reports.

5. **NTSB Safety Recommendations to the FAA with FAA Responses:** The NTSB uses the information it gathers during accident investigations and the determination of probable cause to make safety recommendations to all elements of the transportation industry.
    a. While the recipient of a recommendation does not have to implement the proposed action, it does have to respond formally to the recommendation and specify what action is or is not being taken and why.
    b. This database contains the NTSB recommendations to the FAA and the FAA's responses.
6. **World Aircraft Accident Summary (WAAS):** The World Aircraft Accident Summary (WAAS) provides brief details of all known major operational accidents to jet and turboprop aircraft, helicopters, and the larger piston-engine types worldwide.

B. Most of these databases have a feature that allows you to search for information based on the airport at which the events took place.
1. You may wish to use these databases to find relevant occurrences that took place at your airport in order to point out potential local safety hazards to your students.

III. The Aviation Safety Reporting System (ASRS), mentioned in item B.1.a. above, also has its own web page. The address ishttp://asrs.arc.nasa.gov/

A. This page contains a searchable database of ASRS reports (similar to that described in item B.1.a.above), instructions about how to submit a report, and valuable information about the FAA's policy regarding immunity for pilots who submit ASRS reports.

B. Encourage your students to consider submitting an ASRS report if they are ever involved in an unsafe situation, such as a near-midair-collision or a runway incursion.
1. Remind them that submitting an ASRS report may provide them with limited immunity from an enforcement action that could otherwise result from the unsafe situation.
2. Point out also that, by submitting an ASRS report, your student will provide other pilots with an opportunity to learn from his/her mistakes.

C. As a flight instructor, you are exposed to the flight training environment on a regular basis. You must remember that your risk of being involved in an unsafe situation increases proportionally to your exposure to the flight environment.
1. As such, you should also consider filing an ASRS report any time you inadvertently allow an unsafe situation to develop during a training flight.
2. By identifying and reporting the circumstances that led to the unsafe condition, you may be able to help other instructors avoid a similar situation.

10.3 STALL AND SPIN AWARENESS

I. Ground Training

A. When teaching stall and spin awareness, you should ensure that your student understands some basic concepts. These include
1. The definitions of a stall and a spin, including the aerodynamic requirements for each to occur.
    a. Remind your students that, for a stall to occur, the critical angle of attack must be exceeded. For a spin to occur, the airplane must first be stalled; then it must be allowed to yaw.

2. Aerodynamics related to stalls and spins.
3. The factors affecting stall speed.

B. These topics were discussed in detail in Lesson 1, Teaching Aerodynamics.

II. Flight Training -- Stalls

A. As a flight instructor, you are required to give stall training. You should emphasize to your students that the techniques and procedures required to perform stalls in any given aircraft may differ, and that your students must be aware of the flight characteristics of each aircraft flown.

1. The most effective method of introducing stalls is through the simulation of scenarios that can lead to inadvertent stalls in actual flight.
    a. EXAMPLE: Introduce the concept of a power-off stall by simulating an approach to landing (at a safe altitude) in which the airplane is gradually configured for landing while descending through a simulated traffic pattern.
        i. Explain to your student that you are simulating an attempt to “stretch the glide” to the runway without adding power; then stall the airplane and recover after turning final.
        ii. Before beginning the demonstration, choose a predetermined altitude to represent ground level. Be sure to stall the airplane sufficiently above this predetermined altitude to allow room for a full recovery before reaching the “ground.”

2. You should perform stall demonstrations and practice, including slow flight and other maneuvers incorporating distractions that can lead to inadvertent stalls, at a sufficient altitude to enable recovery above 1,500 ft. AGL in single-engine airplanes and 3,000 ft. AGL in multiengine airplanes.
    a. Ensure that your students are aware of these minimum altitudes before allowing them to practice stalls in solo flight.

3. Single-engine stalls should not be demonstrated or practiced in multiengine airplanes.
    a. Additionally, engine-out minimum control airspeed demonstrations in multiengine airplanes should not be attempted when the density altitude and temperature are such that the engine-out minimum control airspeed is close to the stall speed (i.e., at the critical density altitude), since loss of directional control could result.

B. **Stall avoidance practice at slow airspeeds**

1. The main purpose of practicing slow flight is to enable students to become familiar with the control techniques appropriate for low airspeeds, and the rapidity with which control effectiveness (and thus, aircraft control) can be lost.
    a. When teaching slow flight, you should cover two distinct situations. They are
        i. The establishment and maintenance of airspeeds appropriate for approaches to a landing.
        ii. Turning flight at the slowest airspeed at which the particular airplane is capable of continued controlled flight without stalling.

2. Emphasize to your students that improper airspeed management which results in a stall is most likely to occur when they are distracted by one or more other tasks.
    a. Pilots at all skill levels must be aware of the increased risk of entering an inadvertent stall while performing tasks that are secondary to controlling the airplane.

3. Stall awareness (and thus, avoidance) is best-promoted by creating distractions while the student is practicing certain maneuvers during which the likelihood of an inadvertent stall is increased. The student will learn to detect the signs of an impending stall and quickly apply the appropriate correction in order to avoid a stall.
   a. Have your student divide his/her attention between completing an assigned task (i.e., a distraction) and flying the airplane at a low airspeed while maintaining control and avoiding a stall. The following distractions can be used:
      i. Drop a pencil and ask your student to pick it up.
      ii. Ask your student to determine a heading to an airport using a chart.
      iii. Have your student reset the heading indicator.
      iv. Ask your student to read the outside air temperature.
      v. Ask your student to identify terrain or objects on the ground.
      vi. Have your student climb 200 ft. and maintain altitude, then descend 200 ft. and maintain altitude.
      vii. While flying at a low airspeed, cover the airspeed indicator while having your student use various flap settings and assigning various tasks (distractions).

C. **Stall recognition**

1. Teach your students that there are several ways to recognize that a stall is impending before it actually occurs. When one or more of these indications are noted, initiation of a recovery should be instinctive.
   a. Explain that vision is useful in detecting a stall condition by noting the attitude of the airplane and the airspeed approaching stall speed. Emphasize, however, that this sense can be fully relied on only when the stall is the result of an intentional unusual attitude of the airplane.
   b. Hearing is also helpful in sensing a stall condition, since the tone level and intensity of sounds incidental to flight decrease as the airspeed decreases.
   c. Kinesthesia, or the mind's sensing of changes in direction, speed, or motion, is probably the most important and the best indicator of an approaching stall to the trained and experienced pilot. Explain that, if this sensitivity is properly developed, it will warn of a decrease in speed or the beginning of a settling or "mushing" of the airplane.
   d. Emphasize that the feeling of control pressures is also very important. As speed is reduced, the "live" resistance to pressures on the controls becomes progressively less.
      i. The airplane controls become less and less effective as one approaches the critical angle of attack.
      ii. Point out that, in a complete stall, all controls can be moved with almost no resistance and with little immediate effect on the airplane.
   e. Remind your students that many airplanes are equipped with stall warning devices (e.g., a horn) to alert the pilot when the airflow over the wing(s) approaches a point that will not allow lift to be sustained.
      i. Stress, however, that pilots should not place total reliance on a stall warning device for stall avoidance.

2. Impress upon your students that it is vital for them to maintain positive control of the airplane at all times in the following ways:
   a. Knowing the airplane.
      i. Your students should have an intimate familiarity with the pitch attitudes, power settings, and flap configurations appropriate to various phases of flight.
         - As their flight instructor, it is your job to help them attain this level of familiarity.
      ii. Your students should also be aware of the sights and sounds that are indicative of even the slightest changes of pitch, bank, and yaw.
   b. Flying the airplane in trim. Emphasize that a trimmed airplane can (and should) be flown "hands-off" (i.e., without the need to hold any constant control pressure) so that it remains stable at times when other tasks prevent the pilot from devoting total attention to flying the airplane.

D. **Stall recovery**

1. First and foremost, impress upon your students that the key factor in recovering from a stall is regaining positive control of the airplane by reducing the angle of attack.
   a. Since the basic cause of a stall is always an excessive angle of attack, the cause must be eliminated by releasing the back elevator pressure that was necessary to attain that angle of attack, or by moving the elevator control forward.
2. Second, have your students promptly and smoothly apply maximum allowable power to increase airspeed and to minimize the loss of altitude.
   a. Remind them that the carburetor heat must be turned off in order to obtain maximum power.
3. Third, teach your students to establish straight-and-level flight (or possibly climbing flight) with coordinated use of the controls.
   a. At this time, the wings should be leveled, if they were previously banked.
   b. Emphasize to your students that the ailerons should only be used in conjunction with coordinated rudder input, and only after the angle of attack has been reduced.
      i. Explain that the adverse yaw caused by the downward-deflected aileron, if not counteracted with rudder input, can place the airplane in uncoordinated flight.
         - This could induce a spin if the airplane is still in a stalled condition.
      ii. Thus, the primary control input to raise a lowered wing should be made with rudder.

E. **Power-off stalls**

1. Inform your students that power-off stalls are practiced to simulate inadvertent stalls entered during normal approach-to-landing conditions and configurations.
   a. Many stall/spin accidents have occurred in these power-off situations, such as
      i. Crossed-control turns from base leg to final
      ii. Attempting to recover from a high sink rate on final approach by using only an increased pitch attitude
      iii. Improper airspeed control on final or in other segments of the traffic pattern
   b. When introducing power-off stalls to your students, use a simulation of one or more of the above situations to illustrate how inadvertent power-off stalls can occur and to help your students understand why power-off stalls must be practiced.

F. **Power-on stalls**

1. Inform your students that power-on stalls are practiced to simulate takeoff and climb-out conditions and configurations.
   a. Many stall/spin accidents have occurred during those phases of flight, especially during go-arounds.
      i. A causal factor in go-around accidents has been the pilot's failure to maintain positive control due to a nose-high trim setting or premature flap extraction.
      ii. Failure to maintain positive control during short-field takeoffs has also been an accident causal factor.
   b. When introducing power-on stalls to your students, use a simulation of one or more of the above situations to illustrate how inadvertent power-on stalls can occur and to help your students understand why power-on stalls must be practiced.

G. **Crossed-control stalls in gliding turns**

1. You should demonstrate crossed-control stalls in gliding turns to simulate improper control technique during the turn from base to final.
   a. Perform the stalls from a properly coordinated turn, a slipping turn, and a skidding turn.
2. Explain that the object of a crossed-control stall demonstration is to show the effect of improper control technique and emphasize the importance of coordinated control when making a turn.
   a. You should allow your students to perform crossed-control stalls during dual instruction if they are so inclined, but emphasize that these stalls should NOT be performed during solo flight.
      i. Crossed-control stalls can be unpredictable and, when performed correctly, usually result in an incipient spin.
   b. Point out that crossed-control stalls are used for demonstration purposes only and do not need to be performed on a private pilot or commercial pilot practical test.
      i. Thus, they do not need to be practiced to the same level of proficiency as normal power-off and power-on stalls.

H. **Stalls during go-arounds**

1. Explain to your students that inadvertent stalls frequently occur during go-arounds as the pilot attempts to transition rapidly from a descent into an immediate climb.
   a. Often, the result is poor attitude control, poor coordination, and improper reconfiguration of the airplane (i.e., failure to retract the gear and flaps at the proper time).
2. Demonstrate how an inadvertent stall can occur due to improper go-around procedures.
   a. Have your students perform a full-flap, gear-extended, power-off stall and recovery, but have them attempt to climb with full flaps.
      i. In most airplanes, if a normal climb pitch attitude is held with full flaps, a secondary stall will occur.
   b. Have your student perform a full-flap, gear-extended, power-off stall and recovery, but have them retract the flaps rapidly while holding a higher-than-normal-climb pitch attitude.
      i. A secondary stall or settling with a loss of altitude should result.

I. **Elevator trim stall**

1. Emphasize to your students that elevator trim tabs are extremely powerful devices.
   a. Many airplanes can be induced to stall with NO elevator back pressure whatsoever if they are trimmed full-nose-up and full power is applied.
      i. The situation is often aggravated when flaps are extended.
   b. Point out that, during an approach to landing, the airplane normally has a lot of nose-up trim due to the reduced airspeed, and the flaps are normally extended.
      i. If the pilot does not maintain positive control of the pitch attitude by applying necessary control pressure when power is added during a go-around, the combination of nose-up trim, flaps, and the addition of power can result in a violent pitch-up of the nose and an inadvertent stall.
2. Demonstrate elevator trim stalls to your students as follows:
   a. Have your students place the airplane in the landing configuration, in a trimmed descent.
   b. After the descent is established, take the controls and initiate a go-around by adding full power, holding no elevator pressure and only light rudder pressure.
   c. Allow the nose to pitch up and torque to yaw the airplane to the left.
      i. At the first indication of a stall, recover to a normal climbing pitch attitude by using positive forward pressure on the yoke.
   d. Emphasize the importance of correct attitude control, application of control pressures, and proper trim during go-arounds.
3. You should allow your students to perform elevator trim stalls during dual instruction if they are so inclined, but emphasize that these stalls should NOT be performed during solo flight.

J. **Engine failure in a climb followed by a simulated gliding turn to return to an airport**

1. Your students need to be aware that attempting to return to the departure runway after an engine failure shortly after takeoff is extremely hazardous.
   a. Explain that the combination of low altitude, low airspeed, nose-high pitch attitude, and increased stall speed in a turn all contribute to the likelihood of a stall/spin accident.
      i. Even if the airplane does not stall, it may contact the ground in a wing-low attitude, resulting in a cartwheel that would be catastrophic for the airplane and its occupants.
   b. Emphasize to your students that they should attempt to find a suitable landing area somewhere ahead of the airplane, and try to minimize the amount of turning required.

2. To make this point, you should demonstrate to your students how much altitude the airplane loses following a power failure after takeoff and during a 270° turn back to the airport.
   a. 270° of turn was chosen because the airplane must turn more than 180° to return to the runway, but less than 360° (see figure below).

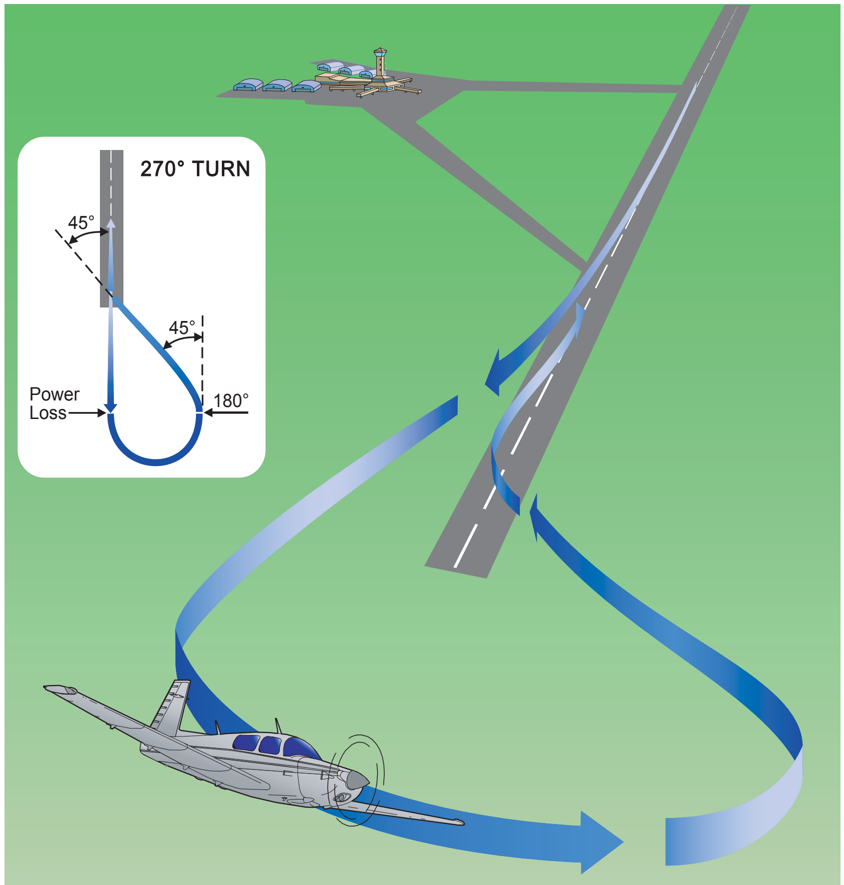


Figure10_1
270 Degree Emergency Landing Turn

3. This maneuver should be performed using medium-to-steep bank, with the emphasis on stall avoidance.
   a. Establish the best rate of climb airspeed (V_Y).
   b. Reduce power smoothly to idle as the airplane passes through a cardinal altitude.
   c. Lower the nose to maintain the best glide airspeed, and make a 270° turn while maintaining airspeed.
   d. Point out the altitude loss, and emphasize how rapidly airspeed decreases following a power failure in a climb attitude.

4. Teach your students to add a reasonable buffer (perhaps 200 ft.) to the amount of altitude lost in the turn, and then add that number to the airport elevation to determine the MINIMUM indicated altitude at which a turn back to the airport should be attempted.
   a. EXAMPLE: If a given airplane loses 600 ft. in a 270° power-off gliding turn and the airport elevation is 100 ft., a turn back to the airport should be attempted no lower than an indicated altitude of 900 ft. (600 ft. altitude loss + 100 ft. airport elevation + 200 ft. buffer = 900 ft. MSL minimum altitude)
   b. Explain that the best ratio of rate-of-turn to altitude loss will be obtained in a medium-to-steep bank (about 35-45°)
   c. Advise your students to make their turn into the wind if a crosswind is present in order to minimize the gliding distance required.

III. Flight Training -- Spins

A. Spin training is required for flight instructor–airplane and flight instructor–glider applicants only.

1. However, at your and your student's discretion, you may wish to provide spin training to private or commercial pilot applicants in an approved airplane.
2. Regardless of the grade of certificate sought, the emphasis of spin training with all pilots (with the possible exception of an aerobatic course) should be placed on spin avoidance.

B. Spin training must be accomplished in an airplane approved for spins.

1. Before practicing intentional spins, you and your students should review the recommended entry and recovery procedures in the airplane's *POH*.
2. The training should begin with the practice of both power-on and power-off stalls so that your students can become familiar with the airplane's stall characteristics.
   a. Spin avoidance, incipient spins, and actual spin entry, spin, and spin recovery techniques should be practiced from an altitude above 3,500 ft. AGL.

C. Incipient spins should be practiced by instructor applicants in order to train them to recover from a student's poorly performed stall or unusual attitude that results in a spin.

D. Spin entry, spins, and spin recovery should be demonstrated by you and repeated, in both directions, by your student.

1. Begin with the entry procedure for a power-off stall (gear and flaps retracted, or as specified by the manufacturer).
   a. As the airplane approaches a stall, smoothly apply full rudder in the direction of desired spin rotation, and continue to apply back elevator pressure to the limit of travel.
   b. The ailerons should be neutral.
2. Allow the spin to develop so your student can experience the sensation and sight picture, but plan to be fully recovered no later than one full turn after entry.
   a. Observe the airspeed indicator during the recovery to ensure that the airplane does not exceed V_{NE}.
3. Emphasize that the recovery procedure recommended by the manufacturer in the *POH* should be followed.
   a. However, in the absence of specific recovery techniques found in the airplane's *POH*, the following general technique is suggested for spin recovery.
      i. Neutralize the ailerons.
      ii. Close the throttle.
         o Power aggravates the spin characteristics and causes an excessive loss of altitude and increase in airspeed during the recovery.
      iii. Apply rudder opposite the direction of rotation to slow the rotation.
      iv. Apply positive forward elevator movement to break the stall.
         o In some airplanes, opposite rudder and forward elevator may need to be held for some time before the spinning stops.
         o However, in many other airplanes (assuming normal trim settings), simply relaxing the elevator back pressure will be sufficient to break the stall.

v. Neutralize the rudder as the spin rotation stops.
- o Otherwise, excessive yaw can occur in the other direction, placing great strain on the airframe and potentially resulting in a secondary spin.

vi. Smoothly apply sufficient back pressure to return to level flight.
- o Avoid excessive elevator back pressure, which could result in over-stressing the airframe or cause a secondary stall.

10.4 TEACHING BY EXAMPLE

I. Your flying habits, as observed by students during flight instruction or when conducting other pilot operations, have a vital impact on safety.

A. Your students use you as a role model whose flying habits they attempt to imitate, consciously or subconsciously.

1. Thus, your advocacy and description of safety practices mean little to your students if you do not demonstrate them consistently.

B. For this reason, you must carefully observe the safety practices that you teach to your students.

1. EXAMPLE: If your student sees you deliberately “bust minimums” during an instrument approach, no amount of instruction on the critical importance of instrument approach minimums will convince him/her to faithfully adhere to them during solo flight operations.

II. To maintain a professional image as a flight instructor, you must carefully observe all regulations and recognized safety practices during all flight operations.

A. In other words, “practice what you preach.”

B. You cannot expect your students to “do as you say, and not as you do.”

10.5 USE OF CHECKLISTS

I. You must use, and you must instruct your students to use, the appropriate checklist for each phase of flight while on the ground or in the air (e.g., before starting engine, climb, before landing, etc.).

II. Explain that a checklist can provide a listing of actions or confirmations. For example, your student either turns on the fuel pump or confirms that the fuel pump is on.

III. Teach your students that all checklists should be read aloud at all times.

A. Explain that calling out each item on the checklist will force them to direct their attention to the item.

B. Emphasize that using a checklist must not be regarded as an objective in and of itself. A checklist is only a tool used to assist the pilot in the safe operation of the airplane—THAT is the objective.

1. Your students must understand that “going through the motions” by simply reading the checklist aloud without actually performing or verifying the items is NOT acceptable.

IV. Impress upon your students that they must remember proper scanning vigilance and division of attention at all times when using a checklist.

10.6 USE OF PERFORMANCE CHARTS AND GRAPHS

I. As a flight instructor, you must display sound judgment when determining whether the required performance is within your airplane's and your own capabilities and operating limitations.

A. Explain to your students that the performance charts, graphs, and/or tables are found in Section 5, Performance, of the *POH*.

1. Emphasize that the performance data do not make any allowance for lack of pilot proficiency or mechanical deterioration of the airplane.
2. Accordingly, pilots must approach performance figures conservatively by adding a suitable buffer to any figures obtained from the *POH*.

B. Explain that performance figures are available in most *POH*s for all critical phases of flight, including takeoff, climb, cruise, descent, and landing.

C. You must instruct your students in the use of performance charts and develop their judgment in determining whether the flight can be safely conducted.

II. **Determinants of Airplane Performance**

A. Explain to your students that **air density** is perhaps the single most important factor affecting airplane performance. The general rule is that, as air density decreases, so does airplane performance.

1. Explain that temperature, altitude, barometric pressure, and humidity all affect air density. The density of the air DECREASES

   a. As air temperature INCREASES
   b. As altitude INCREASES
   c. As barometric pressure DECREASES
   d. As humidity INCREASES

2. Teach your students that the engine produces power in proportion to the density of the air.

   a. Thus, as air density decreases, the power output of the engine also decreases.

      i. This decrease in power is true of all engines not equipped with a supercharger or turbocharger.

3. Additionally, the propeller produces thrust in proportion to the mass of air being accelerated through the rotating blades.

   a. Thus, as air density decreases, propeller efficiency decreases.

4. The wings produce lift as a result of the air passing over and under them.

   a. Thus, as air density decreases, the lift efficiency of the wings decreases.

B. Explain the effect of air density on lift and drag to your students:

1. Lift and drag vary directly with the density of the air.

   a. As air density increases, lift and drag increase.
   b. As air density decreases, lift and drag decrease.

2. Air density is affected by pressure, temperature, humidity, and altitude.
   a. At an altitude of 18,000 ft., the density of the air is one-half the density at sea level (given standard conditions). If an airplane is to maintain the same lift at high altitudes, the amount of air flowing over the wing must be the same as at lower altitudes. Thus, the speed of the air over the wings (true airspeed) must be increased at high altitudes.
      i. Explain that this is why an airplane requires a greater takeoff distance to become airborne at higher altitudes than with similar conditions at lower altitudes.
      ii. Point out, however, that while the airplane requires a higher true airspeed to become airborne at high altitudes, it will become airborne at the same indicated airspeed regardless of altitude.
   b. Because air expands when heated, warm air is less dense than cool air.
      i. When other conditions remain the same, an airplane will require a longer takeoff run on a hot day than on a cool day.
   c. Because water vapor weighs less than an equal amount of dry air, moist air (high relative humidity) is less dense than dry air (low relative humidity).
      i. Therefore, when other conditions remain the same, the airplane will require a longer takeoff run on a humid day than on a dry day.
      ii. Point out that this condition is compounded on a hot, humid day because the expanded air can hold much more water vapor than on a cool day. The more moisture in the air, the less dense the air.
3. Explain that less-dense air causes additional performance losses beyond the loss of lift. Engine horsepower and propeller efficiency decrease because fewer air molecules are available for combustion, resulting in a loss of power, and because the propeller blades (which are airfoils) are less effective when air is less dense.
   a. Because the propeller is not pulling with the same force and efficiency as when the air is dense, it takes longer to obtain the necessary forward speed to produce the lift required for takeoff.
      i. Thus, the airplane requires a longer takeoff run.
      ii. The rate of climb will also be lower for the same reasons.
4. Based on the above discussion, you should emphasize to your students that they should beware of high, hot, and humid conditions, i.e., high altitudes, hot temperatures, and high moisture content (high relative humidity).

10.7 WEIGHT AND BALANCE CONSIDERATIONS

I. Effects of Weight on Flight Performance

A. Impress upon your students that increased weight reduces the performance of their airplane in almost every respect. The most important performance deficiencies of a heavily-loaded or overloaded airplane are

   1. Higher takeoff speed required
   2. Longer takeoff run required
   3. Reduced rate and angle of climb
   4. Shorter range
   5. Reduced cruising speed
   6. Reduced maneuverability
   7. Higher stalling speed
   8. Higher landing speed required
   9. Longer landing roll required

II. Effects of Weight on Airplane Structure

A. Explain that an airplane is certified to be able to withstand certain total loads placed on its structure.

1. Thus, as long as the gross weight and load factor limits are observed, the total load on the airplane will remain within limits.
2. However, if the maximum gross weight is exceeded, load factors well within the load factor limits can cause structural damage.

B. Remind your students that, while structural failures from overloading may be dramatic and catastrophic, they more often affect structural components gradually, in a way that is difficult to detect.

1. The results of habitual overloading tend to be cumulative and may result in structural failure later during completely normal operations.
2. Overloading can also accelerate metal fatigue.

III. Effects of Balance on Flight Performance

A. Explain that the CG location affects the total load placed on the wings in flight.

B. With a forward CG, a greater downward force on the tail is required to counteract the downward-pitching moment of the nose in order to maintain level cruising flight.

1. Thus, the total lift required from the wing is increased.
2. The wing must therefore fly at a higher angle of attack, which results in more drag and a higher indicated stall speed.

C. With an aft CG, less downward force on the tail is required, meaning that less lift is required to be produced by the wing.

1. Thus, the wing flies at a lower angle of attack with less drag and a higher cruise speed.
2. The reduction in wing loading causes a reduction in the stalling speed.

IV. Effects of Balance on Stability

A. Teach your students that, in general, an airplane becomes less stable and less controllable as the CG moves aft.

1. The elevator and rudder have a shorter arm (i.e., distance) from the CG, and therefore require greater deflection to produce the same result.
2. Recovery from a stall is more difficult because the airplane’s tendency to pitch nose-down is reduced.
3. If the CG is moved beyond the aft limit, elevator and rudder authority may be reduced to such an extent that stall and spin recovery can become impossible.

B. As the CG moves forward, the airplane becomes more stable and more controllable, but it also becomes more nose-heavy.

1. If the CG is moved beyond the forward limit, the elevator may not be able to counteract the downward pitching moment of the nose, particularly at low airspeeds, e.g., takeoff, landing, and power-off glides.

V. **Management of Weight and Balance**

A. Teach your students that all aircraft are delivered from the manufacturer with the empty weight, CG data, and the Equipment list.

1. The equipment list is found in Section 6, Weight and Balance/Equipment List, in the *POH*.

a. The equipment list shows not only the equipment that is installed in the airplane but also the weight and arm.

B. Explain that the owner is responsible to ensure that the equipment list and empty weight/CG data are kept up-to-date.

1. Unless this is done, the pilot has no basis for performing loading/CG calculations.

C. Emphasize that there is a significant difference between the basic empty weight (BEW) and the licensed empty weight (LEW).

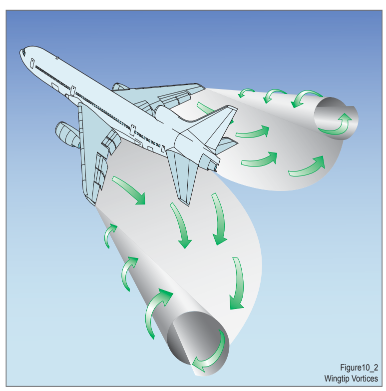
1. The BEW is the weight of the standard aircraft, optional equipment, unusable fuel, and full operating fluids, including full engine oil.

2. The LEW is the weight of the standard aircraft, optional equipment, unusable fuel, and full operating fluids, excluding usable engine oil (older aircraft).

10.8 AVOIDING WAKE TURBULENCE

I. **Wake turbulence**

A. Explain that wake turbulence is a phenomenon resulting from the passage of an aircraft through the atmosphere. Though the term includes thrust stream turbulence, jet blast, jet wash, propeller wash, and rotor wash both on the ground and in the air, it mostly refers to turbulence created by wingtip vortices.



B. **Wingtip Vortices**. Remind your students that lift is generated by the pressure differential between the upper and lower wing surfaces, with the lowest pressure occurring on the upper wing surface and the highest pressure occurring on the underside of the wing.

1. Explain that this pressure differential triggers a roll-up of the airflow behind the wing, originating at the wingtips.

a. It results in swirling air masses trailing downstream of the wingtips.
b. The airflow is outward, upward, and around each wingtip.

2. After the roll-up is completed, the wake consists of two counter rotating cylindrical vortices.

3. Teach your students that most of the energy is within a few feet of the center of each vortex, but pilots should avoid a region within about 100 ft. of the vortex core.

4. Explain that the vortices spread outward and descend at a rate of several hundred feet per minute behind the generating airplane.

C. Explain that the strength of an airplane's wingtip vortices is governed by the weight, speed, and wing shape of the generating aircraft. The angle of attack of a given wing directly affects the strength of its vortex.

1. Point out the following relationships for a given wing in steady-state flight:
    a. For any given airspeed, as weight increases, angle of attack increases.
        i. A wing in the clean configuration (flaps retracted) has a greater angle of attack than when flaps are extended.
    b. As airspeed decreases, angle of attack increases.
2. Emphasize that the greatest vortex strength therefore occurs when the generating aircraft is HEAVY, CLEAN, and SLOW, e.g., especially during takeoff.
    a. Peak vortex tangential speeds exceeding 300 ft. per second have been recorded.
3. Explain that, in rare instances, a wake turbulence encounter could cause in-flight structural damage of catastrophic proportions. However, the usual hazard is associated with induced rolling moments that can exceed the roll-control capability of the encountering aircraft.

D. **Vortex Avoidance Procedures**

1. Inform your students that, under certain conditions, airport traffic controllers employ vortex avoidance procedures for separating IFR aircraft.
    a. Controllers will also provide to VFR aircraft with whom they are in communication and which, in the controller's opinion, may be adversely affected by wake turbulence from a larger aircraft, the position, altitude, and direction of flight of larger aircraft followed by the phrase, "Caution: wake turbulence."
2. Emphasize that, regardless of whether a warning has been given, pilots are expected to adjust their operations and flight path as necessary to preclude serious wake encounters.
3. Explain to your students that the following vortex avoidance procedures are recommended:
    a. **Landing behind a larger aircraft that is landing on the same runway** -- Stay at or above the larger aircraft's final approach flight path. Note the touchdown point and land beyond it.
    b. **Landing behind a larger aircraft that is landing on a parallel runway closer than 2,500 ft. to your runway**-- Consider possible vortex drift to your runway. Stay at or above the larger aircraft's final approach path and note its touchdown point.
    c. **Landing behind a larger aircraft that is landing on a crossing runway** -- Cross above the larger aircraft's flight path.
    d. **Landing behind a larger aircraft departing on the same runway** -- Note the larger aircraft's rotation point. Land well prior to that rotation point.
    e. **Landing behind a larger aircraft departing on a crossing runway** -- Note the larger aircraft's rotation point.
        i. If the larger aircraft rotates past the intersection, continue your approach and land prior to the intersection.
        ii. If the larger aircraft rotates prior to the intersection, avoid flight below its flight path.
            - Abandon the approach unless your landing is assured well before reaching the intersection.

f. **Departing behind a larger aircraft taking off** -- Note the larger aircraft's rotation point and then rotate prior to that rotation point. Continue to climb above and stay upwind of the larger aircraft's climb path until turning clear of its wake.
   i. Avoid subsequent headings that will cross below and behind a larger aircraft.
   ii. Be alert for any critical takeoff situation that could lead to a vortex encounter.

g. **Intersection takeoffs on the same runway**-- Be alert to adjacent larger aircraft operations, particularly upwind of your runway. If an intersection takeoff clearance is received, avoid a subsequent heading that will cross below a larger aircraft's path.

h. **Departing or landing after a larger aircraft has executed a low approach, missed approach, or touch-and-go landing**-- Because vortices settle and move laterally near the ground, the vortex hazard may exist along the runway and in your flight path.
   i. You should ensure that an interval of at least 2 min. has elapsed before your takeoff or landing.

i. **En route VFR**-- Avoid flight below and behind a larger aircraft's path. If you observe a larger aircraft above and on the same track as your airplane (meeting or overtaking), adjust your position laterally, preferably upwind.

4. Emphasize to your students that the bottom line for avoiding a wake turbulence encounter is to stay at or above the flight path of the generating aircraft.
   a. If this is not possible due to performance limitations or other restrictions, it is necessary to pass well clear to either side of the generating aircraft's flight path.

E. Helicopters

1. Inform your students that, in a slow hover taxi or a stationary hover near the surface, the main helicopter rotor or rotors generate downwash which produces high-velocity outwash vortices that extend outward to a distance approximately three times the diameter of the rotor.
   a. When this rotor downwash hits the surface, the resulting outwash vortices have behavioral characteristics similar to wingtip vortices produced by fixed-wing aircraft.
      i. However, the vortex circulation is outward, upward, around, and away from the main rotor(s) in all directions.
      ii. Emphasize that pilots of small aircraft should avoid operating within three rotor diameters of any helicopter in a slow hover taxi or stationary hover.

2. Teach your students that, in forward flight, departing or landing helicopters produce a pair of strong, high-speed trailing vortices similar to wingtip vortices of larger fixed-wing aircraft.
   a. Emphasize to your students that they should use caution when operating behind or crossing behind landing and departing helicopters.

F. **Jet Engine Exhaust**

1. Explain that, during ground operations, jet engine blast (i.e., thrust stream turbulence) can cause damage and upsets if encountered at close range.
   a. Thus, pilots must maintain adequate separation during ground operations.
   b. An illustration of exhaust velocities behind a wide-body jet at takeoff power is shown below.

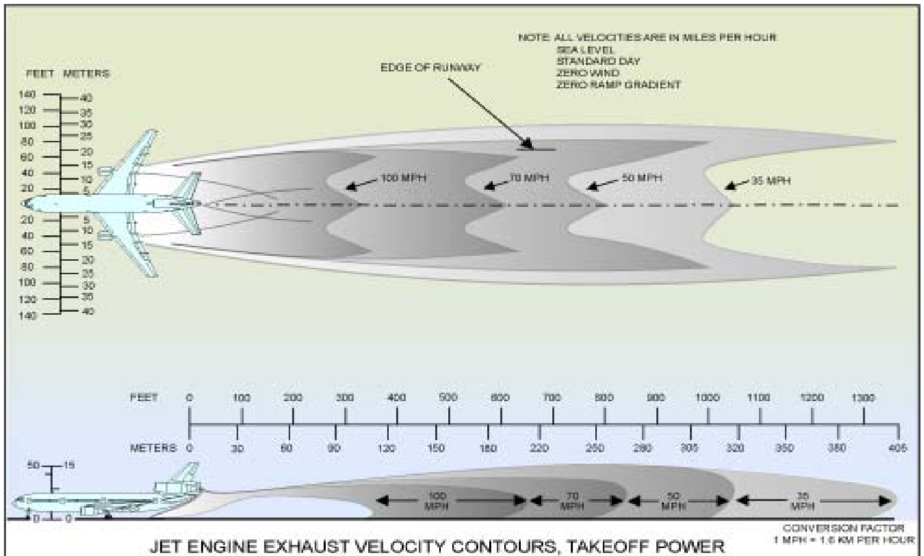


Figure10_3 - Jet Blast

G. **Pilot Responsibility**

1. Teach your students to use the same degree of concern in vortex visualization and avoidance procedures as they do in collision avoidance.
   a. Remind your students that wake turbulence may be encountered in flight as well as during operation on the airport surface.
2. Emphasize to your students that, in operations conducted behind all aircraft, their acceptance of the following instructions from ATC will be considered an acknowledgment that they will ensure a safe takeoff and landing interval and that they also accept the responsibility of providing their own wake turbulence separation:
   a. Traffic information
   b. Instructions to follow another aircraft
   c. A visual approach clearance

10.9 POST-SEPTEMBER 11, 2001 CONSIDERATIONS

I. In the wake of the terrorist attacks that took place on September 11, 2001, U.S. pilots have found themselves in an unusually volatile regulatory environment.

A. Since general aviation operations were allowed to resume following a total shut-down of all civil flight operations on September 11, pilots have seen many changes in their operating environment.

1. These changes include new and expanded Special Use Airspace areas (i.e., Restricted and Prohibited Areas), numerous Temporary Flight Restrictions (TFRs) and other operational limitations or requirements, which may only be in effect part- time and vaguely defined.

B. Some changes have been made with little or no advance notice as government agencies respond to perceived security threats.

1. As a result, information regarding these changes is sometimes inaccurate or incomplete, and pilots may receive varying interpretations of the information from different official and non-official sources.

a. Additionally, recent modifications to airspace dimensions and classifications do not yet appear on most aeronautical charts.

2. It is imperative that pilots speak to a preflight briefer prior to each flight and specifically request all NOTAMs which could affect the proposed flight. Call 1-800-992-7433 (1-800-WX-BRIEF).

a. AOPA also has constant updates about regulatory changes at www.aopa.org. B. Interception by Military or Law-Enforcement Aircraft

II. **Interception by Military or Law-Enforcement Aircraft**

A. Because of the rapidly-changing regulatory situation, pilots must be aware that interception by military or law-enforcement aircraft is a possibility should they unknowingly violate restricted airspace.

B. Accordingly, it is imperative that all pilots be familiar with the procedures to follow if they are intercepted (see Paragraphs 5-6-2 and 5-6-4 of the Aeronautical Information Manual for more information):

1. If you are intercepted, the intercepting aircraft will appear alongside your aircraft (usually slightly above and to the left) and rock its wings up and down.

a. You are expected to rock your wings in response.

2. If the intercepting aircraft wants you to follow it, it will begin a slow, level turn, typically to the left.

a. You are expected to follow the aircraft around to the desired heading.

3. If the intercepting aircraft wants you to land at an airport, it will circle the airport, lower the landing gear, and overfly the runway in the intended direction of landing.

a. You are expected to land at the airport if you determine that it is safe to do so.

4. If the intercepting aircraft has determined that you should be allowed to continue your flight, it will perform an abrupt break-away maneuver consisting of a climbing turn of 90 degrees or more that does not cross your flight path.

a. You are expected to rock your wings in response.

5. If you have been intercepted while in distress, you are expected to flash all of your aircraft's lights at irregular intervals (day or night); this signals to the intercepting aircraft that you are in distress.

C. In addition to using the signals described above, you should squawk 7700 and attempt to establish contact with the intercepting aircraft or with an air traffic control facility on 121.5 MHZ.

D. Finally, it is now more than ever imperative that you monitor the ATC facility in control of your airspace in order to remain aware of any unusual developments. Establish contact with the facility and request VFR flight following.

10.10 FAA 14 CFR PARTS 61, 63, AND 65 REGARDING AIRMAN CERTIFICATES

I. The FAA is adding a section to 14 CFR parts 61, 63, and 65 to expressly make individuals who pose a security threat as determined by the Transportion Security Act (TSA) ineligible to hold certificates, ratings, and authorizations issued under those parts.

A. This ineligibility means that the FAA will not issue a certificate, rating, or authorization to any applicant who the TSA advises the FAA poses a security threat.

B. If the TSA issues an Initial Notification of Threat Assessment to an applicant, the FAA will hold the application pending the outcome of the TSA's final threat assessment review.

C. If the individual is issued a Final Notification of Threat Assessment, the FAA will deny an application for any airman certificate, rating, or authorization.

II. With regard to certificates already issued, the FAA will suspend an individual's airman certificates after receiving the Initial Notification of Threat Assessment from the TSA.

A. Suspension is appropriate in the circumstance, because the TSA's initial assessment that an individual poses a security threat is still subject to review by the TSA's Deputy Administrator.

B. If a Final Notification of Threat Assessment is issued, the FAA will revoke the certificates.

C. If an Initial Notification is withdrawn, the FAA will withdraw its certificate suspension.

GLEIM FLIGHT INSTRUCTOR REFRESHER COURSE
LESSON 11
RECURRENCY AND TRANSITION TRAINING

11.1 RECURRENCY TRAINING – REGULATORY REQUIREMENTS

I. **Sec. 61.56 -- Flight Review**

A. As a flight instructor, you have the responsibility of conducting flight reviews for certificated pilots. You should be aware that a flight review consists of a minimum of 1 hr. of flight training and 1 hr. of ground training. The review must include

1. A review of the current general operating and flight rules of 14 CFR Part 91, and
2. A review of those maneuvers and procedures that, in your judgment, are necessary for the pilot to demonstrate that (s)he is capable of safely exercising the privileges of his/her pilot certificate.

B. Explain to your students that no pilot (other than a student pilot) may act as pilot in command of an aircraft unless, within the preceding 24 calendar months, that pilot has

1. Accomplished a flight review given by a CFI or other person designated by the FAA in an aircraft for which that pilot is rated, and
2. Received a logbook endorsement from the person who gave the review certifying that the review has been completed satisfactorily.

C. However, remind your students that a flight review is not required if, within the preceding 24 calendar months, a pilot has

1. Completed a pilot proficiency check conducted by the FAA, an approved check airman, or one of the U.S. armed forces for a pilot certificate, a rating, or an operating privilege, or
2. Satisfactorily completed one or more phases of the FAA-sponsored Pilot Proficiency Award Program.
   a. This program is commonly known as the Wings Program.

D. A student pilot is also not required to complete a flight review, provided (s)he is undergoing training for a certificate and has a current solo flight endorsement.

E. Flight instructors who hold a current flight instructor certificate and have satisfactorily completed an approved flight instructor refresher course within the preceding 24 calendar months (including the course you are taking now) are not required to accomplish the 1 hr. of ground training normally required for a flight review.

II. **Sec. 61.57 -- Recent Flight Experience: Pilot in Command**

A. Inform your students that they may not act as pilot in command of an airplane carrying passengers or an airplane certificated for more than one required pilot flight crewmember, unless

1. They have made three takeoffs and landings within the preceding 90 days in an aircraft of the same category and class as the aircraft to be flown (e.g., airplane single-engine land), and if a type rating is required, in the same type.
   a. Point out that, in a tailwheel airplane, the landings must also have been made to a full stop.

B. Explain to your students that, to carry passengers at night, they must have made three takeoffs and landings to a full stop at night within the preceding 90 days in the category, class, and type (if a type rating is required) of aircraft to be used.

   1. In this case, night refers to the period beginning 1 hr. after sunset and extending to 1 hr. before sunrise.

C. Instrument experience

   1. Inform your instrument students that, to act as PIC under IFR or in weather conditions less than the minimums prescribed for VFR, they must have logged the following flight experience in actual or simulated instrument flight within the preceding 6 calendar months; this experience must have been obtained in the appropriate category of aircraft to be flown, in an approved flight simulator or flight training device that is representative of the aircraft category to be flown, or in any combination thereof:

      a. At least six instrument approaches
      b. Holding procedures
      c. Intercepting and tracking courses through the use of navigation systems

         i. You may wish to point out that intercepting and tracking courses through the use of navigation systems will occur as a result of performing instrument approaches and holding procedures; accordingly, no special effort is required to specifically obtain this experience.

   2. Explain to your students that, if they do not meet the experience requirements during the prescribed time or within 6 months thereafter, they must pass an instrument proficiency check consisting of the tasks indicated in the FAA's Instrument Rating Practical Test Standards.

      a. The instrument proficiency check may be given by an FAA inspector, a designated examiner, a company check airman, a representative of an armed force, or an appropriately-rated flight instructor.

11.2 RECURRENCY TRAINING – GOALS AND OBJECTIVES

I. Encourage your students to design a currency program that is tailored to their particular operating environments and needs.

A. Point out that, in many cases, currency activities can be incorporated into normal operations in order to reduce the need for separate flights.

   1. EXAMPLE: An instrument-rated pilot can, at the expense of only a few extra minutes at the end of a business or personal flight, take steps to maintain currency by requesting an instrument approach from ATC instead of performing a faster visual approach.

      a. Note that the approach must be performed under simulated instrument conditions with an appropriately rated safety pilot to meet currency requirements.

B. Emphasize to your instrument students that instrument-rated pilots should regard the minimum regulatory currency requirements to act as PIC under IFR as only the foundation for a comprehensive currency program that will enable them to operate safely under IFR in the National Airspace System, taking into account weather conditions and air traffic activity appropriate to their experience levels and operating environments.

C. Stress that, in most cases, pilots should acknowledge the need to adopt a currency program that goes beyond the minimums specified in 14 CFR.

II. Teach your students that they must set specific goals to attain with their personal currency program.

A. These goals may include items such as

1. Minimum flight time per month
2. Regular night operations (flight time, takeoffs, landings)
3. Practicing maneuvers appropriate for the certificate and ratings held
4. Regular flights with a CFI

III. As a CFI, you can assist your students (other than student pilots) in developing a personal currency program.

A. Point out to your students that having a personal currency program will not only help them to maintain adequate currency levels, but will also keep them interested in flying.

1. Additionally, remind your students that the training process for an advanced certificate or rating, should they decide to pursue one, will be significantly less costly and time-consuming if they have maintained their proficiency through a personal currency program.

B. Consider establishing a personal currency program for your former students by contacting them at regular intervals (e.g., every 6 months) to invite them to the airport for a "workout" in the airplane of their choice, during which bad habits can be corrected and areas for improvement can be identified.

11.3 FLIGHT REVIEW

I. Structure and Intent of the Flight Review

A. The objective of the flight review is to ensure that pilots who intend to act as pilot in command have the opportunity to ride with a flight instructor of their choice within a specified period of time, in order to obtain an appraisal of their proficiency level and to have an opportunity to seek assistance or guidance if any deficiency is identified.

1. As an instructor conducting a flight review, you should not treat the review as a test or a check ride, but rather as an instructional service designed to assess a pilot's knowledge and skills.

B. Due to the complexity of the aviation operating environment and the variety of operations conducted within the National Airspace System, you may want specific guidance on how to structure and plan a flight review for which the contents are tailored to the needs of the pilot being reviewed.

1. AC 61-98A, *Currency and Additional Qualification Requirements for Certificated Pilots*, provides information for certificated pilots and flight instructors to use in completing the flight review required by FAR 61.56.

   a. This AC is a useful reference when putting together a flight review.

2. The Practical Test Standards (PTS) appropriate to the pilot's grade of certificate may also assist you in selecting appropriate maneuvers.

II. Pre-review Considerations

A. Before accepting responsibility for conducting the review, you should interview the pilot to determine the nature of his/her flying and operating requirements.

1. You must be willing to refer the pilot to another instructor if, in your judgment, you will not be able to satisfactorily conduct the review.

   a. EXAMPLE: If a pilot asked you to conduct a flight review in his/her pressurized single-engine turboprop when you have no experience with turbine engines or pressurized airplanes, you would not be able to conduct an effective review of the essential procedures required to safely operate the airplane.

B. The following are some, but not all, of the elements to consider:

1. **The type of equipment flown**

   a. The maneuvers and procedures reviewed will vary depending on the category, class, and make and model of aircraft used.

      i. EXAMPLE: A review in a light twin-engine aircraft should be different from one conducted in a small, two-seat tailwheel aircraft without a radioor extra instrumentation.

   b. You may recommend that the pilot take the review in the aircraft usually flown or in the most complex or challenging make and model used if several aircraft are flown regularly.

   c. You may also want to recommend that the pilot take a review in more than one category/class of aircraft under certain circumstances.

      i. EXAMPLE: A pilot with airplane single-engine land and glider ratings may have flown only single-engine airplanes in the last 2 yr. but is also considering flying gliders in the near future.

         o You should recommend that the pilot complete an additional review in a glider given by a qualified flight instructor before he/she acts as pilot in command of a glider.

2. **The nature of the pilot's flight operations**

   a. You should consider the type of flying usually done by the pilot before establishing the plan for conducting the review.

      i. EXAMPLE: A pilot who typically conducts long-distance flights between busy terminal areas may need a review that is different from the review required by a pilot who usually makes local flights into and out of the same airport.

   b. Consider the need for an in-depth review of certain subjects or procedures if the type of flight operations is likely to change or if other extenuating circumstances exist.

      i. EXAMPLE: A pilot who normally conducts only local flight operations at an airport outside of Class B airspace may have plans to begin flying to a location within a Class B airspace area.

         o In this situation, you should emphasize Class B airspace equipment requirements and operating procedures in the flight review.

         o You may even want to perform part of the flight portion of the review inside a Class B airspace area.

3. **The pilot’s total amount and recency of flight experience**
   a. Before beginning the flight review, you should look over the pilot’s logbook to determine his/her total flight time, types of experience, and recency of experience in order to evaluate the need for particular maneuvers and procedures in the review.
      i. EXAMPLES:
         - A pilot who has not flown in several years may require an extensive review of basic maneuvers from the PTS appropriate to that pilot’s grade of certificate.
            - This same pilot may also require a rather extensive review of 14 CFR Part 91.
         - A pilot who is upgrading to a faster airplane should receive more emphasis on aircraft systems, aircraft performance information, and cross-country procedures appropriate to a faster airplane.
   b. Regardless of the pilot’s flight experience, you should ensure that the flight review plan will include all areas in which you determine that the pilot should receive training in order to operate safely.
4. **Your instructor qualifications**
   a. In addition to considering factors related to the pilot who is the subject of the review, you must also consider whether your own experience and qualifications are appropriate to the review.
      i. EXAMPLE: If a pilot wants his/her flight review to concentrate on instrument procedures, but you have little or no experience providing instrument instruction, you may wish to refer the pilot to another instructor.
   b. In order to conduct an effective flight review, you must ensure that you have appropriate experience in the make and model of aircraft in which the review will take place.
      i. You should obtain recent flight experience in any aircraft in which you are not current, or with which you are not familiar, before attempting to conduct a flight review in that aircraft.
         - This experience should include obtaining instructional knowledge of the aircraft’s limitations, characteristics, and performance.
   c. You must hold an appropriate category and class rating on your pilot certificate (and a type rating, if required) for the aircraft in which the review is to be conducted.
      i. You must also have the appropriate category and class rating on your flight instructor certificate for the aircraft in which the review is to be conducted.

C. You may then agree to conduct the review.
1. After analyzing the elements described above, you should review each consideration with the pilot and reach a mutual understanding regarding how the review will be conducted.
2. You may want to provide the pilot with reading materials or some recommended publications for him/her to study before actually beginning the flight review.
3. You should also review the criteria for the pilot's satisfactory completion of the review.

III. Planning and Recording the Review

A. After reaching an agreement with the pilot regarding how the flight review will be conducted, you should prepare a plan for carrying out the review.

1. The plan should include
   a. A list of regulatory subjects to be covered
   b. The maneuvers and procedures to be accomplished
   c. The anticipated sequence in which the segments will occur
   d. The location where the review will be performed
2. A sample Flight Review Plan and Checklist is shown on the following page.
   a. Although not required by 14 CFR 61.189, Flight Instructor Records, you may wish to retain this form as your record of the scope and content of the review.

FLIGHT REVIEW PLAN AND CHECKLIST

Name ______________________ Date ______________________

Grade of Certificates ______________________ Certificate No. ______________________

Ratings and Limitations ______________________

Class of Medical ______________________ Date of Medical ______________________

Total Time Flight ______________________ Time in Type ______________________

Aircraft to Be Used: Make and Model ______________________ N# ______________________

Location of Review ______________________

I. REVIEW OF 14 CFR PART 91

Ground Instruction Hours: ______________________ (minimum 1 hr.)

Remarks: ______________________

II. REVIEW OF MANEUVERS AND PROCEDURES (List in order of anticipated performance.)

A. ______________________

B. ______________________

C. ______________________

D. ______________________

E. ______________________

F. ______________________

G. ______________________

H. ______________________

I. ______________________

J. ______________________

Flight Instruction Hours: ______________________ (minimum 1 hr.)

Remarks: ______________________

III. OVERALL COMPLETION OF REVIEW

Remarks: ______________________

Signature of CFI ______________________ Date ______________________

Certificate No. ______________________ Expiration Date ______________________

I have received a flight review which consisted of the ground instruction and flight maneuvers and procedures noted above.

Signature of the Pilot ______________________ Date ______________________

B. **Review of 14 CFR Part 91 operating and flight rules**

1. You should tailor the review of general operating and flight rules to the needs of the pilot being reviewed.
2. The objective of the review is to ensure that the pilot can comply with all regulatory requirements and operate safely in various types of airspace under an appropriate range of weather conditions.
   a. Thus, you should plan to conduct a review that is broad enough to meet this objective, yet flexible enough to provide a more comprehensive review of any areas in which the pilot's knowledge is weaker.
      i. Because aeronautical information is constantly changing, you may want to use other reference sources in addition to 14 CFR Part 91 (e.g., the *AIM*) to ensure that the pilot's knowledge is up-to-date.
3. The regular occurrence of pilot deviations by certificated pilots in controlled airspace has emphasized the need to ensure that all pilots are familiar with the operating requirements of Class B, Class C, Class D, and other airspace areas.
   a. Remember that the flight review may be the only regular proficiency and recurrency training experienced by some pilots.
   b. You should therefore place appropriate emphasis on this part of the review.
4. A sample format for organizing the 14 CFR Part 91 review is shown on the following page.

Sample Format for Organizing the 14 CFR Part 91 Review

Subpart	Description	Remarks
A	General	All pilots
B	Flight Rules (General) Visual Flight Rules Instrument Flight Rules	All pilots All pilots If applicable (EXAMPLE: Instrument-rated pilot)
C	Equipment, Instrument, and Certificate Requirements	All pilots
D	Special Flight Operations	If applicable (EXAMPLE: Pilot involved in glider towing operations)
E	Maintenance, Preventive Maintenance, and Alterations	All pilots
F	Large and Turbine-Powered Multiengine Airplanes	If applicable (NOTE: Pilot may be subject to requirements of 14 CFR 61.58)
G	Additional Equipment and Operating Requirements for Large and Transport Category Aircraft	If applicable (See Subpart F note.)
H	Foreign Aircraft Operations and Operations of U.S.-Registered Civil Aircraft Outside of the United States	If applicable (EXAMPLE: Flights to Canada or Mexico)
I	Operating Noise Limits	If applicable (EXAMPLE: Agricultural aircraft pilot)
J	Waivers	If applicable (EXAMPLE: Pilot involved in airshows)

C. **Review of maneuvers and procedures**

1. The maneuvers and procedures covered during the review are those that you determine the pilot should perform in order to demonstrate that (s)he can safely exercise the privileges of his/her pilot certificate.
   a. Accordingly, your evaluation of the pilot's skills and knowledge should ensure that (s)he can safely operate at his/her level of certification, within regulatory requirements and throughout a wide range of conditions.
   b. Consistent with the need to include these critical subjects and maneuvers, you should construct a review sequence that closely duplicates a typical flight profile for the pilot who will receive the review.
2. You should prepare a preliminary plan for the flight review based on an interview or another assessment of the pilot's qualifications and skills, as described in item B. above. The proposed sequence of maneuvers should be outlined to the pilot who is taking the review.
   a. The flight portion of the review may consist of a flight to the practice area in order to review maneuvers (with a later return to the departure airport for takeoff and landing practice), or it may be composed of a flight to another airport for takeoff and landing practice, with the maneuvers accomplished en route (e.g., slow flight, stalls, etc.).
   b. You should request that the pilot complete whatever preflight preparation is necessary to conduct the planned review prior to arriving for his/her appointment.
      i. Preparation items may include checking weather, calculating required runway lengths, calculating weight and balance data, completing a flight log, filing a flight plan, and conducting the preflight inspection.
      ii. As the instructor, you should inspect these items for accuracy and discuss them with the pilot as a part of the review.
3. Before beginning the flight portion of the review, you should discuss various operational areas with the pilot.
   a. This oral review should include, but not be limited to, areas such as
      i. Aircraft systems, speeds, and performance
      ii. Meteorological and other hazards (e.g., wind shear and wake turbulence)
      iii. Operations in controlled airspace (e.g., Class B airspace areas)
   b. The emphasis during the discussion should be on having practical knowledge of recommended procedures and regulatory requirements.
4. Regardless of the pilot's experience level, you should review at least those maneuvers that are considered critical to safe flight, such as stalls, slow flight, and takeoffs and landings.
   a. Based on your in-flight assessment of the pilot's skills, you may wish to add other maneuvers from the PTS appropriate to his/her grade of certificate.
5. Remember that the in-flight review does NOT need to be limited to evaluation purposes. You may provide instruction in weak areas or, based on mutual agreement with the pilot, defer this instruction to a followup flight.
6. To assist you in selecting maneuvers and procedures critical to safe flight, a list of maneuvers for various categories and classes of aircraft is shown on the following page.
   a. This list is NOT all-inclusive. It is provided in order to assist you in your selection of appropriate maneuvers and procedures.

SAMPLE LIST OF FLIGHT REVIEW KNOWLEDGE, MANEUVERS, AND PROCEDURES

All Categories and Classes of Aircraft

- Pilot certificates and other 14 CFR Part 61 requirements
- Aircraft performance and limitations
- Aircraft loading, weight and balance
- Aircraft systems and operating procedures
- Abnormal and emergency procedures
- Flight planning and obtaining weather information
- Aircraft documents and records
- Avoidance of hazardous weather
- Air traffic control and airspace
- Preflight inspection
- Use of checklist
- Radio communication and navigation (if aircraft equipped)
- Collision avoidance, traffic pattern operations, ground operations
- Navigation by pilotage

Airplane, Single-Engine Land (ASEL)

- Takeoffs and landings (normal, crosswind, short, and soft-field
- Go-arounds
- Maneuvering during slow flight
- Stalls
- Constant altitude turns
- Simulated forced landings and other emergency operations
- Flight by reference to instruments (except recreational pilots)

Airplane, Multiengine Land (AMEL)

- Same as ASEL, plus:
- Simulated engine-out procedures and performance

Airplane, Single-Engine Sea (ASES)

- Same as ASEL (except soft-field takeoffs and landings), plus:
- Glassy and rough water landings

Airplane, Multiengine Sea (AMES)

- Same as ASEL, AMEL, and ASES, as applicable

Glider

- Takeoff and tow procedures (appropriate to type of tow used)
- Simulated rope break procedures
- Stall recognition and recovery
- Flight at minimum controllable airspeed
- Gliding spirals
- Accuracy landings

IV. **Postreview Considerations**

A. Upon completion of the review, you should complete the Flight Review Plan and Checklist and debrief the pilot.

1. Regardless of whether the review was satisfactory, you should always provide the pilot with a comprehensive analysis of his/her performance (i.e., a critique), including suggestions for improving any weak areas.

B. Unsatisfactory completion of the review

1. You should not endorse the pilot’s logbook to note an unsatisfactory review, but you should sign the logbook to record the instruction given.

a. Then recommend additional training in the areas of the review that were unsatisfactory.

2. A pilot who is denied an endorsement for a flight review may continue to exercise the privileges of his/her pilot certificate, provided a period of 24 calendar months has not elapsed since the pilot's last successful flight review or pilot proficiency check.

3. If a pilot has performed a flight review and believes that you have unfairly judged his/her ability to complete the review successfully, the pilot may request a flight review from another CFI.

C. Satisfactory completion of the review

1. When the pilot has successfully completed the review, you must endorse the pilot’s logbook, certifying that (s)he has satisfactorily accomplished the flight review.

2. Endorsement for completion of flight review:

I certify that (First name, MI, Last name), (pilot certificate) (certificate number) has satisfactorily completed a flight review required by Sec. 61.56(a) on (date).

____________	____________	____________	____________	____________
Signature	*Date*	*Name*	*CFI No.*	*Expiration Date*

11.4 THE FAA’S PILOT PROFICIENCY AWARD (WINGS) PROGRAM

I. The objective of the Pilot Proficiency Award Program (commonly known as the Wings Program) is to provide pilots with an incentive to establish and participate in a personal recurrent training program.

A. Inform your students that all pilots holding at least a recreational pilot certificate and a current medical certificate (when required) may participate in the Wings Program.

B. The following discussion is paraphrased from AC 61-91H, *Pilot Proficiency Award Program*.

II. Explain that the Wings Program is a 20-phase program.

A. Upon the completion of each of the first 10 phases, the pilot is presented with a set of wings (about the size of a lapel pin or tie tack) and a completion certificate.

B. Only a completion certificate is awarded for completion of each of the remaining phases, Phases XI through XX.

III. Training Requirements for Phases I through XX

A. Explain to your students that each phase of the Wings Program can be completed by following the required training profiles that have been established for the various categories and classes of aircraft, including ultralights.

1. These training profiles represent those phases of operation that have been identified by accident reports as the phases that are most likely to produce accidents.

B. Emphasize that all training requirements for a single phase of the program must be completed within 12 months.

1. Tell your students that, after completing each phase of the program, they may begin working on the requirements for the next phase at any time.
   a. However, 12 months must pass between the date of completion of one phase of the program and submission of the application for completion of the next phase.
   b. Thus, the Wings Program is a 20-yr. proficiency program.

C. Explain that the following flight training is required for airplanes:

1. One hr. of flight training to include basic airplane control, stalls, turns, and other maneuvers directed toward mastery of the airplane
2. One hr. of flight training to include approaches, takeoffs, and landings, including crosswind, soft-field, and short-field techniques
3. One hr. of instrument training in an airplane or in an FAA-approved aircraft simulator or training device

D. Safety meetings

1. Explain that all applicants must attend at least one FAA-sponsored or FAA-sanctioned aviation safety seminar, or an industry-conducted recurrent training program.
   a. Attendance at an aviation safety seminar must be verified by a notation in the pilot's logbook or on another proficiency record.
      i. This verification must be signed by an FAA safety program manager, another FAA inspector, or an appointed aviation safety counselor involved in conducting the seminar.
2. Attending a physiological training course that is conducted under the FAA-U.S. Air Force or FAA-U.S. Navy training agreements at various military installations in the U.S. is also acceptable for meeting the "safety meeting" requirement.
   a. Pilots who complete a physiological training course will receive FAA Form 3150-1, Physiological Training.
      i. A completed FAA Form 3150-1 must be submitted to the local FAA safety program manager as verification of the course's completion.

E. Mountain flying course

1. Explain that successful completion of an FAA-sponsored or FAA-sanctioned mountain flying course, including all required ground and flight training, may be substituted for the safety meeting requirement described in item III.D. above.

F. Training substitution

1. Inform your students that completion of a training program or a flight instructor refresher clinic that is conducted by an organization such as a flight school, an air carrier, or another training facility, may be substituted for the requirements to complete a phase of the Wings Program, provided that the minimums outlined in item III. on the previous page are met.

G. Emphasize to your students that involvement in an aircraft or ultralight vehicle accident does NOT preclude participation in the Wings Program.

IV. **Pilot Proficiency Awards Earned by Flight Instructors**

A. In addition to completing phases of the Wings Program in the standard fashion as described in item III. on the previous page, flight instructors can also qualify to complete phases of the program based ontheir instructional activities.

B. Completion requirements for Phases I through III

1. As a CFI, you may earn the wings for Phases I through III by providing the required instruction for completion of a phase of the Wings Program to three pilots (i.e., a minimum of 9 hr. of instruction given).
2. To qualify for a Phase I wings award, you must document the completion of the training you gave to at least three pilots and attend, or participate in, an aviation safety seminar or clinic.
    a. You may repeat these requirements for the Phase II and III awards.
    b. Note that there is no requirement for 12 months to pass between the applications for completion of Phases I, II, and III.

C. Completion requirements for Phases IV through XX

1. You may apply for a Phase IV award 12 months after the date of meeting the requirements for the Phase III award.
    a. After the completion of Phase III, twelve months must pass between the date of completion of each additional phase and application for the award for the next phase.
2. You may earn the appropriate award for each of Phases IV through XX by
    a. Successfully completing an evaluation or a proficiency flight with a designated flight instructor examiner or an FAA operations inspector.
    b. Attending or participating in at least one FAA-sponsored or FAA-sanctioned aviation safety seminar; completing an FAA-approved flight instructor refresher clinic; or completing a physiological training course.
        i. Attendance must be verified in your logbook or other proficiency record as described in item III.D.1.a.

V. **Awarding of the Pilot Proficiency Wings and Certificate**

A. Endorsement verification

1. Explain to your students that, as they complete each step of the training (including attending a safety meeting), their logbooks or other proficiency records must be endorsed by the person(s) who gave the instruction.
2. The endorsement for completion of a phase of the Wings Program should read substantively as follows:

Mr./Ms. ______________________________, holder of pilot certificate # ____________, has satisfactorily completed the training requirements outlined in AC 61-91H, paragraph (state which).

________________	________________	________________	________________	________________
Signature	*Date*	*Printed Name*	*CFI No.*	*Exp. Date*

B. The Pilot Proficiency Award certificate and the appropriate wings will be awarded after the pilot's logbook or other proficiency record is presented to the FAA safety program manager.

11.5 TRANSITION TRAINING

I. The General Aviation Manufacturers Association (GAMA) has developed a Transition Training Master Syllabus, which is an outline of the general items that GAMA suggests be included, as appropriate, in a ground and flight training syllabus that is being developed for the purpose of familiarizing an appropriately-rated pilot with a new airplane.

A. This lesson is based on the GAMA master syllabus.

1. We would like to thank GAMA for granting us permission to use our edited version of their Transition Training Master Syllabus, GAMA Specification No. 5 (including Change 1).
2. The Transition Training Master Syllabus costs $12 (including tax, shipping, and handling). To order your copy, contact

General Aviation Manufacturers Association
1400 K Street, NW
Suite 801
Washington, DC 20005
(202) 393-1500
www.generalaviation.org

II. The goal of transition training is to prevent accidents by ensuring that pilots have proper training in the specific systems and operating characteristics of every airplane model they fly.

A. While it is not legally required for appropriately qualified pilots (i.e., those with proper endorsements/ratings to fly complex/high-performance or multi-engine airplanes), it is strongly recommended that transition training be conducted for each new aircraft that a pilot intends to fly.

B. Transition training is intended to concentrate on those areas in which the pilot might encounter something unique to the airplane, whether in a normal situation or during an emergency procedure or event.

C. Reviewing general aeronautical knowledge or skills that are the same for any airplane is NOT the objective of a transition training program.

1. Of course, instruction in these areas is also highly beneficial.
2. It should therefore be accomplished through other, more-regular means, such as participation in the Wings Program.

III. Applicability

A. Analysis of general aviation airplane accidents combined with the experience of airlines and the military indicate that, whenever a pilot's total "time-in-type" is low, transition training is very beneficial.

B. The transition training described in GAMA's master syllabus is applicable to pilots intending to transition into the following general airplane types:

1. High-performance or complex single-piston-engine small airplanes (12,500 lb. or less)
2. Multi piston-engine small airplanes (12,500 lb. or less)
3. Single- and multi-engine turboprop-powered small airplanes (12,500 lb. or less)

C. The GAMA master syllabus is not intended for use in developing training programs or guides for pilots intending to transition into airplanes for which 14 CFR requires type ratings; for non-complex airplanes with engines of 200 hp or less; or for amateur-built experimental aircraft.

IV. The GAMA master syllabus is intended to be used as the basis for creation of a transition training syllabus for a specific airplane.

A. As a flight instructor, you should be able to use the master syllabus as a guide for developing a transition training syllabus for each of your flight school's aircraft, if you are unable to locate a commercially-developed version.

1. Your syllabus can be very specific or may be a brief outline that refers to the *Pilot's Operating Handbook* or approved *Airplane Flight Manual*.
   a. For older or modified airplanes, when information from the manufacturer or modifier may be limited, you should use judgment in preparing a guide that meets the requirements of the master syllabus.
2. Because the sequence of training may need to be altered to accommodate individual progress or special circumstances, your transition training syllabus should be flexible.
   a. If the prescribed sequence of training is changed, it is your responsibility to make sure that all necessary training is accomplished.
3. Also, because complexity varies greatly from airplane to airplane, you may find it necessary to expand your syllabus beyond the subject areas contained in the master syllabus.

B. You should realize that the master syllabus is a general document that is applicable to many specific airplanes.

1. Accordingly, training items that do not apply to all specific airplanes are marked as such and should be omitted from your airplane's transition training syllabus as appropriate.

C. Module 11.7, Transition Training -- Ground Training Syllabus, details each subject or maneuver that should be accomplished (as applicable) in a transition training course.

1. Note that, while all of the flight portion of the training may be accomplished in an airplane, experience has shown that the use of simulators and flight training devices often increases the margin of safety for some maneuvers and may provide more productive training than could be obtained in an airplane.

a. It is therefore recommended that maximum use be made of simulators and flight training devices for maneuvers that are considered abnormal or emergency in nature.

V. Certain maneuvers in the flight section are designated “IFR only.”

A. These maneuvers are intended to be performed only by pilots with an instrument rating.

1. They are included so that instrument-rated pilots may practice key IFR maneuvers in an unfamiliar airplane under the supervision of an instructor.

VI. It is strongly recommended that you have a minimum of 5 hr. of flight time as pilot in command of the specific airplane before attempting to conduct transition training in that airplane.

A. Flight instructors are also encouraged to complete a transition training program for each aircraft model before giving training in that aircraft, if such a course is available.

B. Transition training applicable to instrument procedures should only be given by a CFII.

C. Multi-engine instruction may only be given by a instructor who holds a multi-engine rating on his/her pilot and flight instructor certificates (i.e., an MEI).

VII. Upon the pilot’s successful completion of transition training, you should endorse the pilot’s logbook with the following statement: “Transition Training for (aircraft model) IAW (in accordance with) cite (author or publisher of the Transition Training guide) satisfactorily completed on (Date) in (aircraft, simulator, or training device name and manufacturer).”

A. EXAMPLE: Transition training for Cessna T210, IAW Jones Transition Course satisfactorily completed on March 23, 1998 using the Smith Hotstick training device.

B. If this is the airman's initial transition to a complex or high-performance airplane, the logbook must also reflect the endorsement required by 14 CFR 61.31(e) or (f), as appropriate. The recommended wording for this endorsement is contained in FAA Advisory Circular 61-65D.

11.6 TRANSITION TRAINING – OBJECTIVE AND STANDARDS

I. **Objective**

A. The objective of transition training is to obtain the skills, proficiency, and aeronautical knowledge necessary for safe operation of a specific make and model of airplane.

II. **Completion Standards**

A. The pilot should demonstrate, through written and flight review, the knowledge and skill necessary to safely operate the specific airplane.

B. Operations should be accomplished within the tolerances specified in the Practical Test Standards appropriate to the grade of pilot certificate that the pilot holds.

III. **Discussion of System Description and Limitations**

A. Several training items require a discussion of the description and limitations aspects of an airplane component or system. In every airplane system, there are limitations based on two factors:

1. The absolute capability of the equipment to perform a particular function
2. The individual pilot's ability to use that equipment

B. Effective training and experience should enable safe operation of an airplane within its limitations.

1. Some airplane systems are more complex and require a higher level of skill and interpretation.

    a. Thus, pilots of aircraft equipped with such systems will require more-extensive training in order to operate them effectively.

2. Pilot skills and knowledge also vary with a pilot's total flight time, time-in-type, and recency of training or experience.

    a. Thus, in addition to being trained to recognize the limitations of aircraft systems, pilots must also be trained to recognize their own limitations.

C. Throughout the ground school and flight curriculum, emphasis should be placed on operating the aircraft within its and the pilot's limitations.

1. Risk management and aeronautical decision-making (ADM) skills should be particularly emphasized.
2. A discussion of limitations, as they apply to the pilot's experience level and with reference to potential problem areas, may prevent many accidents.
3. A transition training syllabus should include a list of items that instructors should discuss with pilots intending to transition into a new aircraft with regard to the limitations of various systems, the flight characteristics of the specific airplane, and the way these items may affect a particular pilot.

11.7 TRANSITION TRAINING – GROUND TRAINING SYLLABUS

I. **Objective**

A. The objective of the ground training syllabus is to obtain the necessary knowledge required for safe operation of the specific airplane.

II. **Completion Standards**

A. The pilot should demonstrate, through written and oral review, the knowledge required to safely operate the specific airplane, using the *Pilot's Operating Handbook* (*POH*) or approved *Airplane Flight Manual* and airplane checklists.

B. All immediate-action emergency procedures must be committed to memory.

C. You should discuss each incorrect response with the pilot to ensure his/her complete understanding of the related system.

III. General Course Requirements

A. Descriptions and limitations

1. Whenever the ground training syllabus specifies a description and discussion of an airplane system or function, you should provide a general overview of the system or function and identify its basic components.
2. The system's limitations should be presented, as described in Section 2 of the *POH*, or the FAA-approved *Airplane Flight Manual*, with emphasis on pilot decision making and safe operation of equipment.

B. Preflight inspection, service, and maintenance

1. Whenever the ground training outline specifies training on these subjects, you should describe what a pilot can normally expect to encounter during a thorough preflight inspection.
   a. Such training is best accomplished while performing an actual preflight inspection on the aircraft.
2. Transition training on service and maintenance should focus on routine service that can be performed or supervised by the pilot.
   a. It is not intended that the pilot perform any maintenance operation requiring an appropriately certificated mechanic or repairman.
3. Emphasis should be placed on determining the aircraft's airworthiness, including compliance with the regulatory requirements relating to aircraft documents, placards, and operation with inoperative equipment.

IV. GAMA's Master Ground Training Outline

A. Airplane familiarization

1. Airplane overview
   a. Location of major subsystems and their relationship to each other
   b. Service limitations of the engine and other time-limited parts
   c. Modifications to original airplane
      i. A pilot should be told where to find information on modifications, if available.
      ii. (S)he should be aware of the operational significance of modifications and special equipment.
2. Use of safety equipment
   a. Emergency exits
   b. Seat operations
   c. Seat belts and shoulder harnesses
   d. Other

B. Controls

1. Description and limitations
2. Inspection, service, and maintenance
3. Flight controls
4. Flaps
5. Trim controls
6. Abnormal (if applicable) and emergency procedures

C. Flight instruments

1. Description and limitations
2. Inspection, service, and maintenance
3. Instrument power systems
4. Abnormal (if applicable) and emergency procedures

D. Performance

1. Description and limitations
2. Takeoff
3. Cruise and leaning procedures (if applicable)
4. Landing

E. Powerplant/propellers

1. Description and limitations
2. Inspection, service, and maintenance
3. Before-takeoff checks
4. Powerplant controls -- engine fuel control, propeller control, induction system, engine ignition system
5. Abnormal (if applicable) and emergency procedures

    a. Engine securing -- flight and ground (including single-engine airplanes)
    b. Engine failure before liftoff
    c. Engine failure after liftoff
    d. Airstart procedures

F. Electrical

1. Description and limitations
2. Inspection, service, and maintenance
3. Sources of electrical power
4. Battery starts
5. External power starts
6. Indicators
7. Lighting systems
8. Abnormal (if applicable) and emergency procedures

G. Airplane fuel system

1. Description and limitations
2. Inspection, service, and maintenance
3. Control system
4. Airframe-related components
5. Indicating system

    a. Quantity indication
    b. Warning system

6. Abnormal (if applicable) and emergency procedures

H. Landing gear system (fixed and retractable)

1. Description and limitations
2. Inspection, service, and maintenance
3. Indicating system (if applicable)
4. Normal operation (if applicable)
5. Abnormal (if applicable) and emergency procedures

I. Environmental

1. Description and limitations
2. Inspection, service, and maintenance
3. Normal operation of heating, ventilation, and cooling
4. Normal operation of pressurization (if applicable)
5. Abnormal (if applicable) and emergency procedures

J. Oxygen (if applicable)

1. Description and limitations
2. Inspection, service, and maintenance
3. Normal operation
4. High-altitude physiology (turbocharged, pressurized, and turbine airplanes)

K. Ice protection (if applicable)

1. Description and limitations
2. Inspection, service, and maintenance
3. Normal operation
4. Abnormal (if applicable) and emergency procedures

L. Weight and balance

1. Description and limitations
2. Controllability, center of gravity, and stall speed

M. Pilot errors common to the specific airplane

1. Systems mismanagement
2. Decision making
3. Operating envelope
4. Other

N. Avionics/autopilot/weather detection equipment

1. Description and limitations
2. Inspection, service, and maintenance
3. Preflight procedures
4. Normal operation
5. Abnormal (if applicable) and emergency procedures

11.8 TRANSITION TRAINING – FLIGHT TRAINING SYLLABUS

I. **Objective**

A. The objective of the flight training syllabus is to obtain the aeronautical skill and proficiency necessary for safe operation of the specific airplane.

II. **Completion Standards**

A. The pilot should demonstrate the necessary aeronautical skill and experience required for the specific airplane.

1. Operations should be accomplished within the tolerances specified in the Practical Test Standards appropriate to the grade of pilot certificate that the pilot holds.

B. In addition, a pilot who holds an instrument rating should demonstrate proficiency in the instrument maneuvers and procedures identified in the flight syllabus within the tolerances specified in the Instrument Rating Practical Test Standards.

III. **GAMA's Master Flight Training Outline**

A. Preflight planning

1. Weight and balance computation
2. Performance computation (takeoff, climb, engine-out considerations, cruise, descent, landing, fuel control/fuel management)

B. Preflight inspection

C. Avionics and airplane modifications

NOTE: The instructor will use the available manufacturer's or modification facility's published information to instruct the pilot on the safe operating procedures and potential problem areas.

1. Autopilot or wing leveler
2. Flight director
3. Severe weather detection equipment
4. Other avionics
5. Airframe modification
6. Powerplant modification

D. Starting engine

1. Battery starts
2. External power starts (may be discussion only)

E. Taxi procedures

F. Before-takeoff checks

1. VFR departure (not required if IFR departure accomplished)
2. IFR departure (required for an IFR endorsement)

G. Normal operations

1. Normal takeoff
2. Other takeoff procedures approved by the manufacturer
3. Climb
4. Cruise
5. High-altitude flight for turbocharged and pressurized airplanes

    a. 18,000 ft. MSL or higher (required for an IFR endorsement)
    b. 17,500 ft. MSL (not required if IFR accomplished).

    NOTE: Pilots who have previously flown as pilots in command above 18,000 ft. MSL are not required to accomplish this maneuver; however, it is recommended.)

6. Descent and arrival procedures

    a. VFR (not required if IFR accomplished)
    b. IFR (required for an IFR endorsement)

7. IFR approaches (required for an IFR endorsement)

    a. ILS
    b. Nonprecision

8. Balked landing

    a. Missed approach will meet balked landing requirement.

9. Missed approach (required for an IFR endorsement)
10. Holding (required for an IFR endorsement)
11. Normal landings
12. Other landing procedures approved by the manufacturer

H. Airwork (Refer to the Appropriate Practical Test Standards for description.)

1. Constant altitude turns
2. Stalls

    a. Power on
    b. Power off

3. Slow flight (all engines operating)

I. Abnormal (if applicable) and emergency procedures

NOTE: All abnormal and emergency procedures will be practiced in accordance with the manufacturer's recommendations. Items applying to multiengine operations will be practiced in accordance with the FAA Multiengine Practical Test Standard for the appropriate pilot certificate.

1. Engine securing -- multiengine airplane (to be accomplished at or above the minimum safe altitude)
2. Simulated engine-out approach and landing -- visual reference
3. Simulated engine-out ILS approach -- multiengine only (required for an IFR endorsement)
4. Simulated engine-out nonprecision approach -- multiengine only (required for an IFR endorsement)
5. Simulated engine failure after liftoff (multiengine only)
6. Simulated engine failure before liftoff (multiengine only)
7. Emergency gear extension (may be discussion only if actual gear extension requires the need for subsequent maintenance)
8. Emergency descent (turbocharged or pressurized airplane or both)
9. No-flap landing
10. Use of crew oxygen (pressurized airplane)
11. Partial panel (required for an IFR endorsement)

12. Recovery from unusual attitudes by instrument reference (must be accomplished by all pilots, not just IFR)
13. 180° turn by reference to instruments and at least 3 min. of straight-and-level flight (not required for pilot receiving IFR training)
14. Fire -- electrical or engine
15. Smoke removal
16. Operation of emergency exit (may be discussion if exit operation would require subsequent maintenance or would damage the aircraft)
17. Simulated loss of pressurization
18. Any other emergency or abnormal procedure (that is recommended by the manufacturer and that, in the judgment of the instructor, can be safely demonstrated or simulated)

GLEIM FLIGHT INSTRUCTOR REFRESHER COURSE
LESSON 12
AVOIDING MIDAIR COLLISIONS AND CONTROLLED FLIGHT INTO TERRAIN (CFIT)

12.1 SEE-AND-BE-SEEN CONCEPT

I. **Regulatory Responsibility**

A. Explain to your students that 14 CFR 91.113, Right-of-Way Rules: Except Water Operations, sets forth the see-and-be-seen concept.

1. This rule requires that each person operating an aircraft maintain vigilance for other traffic at all times (weather conditions permitting), in flights conducted under both IFR and VFR.

B. 14 CFR 91.209, Aircraft Lights, establishes when aircraft lights must be used.

1. Inform your students that aircraft position (navigation) lights must be turned on anytime an aircraft is operated on the ground or in flight during the period between sunset and sunrise.
2. Explain that aircraft equipped with an anticollision light system (rotating beacon and/or strobe lights) are required to keep the lights on during all operations, both day and night.
   a. However, the pilot in command may turn off the anticollision light system when (s)he determines that the light output would constitute a hazard to safety during adverse meteorological conditions or at any other time.
   b. Tell your students that supplementary strobe lights should be turned off on the ground if they adversely affect ground personnel or other pilots.

C. Emphasize to your students that, regardless of the type of aircraft being flown, all pilots must maintain a constant lookout for other aircraft.

II. Inform your students that **Operation Lights On** is an FAA voluntary pilot safety program that is designed to enhance the see-and-be-seen concept.

A. Under this program, pilots are encouraged to turn on their landing lights for takeoff.

B. Pilots are further encouraged to turn on their landing lights when operating below 10,000 ft. MSL, day or night, especially when operating within 10 NM of any airport or in conditions of reduced visibility, and in areas where flocks of birds may be expected, e.g., in coastal areas, in lake areas, around refuse dumps, etc.

C. Emphasize to your students that, although turning on aircraft lights does enhance the see-and-be-seen concept, they should not become complacent about keeping a sharp lookout for other aircraft.

1. Point out that most midair collision (MAC) accidents and near midair collision (NMAC) incidents occur during good day-VFR weather conditions.
   a. Not all aircraft are equipped with lights, and some pilots may not have their lights turned on.
   b. Aircraft manufacturers' recommendations for operation of landing lights and electrical systems must also be observed even if they conflict with Operation Lights On.

12.2 VISION

I. Explain to your students that, of the body senses, vision is the most important for safe flight. It is therefore important for them to understand the eye's construction and the effect of darkness on the eye.

A. Two types of light-sensitive nerve endings called **cones** and **rods** are located at the back of the eye, or retina. These special nerve endings transmit messages to the brain via the optic nerve.

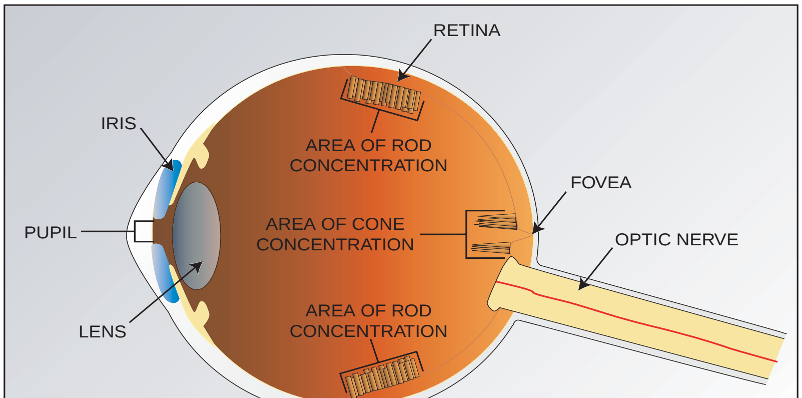


Figure12_1
Anatomy of the Eye

1. Explain that the cones are concentrated around the center of the retina and decrease in number as the distance from the center increases.

   a. Their function is to detect color, details, and distant objects.
   b. Cones function both in daylight and in moonlight.

2. Tell your students that the rods are concentrated around the cones and increase in number as the distance from the center of the retina increases.

   a. Their function in daylight is to detect objects, particularly those in motion, out of the corner of the eye (i.e., peripheral vision).

      i. However, rods do not provide detailed or color images; they only indicate shades of gray.

   b. Rods function in daylight, in moonlight, and in very low light (darkness).

B. Inform your students that the **fovea** is a small, notched area of the retina that is located directly behind the lens. This area contains cones only.

1. Explain that the fovea is the area of sharpest vision.

   a. Thus, when looking directly at an object, the eye focuses the image mainly on the fovea.

2. Point out that the fovea's field of vision is a conical area that consists of only about 1° of the entire visual field.

   a. To demonstrate how small a 1° field is, take a quarter and tape it to a flat piece of glass, such as a window. Have your student stand 4½ ft. from the mounted quarter and close one eye. The area of his/her field of view covered by the quarter is a 1° field.

3. Explain that the normal field of vision for each eye is about 135° vertically and about 160° horizontally, as shown below.

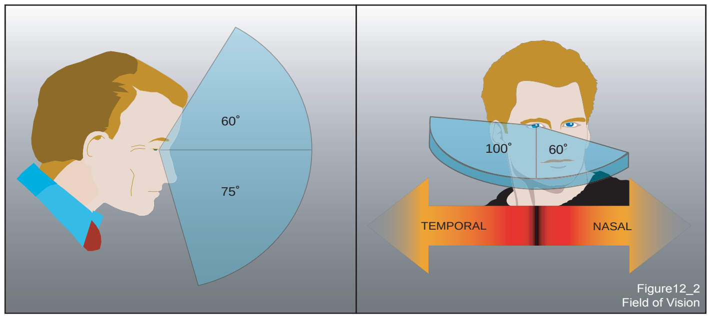


Figure12_2
Field of Vision

   a. The fovea's vision is concentrated in the central 1° area of this field.

4. Inform your students that their visual acuity (detail) drops off rapidly outside of the fovea's field of vision.

   a. EXAMPLE: Outside of a 10° cone (centered on the fovea cone) a pilot will see only about one-tenth of what (s)he can see in the fovea cone.

      i. Put in terms of its effect on collision avoidance, this fact means that an aircraft that can be seen in the fovea cone when 5,000 ft. away must be as close as 500 ft. to be detected with peripheral vision.

C. Explain that because the rods are distributed around the cones and do not lie directly behind the pupils, **off-center viewing** (i.e., looking to one side of an object) is important during night flight.

1. During daylight, an object can be seen best by looking directly at it.

   a. However, because the cones become less effective in progressively lower light levels, a person may not be able to see an object by looking directly at it.

      i. Because the cones are concentrated at the center of the visual field, a central night blind spot develops when the cones stop working due to darkness.

2. Tell your students that at night, they will be able to see things more clearly and definitely by looking to one side of them, rather than looking straight at them. Explain that mastering this technique may require some practice. (See the bottom illustration below.)

   a. Point out that the rods do not detect objects while the eyes are moving; they only work during the pauses.

   b. Accordingly, it is important to scan for traffic at night using small, regularly-spaced intervals.

      i. For more information about proper scanning techniques, see Module 12.3, Visual Scanning.

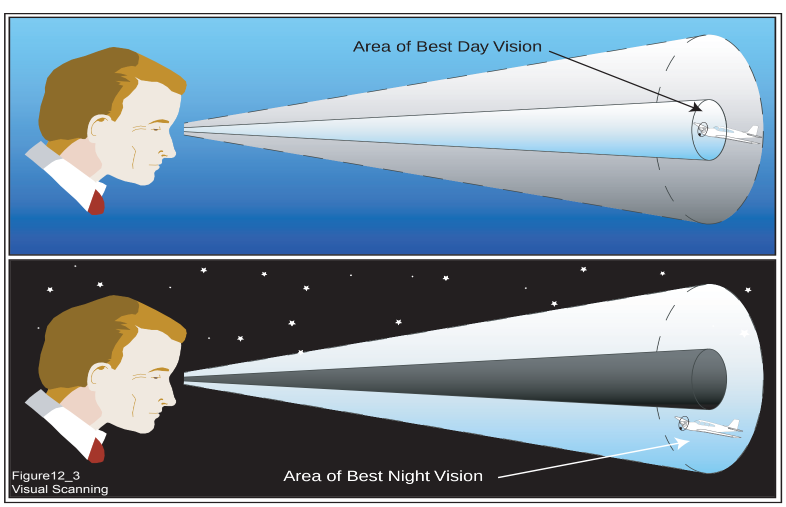


Figure12_3
Visual Scanning

II. Emphasize to your students that adapting their eyes to darkness is an important aspect of night vision.

A. When entering a dark area, the pupils of the eyes enlarge to receive as much of the available light as possible.

B. Explain that while the pupils adjust quite rapidly to darkness, it will take approximately 5 to 10 min. (with enough available light) for the cones to become moderately adjusted to the lower light level. After this adjustment, the eyes become 100 times more sensitive than they were before entering the dark area.

1. EXAMPLE: When you first step into a dark movie theater, you may be unable to see well enough to comfortably search for a seat. After waiting by the door for a few minutes, however, your eyes become sufficiently adjusted to the low light levels for you to find an empty seat.

C. After about 30 min., the rods will be fully adjusted to darkness and become about 100,000 times more sensitive to light than they were in the lighted area.

1. Explain that because the rods can still function in light of 1/5,000 the intensity at which the cones cease to function, only rods are employed for night vision.

D. Emphasize that the rods need more time to adjust to darkness than the cones do to bright light. The eyes become adapted to sunlight in 10 sec., whereas they need 30 min. to fully adjust to a dark night.

1. Accordingly, teach your students to consider the adaptation process before and during night flight.

a. First, the eyes should be allowed to adapt to the low level of light, and then they must be kept adapted.

b. At night, pilots must avoid exposing their eyes to any bright light that may cause temporary blindness, possibly resulting in serious consequences.

i. Temporary blindness may result in illusions or “after images” during the time that the eyes are recovering from the bright light.

III. Inform your students that the eyes are the first part of the body to suffer from low oxygen levels at altitude, because the capillaries in the eyes are very small and have a limited capacity to carry oxygen.

A. Night vision may be adversely affected above 5,000 ft. MSL.

1. Therefore, encourage your students to fly at the lowest safe altitude and/or use oxygen at night.

IV. Explain that good vision depends on a pilot’s physical condition. Fatigue, colds, vitamin deficiency, alcohol, stimulants, smoking, and medication can seriously impair vision.

A. EXAMPLE: Studies show that smoking lowers the sensitivity of the eyes and reduces night vision by approximately 20%.

V. Teach your students to avoid excessive illumination due to light reflected off the canopy, surfaces inside the aircraft, clouds, water, snow, and desert terrain. Excessive light levels cause glare, resulting in uncomfortable squinting, watering of the eyes, and even temporary blindness.

A. Emphasize that sunglasses intended for protection from glare should absorb at least 85% of visible light (i.e., 15% transmittance) and all colors equally (i.e., neutral transmittance), with negligible image distortion from refractive and prismatic errors.

12.3 VISUAL SCANNING

I. Proper Visual Scanning Technique

A. Explain that while the eyes can observe an approximately 160°-wide arc of the horizon at one glance (see illustration on page 3), only the fovea has the ability to send clear, sharply focused messages to the brain.

1. All other visual information that is not processed directly through the fovea will be of less detail.

   a. EXAMPLE: An aircraft at a distance of 7 mi. that appears in sharp focus within the fovea's center of vision would have to be as close as 0.7 mi. in order to be recognized if it were outside of the fovea's vision.

2. Inform your students that, because the eyes can focus only on this narrow viewing area, effective scanning is accomplished with a series of short, regularly spaced eye movements that bring successive areas of the sky into the central visual field.

   a. Each movement should not exceed 10°, and each area should be observed for at least one second to enable detection.

B. Explain that peripheral vision is useful in spotting collision threats from other aircraft.

1. Each time a scan is stopped and the eyes are refocused, the peripheral vision takes on more importance because it is through peripheral vision that movement is detected.

   a. Apparent movement is almost always the first perception of a collision threat.

   b. You must explain to your students, however, that if another aircraft appears to have no relative motion, it is likely to be on a collision course.

      i. If the other aircraft shows no lateral or vertical motion but appears to be increasing in size, evasive action must be taken immediately.

2. Visual search at night depends almost entirely on peripheral vision.

   a. In order to perceive a very dim lighted object in a certain direction, the pilot should not look directly at the object, but should scan the area adjacent to it.

   b. Short stops of a few seconds in each scan will help to detect the light and its movement.

C. Impress upon your students that it is necessary to move their heads in order to search around physical obstructions in the cockpit, such as door and window posts.

1. The doorpost can cover a considerable amount of sky, and a small head movement may uncover an area that could be concealing an airplane.

2. Point out that the lack of brightness and color contrast in daytime and the presence of conflicting ground lights at night also increase the difficulty of visually detecting other aircraft.

D. Emphasize that poor visual scanning unnecessarily increases the risks of a midair collision. You and your students should be conversant with proper techniques, and practice them consistently.

   1. Ensure early in your student's training that (s)he does not fixate on the flight instruments, but instead uses them to fine-tune the visual references.

E. Effective scanning also helps avoid "empty-field myopia." This condition usually occurs when flying above the clouds or in a haze layer that provides nothing specific to focus on outside the aircraft.

   1. This causes the eyes to relax and seek a comfortable focal distance, which may range from 10 to 30 ft.
   2. For the pilot, this means looking without seeing, which is dangerous.

II. Time-Sharing Technique

A. Studies show that the time a pilot spends on visual tasks inside the cabin should represent no more than 1/4 to 1/3 of the scan time outside, or no more than 4 to 5 seconds on the instrument panel for every 16 seconds outside.

B. Explain to your students that because the brain is already trained to process sight information that is presented from left to right, they may find it easier to start scanning over the left shoulder and proceed across the windshield to the right.

C. Pilots should realize that their eyes may require several seconds to refocus when switching views between items in the cockpit and distant objects outside.

   1. Eyes will also tire more quickly when forced to adjust to distances immediately after close-up focus, as required for scanning the instrument panel.
   2. Eye fatigue can be reduced by looking from the instrument panel to the left wing, then past the wingtip to the center of the first scan quadrant, when beginning the exterior scan.

      a. After having scanned from left to right, the eyes should be allowed to return to the cabin along the right wing, from its tip inward.

D. Point out that studying maps, checklists, and manuals before flight, along with other proper preflight planning (e.g., noting necessary radio frequencies) and organization of cockpit materials can reduce the amount of time required to look at these items during flight, thus allowing more scan time.

III. Proper Clearing Procedures

A. Prior to taxiing onto a runway or landing area in preparation for takeoff, teach your students to scan the approach areas for possible landing traffic, executing appropriate clearing maneuvers to provide a clear view of the approach areas.

B. During climbs and descents in flight conditions that permit visual detection of other traffic, teach your students to execute gentle banks left and right at a frequency that permits continuous visual scanning of the airspace ahead.

   1. Alternatively, the nose may be briefly lowered to the horizon during climbs to clear the airspace ahead.

C. Teach your students that sustained periods of straight-and-level flight in conditions that permit visual detection of other traffic should be broken at intervals with appropriate clearing procedures (e.g., momentarily raising each wing) to allow effective visual scanning.

D. Emphasize that entry into a traffic pattern while descending creates specific collision hazards and should be avoided.

E. You should also emphasize the need for sustained vigilance in the vicinity of VORs and airway intersections due to the convergence of traffic.

F. Operators of pilot training programs should adopt the following practices:

1. Pilots undergoing flight instruction at all levels should be requested to verbalize clearing procedures (call out, “clear,” “left,” “right,” “above,” or “below”) to instill and sustain the habit of vigilance during maneuvering.
2. In a high-wing airplane, momentarily raise the wing in the direction of the intended turn and look.
3. In a low-wing airplane, momentarily lower the wing in the direction of the intended turn and look.
4. Appropriate clearing turns (i.e., a 180° turn or two 90° turns in opposite directions) should precede the execution of all maneuvers, including chandelles, lazy eights, stalls, slow flight, climbs, spins, and other combination maneuvers.
   a. Teach your students to use clearing turns as an opportunity to re-orient themselves to familiar landmarks and thereby remain inside the normal practice area when practicing solo maneuvers.

IV. Relationship Between Aircraft Speed Differential and Collision Risk

A. Inform your students that the high performance capabilities of many airplanes (in both speed and rates of climb/descent) result in high closure rates between two such airplanes, thereby limiting the time available for detection, decision, and evasive action.

B. EXAMPLE: Two aircraft are approaching head-on, and visual detection is made at 3 NM.

1. If the aircraft are converging at a speed of 200 kt., each pilot has 54 sec. to react to avoid a collision.
2. If the aircraft are converging at a speed of 300 kt., each pilot has 36 sec. to react to avoid a collision.

C. Studies have shown that the minimum time required for a pilot to spot traffic, identify it as a collision threat, react, and have the airplane respond is 12.5 sec.

V. Judgment Aspects of Collision Avoidance

A. **Determining relative altitude**: Teach your students to use the horizon as a reference point. If another aircraft is above the horizon, it is probably on a higher flight path. If it appears to be below the horizon, it is probably flying at a lower altitude.

B. **Taking appropriate action**: Your students must be familiar with the rules of right-of-way so that, if an aircraft is on an obvious collision course, they can take the appropriate evasive action.

1. Emphasize, however, that your students must not assume that the other aircraft will yield to them simply because they have the right-of-way in a particular situation.
   a. The other pilot may not realize that your student has the right-of-way, or (s)he may not see your student.

C. **Considering multiple threats**: Explain that the decision to climb, descend, or turn is a matter of personal judgment, but your students should anticipate that the other pilot may also be making a quick maneuver. Teach your students to watch the other aircraft during the maneuver, but also to resume scanning again immediately, as there may still be other aircraft in the area.

D. **Collision course targets**: Inform your students that any aircraft that appears to have no relative motion and stays in one scan quadrant is likely to be on a collision course. Accordingly, if a target shows no lateral or vertical motion, but appears to increase in size, evasive action should be taken immediately.

E. **Recognizing high hazard areas**:

1. Explain that airways, VORs, and airport traffic areas are places where aircraft tend to cluster.
2. Point out that most collisions occur on days when the weather is good because more aircraft tend to be airborne under such conditions.

F. **Cockpit management**: Teach your students to study maps, checklists, and manuals before the flight, along with performing other proper preflight planning procedures. Being organized ahead of time allows the pilot to spend more time looking outside the cockpit.

G. **Windshield conditions**: Dirty or bug-smeared windshields can greatly reduce a pilot's ability to see other aircraft. Teach your students to keep a clean windshield.

H. **Visibility conditions**: Point out that smoke, haze, dust, rain, and flight into the sun can greatly reduce a pilot's ability to detect other aircraft.

I. **Visual obstructions in the cockpit**:

1. Teach your students to move their heads to see around blind spots caused by fixed aircraft structures, such as door posts, wings, etc. Point out that it may even be necessary occasionally to maneuver the airplane (e.g., lifting a wing) to maximize visibility.
2. Remind your students to check that curtains and other cockpit objects (e.g., maps that glare on the windshield) are stowed during flight, and to keep the interior lights low at night so that they can see out in the dark.

J. **Lights on**: Impress upon your students that, day or night, exterior lights can greatly increase the visibility of any aircraft.

K. **ATC support**: ATC facilities often provide radar traffic advisories (i.e., flight following) on a workload-permitting basis. Teach your students to use this support whenever possible.

1. Emphasize, however, that despite operating in a radar environment (i.e., where traffic is separated by radar) vigilance is still required to avoid collisions. Radar does not relieve a pilot of the responsibility to see and avoid other aircraft.

12.4 USE OF COMMUNICATION EQUIPMENT AND AIR TRAFFIC ADVISORY SERVICES

I. Explain that it has been shown that one of the major factors contributing to the likelihood of NMAC incidents in terminal areas that have an operating ATC system is the mix of known arriving and departing traffic with unknown traffic.

A. The known aircraft are generally in radio contact with the controlling facility (local, approach, or departure control), while the unknown aircraft are neither in two-way radio contact nor identified by ATC at the time of the NMAC.

1. This situation precludes ATC from issuing traffic advisory information to either aircraft.

II. Emphasize that before communication can be used effectively to assist in collision avoidance, a pilots must know his/her location in order to give accurate position reports.

A. Teach your students to use landmarks or navigation aids to determine their position and range more accurately. Do not allow them to guess.

B. Explain that at controlled airports, ATC can issue accurate traffic advisories to your students and to other aircraft.

1. Inform your students that visual observation of aircraft by ATC in a nonradar terminal area is limited by distance, depth perception, aircraft conspicuousness, and other normal visual acuity problems.

2. Point out that it is possible that a controller may not see the aircraft to which (s)he is providing traffic advisories.

a. In this situation, the controller's advisories will be based solely on the accurate position reporting of the pilots operating in the area.

3. When requesting radar traffic information services (i.e., flight following), accurate position reporting will allow the controller to identify an aircraft on radar more quickly and to determine whether services can be provided.

C. Explain that at airports without an operating control tower, pilots monitoring the CTAF will be made aware of traffic on or near the airport by the pilots' accurate reports of their positions and intentions.

1. Emphasize, however, that radio communication is not required at airports without an operating control tower, so your students must remain vigilant even when no traffic is reported in the area.

III. Teach your students that radio contact should be initiated early enough not only to allow them to work into the flow of traffic into an airport, but also to let others know of their intentions.

A. A pilot must establish radio contact with ATC and receive clearance prior to entering Class B airspace.

B. A pilot should contact ATC at least 20 NM from the primary airport of Class C airspace, and at least 10 NM from the primary airport of Class D airspace.

C. At an airport without an operating control tower (Class E or G airspace), a pilot should communicate/monitor on the CTAF at least 10 NM out.

D. Teach your students that they should at least monitor the appropriate frequency if they overfly an uncontrolled airport or fly above Class B, C, or D airspace (but not into Class A airspace).

IV. Explain that radar traffic information service advises a pilot of any radar target observed on the controller's radar display that may warrant his/her attention.

A. This service serves to alert a pilot to the presence of traffic so that (s)he can be on the lookout for it and be in a better position to take appropriate action, if necessary.

B. Inform your students that radar services to VFR aircraft may be limited by factors such as the limitation of radar, traffic volume, controller workload, and unknown traffic, and may prevent ATC from providing traffic advisory information.

1. Emphasize that VFR traffic advisories are secondary to the controllers' primary duties of assuring the separation of IFR aircraft and issuing safety alerts.

C. Radar services should be requested and used when available to help pilots to see and avoid other traffic by augmenting their own visual scanning, but should never be used as a substitute for visual scanning.

1. Remind your students that this service does not relieve them of their responsibility to be continually vigilant and to see and avoid other aircraft.

D. Inform your students that information about radar traffic information service is found in the *AIM* and the *Airport/Facility Directory (A/FD)*.

1. The *AIM* contains a section dealing with services available to pilots. This includes

   a. Approach control facilities for VFR arriving aircraft
   b. Traffic advisory practices at airports without operating control towers
   c. Radar traffic information service
   d. Radar assistance to VFR aircraft
   e. Terminal radar programs for VFR aircraft

2. The *A/FD* contains a list of all public airports, showing the services available to pilots and the appropriate communication frequencies.

12.5 SITUATIONAL AWARENESS AND THE CFI'S ROLE IN COLLISION AVOIDANCE

I. Teach your students that **situational awareness (SA)** is the accurate perception and understanding of all the factors and conditions that affect a flight.

A. These factors include, but are not limited to

1. Weather
2. Fuel supply and fuel flow rate
3. Airspace
4. Traffic
5. Terrain
6. Pilot fatigue

B. In essence, situational awareness is a pilot's knowledge of what is going on in and around his/her airplane.

II. It is vital that you as the instructor maintain situational awareness at all times during training flights.

A. Many instructional activities, particularly instrument flying, can direct your attention as well as your student's attention inside the cockpit.

1. Allowing your attention to be directed away from navigating the airplane and looking for other traffic for extended periods could cause you to enter restricted airspace without a clearance or experience a mid-air collision.

B. One aid to maintaining situational awareness during VFR training flights is to use clearing turns as an opportunity not only to look for traffic, but also to re-orient yourself to nearby landmarks.

1. If you see that the airplane is drifting toward the edge of your normal practice area, you can direct your student to turn to a heading that will return you to the practice area.
2. Instruct your students to use this technique to maintain orientation and ensure collision avoidance when they are flying solo.
3. From very early in their training, you must instruct your students to devote maximum attention to maintaining SA and watching for traffic while conducting flight operations.

   a. You should set the example by carefully observing all regulations and recognized safety practices, since your students will consciously and subconsciously imitate your flying habits.

4. Explain to your student that radar services for arriving and departing aircraft are available at some airports, and encourage the use of these services, as well as the use of radar traffic information service for flying between en route points.

   a. Understand and explain the limitations of radar that may frequently limit or prevent the issuance of radar advisories by ATC.

5. At airports with an operating control tower, notify ATC of a student's first solo flight.
6. Place special training emphasis on the areas of concern mentioned in this lesson, in which

improvements in pilot education, operating practices, procedures, and techniques are needed to reduce midair conflicts.

12.6 CONTROLLED FLIGHT INTO TERRAIN - GENERAL

I. **Controlled flight into terrain (CFIT)** can be defined as an event in which a normally-functioning aircraft is inadvertently flown into terrain, water, or obstacles, often without prior knowledge by the crew.

A. Inform your students that due to the physical forces involved, the vast majority of CFIT accidents are fatal to one or more of the aircraft's occupants.

1. Point out that the element of surprise is also a factor in the lethality of CFIT accidents because it prevents the crew from taking actions (such as reducing airspeed or modifying the flight path) to minimize the impact forces.
2. Accordingly, you must aggressively emphasize **avoidance** of the scenarios that lead to CFIT accidents.

B. Explain that, while CFIT accidents are typically associated with IFR operations in mountainous areas, they can happen to aircraft operating under IFR or VFR, over all kinds of terrain, and at any time of day or night.

1. Point out that while many factors can contribute to a CFIT accident, one causal factor common to most such accidents is **the crew's loss of situational awareness**.
   a. You should therefore teach your students to devote maximum possible attention to maintaining situational awareness during all phases of flight.
2. Emphasize that the risk of losing situational awareness is greatest in conditions of darkness or reduced visibility and during times of high workload.
   a. Without a clearly-discernible horizon, even large deviations from a desired heading, attitude, altitude, or course may not be immediately obvious.
   b. Under high-workload conditions, a pilot's instrument scan can break down, allowing such changes to go unnoticed and setting the stage for a CFIT event.
3. Point out, however, that times of low workload can also be hazardous because they can lead to boredom and complacency at a time that the pilot should be monitoring the progress of the flight and preparing for the upcoming phases.
   a. Explain that **complacency** is an unsubstantiated sense of well-being or security that is accompanied by unawareness of potential hazards.
   b. Complacency can lead to a pilot's loss of situational awareness by causing him/her to monitor the progress of the flight inadequately due to the mistaken belief that "nothing will go wrong because nothing has gone wrong."
      i. EXAMPLE: While navigating GPS-direct and using the autopilot during a long cross-country flight, a pilot may have so little to do that (s)he regards the airplane to be "flying itself."
         o With such an attitude, the pilot effectively becomes a passenger. If immediate action becomes necessary, (s)he might not be mentally prepared to take control of the airplane and successfully navigate it to a safe outcome.

4. Teach your students to maximize their situational awareness by always thinking ahead of the airplane, and by using low-workload periods to plan ahead for high-workload periods.
   a. Impress upon your students that a good pilot is always asking him/herself, "what happens next?" This habit allows the pilot to anticipate what actions will be necessary in the next several minutes and to perform as many of them ahead of time as possible.
      i. EXAMPLE: While still at cruising altitude and several minutes from the destination airport, a pilot should know that it is time to obtain the ATIS information, determine the approach in use, find and review the appropriate approach chart and airport diagram, tune any anticipated frequencies, etc., all without prompting from ATC.
   b. Emphasize that, particularly for IFR flights, preparation for known periods of high workload must be accomplished during times of low workload if all procedures are to be satisfactorily performed in the time available.
      i. EXAMPLE: If ATC or the ATIS advises a pilot to expect the ILS Runway 28 approach at the destination airport, (s)he can begin preparing for the approach several minutes in advance by finding the approach chart, reviewing courses and altitudes, tuning and identifying the navigation radios, etc.
         o If the pilot waits to complete all steps necessary to perform the approach until cleared for the approach by ATC, a successful outcome is unlikely.

II. Inform your students that the following are some phases of flight where the likelihood of a CFIT event is increased:

A. Takeoff into conditions of low ceilings or visibility.
B. Takeoff over water or unlit terrain on a dark, moonless night, or under an overcast sky (i.e., a "dark night" takeoff).
C. Single-pilot IFR operations.
D. VFR flight in marginal VFR or IFR conditions (i.e., scud running).
E. Continued VFR flight into IFR conditions.
F. Low-level maneuvering flight, regardless of weather conditions.
G. Night flight in mountainous areas.
H. Non-precision instrument approaches in a non-radar environment.
I. Visual approaches to an airport that is surrounded by water or unlit terrain on a dark, moonless night, or under an overcast sky (i.e., "black hole" approaches).

12.7 CATEGORIES OF CFIT ACCIDENTS

I. This module discusses three categories of CFIT accidents:

A. Accidents in good VFR conditions.
B. Accidents in marginal VFR conditions or developing IFR conditions.
C. Accidents in IFR conditions.

II. **CFIT accidents in good VFR conditions** are surprisingly well-represented among CFIT accidents. Their causes include the following:

A. **Night flight:** Inform your students that there are many hazardous illusions associated with flight at night. In addition to the obvious hazard of being unable to see darkened terrain or obstacles, operations such as "dark night" takeoffs and "black hole" approaches are commonly associated with CFIT accidents.

1. **Dark night conditions** occur when there is little or no lighting of darkened terrain by natural or artificial sources. These conditions typically occur in remote areas and coastal regions on moonless or overcast nights. They are most-hazardous during the period immediately after takeoff.

a. Explain that during a **dark night takeoff**, outside visual reference may be lost when the airplane's nose is rotated to the climb attitude, blocking the runway lights from view.

i. If good weather conditions exist at the time of the takeoff, the pilot may be expecting to make an entirely visual departure.

ii. Thus, (s)he may not have the proper state of mind to devote his/her full attention to the flight instruments in order to maintain control of the aircraft when visual references are lost.

- Emphasize to your students that during a night departure, failure to devote sufficient attention to the flight instruments to maintain straight flight and a positive rate of climb may lead to loss of control and collision with terrain or obstacles.

b. The **somatogravic illusion** is another factor in CFIT accidents during dark night takeoffs.

i. This illusion creates the sensation of pitching up as an airplane accelerates.

- Point out to your students that most airplanes accelerate as they climb shortly after takeoff (e.g., after gear and flaps are retracted).

ii. A pilot who is affected by this illusion will pitch the nose down in order to return the airplane to what is perceived to be the correct climb attitude.

- In reality, the pilot will have reduced the pitch attitude below the attitude for a normal climb, possibly stopping the climb or initiating a descent.

iii. Without outside references to reveal the airplane's improper attitude, the pilot may believe that (s)he is climbing normally when the airplane is climbing inadequately to clear terrain ahead, maintaining level flight, or even descending.

- Unless the airplane's attitude is corrected using the flight instruments, the pilot may continue maintaining the improper attitude until the airplane impacts rising terrain or obstacles.

c. You must emphasize to your students that a dark night takeoff will require that they devote full attention to maintaining aircraft control.

i. However, you must also point out that while use of the flight instruments may be essential to controlling the airplane during a dark night takeoff, your students must still look outside for other traffic if they are operating in visual conditions.

2. A **black hole approach** is an approach that is made to a brightly-lit runway from over water or other unlighted terrain where the runway lights are the only source of light between the airplane and the runway. Explain that there are two specific hazards associated with black hole approaches that cause them to be associated with CFIT accidents.

   a. **Spatial disorientation** may result during an approach to a lighted runway that is surrounded by darkened terrain, beyond which the horizon is not visible.

      i. Inform your students that without peripheral cues to help a pilot maintain orientation with the earth, (s)he may misinterpret the relationship between the airplane's attitude and the runway lights.

         o In some cases, disorientation may be so severe that it causes the pilot to allow the airplane to fly into terrain without ever realizing that a dangerous attitude had been entered.

         o Point out that this hazard is magnified when flying an airplane with a constant-speed propeller, because even large changes in pitch attitude will not be accompanied by changes in engine noise.

      ii. EXAMPLE: In the image on the lower left, the pilot may interpret the airplane's attitude to be level as (s)he approaches a runway that is sloping upward and angled across his/her flight path.

         o When the horizon is revealed in the image on the lower right, however, it becomes apparent that the airplane is actually in a nose-low right bank.

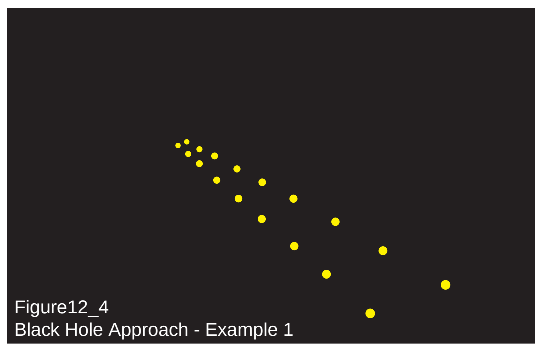


Figure12_4
Black Hole Approach - Example 1

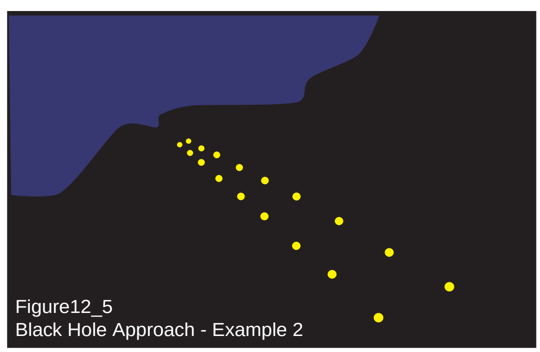


Figure12_5
Black Hole Approach - Example 2

      iii. Emphasize that spatial disorientation can be avoided at night by frequently cross-checking the flight instruments against visual references to confirm the airplane's attitude.

b. **A long, straight-in approach** to a lighted runway with darkened terrain before the runway and bright city lights beyond it creates an illusion of being closer to the runway than what is actually the case. Explain that the tendency is to fly a lower-than-normal approach.

i. Several factors contribute to this illusion and contribute to a lower-than-normal approach and an increased risk of CFIT:

- o The human brain interprets brightly-lit objects to be closer than more dimly-lit objects.
  - ■ Explain that the presence of a darkened foreground against a backdrop of a brightly-lit runway and bright city lights eliminates any relative change of brightness with distance, causing the runway and city to appear closer than they would in daylight.
  - ■ Point out that this effect is magnified on very clear nights, where the lack of a "hazing" effect as distance increases makes distant light sources appear much closer than they actually are.
- o When flying a long, straight-in approach to a lighted runway with a darkened foreground, the tendency exhibited by pilots of all skill levels is to fly an approach that causes the runway to maintain a constant visual angle in the windshield.
  - ■ Inform your students that such an approach does NOT result in a straight glide path to the runway. Instead, it results in the airplane following a curved path which, if allowed to continue for the duration of the approach, will result in the airplane landing short of the runway.
  - ■ Point out, however, that this illusion usually disappears within 2-3 miles of the runway, making an actual landing short of the runway unlikely.
  - ■ Emphasize that true danger of this illusion is that the curved approach path may intersect darkened high terrain while still several miles out on the approach.
  - ■ Because the foreground is not lit, the only warning of an impending crash may be the sudden disappearance of the runway/city lights as they are obscured by terrain.

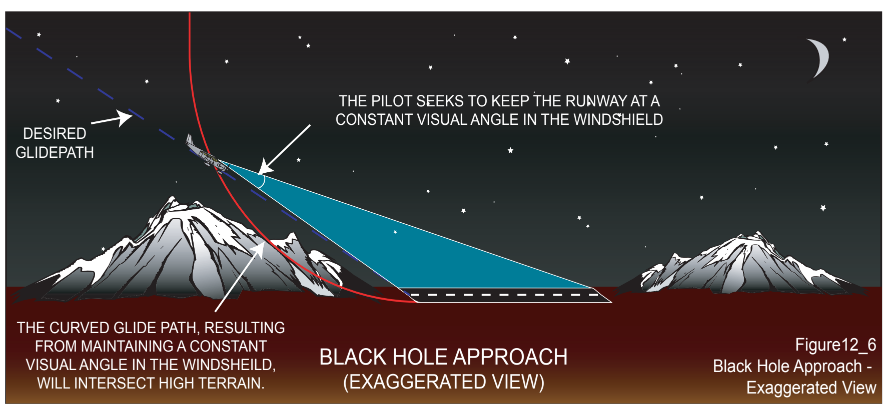


Figure12_6 Black Hole Approach - Exaggerated View

ii. Impress on your students that they should avoid making long straight-in visual approaches at night.

- o It is safer to proceed inbound to the airport at a known safe altitude until the airplane is within a few miles of the airport, at which point a descent into the traffic pattern and a normal landing can be made.
- o Advise your students to use all means at their disposal to ensure that a proper glide path is followed if they must conduct a straight-in visual approach at night, including visual and electronic glide slopes when

available.

B. **Inappropriate reliance on IFR procedures during VFR flight:** Inform your students that selectively employing IFR procedures while operating under VFR can lead to a CFIT accident. It is not appropriate for a pilot to rely on an IFR procedure for any purpose unless (s)he is operating under IFR.

1. Explain that there are many potential variables that can affect IFR procedures, including departure procedures (DPs) and instrument approach procedures (IAPs).
   a. Any one of these variables could create an unsafe situation for a pilot who is relying on the procedure to provide terrain/obstacle clearance or to locate an airport. The following examples illustrate this point:
      i. A VFR pilot who relies on a DP to provide terrain clearance on a dark night may not be aware of an unreliable NAVAID along the route if (s)he has not obtained current NOTAMs from a flight service station or has not been informed by ATC.
         o Without these services that are available to pilots operating under IFR, a VFR pilot will have no warning that a procedure (s) he has successfully depended on in the past has become unsafe.
      ii. A VFR pilot who elects to use a non-precision IAP to find an uncontrolled airport on a hazy day may not bother to obtain a current local altimeter setting.
         o If a strong pressure gradient exists between the pilot's departure airport and the destination airport, with lower pressure at the destination airport, the pilot will descend below applicable minimum altitudes for various segments of the approach, potentially putting him/herself dangerously close to terrtain or obstacles.
   b. Impress upon your students that they should only rely on IFR procedures when operating under IFR after having received a complete briefing.
2. Explain to your instrument students that it is acceptable to **practice** IFR procedures while operating under VFR as long as due attention is given to collision avoidance, and IFR procedures are not depended upon for any critical navigation purpose.
   a. Encourage your instrument-rated students to consider filing an IFR flight plan in order to practice IFR procedures, as the practice will be safer and more realistic when in contact with ATC.
      i. As an alternative, you or your students can contact an appropriate ATC facility to request VFR flight following during your practice flight.

C. **Flight in the vicinity of difficult-to-see obstacles such as towers and tethered balloons:** Emphasize to your students that tall obstructions such as radio transmission towers and tethered balloons are often difficult to see, even on a clear VFR day.

1. Point out that while many radio towers are lighted and painted with high-visibility orange-and-white color bands, these structures are often stabilized with support wires that are not marked.
   a. The support wires extend outward from the main structure for some distance and are nearly invisible.
      i. Accordingly, it is essential that pilots operating in the vicinity of towers allow sufficient lateral spacing to ensure that a collision with support wires will not occur.
   b. A related hazard is that such towers are often topped with a radio antenna that extends above the tower's main structure.
      i. Like support wires, these antennas are not specially marked and are difficult to see.
      ii. You should therefore advise your students to avoid directly overflying towers

unless they are at a known safe altitude.

2. Inform your students that the FAA operates several tethered radar balloons in the southern United States as a means of increasing low-level radar coverage up to 200 NM offshore and beyond the border with Mexico. The system's primary function is to aid drug interdiction missions by allowing early detection of inbound aircraft operating at low altitudes.
   a. Explain that these balloons, which operate at an altitude of 15,000 ft. MSL, are tethered to the ground by unmarked cables that are almost impossible to see from any significant distance.
      i. In addition, the balloons themselves, while quite large, are not lighted or marked and may be difficult to see at night or in conditions of reduced visibility.
   b. Tethered balloons therefore present a significant hazard to flight for any aircraft operating at or (especially) below their altitude.
      i. Restricted areas have been designated for each radar balloon in order to alert pilots of the hazard.
      ii. If your airport is located in the vicinity of a tethered radar balloon, be sure to point out the restricted area to your students and discuss the hazards with them.
         - Emphasize that the best procedure to avoid a collision with the cable is to remain clear of the associated restricted area.

III. **CFIT accidents in marginal VFR conditions or developing IFR conditions** typically involve pilots operating under VFR in conditions where VFR flight is inappropriate. Their causes include the following:

A. **Scud running:** Remind your students that scud running is the hazardous and often illegal practice of attempting to maintain visual contact with the terrain while instrument conditions exist by operating dangerously close to the clouds and/or ground.

1. Pilots typically scud-run when
   a. Low ceilings force them down in order to remain out of the cloud bases, and/or
   b. Poor visibility makes the horizon and landmarks difficult to detect from a higher altitude.
2. Explain that while the legal minimum VFR visibility and cloud clearance requirements vary depending on airspace and altitude, the most common VFR weather minimums below 10,000 ft. are 3 SM visibility and a 1,000-ft. ceiling.
   a. For the sake of this discussion, weather conditions below these minimums can be regarded as IFR conditions.
3. Impress upon your students that scud running is extremely hazardous and should not be regarded as a "normal" operation.
   a. Emphasize that most situations that require scud running as an "abnormal" operation (e.g., a VFR pilot trapped by rapidly-deteriorating weather) can be avoided by obtaining a complete weather briefing before beginning a flight.
      i. If the briefing indicates that beginning a VFR flight would be unwise, the flight should be postponed or conducted under IFR (if possible).
      ii. Under NO circumstances is it appropriate to depart on a flight with the intention of scud running.
4. Point out that operating beneath low ceilings (i.e., below 1,000 ft. AGL) creates several hazards.
   a. The airplane may be beneath the height of nearby obstacles or terrain.
   b. Even if the surface visibility is good, the pilot will not be able to see as far ahead of the

airplane due to the low altitude, allowing less time to see and avoid obstacles.

c. Climbing to avoid an obstacle or rising terrain that appears suddenly may not be an option if the airplane is operating close to the cloud bases.

i. Climbing will cause the airplane to enter the clouds, possibly leading to spatial disorientation and loss of control.

ii. Even if the pilot were able to maintain control of the airplane after entering the clouds, there would be no guarantee of terrain/obstruction avoidance because (s)he would not be able to see where to go.

5. Operating close to the ground under low-visibility conditions exposes a pilot to most of the hazards listed in item III.A.4., with the possible exception that climbing to avoid obstacles or terrain may be an option.

a. However, point out that spatial disorientation and loss of control could still result due to the loss of the natural horizon in the climb.

B. **Continued VFR flight into IMC:** Remind your students that continued VFR flight into IMC occurs when a pilot presses on under VFR despite worsening weather conditions. Point out that scud running is a common predecessor to VFR flight into IMC.

1. Inform your students that continued VFR flight into IMC is very hazardous to both instrument-rated and non-instrument-rated pilots.

a. The hazards of VFR flight into IMC include spatial disorientation and loss of control, loss of situational awareness, midair collision with an IFR aircraft, and collision with unseen terrain or obstacles.

b. Emphasize that instrument-rated pilots are not immune to these hazards because they will not be properly prepared to conduct an IFR flight.

i. Safely conducting an IFR flight requires the pilot to have filed an IFR flight plan. The pilot must also be in contact with ATC, and should have the appropriate charts.

IV. **CFIT accidents in IFR conditions** are the accidents that usually come to mind when discussing controlled flight into terrain. These accidents typically involve flight inside clouds immediately preceding the collision with terrain or obstacles. While CFIT accidents in IFR conditions can occur during any phase of the flight, this discussion will focus on accidents occurring during the approach phase. Their causes include the following:

A. **Incorrectly-performed instrument approach procedures (IAPs):** You must impress upon your students that the nature of most IAPs, particularly the non-precision variety, makes them very unforgiving of pilot oversights during the preparation for and execution of the approach.

1. Emphasize that a careful cross-check of the approach chart against the instrument indications is absolutely necessary to alert the pilot to any error in his/her performance.

2. The following are some examples of errors in the performance of an IAP that could lead to a CFIT accident:

a. **Performing an approach with an incorrect altimeter setting** could cause the pilot to unintentionally descend below applicable minimum altitudes for the approach, possibly resulting in a collision with terrain or obstacles.

i. EXAMPLE: If a controller informs a pilot that the altimeter setting at his/her destination airport is “three zero one one (30.11" Hg),” but the pilot misunderstands the controller and thinks that (s)he hears “three zero four one (30.41" Hg),” his/her altimeter will indicate approximately 300 ft. higher than the airplane’s actual altitude if the erroneous setting is used.

- Therefore, if the pilot conducts the approach with an altimeter setting of 30.41" Hg, his/her airplane will be approximately 300 ft. lower than the indicated altitude at all times.

ii. Point out that it is possible to cross check the altimeter indications against the appropriate reference altitude for an on-glide slope indication at the outer marker for most ILS approaches.

- o Some ILS approaches and most non-precision approaches, however, have NO way to verify the altimeter's indications.
- o Therefore, while it is not common practice to read back all altimeter settings provided by ATC, you may wish to suggest that your students read back any altimeter settings provided when anticipating an instrument approach and nearing the terminal area.

b. **Misreading or misunderstanding IAP charts** can lead to hazardous errors such as descending to the wrong altitude, descending to a lower altitude prior to reaching the appropriate fix, setting the wrong radial or approach course into the OBS, tracking the wrong NDB bearing, or incorrectly defining an intersection.

i. You must emphasize the importance of carefully verifying each item on an IAP before performing the procedure. Rushed preparations for an approach, particularly a non-precision approach, invite mistakes.

- o EXAMPLE: The final approach fix for a localizer approach to Runway 27 is the intersection of the localizer and the 001 radial of a VOR that is almost due south of the airport. A pilot might misread the approach chart and set the 010 radial into the OBS as the cross-radial used to identify the intersection.
  - ■ As a result, the pilot will begin descent to the MDA too early,possibly resulting in a CFIT accident.

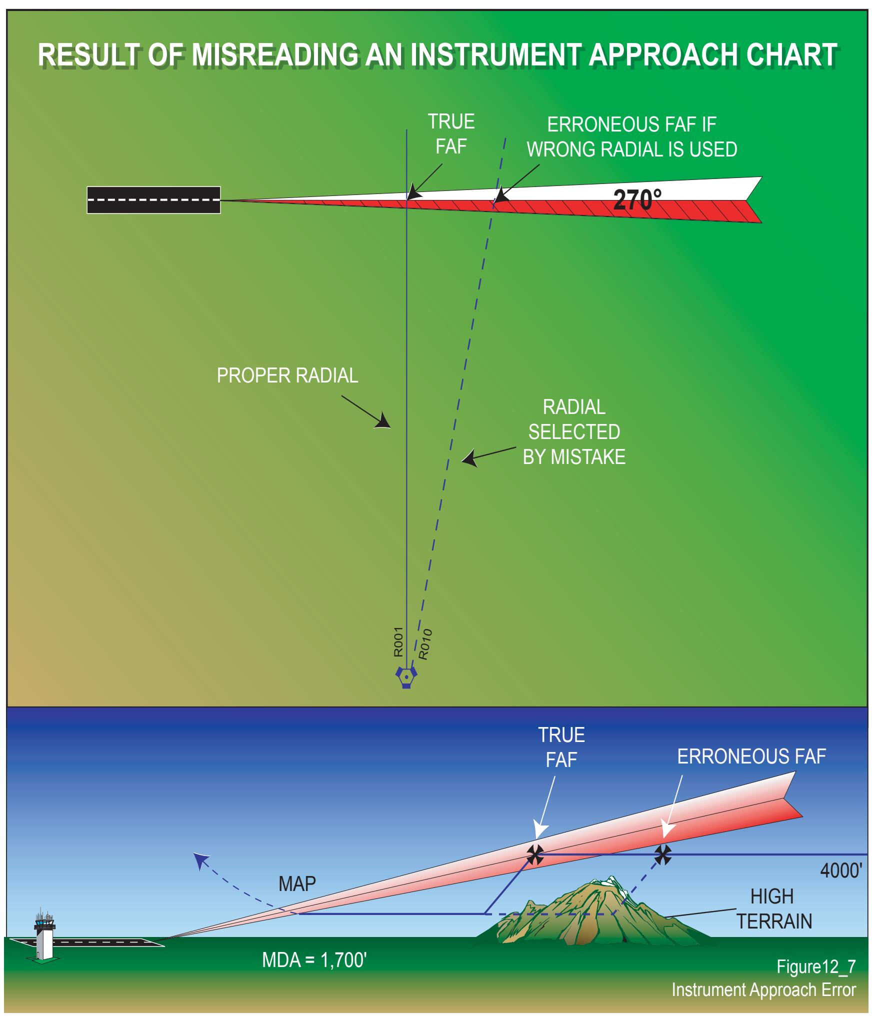


Figure12_7
Instrument Approach Error

ii. Ensure that your students have an adequate working knowledge of IAP charts by quizzing them on several different types of approaches in your area.

- Beginning at a specific altitude and a specific location on the chart, create different scenarios and ask your students to explain everything that would take place during the approach from the airplane's initial location through the completion of the missed approach procedure.
- Such quizzing is the best way to identify and correct misconceptions that your students may have regarding the "what, where, when, how, and why" of performing an instrument approach.

c. **Misreading or misunderstanding instrument indications** can cause a pilot to maintain the wrong altitude, turn to the wrong heading, make improper corrections to track a bearing or radial, etc.

i. You must ensure that your students fully understand the indications of each flight instrument in order to avoid a CFIT event involving instrument misinterpretation.

ii. The following flight instruments are particularly prone to misinterpretation, so your student's knowledge of them should be carefully evaluated during training:

- **The magnetic compass** can be misinterpreted due to magnetic dip errors, compass card oscillation in turbulence, and the "backwards" relationship between actual headings and headings indicated on the compass.
- **The three-pointer altimeter** can easily be misinterpreted by hundreds or thousands of feet if a pilot glances quickly at the instrument.
- **The VOR instrument** can be misinterpreted or misused in several ways, including using an OBS setting that yields reverse sensing; not being aware of reverse sensing during a back course approach; and misunderstanding the relationship between the CDI, the OBS selection, the airplane's heading, and the TO/FROM indicator.
- **The horizontal situation indicator (HSI)** can be misused by failing to use a proper OBS setting for ILS, localizer, and back-course approaches, possibly leading to reverse sensing. The instrument is also prone to misinterpretation by pilots who are not familiar with its use.
- **The ADF instrument** can be confusing to pilots who are inexperienced with the ADF or who are not current with its use. Pilots frequently misinterpret their aircraft's location relative to the desired bearing, their orientation relative to the station, and the relationship between the aircraft's heading and its location relative to the NDB.

d. **Failure to monitor navigation instruments for indications of failure or loss of signal** could result in a CFIT accident if the failure or signal loss occurs at a critical phase of the approach.

i. Point out that the cockpit displays of VOR and ILS/localizer receivers fail with an "on-course" indication; i.e., with the course deviation indicator and glide slope needles centered.

- Typically, the only indication that a loss-of-signal has occurred is the presence of one or two small flags on the face of the instrument.
  - These flags are usually orange or red in color, but the loss-of-signal indication may be as subtle as the disappearance of a normal TO/FROM indication.
- Explain that a pilot's failure to notice the appearance of VOR/ILS warning flags after becoming established on a segment of the approach means that (s)he might think that the airplane is "staying right on course" when all navigation guidance has been lost.

ii. If an NDB stops providing a reliable signal, the ADF needle will simply remain in the last position in which a usable signal was received.

- o ADFs do not display flags to warn the pilot of unreliable instrument indications.
  - ■ The only way to ensure that an ADF's indications are reliable is to continually monitor the station identification over the speaker or headset.
- o Point out that if an ADF receiver failure or loss-of-signal occurs after the pilot has become established on a segment of the approach, (s)he may not realize that the instrument is no longer reliable because the ADF needle will not move from the "on-course" indication as the result of a failure.
  - ■ As a result, the pilot may continue the approach with no navigation guidance at all, possibly waiting for an instrument indication that will never come (e.g., station passage) before taking further action (e.g., executing a missed approach procedure).

e. **Improper operation of navigation equipment or audio panels** can cause a pilot to believe that the navigation facility on which an approach is based has been tuned and is ready for use when it is not.

i. Explain that many newer navigation receivers have two frequency displays one for the "active" or "in use" frequency, and one for a "standby" or "next up" frequency. A button is used to "flip-flop" back and forth between the standby and active frequencies.

- o Inform your students that frequency changes for this type of receiver are typically made by using knobs to change the digits of the standby frequency, and then using the flip-flop button to move the new frequency into the active display.
- o If a pilot simply tunes the new frequency in the standby display without moving it to the active frequency display, the navigation receiver will not be tuned to the desired facility.
  - ■ Instead, it will be tuned to the previously-selected facility. If this facility is no longer within reception range, the pilot should detect the problem when no usable information appears on the navigation display. If, however, the facility IS still in range, the pilot may attempt to conduct the approach relative to the wrong facility, possibly leading to a CFIT event.

ii. Another source of potential confusion is the presence of multiple VOR receivers in most IFR-certified aircraft.

- o A pilot may have properly tuned and identified a station on the No. 1 VOR receiver, but attempt to navigate using the No. 2 VOR display.
  - ■ Unless the No. 2 VOR receiver is tuned to the same station as the No. 1 receiver, the pilot will not be able to navigate relative to the proper facility.
- o You must ensure that your students understand which VOR display corresponds to each receiver.

iii. Many pilots do not take the time necessary to FULLY understand the functions of the communication radios, navigation radios, and audio panel of their airplanes.

- o Confusion about the operation of any of these critical devices could lead to a CFIT accident.

B. **Effects of fatigue and distractions on pilot performance**: Remind your students that instrument flying is an activity that requires a pilot's complete attention in order to minimize risks and maximize safety.

1. Many CFIT accidents have been shown to be the result of operational errors on the part of the crew, mostly of the type discussed in item d. on page 20 that occurred as a result of fatigue or distractions.
2. Impress upon your students that safely conducting an instrument approach requires that the pilot maintain a rapid cross-check of the flight instruments, both against one another and against the approach chart.
   a. A rapid cross-check of the instruments against one another is essential in order to maintain precise control of the airplane when close to terrain.
   b. A rapid cross-check of the instruments against the approach chart is essential in order to detect discrepancies in the pilot's performance of the approach procedure.
3. Fatigue and distractions can significantly impede a pilot's ability to cross-check all of the items that are required to safely conduct an instrument approach.
   a. Emphasize, therefore, that your students should not attempt to operate under IFR unless they are confident that they can operate at "one hundred percent."

C. **Non-stabilized approaches**: Inform your students that CFIT accidents sometimes occur when a pilot who is conducting a non-precision approach allows the airplane to develop a very high sink rate while close to the ground.

1. Explain that pilots typically allow high sink rates to develop because a lack of planning causes them to run out of room in which to lose altitude at a reasonable rate.
   a. As a result, the descent becomes rushed as the pilot attempts to lose hundreds or thousands of feet in a relatively short distance.
   b. The pilot must use a high rate of descent to reach the target altitude in the space available.
2. Emphasize that establishing a stabilized approach is not a practice that is reserved for ILS approaches. The use of a stabilized approach is recommended whenever possible.
   a. A stabilized approach is an approach that is conducted at a constant airspeed and along a constant glide path.
      i. Such an approach offers greater control by requiring minimal power and attitude changes in order to establish and recover from the descent.
      ii. A stabilized approach also requires a minimal rate of descent to descend from the initial altitude to the target altitude or runway.
   b. Explain that, to use a stabilized approach while conducting a non-precision instrument approach, some simple calculations are required in order to determine the necessary rate of descent.
      i. EXAMPLE: If the distance between the final approach fix and the missed approach point is 6 NM and the airplane's ground speed is 120 kt., the airplane will cover the distance in 3 min.
         - However, because the design of most non-precision approach procedures places the missed approach point near the approach end of the runway, it is desirable to reach the MDA 1-2 NM prior to the missed approach point in order to allow sufficient room to complete the descent to a landing.
            - Accordingly, reduce the distance in which to complete the descent from 6 NM to 4 NM. At a ground speed of 120 kt., the airplane will cover this distance in 2 min.

- o If the airplane must descend from 1,500 ft. MSL to 500 ft. MSL (a change of 1,000 ft.) in 2 min., a descent rate of 500 fpm is required in order to reach the target altitude at a point that would allow sufficient room to continue the descent from the MDA to a normal landing.

c. Tell your students that some pilots like to use a “minute-to-live” rule when performing non-precision approaches, in which the airplane’s rate of descent is never allowed to exceed its height above the terrain.

  i. EXAMPLE: Passing through 1,000 ft. AGL, the maximum permissible descent rate is no more than 1,000 fpm; passing through 800 ft. AGL, the maximum permissible descent rate is no more than 800 fpm, etc.

  ii. Adherence to such a rule will prevent the development of an unrecoverable sink rate near the ground.

GLEIM FLIGHT INSTRUCTOR REFRESHER COURSE
LESSON 13
FLIGHT INFORMATION PUBLICATIONS 2

13.1 FAA ADVISORY CIRCULAR (AC)

I. The FAA issues advisory circulars (ACs) to provide a systematic method of distributing nonregulatory information that is of interest to the aviation public.

A. Advise your students that, unless incorporated into a regulation by reference, the contents of an AC are not binding (i.e., they are only advisory in nature).

B. Explain that an AC is issued to provide guidance and information in its designated subject area or to show a method acceptable to the FAA for complying with a related regulation.

II. Point out to your students that ACs are issued using a numbered system of general subject matter areas that correspond to the subject areas in Title 14 of the Code of Federal Regulations (14 CFR).

A. The general subject numbers and the subject areas are as follows:

00-- General
10-- Procedural Rules
20-- Aircraft
60-- Airmen
70-- Airspace
90-- Air Traffic and General Operating Rules
120-- Air Carriers, Air Travel Clubs, and Operators for Compensation or Hire: Certification and Operations
140-- Schools and Other Certificated Agencies
150-- Airport Noise Compatibility Planning
170-- Navigational Facilities
180-- Administrative Regulations
190-- Withholding Security Information
210-- Flight Information (NOTE: This series is about aeronautical charts and does not relate to a part of the regulations.)

III. ACs are frequently revised by the FAA. As an instructor, it is important for you to be aware of the most current ACs that affect your flight training activities.

A. The FAA provides a free list of all current ACs called the *Advisory Circular Checklist*, AC 00-2. Use the order form on page 2 to request a copy.

B. If no price is listed after the AC, it is free.

C. If a price is listed after the AC description, the AC is sold by the Superintendent of Documents, U.S. Government Printing Office. When “(Sub.)” is included with the price, the AC is available on a subscription basis only. This means that supplements or changes to the basic document will be sent to you at no additional charge until the subscription expires.

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13.2 AERONAUTICAL INFORMATION MANUAL (AIM)

I. The *Aeronautical Information Manual* (*AIM*) provides pilots with a vast amount of basic flight information and explanations of ATC procedures that are used in the U.S. National Airspace System (NAS).

A. Explain to your students that this information is vital to their understanding of the structure and operation of the ATC system and their role within it.

II. Your students should be aware that the *AIM* is also a reference that contains items of general interest to all pilots.

A. These items include

1. Health and medical facts
2. Factors affecting flight safety
3. Pilot/controller glossary of terms used in the ATC system
4. Information on safety, accident, and hazard reporting

B. Accordingly, your students should familiarize themselves with the contents of the *AIM* during their training, both for the purpose of initially learning the material and for later use of the documentas a reference book.

III. Explain that the *AIM* has a comprehensive and useful index to help your students find topics of interest.

IV. Your students should be aware that, like most FAA publications, the *AIM* is updated periodically. The *AIM* is published as a basic manual every 24 months, with page changes issued approximately every 170 days by the FAA.

A. A basic manual with scheduled page changes for an indeterminate period is available from the Government Printing Office at (202) 512-1806 for $74. MasterCard, VISA, and Discover are accepted.

V. ***AIM* Chapters and Section Titles**

A. **CHAPTER 1. NAVIGATION AIDS**

Section 1. Air Navigation Radio Aids
Section 2. Radar Services and Procedures

B. **CHAPTER 2. AERONAUTICAL LIGHTING AND OTHER AIRPORT VISUAL AIDS**

Section 1. Airport Lighting Aids
Section 2. Air Navigation and Outstanding Lighting
Section 3. Airport Marking Aids and Signs

C. **CHAPTER 3. AIRSPACE**

Section 1. General
Section 2. Controlled Airspace
Section 3. Class G Airspace
Section 4. Special Use Airspace
Section 5. Other Airspace Areas

D. **CHAPTER 4. AIR TRAFFIC CONTROL**

Section 1. Services Available to Pilots
Section 2. Radio Communications Phraseology and Techniques
Section 3. Airport Operations
Section 4. ATC Clearances/Separations

E. **CHAPTER 5. AIR TRAFFIC PROCEDURES**
- Section 1. Preflight
- Section 2. Departure Procedures
- Section 3. En Route Procedures
- Section 4. Arrival Procedures
- Section 5. Pilot/Controller Roles and Responsibilities
- Section 6. National Security and Interception Procedures

F. **CHAPTER 6. EMERGENCY PROCEDURES**
- Section 1. General
- Section 2. Emergency Services Available to Pilots
- Section 3. Distress and Urgency Procedures
- Section 4. Two-Way Radio Communications Failure

G. **CHAPTER 7. SAFETY OF FLIGHT**
- Section 1. Meteorology
- Section 2. Altimeter Setting Procedures
- Section 3. Wake Turbulence
- Section 4. Bird Hazards and Flight over National Refuges, Parks, and Forests
- Section 5. Potential Flight Hazards
- Section 6. Safety, Accident, and Hazard Reports

H. **CHAPTER 8. MEDICAL FACTS FOR PILOTS**
- Section 1. Fitness for Flight

I. **CHAPTER 9. AERONAUTICAL CHARTS AND RELATED PUBLICATIONS**
- Section 1. Types of Charts Available

J. **APPENDICES**
- Appendix 1. Bird Strike Incident/Ingestion Report
- Appendix 2. Volcanic Activity Reporting Form (VAR)

K. **PILOT/CONTROLLER GLOSSARY**

L. **INDEX**

13.3 NOTICE TO AIRMEN (NOTAM) SYSTEM

I. The National Notice to Airmen (NOTAM) System disseminates time-critical aeronautical information that either is of a temporary nature or is not sufficiently known in advance to permit publication on aeronautical charts or in other operational publications.

A. Emphasize to your students that NOTAM information is aeronautical information that could affect their decision to make a flight.

II. Explain that NOTAM information is classified into three categories.

A. NOTAM (D), or distant NOTAM, includes information such as airport or primary runway closures; changes in the status of navigational aids, ILSs, and radar service availability; and other information essential to planned en route, terminal, or landing operations.

1. This information is disseminated for all navigational facilities that are part of the National Airspace System (NAS), public-use airports, seaplane bases, and heliports listed in the *Airport/Facility Directory* (*A/FD*).
2. The complete file of all NOTAM (D) information is maintained in a computer database at the Weather Message Switching Center (WMSC), located in Atlanta, Georgia.

3. Explain that NOTAM (D) information is distributed to air traffic facilities, primarily flight service stations (FSSs), automatically via Service A (weather) communications systems.
   a. Your students should know that NOTAM (D) information is obtained from a standard pilot briefing, and that these NOTAMs are available to the briefer for the proposed route.
   b. Direct User Access Terminal System (DUATS) vendors will also provide NOTAM (D) information that is available from the WMSC.
4. EXAMPLE: **TLH 04/009 TLH 9-27 CLSD TIL 07182359** means that this NOTAM is part of the Tallahassee Regional (TLH) NOTAM file and is the ninth NOTAM of the fourth month. The NOTAM states that TLH runway 9-27 is closed until July 18 (0718) at 2359Z.
5. Tell your students that NOTAM (D) information will remain available from the WMSC for the duration of its validity or until it is published.
   a. Once published, the NOTAM is deleted from the computer database.

B. NOTAM (L), or local NOTAM, includes information such as taxiway closures, personnel and equipment near or crossing runways, airport rotating beacon outages, and airport lighting that does not affect instrument approach procedure (IAP) criteria (e.g., VASI).

1. Explain to your students that the information contained in these NOTAMs is not generally considered critical to long-distance flight planning; e.g., few pilots would cancel a cross-country flight due to an inoperative airport beacon.
2. Accordingly, a separate file of local NOTAMs is maintained at each FSS for only the facilities in its area.
   a. NOTAM (L) information for other FSS areas must be specifically requested directly from the FSS that has responsibility for the airport concerned.
   b. Since NOTAM (L) information is only distributed locally, it is not available at other FSSs via the weather communication system.
3. Direct User Access Terminal System (DUATS) vendors are not required to provide NOTAM (L) information.

C. A **Flight Data Center (FDC) NOTAM** is regulatory in nature and includes information such as amendments to published IAPs and other current aeronautical charts.

1. FDC NOTAMs are also used to advertise **temporary flight restrictions** caused by natural disasters, large-scale public events, or other phenomena that may generate a congestion of air traffic over a site.
   a. Emphasize to your students that temporary flight restrictions in the vicinity of potentially vulnerable sites have become common following the terrorist acts of September 11, 2001. These flight restrictions frequently appear with little advance notice.
   b. Accordingly, it is essential that pilots obtain a preflight briefing prior to every flight.
2. Explain to your students that FSSs are responsible for maintaining a file of current, unpublished FDC NOTAMs concerning conditions within 400 NM of their facilities.
   a. Explain that FDC information that concerns conditions beyond 400 NM from the FSS or that is already published will be provided only when requested.
3. DUATS vendors will provide FDC NOTAMs only upon site-specific requests using a location identifier.

III. ***The Notices to Airmen Publication*** (***NTAP***) is issued every 28 days and is an integral part of the NOTAM System. Once a NOTAM is published in the NTAP, the NOTAM is not provided during pilot weather briefings unless specifically requested.

A. Explain that the *NTAP* consists of two sections.

1. The first section contains NOTAMs (D) that are expected to remain in effect for an extended period and FDC NOTAMs that are current at the time of publication.

a. Occasionally, some NOTAMs (L) and other unique information are included in this section when they will contribute to flight safety.

2. The second section contains special notices that either are too long to be integrated into the first section or that concern a wide or unspecified geographic area.

B. Inform your students that the number of the latest FDC NOTAM included in the *NTAP* is noted on the first page to assist them in updating the listing with any FDC NOTAMs that may have been issued between the cut-off date and the date the publication is received.

1. All information contained in the *NTAP* will be carried until the information expires, is canceled, or, in the case of permanent conditions, is published in other publications (e.g.,*A/FD*, aeronautical charts, etc.).

C. All new NOTAMs entered, excluding FDC NOTAMs, will be published only if the information is expected to remain in effect for at least 7 days after the effective date of the *NTAP*.

IV. NOTAM information is not available from a Supplemental Weather Service Location (SWSL).

A. An SWSL is an airport facility staffed with contract personnel who take weather observations and provide current local weather to pilots via telephone or radio.

B. An SWSL is not a flight service station (FSS).

V. The *NTAP* is available through subscription from the Government Printing Office at a cost of $208 per year.

13.4 THE FAA'S FLIGHT INFORMATION PUBLICATION POLICY

I. The following is, in essence, the statement issued by the FAA Administrator and published in the December 10, 1964 issue of the Federal Register, concerning the FAA policy pertaining to the kind of information that will be published as NOTAMs and in the *AIM*.

A. It is a pilot's inherent responsibility to be alert at all times for, and in anticipation of, all circumstances, situations, and conditions affecting the safe operation of the aircraft.

1. For example, a pilot should expect to find air traffic at any time or place.

2. At or near both civil and military airports and in the vicinity of known training areas, a pilot should expect concentrated air traffic and understand that concentrations of air traffic are not limited to these places.

B. It is the general practice of the FAA to advertise by NOTAM or other flight information publications any information it may deem appropriate; information that the agency may make available to pilots from time to time is solely for the purpose of assisting them in executing their regulatory responsibilities.

1. Such information serves the aviation community as a whole and not pilots individually.

C. The fact that the FAA under one particular situation or another may or may not furnish information does not serve as a precedent of the FAA's responsibility to the aviation community; neither does it give assurance that other information of the same or a similar nature will be advertised, nor does it guarantee that any and all information known to the agency will be advertised.

D. The *AIM*, while not regulatory, provides information that reflects examples of operating techniques and procedures that may be requirements in other federal publications or regulations.

1. It is made available solely to assist pilots in executing their responsibilities required by other publications.

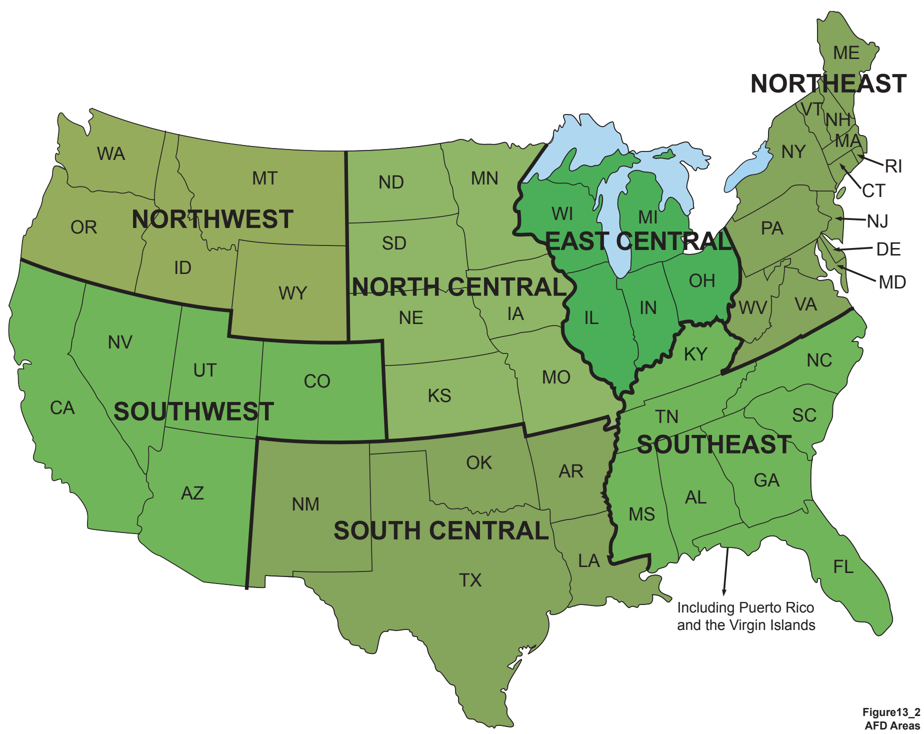
II. Consistent with the above, the policy of the FAA shall be to furnish information only when, in the opinion of the FAA, a unique situation should be advertised and not to furnish routine information such as concentrations of air traffic, either civil or military.

A. The *AIM* will not contain informative items concerning everyday circumstances that pilots should, either by good practices or regulation, expect to encounter or avoid.

13.5 AIRPORT/FACILITY DIRECTORY (A/FD)

I. The *Airport/Facility Directory (A/FD)* is a Civil Flight Information Publication published by the National Aeronautical Charting Office (NACO), a division of the FAA.

A. Your students should be aware that this directory is issued in seven volumes, each covering a specific geographic area of the conterminous U.S. (including Puerto Rico and the U.S. Virgin Islands), as shown below.



B. Inform your students that each volume of the *AF/D* is reissued in its entirety every 56 days.

C. Explain that each volume is indexed alphabetically by state, airport, navigational aid, and ATC facility for the area of coverage.

1. All pertinent information concerning each entry is included.

D. Subscriptions to the publication are for sale by the

FAA Distribution Division
AVN-530
National Aeronautical Charting Office
Riverdale, MD 20737-1199
Telephone: (800) 638-8972

II. Emphasize to your students that use of the *A/FD* is a vital part of cross-country flight planning, and that a copy should be aboard the airplane during the flight.

A. Explain that simply having an appropriate VFR sectional chart is insufficient for cross-country flight planning because the *A/FD* shows data that cannot be readily depicted in graphic form; e.g., airport hours of operations, types of fuel available, runway lengths, etc.

B. All pertinent information regarding airports, seaplane bases, and heliports open to the public; FSS contact information; communication frequencies; etc., is contained in this directory.

1. The *A/FD* also contains National Weather Service telephone numbers listed alphabetically by state.
2. The Aeronautical Chart Bulletin section contains a listing of major changes (e.g., new frequencies, obstructions, etc.) to each sectional, VFR terminal area, and helicopter route chart within each chart cycle.

III. **Table of Contents of the *A/FD***

1. Abbreviations
2. Legend, Airport/Facility Directory
3. Airport/Facility Directory
4. Heliports
5. Seaplane Bases
6. Notices
7. FAA and National Weather Service Telephone Numbers
8. Air Route Traffic Control Centers
9. Flight Service Station Communication Frequencies
10. FSDO (Flight Standards District Office) Addresses/Telephone Numbers
11. Preferred IFR Routes
12. VOR Receiver Check
13. Parachute Jumping Areas
14. Aeronautical Chart Bulletin
15. Tower En Route Control (TEC)
16. National Weather Service (NWS) Upper Air Observing Stations
17. En Route Flight Advisory Service (EFAS)

IV. **VOR Checkpoints**

A. Explain to your students that VOR checkpoints are one means of checking VOR receiver accuracy.

1. Using a VOR test facility (VOT) or performing a VOR cross-check are the other approved methods.

B. VOR receiver checkpoints are listed in a separate section of the *A/FD* as the excerpt below illustrates. They include

1. Facility (airport) name
2. Frequency and identification
3. Type of checkpoint: identified as ground (G) or airborne (A)
   a. Includes altitude if an airborne checkpoint
4. Checkpoint's magnetic direction from the VOR (i.e., radial)
5. Checkpoint's distance from the VOR in nautical miles (NM)
6. Checkpoint description

C. Example listing

KENTUCKY

VOR RECEIVER CHECKPOINTS

Facility Name (Arpt Name)	Freq/Ident	Type Checkpt. Gnd. AB/ALT	Azimuth from Fac. Mag	Dist. from Fac. N.M.	Checkpoint Description
Bowling Green-Warren Co..........................	117.9/BWG	G	023	2.2	On twy in front of Admin Bldg.
Central City (Muhlenberg Co).......................	109.8/CCT	A/2500	149	11.0	Over intersection of rwy 23 and central taxiway
Cincinnati (Greater Cincinnati).....................	117.3/CVG	G	045	2.5	On twy m E of twy B
Clarksville (Campbell AAF)..........................	110.6/CKV	G	298	5	On end of old rwy 36 near Maltese Cross
Clarksville (Hopkinsville-Christian Co)............	110.6/CKV	A/2000	345	13.5	Over hangar
Cunningham (Barkley)...............................	113.6/CNG	G	043	4.6	Intersection of taxiways and west corner of ramp
London (London-Corbin Arpt-Magee Fld).........	116.1/LOZ	G	034	3.8	On parking ramp taxiway entry

13.6 VFR NAVIGATION CHARTS

I. The National Aeronautical Charting Office (NACO), which is part of the FAA, publishes and sells civil aeronautical charts of the United States and its territories and possessions. Summarize the types of charts most commonly used under VFR for your students, including

  A. Sectional charts. The scale is 1:500,000 (1 in. = 6.86 NM).

    1. Explain that this chart is normally used for VFR navigation.

  B. VFR terminal area charts. The scale is 1:250,000 (1 in. = 3.43 NM).

    1. Explain that VFR terminal area charts are published for use in Class B areas. The information found on these charts is similar to that found on sectional charts, but is presented in greater detail due to the larger scale. The greater detail assists pilots in navigating in and around Class B airspace areas.
    2. Most of the sectional and VFR terminal area charts are revised semiannually.

  C. World aeronautical charts. The scale is 1:1,000,000 (1 in. = 13.7 NM).

    1. Explain that these charts are very similar to sectional charts except they cover larger areas so they have a smaller scale.
    2. These charts are generally revised annually.

II. Explain that sectional and VFR terminal area charts are designed for visual navigation by slow- and medium-speed aircraft.

  A. The topographical information featured on these charts portrays surface elevation levels and a great number of visual checkpoints that can be used for VFR flight.

    1. Checkpoints include populated places, lakes, rivers, roads, railroads, and other distinctive landmarks.
    2. Emphasize to your students that some items shown on VFR charts may not accurately depict reality due to various factors.

      a. EXAMPLE: The boundaries of lakes, rivers, and other bodies of water can vary significantly from what is shown on the chart due to drought, heavy rain, erosion, etc.

  B. Point out that the information shown on sectional charts includes visual and radio aids to navigation, airports, controlled airspace, restricted areas, obstructions, and related data.

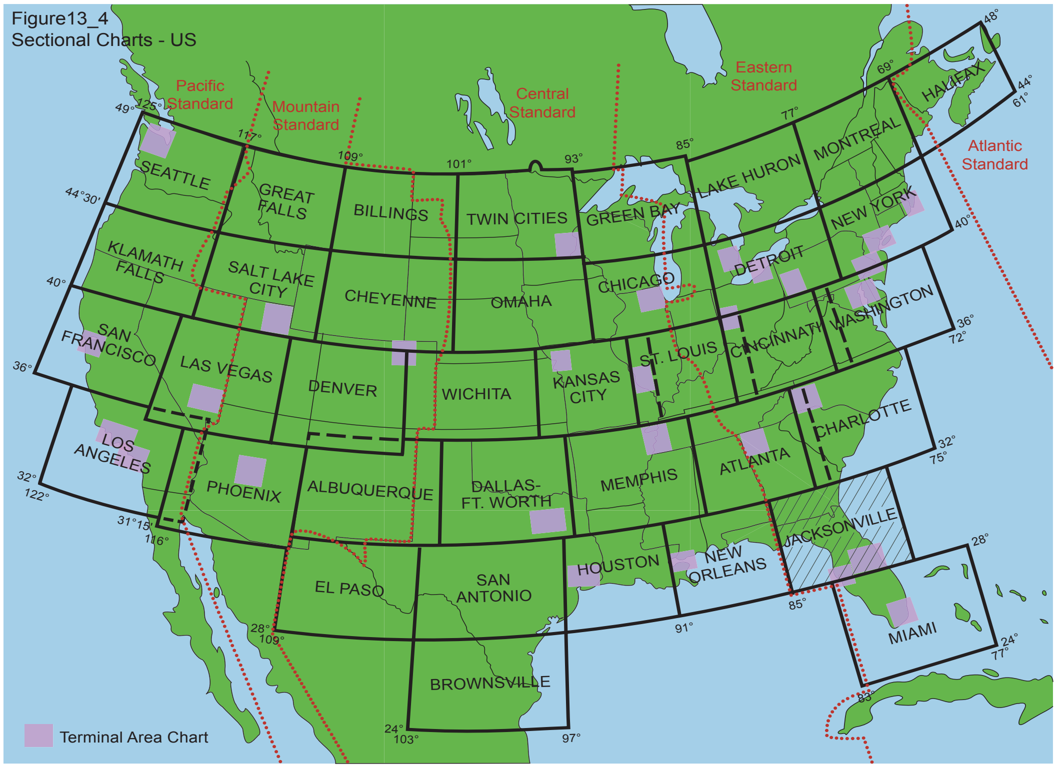
  C. On the back of selected VFR terminal area charts is a Charted VFR Flyway Planning Chart. The scale is the same as the terminal area chart.

    1. Explain that flyway planning charts depict flight paths and altitudes recommended for use to bypass high traffic areas.

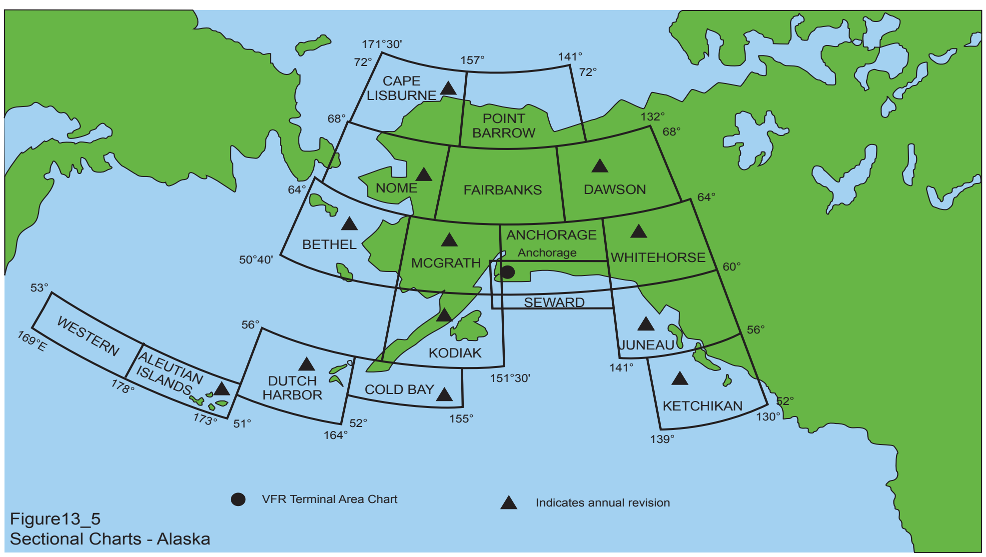
      a. Ground references are provided as a guide for visual orientation.

    2. Flyway planning charts are designed for use in conjunction with terminal area and sectional charts and are not to be used for navigation.

III. Each rectangle on the U.S. map (shown below) is an area covered by one sectional chart. A magenta square indicates a VFR terminal area chart.



Sectional and VFR Terminal Area Charts for the Conterminous U.S.



Sectional and VFR Terminal Area Charts for Alaska

IV. Explain that world aeronautical charts (WACs) are designed to provide a standard series of aeronautical charts, covering land areas of the world, at a size and scale convenient for navigation by moderate-speed aircraft.

A. Topographic information includes cities and towns, principal roads, railroads, distinctive landmarks, drainage, and relief.

1. Relief is shown by spot elevations, contours, and gradient tints.

B. Aeronautical information includes visual and radio aids to navigation, airports, airways, restricted areas, obstructions, and other pertinent data.

V. Emphasize that obsolete charts must be discarded and replaced by new editions. This is important because revisions in aeronautical information occur constantly.

A. These revisions include changes in radio frequencies, new obstructions, temporary or permanent closing of certain runways and airports, and other temporary or permanent hazards to flight.

B. Point out, however, that even current charts may have outdated information, so it is important to refer to the Aeronautical Chart Bulletin section of the *AF/D*, in addition to obtaining any FDC NOTAMs from an FSS briefer.

VI. Inform your students that VFR aeronautical charts are available from the National Aeronautical Charting Office on an individual or subscription basis. For information contact:

FAA Distribution Division
AVN-530
National Aeronautical Charting Office
Riverdale, MD 20737-1199
Telephone: (800) 638-8972 (from within U.S.)

A. Charts are also available at most FBOs and pilot supply stores.

13.7 AIRSPACE CLASSIFICATIONS AND CHART DEPICTIONS

I. Ensure that your students understand the following information about airspace depiction on VFR charts:

A. Class A airspace is not shown.

B. Class B airspace:

1. The lateral limits of Class B airspace are depicted by heavy blue lines on a sectional or terminal area chart.

   a. Explain that the vertical limits (i.e., floor and ceiling) of each sector of a Class B airspace area are shown in hundreds of feet MSL, separated by a horizontal line (see item A.2.c. below).

2. The boundaries of a 30-NM radius from the primary Class B airport, within which an altitude-reporting transponder (Mode C) is required regardless of aircraft altitude, is depicted for each Class B area by a thin magenta circle.

   a. Explain to your students that this "Mode C veil" is not technically a type of airspace.
   b. Rather, it is simply a ring on the chart that indicates the area within 30 NM of the primary Class B airport, and thus where a Mode C transponder is required.

3. Class B airspace is shown on the chart as in the example below.
    a. Class B vertical limits in this example are
        i. From the surface (SFC) to 10,000 ft. MSL (100) in the inner circle
        ii. From 3,000 ft. MSL (30) to 10,000 ft. MSL in the middle circle
        iii. From 5,000 ft. MSL (50) to 10,000 ft. MSL in the outer circle

CLASS B AIRSPACE

Figure 13_6
Class B Airspace

    b. Emphasize to your students that they may be within the lateral boundaries of Class B airspace while still remaining clear of the airspace by being below the floor of that particular airspace sector.

C. Class C airspace:

1. The lateral limits of Class C airspace are depicted by solid magenta lines on sectional and some terminal area charts.
    a. The vertical limits of each sector are shown in hundreds of feet MSL.
2. Class C airspace is shown on the chart as in the example below.
    a. Class C airspace vertical limits in the example extend
        i. From the surface (SFC) to 4,500 ft. MSL (45) in the surface area
        ii. From 1,700 ft. MSL (17) to 4,500 ft. MSL in the shelf area
    b. Remind your students that they may be within the lateral boundaries of Class C airspace while still remaining clear of the airspace by being below the floor or above the ceiling of that particular airspace sector.

CLASS C AIRSPACE

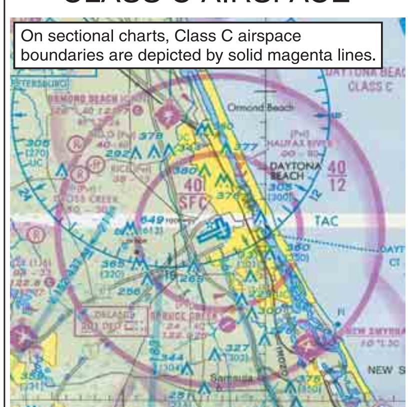


Figure 13_7
Class C Airspace

    c. The dashed magenta line in the example above shows an area of Class E airspace extending upward from the surface to the overlying Class C airspace.

D. Class D airspace

1. The lateral limits of Class D airspace are depicted by dashed blue lines on a sectional or terminal area chart.
    a. The ceiling is shown within the circle in hundreds of feet MSL.
2. Class D airspace is shown on the chart as in the example below.
    a. The ceilings of Class D airspace in the examples are 2,600 ft. MSL.
    b. Again, remind your students that they may be within the lateral boundaries of Class D airspace while still remaining clear of the airspace by being above the ceiling.
    c. On sectional charts, a dashed magenta line (see right side of the example below) illustrates an area of Class E airspace extending upward from the surface.

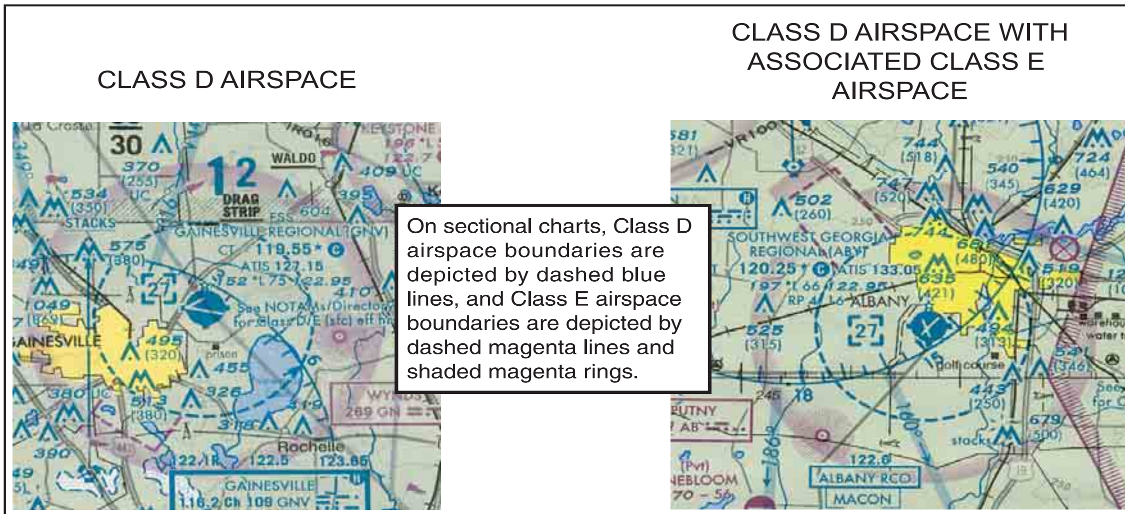


Figure 13_8
Class D Airspace

E. Class E airspace

1. A dashed magenta line around an airport indicates Class E airspace extending upward from the surface to the base of the overlying airspace (often Class A airspace).

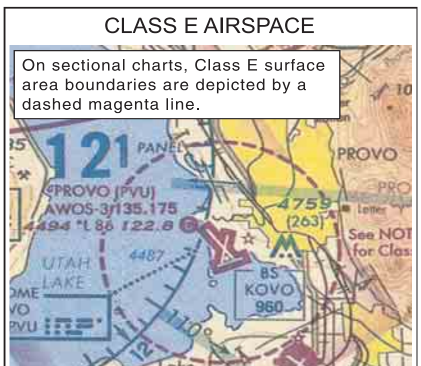


Figure13_9
Class E Airspace - 1

2. A light magenta-shaded line indicates Class E airspace extending upward from 700 ft. AGL to the base of the overlying airspace.

CLASS E AIRSPACE
(700 ft. AGL and above.)

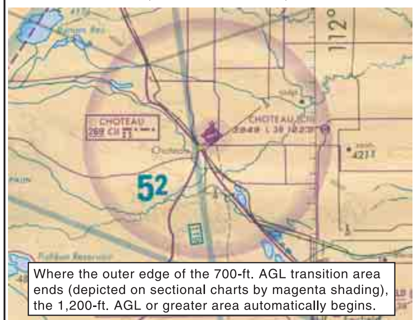


Figure13_10
Class E Airspace - 2

3. The symbol shown below indicates Class E airspace extending upward from the indicated altitude to the base of the overlying airspace. On sectional charts, it is illustrated in blue.

CLASS E AIRSPACE

Figure13_11
Class E Airspace - 3

F. Class G airspace

1. Explain to your students that Class G airspace is not indicated by special chart symbols. Rather, Class G airspace is understood to exist in those areas that are not shown by chart symbols to be other airspace classes.
2. For example, Class G airspace that extends upward to the floor of Class E airspace beginning at 14,500 ft. MSL is indirectly depicted by the distinct side of a light blue-shaded line on a sectional or terminal area chart, as shown below.
   a. Note that Class E airspace begins at 1,200 ft. AGL or higher on the fuzzy side of the blue line.

CLASS G AIRSPACE

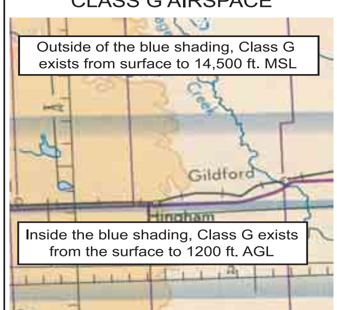


Figure13_12
Class G Airspace

3. Class G airspace that underlies Class B, C, D, or E airspace is implied -- it is not directly indicated on the chart.

13.8 IFR NAVIGATION CHARTS

I. IFR Enroute Low Altitude Charts

A. Explain that enroute low altitude charts provide aeronautical information for navigation under IFR conditions below 18,000 ft. MSL. There are 28 charts that cover the conterminous U.S. These charts are revised every 56 days.

1. IFR low altitude enroute charts depict airways, controlled airspace boundaries, NAVAIDs, airports, minimum operating altitudes, airway distances, reporting points, special-use airspace, and military training routes.

B. Tell your students that the scale of IFR enroute low altitude charts varies from 1 inch = 5 NM to 1 inch = 20 NM, and that they will need a special IFR plotter because VFR plotters do not have appropriate scales for IFR charts.

C. IFR Area Charts supplement low altitude enroute charts by depicting congested terminal areas at a large scale.

II. IFR Enroute High Altitude Charts

A. Explain that enroute high altitude charts are designed for navigation at or above 18,000 ft. MSL. There are 6 charts that cover the conterminous U.S. These charts are revised every 56 days.

1. IFR high altitude enroute charts depict jet routes, NAVAIDs, selected airports, and reporting points.

B. Inform your students that, like the low altitude charts, IFR high altitude enroute charts use more than one scale.

III. U.S. Terminal Procedures Publication (TPP)

A. TPPs are used for navigation in terminal areas. TPPs are published in 20 loose-leaf or bound volumes that cover the conterminous U.S., Puerto Rico, and the Virgin Islands.

B. Explain that the TPPs include the following types of charts:

1. Instrument Approach Procedure (IAP) charts

   a. These charts portray the aeronautical data that is required to execute instrument approaches to airports, including the IAP, related navigation data, communications information, and an airport sketch.

2. Instrument Departure Procedure (DP) charts

   a. These charts are designed to expedite clearance delivery and to facilitate transition between takeoff and enroute operations.

   b. Departure routing clearance information is presented in graphic and textual form.

3. Standard Terminal Arrival (STAR) charts

   a. These charts are designed to expedite ATC arrival procedures and to facilitate transition between enroute and instrument approach operations.

   b. STARs depict preplanned IFR ATC arrival procedures in graphic and textual form.

   c. Point out to your students that each STAR procedure may serve multiple airports in a given area.

4. Airport Diagrams

   a. These full-page diagrams of the airport layout depict runways, taxiways, and ramp areas.

   b. Airport diagrams are designed to assist in the movement of ground traffic at locations with complex runway/taxiway configurations.

C. Inform your students that IFR aeronautical charts are available from the National Aeronautical Charting Office (NACO) on an individual or subscription basis, as well as most FBOs and pilot shops.

1. Contact information for the NACO is listed in Module 13.6, item F.

IV. Impress on your students that it is absolutely critical to discard obsolete IFR charts and replace them with new editions.

A. The presence of a new obstacle or a relocated NAVAID could make the use of old charts for IFR operations potentially deadly.

B. Remind your students, however, that even current charts may contain outdated information, so it is important to refer to the Aeronautical Chart Bulletin section of the *AF/D*, in addition to obtaining any FDC NOTAMs from an FSS briefer.

13.9 IFR CHART SYMBOLS

I. Ensure that your instrument students are familiar with the following IFR chart symbols (NACO charts only):

A. IFR Enroute Low Altitude charts

1. Airports, seaplane bases, and heliports are depicted on low altitude en route charts using the following standard symbols:

Figure13_13
Airport Symbols

a. Explain that airports shown in blue or green have a published IAP, while those shown in brown do not.

b. The distinction between blue and green airports is only of interest to military pilots.

2. The following information is contained in the airport information block:

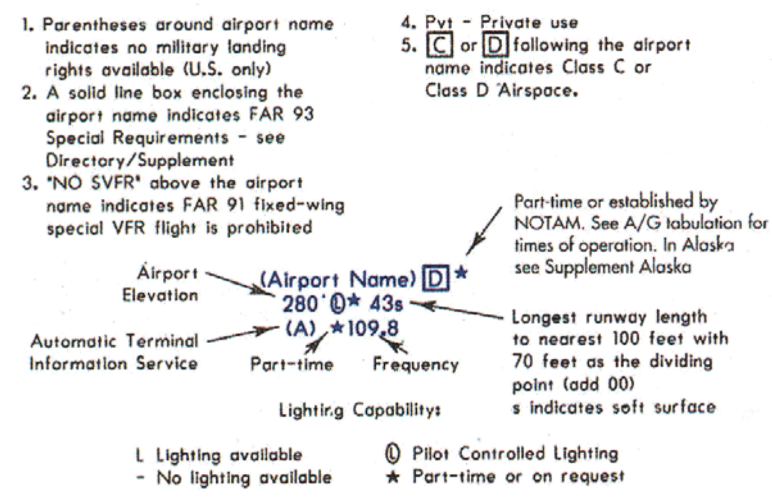


Figure13_14
Airport Name Key

3. NAVAIDs, their frequencies, and associated information are shown using the following symbols:

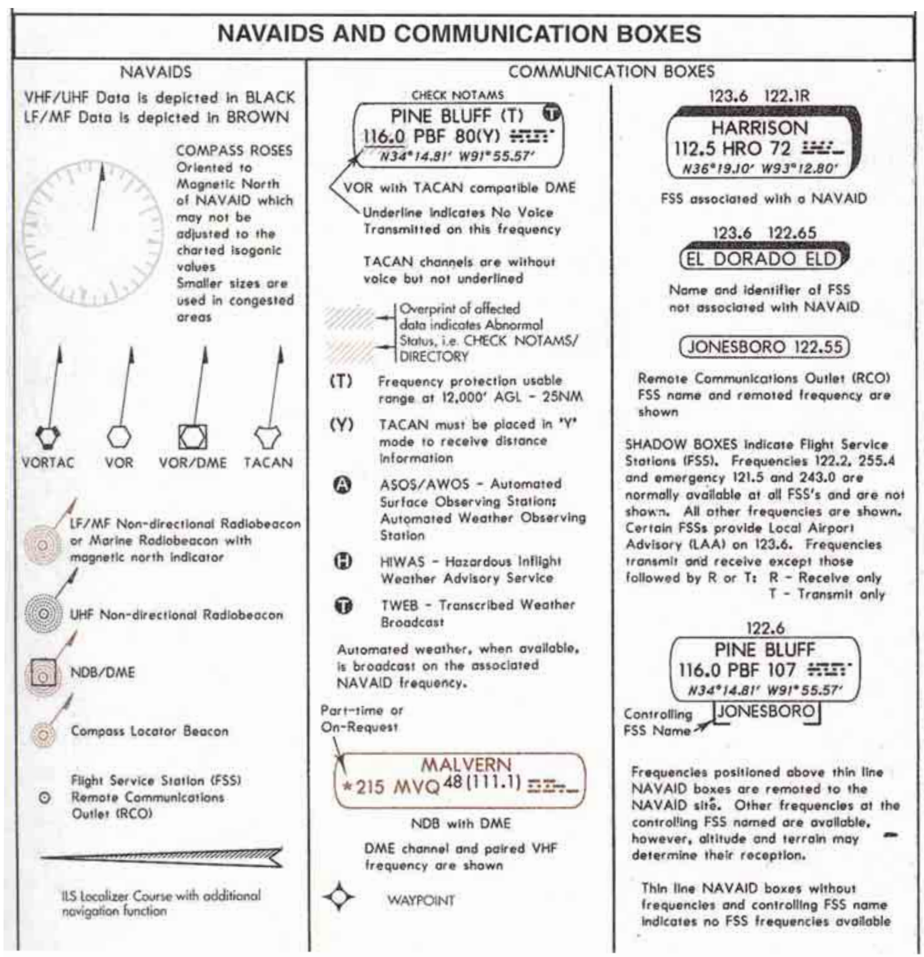


Figure13_15
Chart NAVAID Symbols

4. Victor airways, airway segments, and other route structure information is shown with the following symbols:

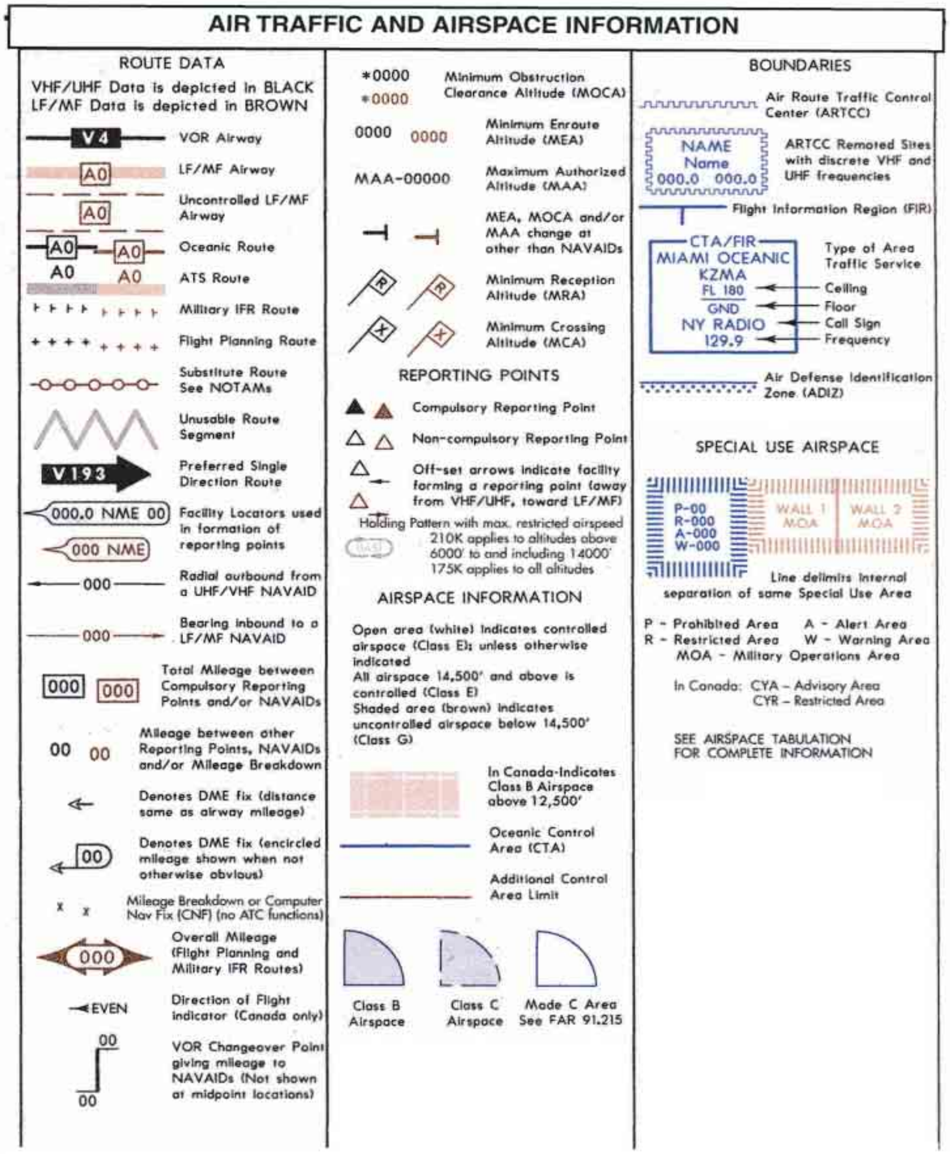


Figure13_16
Chart Symbols

5. Use a local IFR low altitude en route chart to quiz your students on their understanding of the chart symbols.
    a. One good way to test a student's broad understanding of chart symbols and regulations is to use scenarios, rather than asking direct questions.
    a. EXAMPLE (see figure below): Instead of asking, "What is the minimum crossing altitude (MCA) at Roseburg VOR/DME (RBG)," ask, "If you experience a loss of radio communications while traveling southeast bound on V121 between North Bend VORTAC (OTH) and Roseburg VOR/DME (RBG) at your last assigned altitude of 5,000 ft., at what minimum altitude should you cross RBG if the next fix along your assigned route is KOLER intersection?"
        i. ANSWER: 5,000 ft.
        ii. This kind of question tests your student's knowledge of chart symbols, regulations, and lost communications procedures simultaneously, and a correct response indicates a thorough understanding of each subject.

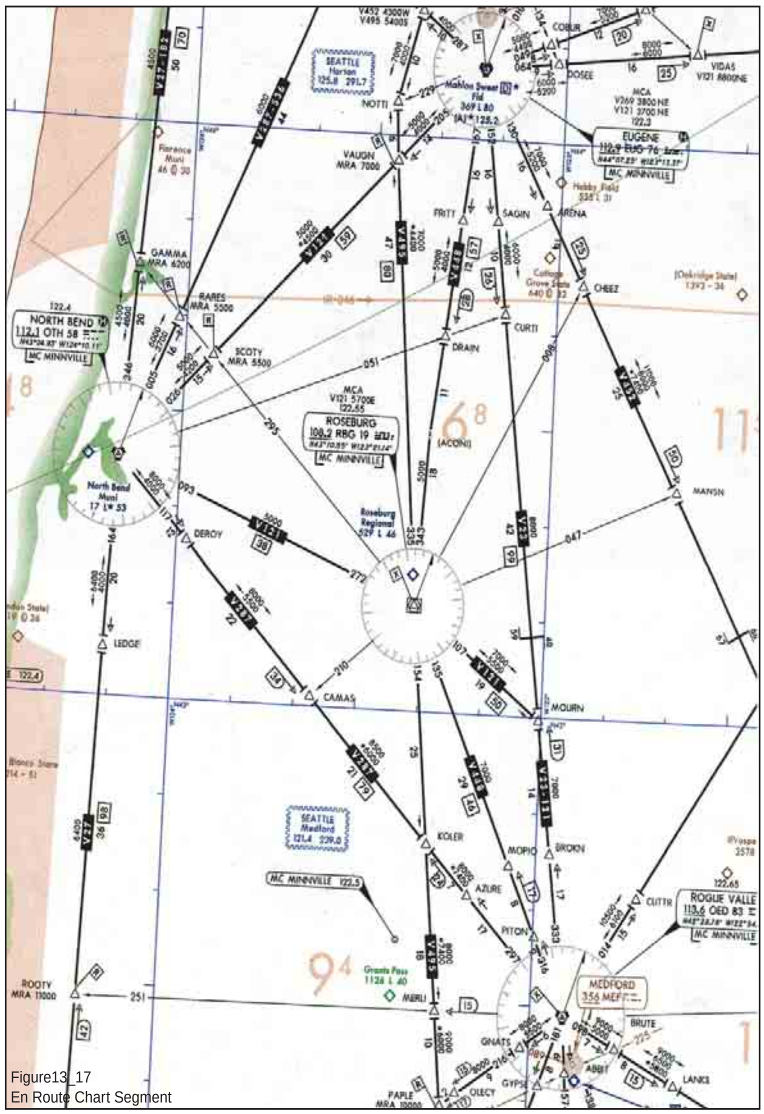


Figure13_17
En Route Chart Segment

B. Instrument Approach Procedure (IAP) charts.

NOTE: This discussion focuses only on some of the more-critical IAP chart symbols; additional symbols can be found in the U.S. Terminal Procedures Publication legend.

1. IAP charts consist of 5 sections:
   a. The **briefing section** lists critical information about the approach procedure, including the navigation and communication frequencies, final approach course heading, runway length, airport elevation, and missed approach procedure.
      i. EXAMPLE:

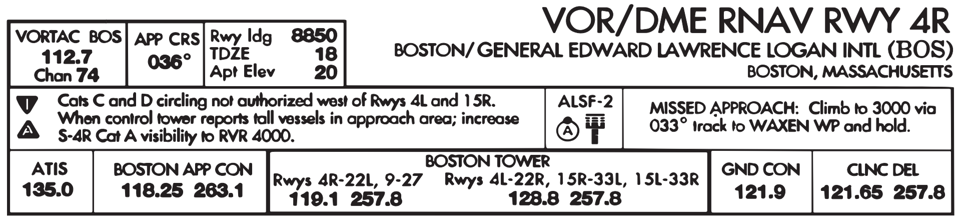


Figure13_18
IAP Briefing Section

   b. The **planview** consists of an overhead view of the entire IAP, including feeder routes, initial approach fixes, the procedure track, the missed approach track, and some minimum altitudes.
      i. Below are some of the important planview symbols:

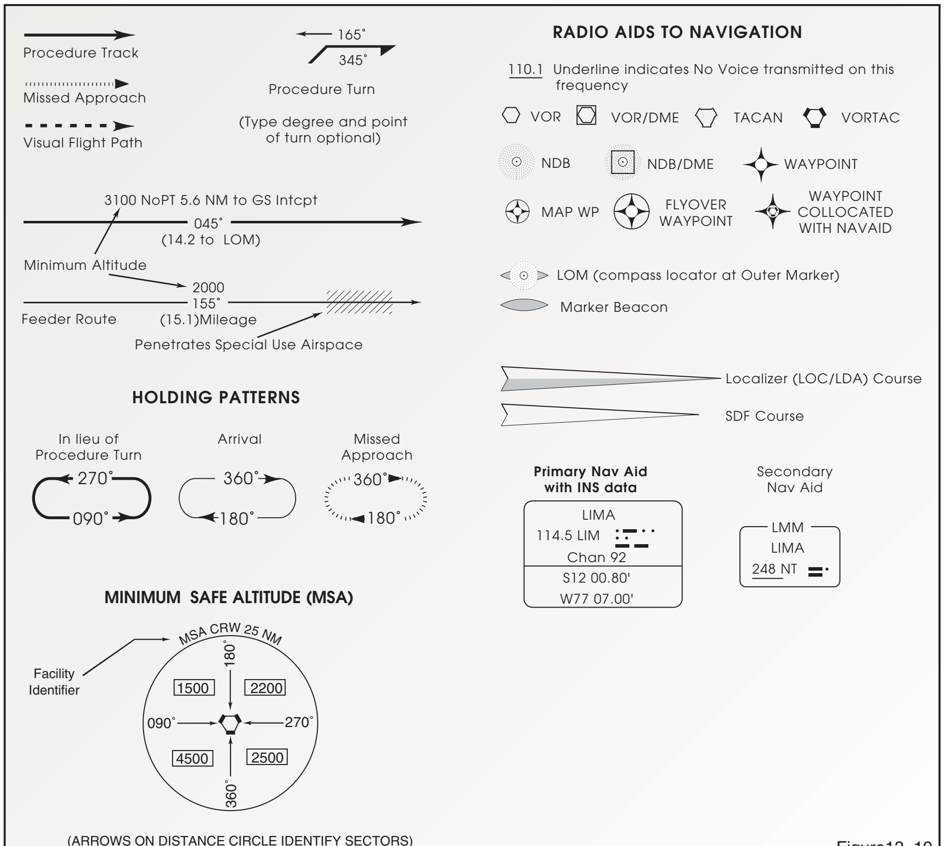


Figure13_19
IAP Chart Symbols

c. The **profile view** consists of a side view of the IAP, including any required course reversal, the final approach fix (FAF), the missed approach point (MAP), and all minimum altitudes except the minimum descent altitude (MDA) or decision altitude/height (DA/H).

i. Below are some of the important profile view symbols:

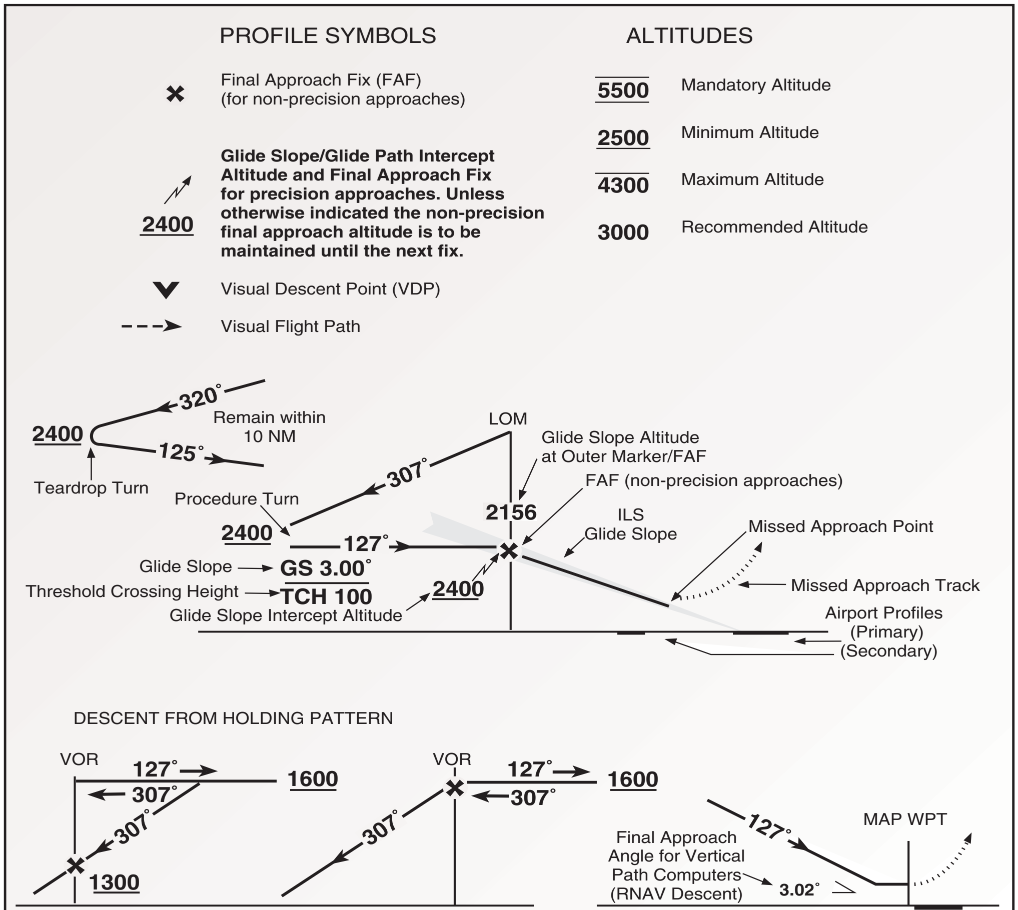
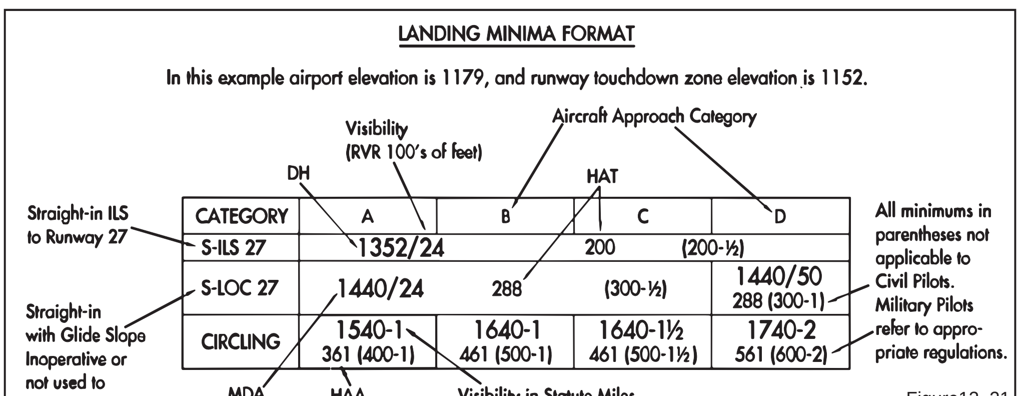


Figure13_20
IAP Profile View

d. The **minimums section** lists the MDA or DA/H and visibility or runway visual range (RVR) requirements for straight-in and circling approaches applicable to each aircraft category.

i. Below is an explanation of the contents of the minimums section:



CATEGORY	A	B	C	D
S-ILS 27	1352/24		200	(200-½)
S-LOC 27	1440/24	288	(300-½)	1440/50 288 (300-1)
CIRCLING	1540-1 361 (400-1)	1640-1 461 (500-1)	1640-1½ 461 (500-1½)	1740-2 561 (600-2)

Figure13_21
IAP Landing Minima

e. The **airport diagram** depicts the layout of runways and taxiways, runway distance information, runway lighting information, and nearby obstacles.

i. EXAMPLE:

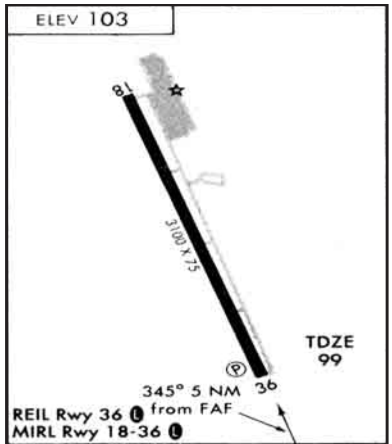


Figure13_22
IAP Airport Diagram

2. You must impress upon your instrument students the importance of having immediate familiarity with IAP chart symbols.

   a. Explain that this familiarity is critical because the information contained in IAP charts is used to ensure clearance from terrain, obstructions, and conflicting traffic.

   b. Even momentary confusion about the meaning of an IAP chart symbol while operating under IFR could prove fatal.

3. As with IFR low altitude en route charts, use a local IAP chart to quiz your students on their understanding of chart symbols.

   a. Again, scenario-based questions are better than direct questions for evaluating the student's understanding of IAPs.

GLEIM FLIGHT INSTRUCTOR REFRESHER COURSE
LESSON 14
THE FEDERAL AVIATION ADMINISTRATION

14.1 GENERAL

I. Explain to your students early in their training that the Federal Aviation Administration (FAA) regulates how you train your students and how they will fly on their own at the completion of their training.

A. Therefore, it is important for your students to have a good understanding of the FAA's mission and how that mission affects their flying activities.

1. Your students need to know what to expect from the FAA.
2. With this knowledge, they will be able to deal with the FAA from a position of understanding and confidence, rather than fear and avoidance.

II. The FAA's role is to promote safe flight by establishing rules and providing services for the benefit of ALL PILOTS.

A. Impress upon your students that the FAA is the cornerstone of the best, easiest-to-use, least-expensive, and most-accessible aviation environment in the world. Our system has been established for the benefit of pilots, and pilots need to support it.

1. EXAMPLE: Pilots frequently encounter other pilots, and even flight instructors, complaining about the FAA and its regulations.
   a. Remind your students that our system is not perfect, but it is the best aviation regulatory system in the world.
   b. Encourage your students to help make the system better by
      i. Recognizing it as the best in the world.
      ii. Supporting the FAA's efforts to promote safe flight.
      iii. Contributing to the development and maintenance of the system by joining and supporting organizations such as AOPA and EAA, which function as liaisons between the pilot population and the FAA.

14.2 A BRIEF HISTORY OF THE FAA

I. For your students to understand and appreciate the modern FAA, they should know a little about the organization's history and how it became the super agency (i.e., an agency that writes and enforces its own regulations) that it is today.

A. To put things into perspective, point out that the Wright brothers first flew a powered airplane on 17 December, 1903. At that time, there was no FAA or other governmental involvement in aviation, and there were no rules that had to be followed.

1. There were also no aeronautical charts, aircraft airworthiness standards, flight training standards, or other enhancements to flight safety that are now the responsibility of the FAA.

B. In 1918, the U.S. Post Office Department took over the operation of a new air mail system that was being operated by the Army, and implemented the first civilian aviation regulations in order to improve aviation safety and reliability.

1. Mail pilots had to meet specified minimum training and flight hour requirements, and Postal aircraft were frequently inspected for airworthiness.

C. In 1926, the Aeronautics Branch was created as a division of the Department of Commerce. This entity was followed in 1938 by the Civil Aeronautics Authority (CAA), which was created when President Roosevelt signed the Civil Aeronautics Act into law.

   1. The CAA became increasingly involved in control tower operations, airway development, pilot licensing, and air traffic control during its existence.

D. In 1958, the Federal Aviation Agency (FAA) was created when President Eisenhower signed the Federal Aviation Act of 1958 into law.

   1. This independent agency grew into the FAA that we know today.

E. The Department of Transportation (DOT) was created by the Department of Transportation Act of 1966, and the FAA was incorporated into this organization and re-named the Federal Aviation Administration.

   1. The DOT Act also created, within the DOT, a five-member National Transportation Safety Board (NTSB), which later became a totally independent agency of the Federal government reporting directly to Congress.

      a. While the NTSB is not a part of the FAA, the Board works with the FAA to conduct aircraft accident investigations. The NTSB is in charge of the investigations.

14.3 FAA ORGANIZATION

I. **GENERAL:** Explain that the Federal Aviation Administration (FAA) is the agency of the U.S. government that has primary responsibility for the safety of civil aviation.

A. The FAA's major functions include:

   1. Regulating civil aviation in order to promote safety and fulfill the requirements of national defense
   2. Encouraging the development of air commerce and civil aeronautics
   3. Developing and operating a common system of air traffic control and navigation for both civil and military aircraft
   4. Conducting research and development with respect to the National Airspace System and civil aeronautics
   5. Developing and implementing programs designed to control aircraft noise and other environmental effects of civil aviation.

B. Inform your students that the FAA has three major levels of organization:

   1. The national headquarters in Washington, D.C.
   2. Nine geographic regions
   3. Many local offices.

II. **FAA National Headquarters**: The FAA is headed by an Administrator, who is assisted by a Deputy Administrator. The Administrator, who must be a civilian and a U.S. citizen, is appointed by the President and confirmed by the Senate.

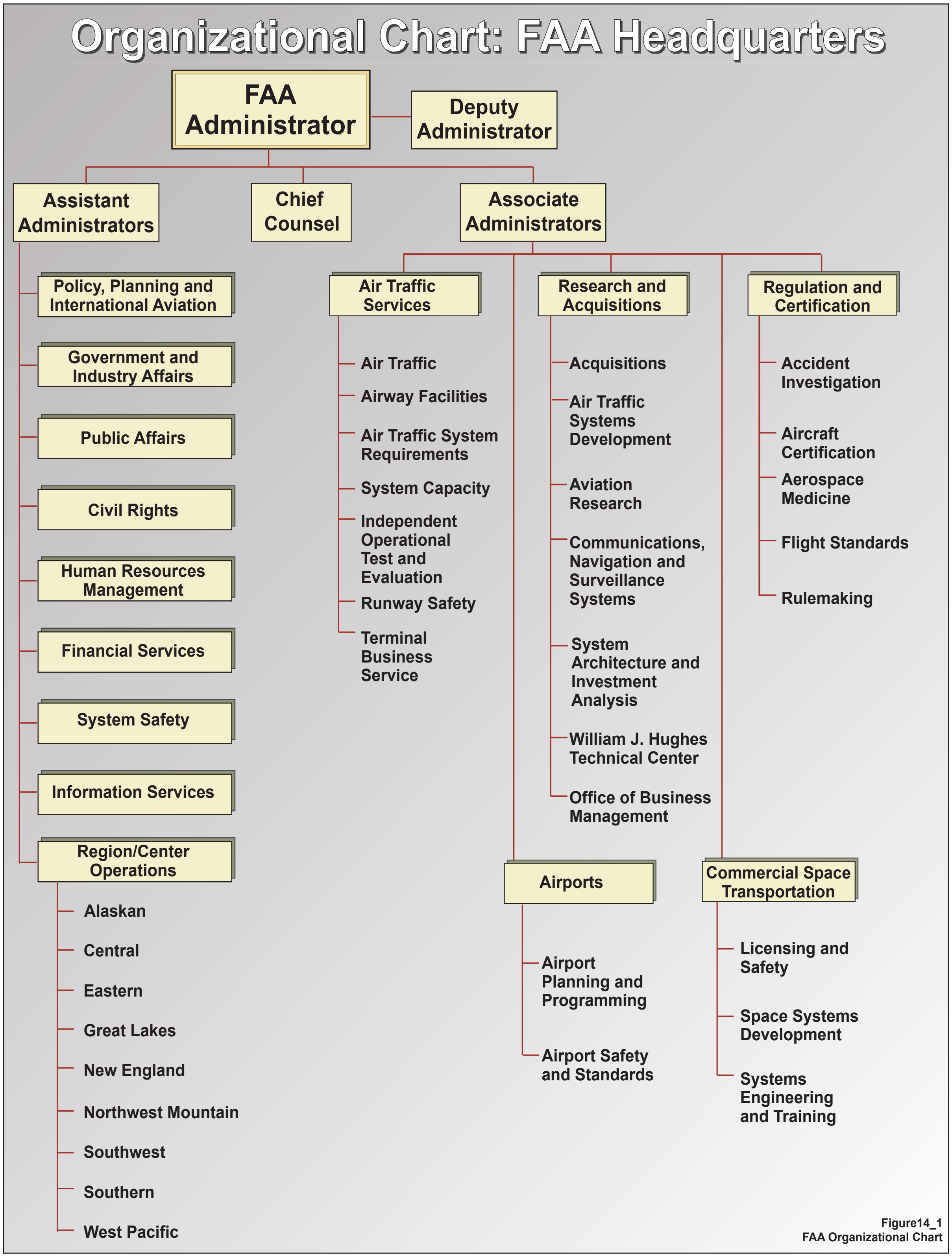
A. On most matters, the Administrator reports to the Secretary of the Department of Transportation, who reports to the President.

B. Reporting to the Administrator are

   1. Nine Assistant Administrators, who direct the line-of-business organizations that carry out the agency's principle functions;
   2. The Chief Counsel, who supports the FAA's mission by furnishing timely and responsive legal services; and

3. Five Associate Administrators, who are responsible for other key programs.

C. Tell your students that it is unlikely that they will ever have to deal personally with the FAA at the National Headquarters level.



III. **Geographic regions**: The FAA's field organization includes nine geographic regions and two major centers, the Mike Monroney Aeronautical Center and the William J. Hughes Technical Center. The geographic regions are shown on the map below.

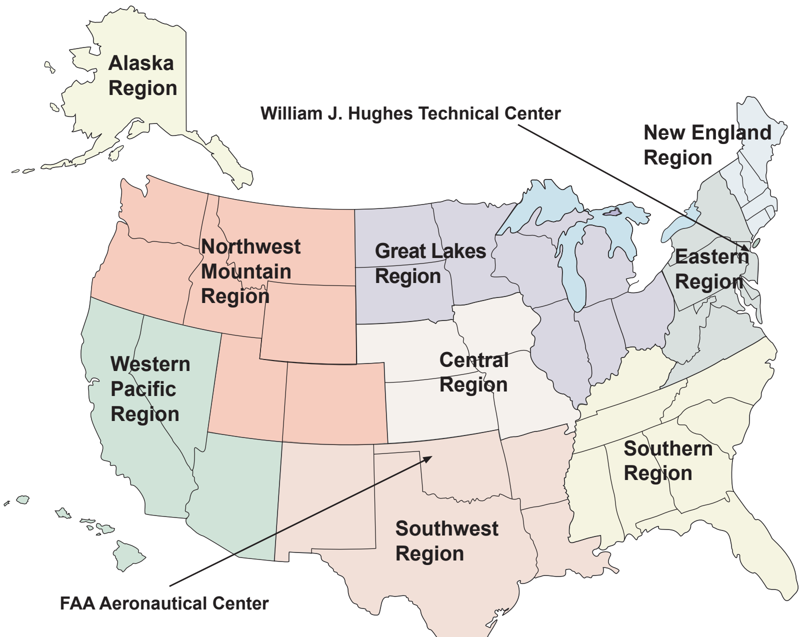


Figure14_2
FAA Regional Chart

A. Each region is headed up by a Regional Administrator and has a headquarters, various field offices, and other facilities. The Regional Administrators and their staffs are responsible for the following items within their regions:

1. Air Traffic Control (ATC) services
2. Aviation security
3. Inspections, certification, and surveillance
4. Facilities and maintenance
5. Airports
6. Airman medical certification
7. Legal matters

B. A typical region provides the following main service facilities:

1. Air Route Traffic Control Centers (ARTCC)
2. Air Traffic Control Towers (ATCT)
3. Automated Flight Service Stations (AFSS)
4. Flight Standards District Offices (FSDO)

IV. **Local**: Each FAA region has several local offices with various functions.

A. A region will typically have several FSDOs, each with its own manager and support staff.

1. Inform your students that, except for obtaining routine AFSS briefings, the Flight Standards District Office (FSDO) is the local FAA office that they are most likely to deal with.

B. The FSDO Office Manager has an Operations Section Supervisor and an Airworthiness Section Supervisor reporting to him/her.

1. The Section Supervisors have several supervisors under them, and each of these supervisors is in charge of several inspectors.
2. Some FSDOs also have an Aviation Safety Program Manager.

C. The following are some of the services and functions of a typical FSDO:

1. Overseeing programs that include airman certification, inspections, and surveillance of general aviation ground and flight operations.
2. Providing a multitude of safety programs and seminars designed to help your students to be safer pilots. Aviation safety counselors are assigned to each FSDO.
3. Maintaining a current list of Part 141 flight schools and designated pilot examiners.
4. Offering high altitude pressure chamber training for general aviation pilots who are interested in experiencing the symptoms of hypoxia firsthand in a safe, controlled environment.
5. Overseeing the FAA's Wings program, designed to recognize general aviation pilots who demonstrate a commitment to continuing safety education.
6. Providing opportunities for your students to visit local air traffic control facilities to "plug in" with an air traffic controller in order to see the real world of ATC and gain a better understanding of how to work within the system.
   a. This program has been reinstated after a brief hiatus following the terrorist acts of September 11, 2001.
7. Maintaining excellent websites that provide a complete listing of the individual services and programs offered by the FSDO, as well as links to other FAA sites.

D. Explain that the location of the nearest FSDO can be obtained at the following website: www.faa.gov/avr/afs/fsdo/index.cfm

1. Links are provided to each FSDO's individual website.
   a. These sites usually include the FSDO's address, contact information, driving directions, and information about scheduling an appointment.
   b. Inform your students that many FSDOs now require visitors to make an appointment prior to their arrival due to increased security measures that have been put into effect following the terrorist acts of September 11, 2001.

E. As an instructor, it is critical that you deal with all FAA personnel, including those assigned to your FSDO, with the utmost courtesy and professionalism, and that you train your students to do likewise.

1. Remember that an adversarial or belligerent approach, even if you think an inspector is wrong, is almost always counterproductive.
2. In order for you and your students to establish a professional relationship with FSDO personnel, it is helpful to know the titles and duties of the inspectors with whom you will be dealing.
   a. **Aviation Safety Inspector (ASI):** This title is given to all FAA inspectors.
      i. An ASI with an operations (OPS) specialty deals primarily with flight operations issues and pilots.
      ii. An ASI with an airworthiness (AW) (i.e., maintenance) specialty deals primarily with aircraft maintenance issues and mechanics.
      iii. Note that some ASIs are dual-qualified.
   b. **Principal Operations Inspector (POI):** POIs are responsible for conducting operational surveillance, ensuring regulatory compliance, and enforcing air carrier and general aviation flight operations.
      i. Note that each Part 141 (i.e., FAA-approved) flight school is assigned a POI to monitor the school's operations.
      ii. If you or your student have an unresolved safety issue with a Part 141 flight school, a call to the school's POI may be beneficial in resolving the issue.

V. Emphasize to your students that the entire structure of the FAA exists for one primary purpose: to improve aviation safety.

A. Impress upon your students that the FAA employs thousands of people and spends billions of dollars in a concentrated effort to keep them safe.

B. Help your students learn to appreciate what the FAA provides with their tax dollars. Pilots should support the FAA's efforts at every opportunity.

1. Some instructors set just the right tone when discussing the FAA with their students by referring to it as the "Friendly Aviation Association."

2. Point out that in any large bureaucratic organization like the FAA, there will inevitably be a few individuals with poor people skills, negative attitudes, and rude personalities.

a. Emphasize, however, that the vast majority of FAA personnel are extremely dedicated and highly qualified professionals who have a genuine interest in aviation and in promoting flight safety.

14.4 FAA RULEMAKING

I. **Administrative Law**. The United States government relies on the process of **administrative regulation** to regulate highly technical and specialized areas such as aviation.

A. The federal government establishes **agencies** (e.g., the FAA) that have special purposes (e.g., regulation of aviation).

1. Agencies write, publish, and enforce **federal regulations**, which are rules that carry the force of law.

2. As an agency, the FAA is empowered to control the actions of individual pilots and aviation organizations (e.g., a flight school or an aircraft manufacturer) by writing and enforcing regulations.

B. Remind your students that the primary, underlying purpose of all of the regulations developed and enforced by the FAA is to promote aviation safety.

1. EXAMPLE: Your students may wonder why they are required to notify the FAA of a change to their permanent mailing address within 30 days of the change (Sec. 61.60), and why they are prohibited from exercising the privileges of their pilot certificate if they fail to do so.

2. Inform your students that the FAA needs to be able to contact all pilots by mail in order to send them safety information, request amplifying information on pilot certification applications or medical certificates, and send notices about possible enforcement actions being considered.

C. Explain that two of the basic assumptions of our system of administrative regulation are that the FAA has expert knowledge of all facets of aviation, and that the agency engages in continuous supervision of those it regulates.

1. At the local level of the FAA, this means that each Aviation Safety Inspector (ASI) must be an expert in his/her field (i.e., operations or airworthiness) and that each FSDO must establish and maintain a continuing inspection program within its district.

a. Because no FSDO has enough staff to do all the work that is required, the FAA frequently uses non-FAA experts to assist with specific tasks.

i. EXAMPLE: Each FSDO conducts practical tests without charge to the applicant.

ii. In most districts, however, the FSDO is only able to conduct a small percentage of practical tests due to limited staffing and high demand.

o These tests are usually reserved for initial flight instructor certification.

iii. In order to accomplish most of the practical tests within each district, FSDOs designate examiners by carefully selecting highly experienced applicants from a pool of candidates.

iv. These designated pilot examiners (DPEs) are not FAA employees and are not compensated for their work by the FAA.

- For this reason, DPEs (unlike ASIs) are allowed to be compensated by individual applicants.

v. DPEs are very carefully trained and are periodically checked by the FAA.

- They are considered to be representatives of the FAA administrator when they are performing their duties.

D. Another basic assumption of our system of administrative regulation is that those who are being regulated (i.e., you and your students) have the right and obligation to participate directly in the regulatory process. Accordingly, teach your students that they are encouraged to carefully study proposed rules and offer comments to the FAA.

1. Remind your students that they have many rights in our system of government, and that these rights are protected by the laws that control the FAA's actions in rulemaking.
2. Inform your students that

a. They can propose an entirely new rule on their own and expect that their proposal will be taken seriously; they are not limited to simply giving their response to an FAA proposal.

b. They can initiate a proposal for an existing rule to be eliminated or modified.

c. They can recommend changes to new rules proposed by the FAA or others.

i. Their comments will be carefully documented and will become part of the master file, or "docket" for each new proposed rule.

ii. All comments become part of the public record.

II. **Code of Federal Regulations and the Federal Register**. Explain that a fundamental requirement of any agency's rulemaking process is that those who are being regulated must be notified of existing and proposed rules.

A. To notify those being regulated of existing rules, the government publishes all of the existing rules that have been created by agencies in the **Code of Federal Regulations (CFR)**, which is divided into 50 subject areas called **Titles**. The CFR is updated annually.

1. The federal aviation regulations are contained in Title 14, Aeronautics and Space.

a. Title 14 is divided into five volumes, of which the first three comprise Chapter I.

i. Chapter I is assigned to the FAA.

ii. The fourth volume is assigned to the Secretary of Transportation, and the fifth volume is assigned to NASA.

b. CFR Chapters are then divided into **Parts**, each of which typically addresses just one main subject (e.g., Part 141 - Flight Schools).

c. Parts are further divided into sections with paragraphs and subparagraphs.

i. EXAMPLE: The federal aviation regulation that addresses the responsibility and authority of the pilot in command during an in-flight emergency is located in Title 14 of the CFR, Chapter 1, Part 91, Section 91.3, paragraph (b), and is cited as 14 CFR 91.3 (b).

ii. Note that frequently in publications that are only about aviation, regulations will be cited using just the section and paragraphs for convenience (e.g., Sec. 91.3 (b)).

d. Explain to your students that in the past, the abbreviation “FAR” was widely used in official publications to mean “Federal Aviation Regulation,” but that this abbreviation has recently fallen into disuse. Officially, the abbreviation “FAR” means “Federal Acquisition Regulations.”
   i. Instead of referring to a regulation as FAR 61.60, it should be referred to as 14 CFR 61.60.
   ii. Point out that there are still many official aviation publications that refer to FARs, and it will probably take a few more years for this abbreviation to work its way out of the system as revisions are made.

e. Show your students that all current aviation regulations can be found online at http://www.access.gpo.gov/nara/cfr/cfrhtml_00/Title_14/14tab_00.html.
   i. Chapter 1 of Title 14 is also available as three bound volumes from the Government Printing Office (GPO) for $147.
      o A cheaper alternative for obtaining a hard copy of the regulations is to purchase a commercially produced *FAR/AIM*, which includes only the most frequently-used Parts of 14 CFR.

B. Inform your students that proposed and newly established regulations are published in the **Federal Register**.

1. Explain that the Federal Register Act requires the President and agencies such as the FAA to publish executive orders and rules in a publication called the Federal Register.
   a. The Federal Register is published every day the U.S. Congress is in session, and provides a consistent method of notifying the public of new and proposed rules.
2. Show the Federal Register to your students by going to the Federal Register website at http://www.access.gpo.gov/nara
   a. Explain to them that this site is where they may receive official notification of FAA proposed and final rules. The Federal Register website also provides access to the Code of Federal Regulations (CFR).
   b. Although data about new and proposed rules is included on many aviation websites, only the U.S. government’s Federal Register website should be regarded as official notification of final and proposed rules.
      i. The government cannot control the content of non-government websites, which may contain errors or omissions.
3. The Federal Register is also published as a paper document that is available from the Government Printing Office by subscription.

C. Explain that new regulations that are published in the Federal Register must be encoded into the CFR through the following process:

1. The FAA submits new regulations to the Office of the Federal Register.
2. The new regulations are published in the Federal Register so that they are available for public inspection.
3. All FAA regulations that have been published in the Federal Register are then encoded into the Code of Federal Regulations.

D. When FAA rules and proposed rules are published in the Federal Register, two very important legal actions are accomplished:

1. You and your students are officially notified of the regulation.
2. You and your students have a complete and correct copy of the regulation.

14.5 FAA CERTIFICATES

I. One way that the FAA carries out its safety responsibilities is by issuing certificates to indicate that individuals and organizations are qualified to exercise certain privileges. These certificates fall into several categories:

A. Airman Certificates (e.g., a Private Pilot Certificate or a Flight Instructor Certificate)

1. Ratings are added to airman certificates to denote specific authorizations (e.g., airplane--single-engine land or instrument-airplane).

B. Medical Certificates (e.g., First-, Second-, or Third-Class)

C. Aircraft Certificates (e.g., an Airworthiness Certificate or a Type Certificate)

D. Operating Certificates (e.g., an Air Carrier Certificate)

E. Air Agency Certificates (e.g., a Part 141 Flight School Certificate)

F. Airport Operating Certificates

G. Representative of Administrator Certificates (e.g., Designated Pilot Examiner Certificate)

II. Emphasize to your students that, while functionally similar, the FAA issues certificates rather than licenses.

A. A license grants permission, while a certificate states that certain requirements have been met, thereby authorizing certain privileges.

B. As an instructor, you should always use correct terminology when discussing pilot certificates.

III. Tell your students that any certificate that is issued by the FAA, including a combined Student Pilot Certificate and Medical Certificate, remains the property of the FAA.

A. Explain that any certificate may be suspended or revoked by the FAA with due process.

1. Suspension is a temporary measure; the FAA retains the certificate and then returns it to the holder after a specified period has elapsed (e.g., 90 days).

2. Revocation is permanent; the certificate will not be returned, though in some cases an application for retesting and reinstatement can be made after a specified period (e.g., 1 year).

B. Point out that some airman certificates expire and must be renewed (e.g., student pilot and flight instructor certificates), but most have no expiration date.

C. Explain that a certificate demonstrates that the holder has been authorized by the FAA to exercise the privileges of that certificate.

1. Therefore, the certificate must be carried when the holder is exercising those privileges.

14.6 ADVISORY CIRCULARS

I. Explain that the primary method that the FAA uses to provide non-mandatory advisory information to pilots is via Advisory Circulars (ACs).

II. The FAA will issue an Advisory Circular to provide guidance and information about a designated subject area or to show a method acceptable to the FAA Administrator for complying with a federal aviation regulation.

A. Many ACs are free, but some are only available for a modest fee. A complete list of ACs can be found in the Advisory Circular Checklist (AC 00-2), which is available online at http://www.faa.gov/aba/html_policies/acc00_2.html.

B. An AC may be just a page or two, or it may be an entire book or manual, such as the Pilot's Handbook of Aeronautical Knowledge (AC 61-23C).

C. Tell your students that the content of ACs is generally not binding, except in rare instances when it is referred to by a regulation. However, FAA inspectors often rely on ACs to help establish compliance with a particular regulation.

14.7 SERVICE BULLETINS AND AIRWORTHINESS DIRECTIVES

I. Inform your students that Service Bulletins are published by aviation manufacturers (e.g., Lycoming or Cessna). They are used to advise owners of manufacturer recommendations that specific issues with the manufacturers' products should be resolved, and to alert owners to new Airworthiness Directives that are published by the FAA.

II. Service Bulletins are generated when a number of problem reports are received from mechanics in the field.

A. Compliance with Service Bulletins is not normally mandatory for Part 91 aircraft operators.

B. A manufacturer can, however, designate a Service Bulletin as "mandatory" if the bulletin refers to an Airworthiness Directive (AD), or if the manufacturer wants to emphasize the bulletin's importance.

III. Explain that when the FAA is made aware of dangerous conditions or potential conditions involving an aircraft or an aircraft component, it notifies all concerned by issuing an Airworthiness Directive (AD).

A. The FAA may have been made aware of the dangerous condition by the manufacturer involved, by reports from the field, or as a result of an accident investigation that revealed an unsafe aircraft component.

B. Emphasize to your students that compliance with an AD is mandatory, regardless of the type of flight operations being conducted.

1. Remind your students that in order for an airplane's airworthiness certificate to remain valid, all required maintenance must be accomplished.

a. Because ADs are mandatory, they are required maintenance and must therefore be complied with in order to maintain a valid airworthiness certificate.

C. If the circumstances related to an AD are not considered to be an emergency, the FAA may make a proposed AD available for public comment by publishing a Notice of Proposed Rulemaking (NPRM) in the Federal Register.

1. This process allows those who will be impacted by the proposed AD to study its contents and comments, and make their own comments.

2. Owners groups such as the Cessna Pilots Association, with over 14,000 members, have been instrumental in modifying proposed ADs in order to reduce the negative impact on aircraft owners while still achieving the desired safety outcome of the AD.

D. Emergency ADs (i.e., those that immediately address life-threatening situations) are issued without prior notice and are effective immediately.

1. An AD is published in the Federal Register as a final rule and becomes effective at that time; owners are notified by telegram.

14.8 ENFORCEMENT

I. Emphasize to your students that one of the FAA's goals is to encourage 100% voluntary compliance with the safety standards (i.e., regulations) that it has established.

- A. Because of this goal, the majority of the FAA's enforcement efforts are directed toward educating the aviation community about the standards set forth in the regulations and providing recommendations about how to ensure compliance with those standards (e.g., ACs).
    1. Explain that the FAA understands that it is very important for those who are being regulated to have a clear understanding of the regulations that control their actions.
    2. To help achieve this goal, a summary is available for each federal aviation regulation. This summary explains the FAA's reason for having the regulation (i.e., its spirit and intent).
    3. Summaries are included in the files for all new regulations going through the rulemaking process, and are always available to the public.
        - a. Summaries of all regulations are also available in the Preamble to each CFR part.
    4. Whenever possible, use the information contained in these summaries to explain the reasoning behind complex regulations to your students.

II. Inform your students that internal FAA orders (i.e., rules) require that enforcement actions be taken only after the FAA's efforts to obtain voluntary compliance have failed.

- A. FAA orders also require that enforcement actions not only be consistent and fair, but also that they be perceived as consistent and fair by those being regulated.
    1. EXAMPLE: According to this requirement, if one pilot is subjected to a civil penalty for a certain violation (e.g., entering Class B airspace without a clearance), all pilots who violate the same regulation under the same circumstances should receive the same civil penalty.
    2. The FAA understands that faith and confidence in the system will be lost if violators are not treated consistently and fairly.
- B. Before beginning an enforcement action, the FAA will carefully consider the alleged violator's explanation of the situation and examine any extenuating circumstances.
    1. Explain that the conditions surrounding an alleged violation are sometimes unusual, and the FAA will take any unusual conditions into consideration.

III. Inform your students that alleged violators must be provided with **due process**, as required by the 5th Amendment of the U.S. Constitution.

- A. Explain that due process includes the following provisions:
    1. The alleged violator may be represented by an attorney.
        - a. Inform your students that many aviation law experts strongly recommend that anyone who believes that (s)he might be subject to an FAA enforcement action should contact an aviation attorney.
            - i. Having access to expert advice is important, even for a seemingly trivial matter or one to which the pilot freely admits his/her guilt.
        - b. Tell your students that they should consider enrolling in a legal services plan such as that offered by the Aircraft Owners and Pilots Association (AOPA).
            - i. The AOPA Legal Services Plan provides personal legal counsel and representation in FAA enforcement cases, aircraft accident matters, U.S. Customs enforcement matters, and in connection with drug and alcohol testing and federal tax issues.
                - o Among the benefits of the plan is a free half-hour consultation about any aviation legal matter with one of the 600 Plan attorneys nationwide.

ii. The cost for the plan (as of December, 2002) is $26 per year for Student, Recreational, and Private pilots, $52 per year for flight instructors, and $99 per year for pilots acting as ATPs.

- o Encourage your students to call AOPA at (800) 872-2672 or to access the Member's Section of the AOPA website at http://www.aopa.org in order to receive details of this plan.

c. You should also encourage your students to consider carrying personal liability insurance to cover their flight activities.

i. Ensure that your students have a clear understanding of their personal liability exposure during their flying. Point out that while most flight schools have liability insurance to cover themselves in the event of a mishap, few provide coverage for their students or certificated renters.

- o EXAMPLE: If a Private Pilot rents an airplane from an FBO or a flight school, and is then involved in a mishap that destroys the airplane, the flight school's insurance provider will pay the flight school for the loss of the airplane, minus the deductible.
- o However, the insurance provider might then sue the pilot or his/her estate to recover the company's loss, and the flight school might sue to recover the amount of the deductible.

d. Many pilots, especially student pilots, are unaware of the risk they are taking by flying without insurance or legal protection; it is your responsibility to provide them with the information they need to make an informed decision to protect themselves.

2. The FAA must prove its case before a judge.

a. The judge can be an NTSB Administrative Law Judge or a Transportation Department Administrative Law Judge.

3. The alleged violator may cross-examine any witness who testifies against him/her.
4. The alleged violator may present evidence on his/her own behalf.
5. The alleged violator may appeal the judge's decision.

IV. Explain that the steps taken during a typical FAA enforcement action are as follows:

A. The FAA becomes aware of an event that may constitute a violation of federal aviation regulations.

B. A Letter of Investigation is sent to the alleged violator.

1. Depending on the circumstances and the alleged violator's response (or lack of response), the matter may be dropped, the alleged violator may be reexamined (i.e., a practical test or flight check may be required), a Warning Notice or Letter of Correction (Administrative Action) may be sent to the alleged violator, remedial training may be offered, or enforcement may occur.
2. Explain that enforcement generally consists of either a Certificate Action or a Civil Penalty.

a. A Certificate Action means that the pilot's certificate is suspended for a period of time or permanently revoked.

i. Usually, the FAA tends to use a Certificate Action in cases where the violator does not earn his/her living by flying.

ii. EXAMPLE: In a typical general aviation certificate action, a pilot's certificate might be suspended for 60 or 90 days due to the pilot's failure to remain clear of Class C airspace when instructed by ATC to do so, if the violation did not cause an accident.

b. A Civil Penalty consists of a monetary fine.
   i. Generally, the FAA tends to use Civil Penalties in cases where the violator earns his/her living by flying (e.g., an airline pilot or flight instructor).
   ii. In these cases, even a short certificate suspension could result in loss of the pilot's job.

c. In rare, extreme cases (e.g., an airline pilot flying a scheduled trip while under the influence of alcohol), the violator can expect a large civil penalty, a permanent revocation of his/her pilot certificate, and a prison term.

C. Following several intermediate steps in the enforcement process (e.g., informal conferences), during which the case against the alleged violator may be dropped or a settlement may be reached (e.g., the pilot admits that (s)he made a mistake and agrees to receive remedial training), the FAA's case against the alleged violator is heard before a Transportation Department Law Judge.

1. If the alleged violator is found guilty, (s)he may appeal to the NTSB, which is responsible for hearing appeals of FAA enforcement actions.

a. The alleged violator may appeal the ruling of the NTSB Administrative Law Judge to the full NTSB, whose ruling may then be appealed to the U.S. Court of Appeals.
   i. Ultimately, the alleged violator may appeal his/her case to the U.S. Supreme Court, though as a practical matter, this almost never happens.

V. Explain that the FAA understands that occasional errors are made by pilots that might result in a violation of a regulation (e.g., inadvertently allowing the airplane to deviate from its assigned altitude). Because the goal of the FAA is to enhance aviation safety through voluntary compliance, and not the prosecution of pilots, a program called the Aviation Safety Reporting System (ASRS) was created in 1975.

A. This program is designed to encourage pilots, air traffic controllers, and others (e.g., mechanics and cabin crew) to voluntarily submit reports of operational incidents that highlight potential safety problems, including incidents created by human error.

B. The reports are sent to NASA, where they are analyzed and forwarded to the FAA without the submitter's identification.

C. Under most circumstances, the FAA is prohibited from using the reports for enforcement actions (e.g., a Certificate Action or Civil Penalty) except in cases of criminal acts or accidents.

1. The following conditions must be met for the FAA to withhold enforcement action:

a. The violation was inadvertent, not intentional.
b. The violation did not involve a criminal act.
c. The pilot has not committed a prior violation within the preceding five years.
d. The pilot can prove that (s)he properly filed the report within 10 days after the date of the violation.
   i. This proof is furnished by the identification strip that is removed from the top of the report form and returned to the pilot when it is received by NASA.
   ii. Emphasize to your students that they must not lose the identification strip if they file an ASRS report.

D. Tell your students that, even though no enforcement action will be taken when a timely report is submitted and other criteria are met, a violation may still be assessed (i.e., only the penalty is withheld).

1. EXAMPLE: A pilot is assigned an altitude of 5,000 ft. While the pilot is distracted by programming his/her GPS receiver, (s)he allows the aircraft to climb 500 ft.
2. The air traffic controller notices that the aircraft is not maintaining its assigned altitude and alerts the pilot, who promptly returns to 5,000 ft.
3. No accident resulted and no separation standards were compromised, but a clear violation of 14 CFR 91.123, compliance with ATC clearances and instructions, has occurred, and the FAA is aware of the violation.
4. The pilot submits an ASRS report to NASA within 10 days, explaining the circumstances of the altitude deviation, and how (s)he was distracted by operating a complex piece of equipment.
    a. This data is combined with other similar data and is ultimately used to document a need for simplified GPS controls, thereby increasing aviation safety.

E. Inform your students that full details of this joint FAA and NASA program are available on the ASRS website at http://asrs.arc.nasa.gov/.

1. Point out that copies of the ASRS reporting form, commonly referred to as a “NASA Form,” may be downloaded from this site.

GLEIM FLIGHT INSTRUCTOR REFRESHER COURSE
LESSON 15
GPS TRAINING

15.1 GLOBAL POSITIONING SYSTEM (GPS) OVERVIEW

I. Inform your students that GPS is a satellite-based radio navigation system operated by the Department of Defense (DOD).

- A. Explain that the system provides highly accurate position information to an unlimited number of users worldwide.
- B. GPS is unaffected by weather and utilizes a common grid reference system based on the earth-fixed coordinate system.

II. GPS was originally built for military use in the 1970s. In the 1980s the technology was adapted for public use. GPS equipment accurate to within about 300 feet was readily available for civilians by the early 1990s. The inaccuracy was a result of Selective Availability (SA), a deliberate distortion of the signal intended to prevent civilian equipment from being used in a military attack.

- A. In May 2000, SA was eliminated as an incentive to increase civilian and commercial use of GPS throughout the world. As a result, civilian GPS, now accurate to within 40 feet or better, has become a global utility.
  1. After the terrorist attacks of September 11, 2001, there was speculation in the aviation industry about a return to SA. However, within a week of the attacks, the Interagency GPS Executive Board (IGEB, the agency that regulates the GPS system) definitively announced that the United States has no intent to ever reactivate SA.

III. Explain to your students that GPS operation is based on the concept of ranging and triangulation from a group of satellites in space that act as precise reference points.

- A. A GPS receiver measures its distance from a particular satellite by using the travel time of a radio signal transmitted from that satellite.
  1. Each satellite transmits a specific code, called a **coarse in/acquisition (CA) code**, which contains information on the satellite's position, the GPS system time, and the health and accuracy of the transmitted data.
  2. By knowing the speed at which the signal travels (approximately 186,000 miles per second) and the exact broadcast time, the GPS receiver can compute the distance traveled by the signal based on the arrival time.
     - a. The distance derived from this method of computing distance is called a **pseudo-range** because it is not a direct measurement of distance; it is a measurement based on time.
       - i. Explain that a pseudo-range is subject to several error sources, including ionospheric and tropospheric delays and multipath interference caused by signal reflection.
- B. The GPS receiver then matches the CA code obtained from the satellite to a code in the receiver's database.
  1. This step is used to determine which of the 24 GPS satellites sent the signal.

C. Point out that in addition to knowing the distance to a satellite, the GPS receiver needs to know that satellite's exact location in space to derive position information. This location is known as the satellite's **ephemeris**.

1. Each satellite transmits information about its exact orbital location.
2. The GPS receiver uses this information to precisely establish the location of the satellite relative to the earth's surface.

D. Teach your students that the GPS receiver mathematically determines its position by triangulation using the calculated pseudo-range and position information supplied by the satellites.

1. Explain that the GPS receiver needs at least four satellites to yield a three-dimensional position (latitude, longitude, and altitude).
2. The GPS receiver computes navigational values such as distance and bearing to a waypoint, ground speed, etc., by referencing the aircraft's computed position and position trend over time to a database built into the receiver.

IV. Inform your students that the GPS constellation of 24 satellites is designed so that a minimum of five are always observable by a user anywhere on earth.

A. The receiver requires data from a minimum of four satellites above the mask angle (the lowest angle above the horizon at which a satellite can be used) to determine its position.

V. Explain that a GPS receiver verifies the integrity (usability) of the signals that it receives from the GPS constellation via **receiver autonomous integrity monitoring (RAIM)**. This system can determine if a satellite is providing corrupted information.

A. At least one additional satellite must be in view for the receiver to perform the RAIM function; alternatively, the GPS can use information from an altimeter in place of an extra satellite to provide RAIM.

1. Thus, the GPS receiver requires a minimum of five satellites in view, or four satellites and a barometric altimeter (baro-aiding) to detect an integrity anomaly.

B. **Baro-aiding** is a method of augmenting the GPS integrity solution by using a nonsatellite input source.

1. Emphasize to your students that GPS-derived altitude should not be relied upon to determine the aircraft's altitude since the vertical error can be quite large.
2. To ensure that baro-aiding is available, the current altimeter setting must be entered into the receiver as described in the GPS's *Pilot Guide*.

C. For receivers capable of doing so, RAIM requires six satellites in view (or five satellites with baro-aiding) to isolate the corrupt satellite signal and remove it from the navigation solution.

VI. Point out that while RAIM error messages vary somewhat between receivers, there are generally two types.

A. One type indicates that there are not enough satellites available to provide RAIM capability.

B. The other type indicates that the RAIM system has detected a potential error that exceeds the limit for the current phase of flight.

C. Impress upon your instrument students that without RAIM capability or adequate signal integrity, a pilot has no assurance of the accuracy of the GPS position for IFR navigation. Thus, the aircraft's position must be monitored with other NAVAIDs.

VII. For additional information on GPS, see *AIM* Para 1-1-21, Global Positioning System (GPS), at http://www.faa.gov/ATpubs/AIM/chap1toc.htm and the FAA's GPS website at http://gps.faa.gov/GPSbasics/index.htm.

15.2 VFR USE OF GPS

I. GPS navigation has become a great asset to VFR pilots, providing increased navigation capability and enhanced situational awareness.

A. Explain to your students, however, that while GPS offers many benefits to a VFR pilot, a pilot must thoroughly learn to use the unit available to him/her in order to ensure that (s)he does not try to exceed the capabilities of his/her GPS receiver.

1. VFR pilots may use any type of GPS receiver, whether panel-mounted (with either an IFR or VFR installation) or hand-held.

II. Discuss the following items regarding VFR use of GPS with your students.

A. Emphasize that a VFR pilot should never rely solely on one system of navigation.

1. GPS navigation must be used with other forms of navigation such as VORs, pilotage, and dead reckoning.

B. Advise your students to check the GPS's *Pilot's Guide* to see if the unit has receiver autonomous integrity monitoring (RAIM) capability.

1. Without RAIM capability, there will not be any alert to deteriorating navigation capability, and an undetected navigation error could occur.

C. Remind your students to check the currency of the database regularly.

1. If the database has expired, the database should be updated as suggested by the manufacturer.

2. If an update of an expired database is not possible, it is prudent to disregard any moving map display of airspace for critical navigation decisions (such as flying around a restricted area or Class B airspace segment).

a. Limits of airspace areas and named waypoints may have been added, deleted, or modified since the database was last updated.

D. Teach your students to plan a flight carefully before taking off.

1. If your student desires to navigate to user-defined waypoints entered using latitude-longitude coordinates, advise him/her to enter the waypoints into the GPS database before flight, not during the flight.

2. The flight path should also be verified on a current sectional chart to ensure that it follows the desired route.

E. Impress upon your students that they must minimize head-down time (working the GPS) and always maintain a sharp lookout for traffic, terrain, and obstacles.

1. Explain that one way for your students to minimize head-down time is to become very familiar with the GPS receiver's operation.

15.3 GPS TRAINING OVERVIEW

I. The National Air Transportation Association (NATA) has printed a GPS instructor guide, which was developed by Transport Canada.

A. While this guide was originally intended for use in Canada, it is still very useful to any pilot in developing a training syllabus for a specific make and model of GPS.

1. This guide can be thought of as a master syllabus.

B. We have edited the format and length of the material and changed references from Canadian regulations to U.S. regulations for the following discussion.

II. The intent of this master syllabus is to provide you with a general outline of the items that should be covered in ground and flight training on the use of GPS.

A. From this master syllabus, you can then develop a training syllabus for a specific make and model(s) of GPS.

B. Your training syllabus can be very specific and detailed, or it can be a concise outline that refers to the GPS's *Pilot's Guide* that comes with the unit from the manufacturer.

C. Although the master syllabus is written for IFR procedures, it can be adapted to a VFR training syllabus.

III. Inform your students that GPS receivers require more pilot attention than traditional VOR or ADF receivers, particularly during the approach phase. GPS receivers are essentially navigation management computers with many features, modes, and controls.

A. Before flying a stand-alone approach in instrument conditions, a pilot must be completely familiar with GPS fundamentals, system operation, and the approach procedure to be flown.

B. Explain that general aviation pilots are not required to complete an approved training program, nor is there any special logbook endorsement to qualify them to conduct GPS stand-alone approaches.

1. However, it is strongly recommended that pilots take advantage of GPS receiver simulation modes, commercially available training, and every opportunity to fly practice GPS approaches in visual conditions.

2. Pilots are also encouraged to develop and adopt standard GPS operating procedures for the en route, approach, and missed approach phases of flight.

15.4 ORGANIZING THE TRAINING

I. A combination of classroom instruction and hands-on training works best in teaching students how to operate a GPS receiver.

A. It is recommended that you demonstrate the receiver and its capabilities during an introductory flight in order to help give your students an appreciation of the level of skill required to operate the receiver efficiently and safely.

B. The use of a GPS simulator (i.e., computer software that simulates the functions and interface of the receiver for training purposes) or the actual receiver in a simulation or "take-home mode" is highly recommended.

1. Time spent in the classroom will pay dividends in the air.

II. Try hard not to overwhelm your students with too many facts and figures about the GPS system in general.

A. Teach them the basics and instill in them the desire to learn more about the system on their own.

B. Typically, once a student is proficient in conducting basic GPS operations, (s)he will have a strong desire to learn the advanced functions of the receiver as well, instead of just using the receiver as a "direct-to box."

III. Throughout the training, you should stress that only approaches retrieved from a current database are approved for IFR operations.

A. You must discourage students from inventing their own approaches, and do not demonstrate how to create or fly a user-invented approach at any time.

IV. The next eight modules can be used as master lesson plan outlines for developing a GPS training syllabus that addresses the following key subjects:

   A. Preflight preparation
   B. Departure procedures
   C. En route procedures
   D. Holding procedures
   E. Approach procedures
   F. Missed approach procedures
   G. Flying to an alternate airport
   H. System malfunctions

15.5 PREFLIGHT PREPARATION

I. **Objective.** The objective of the preflight preparation lesson is to facilitate student learning of the following:

   A. The background knowledge necessary to operate the GPS receiver in all phases of flight
   B. The interface between the GPS receiver and other cockpit instruments

II. **Motivation**

   A. A good overall understanding of GPS will pique the interest of students and enhance their learning experience.

      1. A secondary aim is to motivate the students to learn more about the system on their own.

   B. The manner in which the GPS integrates with other cockpit instruments is critical to the safe and efficient operation of the aircraft.

III. **Essential Background Knowledge.** Prior to teaching students about preflight preparation, you should explain the following:

   A. The general principles of GPS operation, including:

      1. An overview of the system, including the number of satellites, a general description of the orbits, and the area of coverage;
      2. An overview of the general principles of how the receiver determines its position;
      3. An overview of receiver autonomous integrity monitoring (RAIM);
      4. An insight into other applications; and
      5. An overview of similar systems that have been put into service by other nations.

   B. The advantages of GPS, including its accuracy.
   C. The limitations and possible errors of the system, including database errors and interference from VHF emissions.
   D. The basic components of a GPS installation:

      1. Sensor/navigation computer
      2. Database
      3. Antenna

   E. The function of the various modes of the GPS receiver.
   F. The GPS interface with the CDI/RMI/HSI, if equipped.
   G. The GPS interface with the autopilot/flight director, if equipped.
   H. The GPS interface with other flight management systems, if equipped.

I. The terms and conditions of the approval to use GPS in the U.S. and other countries.

IV. **Advice to Instructors**

A. Most GPS manufacturers publish a *Pilot's Guide* that contains the essential background knowledge and system configuration information to satisfy the requirement of this task.

1. An additional reference is the *AIM*.

B. Remember that students do not have to master all of the navigational and other functions of the GPS receiver in order to operate it competently.

1. Ensure that students have a thorough knowledge of the functions required to use the GPS receiver for flight in instrument meteorological conditions (IMC), and encourage them to learn the other functions as desired or necessary.

C. Use a GPS simulator or the simulation mode of the receiver to demonstrate the various modes and functions of the receiver prior to starting instruction in the aircraft, if possible.

D. Use the aircraft itself on battery power or with a ground power unit (GPU) if a simulator is not available.

E. Review the *Pilot's Operating Handbook (POH)* or flight manual supplement for a description of the receiver installation and any restrictions.

F. Take the student to the aircraft and point out the various components of the installation, including the receiver, the antenna, and, if equipped, the various annunciators, the CDI, RMI, or HSI and the autopilot/flight director.

V. **Instruction and Student Practice**

A. Demonstrate how to turn the GPS receiver on and the general functions of each of the modes. Allow ample time for the student to experiment with the receiver before beginning the actual operational instruction.

VI. **Completion Standards**

A. The student shall be able to describe:

1. GPS in general terms;
2. The major components of the GPS installation and any restrictions contained in the *POH* or flight manual supplement;
3. The phases of flight for which the equipment is approved; and
4. The terms and conditions of the approval to use the equipment in the U.S.

15.6 DEPARTURE PROCEDURES

I. **Objective**

A. The objective of the departure procedure lesson is to facilitate student learning of the following procedures:

1. Initializing the GPS receiver
2. Creating a flight plan in the GPS from the point of departure to the destination
3. Taking off and flying the aircraft to the first en route waypoint

II. **Motivation**

A. Preparation for departure is the foundation of a safe and effective flight.

B. Pilots must be able to initialize and verify the functioning of the GPS receiver and accurately program it while ensuring that the essential duties of operating the aircraft are conducted safely.

III. **Essential Background Knowledge.** Prior to teaching students how to perform departure procedures, you should explain the following:

A. How to turn on the GPS receiver
B. Operation of the GPS receiver controls
C. Completion of the receiver initialization with pilot inputs, if required
D. The function of the flight plan (FPL) mode of the GPS receiver
E. Creation of a flight plan in the GPS
F. Confirmation of RAIM availability for the approach at destination
G. Modification of the flight plan by deleting or inserting waypoints
H. Creation of user-defined waypoints
I. Addition of an instrument departure procedure (DP) to the flight plan

    1. Note that not all receivers have the capability of adding a DP.

J. Airspace advisories and alerts
K. The importance of flying the aircraft at all times and of not fixating on the GPS operation

IV. **Advice to Instructors**

A. Because this phase tends to be time consuming, the student should spend as much time as possible in the classroom learning the programming functions of the GPS receiver.

B. Ensure that students do NOT get so involved in learning to use the GPS receiver that they forget to fly the aircraft. This advisory applies to all phases of the flight.

C. Using the GPS, especially in the early stages of the learning curve, tends to draw pilot and instructor attention into the cockpit. Be careful, and remember to watch vigilantly for other aircraft.

D. You should instruct your students to cross-check GPS positions with other navigational equipment. Databases have been known to be wrong.

V. **Flight Training and Student Practice**

A. Have the student operate the GPS receiver as much as possible.

    1. The student will be slow at first and will make mistakes. Resist speeding up the process by jumping in to help.
    2. Allow the student to make mistakes, and give him/her the time to figure out where (s)he went wrong, within reason.

B. Emphasize the need to be accurate when information, especially waypoint coordinates, are entered into the receiver.

    1. Because input errors are the largest single source of system errors, instruct the student to double-check all information as it is entered.

VI. **Completion Standards**

A. The student shall be able to

    1. Turn on and operate the GPS receiver
    2. Monitor and verify the receiver self-test and initialization
    3. Verify that the data displayed on the receiver self-test page is the same as the data displayed on the aircraft instruments interfaced with the receiver, if applicable
    4. Verify that the external annunciators, if any, illuminate as designed
    5. Verify that the database is current
    6. Complete the receiver initialization with pilot inputs, if required
    7. Create a flight plan in the GPS receiver

8. Modify the flight plan, including inserting and deleting waypoints
9. Create user-defined waypoints
10. Retrieve airport information from the database, if the receiver has this function
11. Add a DP to the flight plan, if the point of departure has one
12. Take off and fly the DP or ATC clearance to intercept the track to the first waypoint en route
13. Maintain a track to the first waypoint en route within 1/2-scale deflection of the CDI
14. Maintain assigned altitudes within 100 ft.
15. Understand the function of the message page and take appropriate action

15.7 EN ROUTE PROCEDURES

I. **Objective**

A. The objective of the en route procedures lesson is to facilitate student learning of procedures used to navigate from the point of departure to the destination using GPS.

II. **Motivation**

A. The introduction of GPS has revolutionized how pilots navigate en route.

B. It is essential that students acquire and maintain a high standard of operating skill for this phase of flight.

III. **Essential Background Knowledge.** Prior to teaching students how to perform en route procedures, you should explain the following:

A. The functions of the navigation (NAV) mode of the GPS receiver
B. The moving map display screen symbology, if applicable
C. The CDI sensitivity parameters in NAV mode
D. The "direct TO" function of the GPS
E. Retrieval of information about the nearest suitable airport to the route of flight
F. The addition of Standard Terminal Arrival Routes (STARs) to the flight plan

IV. **Advice to Instructors**

A. Take care not to become so involved in demonstrating the functions and explaining the features of the GPS that your collision avoidance procedures are compromised.

B. If no airport with a STAR is near the training area, you should use a GPS simulator or the simulation mode of the receiver to teach your students how to input STAR information.

C. Sometime during the lesson, give the student a simulated emergency that requires him/her to divert to the nearest suitable airport.

1. Ensure that the student first takes care of the emergency situation and THEN programs the GPS.
2. Do not allow the student to be so concerned with programming the GPS that aircraft safety becomes a secondary consideration.

V. **Flight Training and Student Practice**

A. The student should fly the aircraft to several waypoints en route so that (s)he can practice normal en route navigation techniques, including determining fuel flows, making position reports, and calculating ETAs.

1. Flying at least three legs of 10-15 minutes each will be sufficient for this practice.

B. Ensure that the student practices going direct to a waypoint and adding a STAR to the flight plan.

VI. **Completion Standards**

A. The student shall be able to

1. Navigate from the point of departure to the destination, using GPS for guidance
2. Describe the CDI sensitivity parameters in NAV mode
3. Intercept a track to a waypoint
4. Maintain a track within 1/2 deflection of the CDI
5. Maintain assigned altitudes within 100 ft.
6. Delete or add waypoints to the flight plan
7. Create user-defined waypoints
8. Program the receiver and fly "direct to" a waypoint
9. Divert to the nearest suitable airport in the event of an emergency
10. Retrieve airport information from the GPS database
11. Add a STAR to the flight plan

15.8 HOLDING PROCEDURES

I. **Objective**

A. The objective of the holding procedures lesson is to facilitate student learning of procedures used to program a hold into the GPS receiver, if the unit is capable, and to execute holding procedures using GPS. Additionally, students will be able to program and fly a route from a holding pattern.

II. **Motivation**

A. The ability to execute a hold is essential for all pilots operating under IFR.

III. **Essential Background Knowledge.** Prior to teaching students how to perform holding procedures, you should explain the following:

A. The various types of holds the student may encounter when flying IFR
B. The addition of a hold to the flight plan in the GPS receiver, if the unit is capable
C. Programming and flying a route from a holding pattern.

IV. **Advice to Instructors**

A. Initiate each holding pattern by either giving the student a simulated holding clearance or asking ATC to issue one.

B. Ensure that the student is able to configure the GPS for holding and to perform a holding procedure at a VOR, an NDB, an intersection, and a GPS waypoint.

C. If the hold entry is executed on autopilot, question the student to ensure that (s)he has correctly anticipated the pattern entry required for each hold, as well as how to perform the entry.

D. Ensure that the student can enter a route to fly when leaving a holding pattern.

V. **Flight Training and Student Practice**

A. Ensure that the student practices at least one of each type of hold, if practicable.

B. The direction of entry should be varied so that the student can practice the recommended pattern entry procedures found in the *AIM*.

C. Ensure that the student practices programming and flying a route from a holding pattern.

VI. **Completion Standards**

A. The student shall be able to

1. Add a hold to the flight plan in flight
2. Activate a hold
3. Execute a holding procedure using GPS
4. Take prompt corrective action if the aircraft does not perform as anticipated during an autopilot-flown hold entry
5. Program and fly a route from a holding pattern

15.9 APPROACH PROCEDURES

I. **Objective**

A. The objective of the approach procedures lesson is to facilitate student learning of procedures used to retrieve and arm an approach procedure from the GPS database and to execute an approach using GPS.

II. **Motivation**

A. In the future, all IFR terminal navigation will likely be conducted using GPS as the primary navigation aid.

1. Pilots wishing to fly in this environment will need a thorough understanding of the system, its limitations, and its use in the approach environment.

III. **Essential Background Knowledge.** Prior to teaching students how to perform approach procedures, you should explain the following:

A. The transition from the en route phase to the approach phase using GPS for guidance

B. The requirement that approaches be retrieved from a current database rather than being created by the pilot's manual input of individual waypoints

C. The addition of approaches to the flight plan

D. The way to arm approaches

E. The change or deletion of an approach once it has been added to the flight plan

F. The various sensitivity parameters of the CDI during approaches and the way to confirm that they have changed at the appropriate time

G. The requirement for Receiver Autonomous Integrity Monitoring (RAIM) availability

H. The cockpit indications, if any, and the actions to take if RAIM failure occurs during the approach, both before and after the final approach waypoint (FAWP)

I. Verification of approach waypoints

J. The performance of GPS approaches

IV. **Advice to Instructors**

A. The transition from en route procedures to a GPS approach should be conducted exactly the same as for traditional navigation aids.

1. You should emphasize the importance of planning the approach in a methodical and deliberate manner so that the student can anticipate and react smoothly to ATC instructions.

B. Emphasize that making correct inputs into the GPS receiver is especially critical during approaches. In some cases, an incorrect entry can cause the receiver to leave the approach mode.

V. **Flight Training and Student Practice**

A. The student should practice GPS stand-alone and overlay approaches until (s)he can demonstrate to the instructor that (s)he can perform the approaches safely and effectively.

VI. **Completion Standards**

A. The student shall be able to

1. Transition from the en route phase to the approach phase, including performance of before-landing and approach checks, briefings, management of approach aids, and adherence to ATC clearances
2. Add approaches to the flight plan from the GPS database
3. Change or delete an approach that has been added to the flight plan
4. Arm approaches
5. Describe the various sensitivity parameters of the CDI during approaches
6. Identify and take the appropriate action for a RAIM failure indication
7. Verify approach waypoints against the approach chart
8. Select and verify cockpit navigation sources
9. Select and verify the automatic flight control guidance source switches, if equipped
10. Establish the aircraft on the required track
11. Maintain the track within 1/2 deflection of the CDI
12. Maintain published or assigned altitudes within 100 ft. prior to the FAWP and within +100 ft., 0 ft. after the FAWP
13. Identify waypoint passage
14. Execute approaches to minima using GPS for guidance

15.10 MISSED APPROACH PROCEDURES

I. **Objective**

A. The objective of the missed approach procedures lesson is to facilitate student learning of procedures used to retrieve and arm the missed approach procedures from the GPS database and how to execute the missed approach using GPS.

II. **Motivation**

A. Pilots flying under IFR must be prepared to execute a missed approach on all approaches.

III. **Essential Background Knowledge.** Prior to teaching students how to perform missed approach procedures, you should explain the following:

A. How to activate a missed approach
B. How to execute a missed approach

IV. **Advice to Instructors**

A. Missed approach procedures should be practiced frequently to ensure that the student can perform them efficiently and safely.

B. Making a transition from the landing configuration to the go-around, completing after-takeoff aircraft checks, conducting frequency shifts for radio calls, and activating the GPS missed approach procedures are activities that draw pilot attention into the cockpit during this critical regime of flight.

1. Extreme care must therefore be taken to ensure that a proper lookout is maintained for other traffic.

V. **Flight Training and Student Practice**

A. The student should execute a missed approach on the majority of approaches.

1. However, while it is assumed that the student knows how to land the aircraft, the transition from instrument to outside references is challenging and must be occasionally practiced.

VI. **Completion Standards**

A. The student shall be able to

1. Activate the missed approach
2. Execute the missed approach procedure, including performance of the after-takeoff checklist, management of navigation aids, and adherence to ATC clearances
3. Establish the aircraft on the missed approach track
4. Maintain the track within 1/2 deflection of the CDI
5. Maintain published or cleared vertical navigation minima within 100 ft.
6. Identify waypoint passage
7. Execute missed approaches using GPS for guidance

15.11 FLYING TO AN ALTERNATE AIRPORT

I. **Objective**

A. The objective of this lesson on flying to an alternate airport is to facilitate student learning of procedures used to add the routing to an alternate airport to the flight plan (either in flight or prior to departure), and to execute a diversion to an alternate airport using GPS.

B. Inform your students that while diverting to an alternate airport using GPS is the focus of this portion of the GPS training, all available NAVAIDs should be used for diversion in order to be prepared if the receiver fails or satellite signals are lost.

II. **Motivation**

A. Pilots must always be prepared to proceed to an alternate airport when operating an aircraft under IFR.

III. **Essential Background Knowledge.** Prior to teaching students about diversion to alternate airports using GPS, you should explain the following:

A. The addition of alternate routing to the flight plan either on the ground prior to departure or in flight

B. The way to change flight plans to enable flying to the alternate, for those receivers that will not permit an alternate to be added to the flight plan

C. The requirement that conventional NAVAIDS be available for a diversion to an alternate if the GPS fails or signals are lost

IV. **Advice to Instructors**

A. Impress upon the student that (s)he must be prepared to divert to an alternate airport at any time, irrespective of the weather.

V. **Flight Training and Student Practice**

A. Ensure that the student practices setting course to an alternate at least once during training.

VI. **Completion Standards**

A. The student shall be able to

1. Add the routing to an alternate airport to the flight plan either in flight or prior to departure
2. Execute a diversion to an alternate airport using GPS for guidance

15.12 SYSTEM MALFUNCTIONS

I. **Objective**

A. The objective of the system malfunctions lesson is to facilitate student learning of procedures used to recognize a system malfunction and to take appropriate action in the event of a system malfunction.

II. **Motivation**

A. It is extremely important that pilots who are operating database-dependent navigation equipment be aware that they must be vigilant and monitor the information and guidance that are being provided by their aircraft's navigation systems.

B. Anomalies have been detected that are a result of software problems or a result of the way procedures and information have been encoded into the database of some GPS equipment.

1. These anomalies may not be apparent to the user until such time as the aircraft departs from its expected route or path of flight.

III. **Essential Background Knowledge.** Prior to teaching students about system malfunctions, you should explain the following:

A. Verification of database waypoints

1. The verification method to be used is determined at your discretion, provided it is effective.
2. Separate waypoint verifications should be carried out for en route and terminal procedures.

B. The review of the RAIM check and the appropriate actions

C. The appropriate action for a GPS receiver power failure

IV. **Advice to Instructors**

A. GPS receiver performance is typically so accurate that it may lead students to develop a false sense of security.

1. Ensure that each student regularly cross-checks the system with conventional navigation aids, and occasionally give him/her a simulated GPS failure to ensure that (s)he can smoothly transition to traditional navigation methods.

B. The student should diligently monitor the performance of his/her equipment and verify the accuracy of each selected waypoint using current data from charts prior to using his/her equipment for IFR navigation.

1. If there are any discrepancies between the information in the database and the charts, the student must ensure that (s)he follows the chart procedure.

V. **Flight Training and Student Practice**

A. Some systems have malfunction reports embedded in their databases; if so, have the student retrieve a report and record the information provided.

VI. **Completion Standards**

A. The student shall be able to recognize a system malfunction, and take appropriate action.

15.13 GPS MANUFACTURERS

I. The following is an alphabetical list of most of the major GPS manufacturers (for both panel-mounted and hand-held units) and their websites:

Allied Signal (Bendix/King) http://www.bendixking.com	Narco Avionics, Inc. http://www.narco-avionics.com
Arnav Systems, Inc. http://www.arnav.com	Northstar Technologies http://www.northstarcmc.com
Garmin International http://www.garmin.com	Trimble Navigation http://www.trimble.com
Lowrance Electronics http://www.lowrance.com	UPS Aviation Technologies (Apollo) http://www.upsat.com
Magellan Systems Corp. http://www.magellangps.com	

A. Contact the manufacturers for information about their products.

1. Some manufacturers offer free GPS simulators that are representative of their products and can be downloaded from their website.

B. We do NOT endorse any manufacturer.

C. Please contact firc@gleim.comwith additions, deletions, and corrections.

GLEIM FLIGHT INSTRUCTOR REFRESHER COURSE
LESSON 16
INTERNET RESOURCES

16.1 INTRODUCTION

I. This lesson describes several valuable resources for students, pilots, and flight instructors that are available via the Internet.

A. The information contained in this lesson may be useful to you as an instructor in several ways:

1. Some resources can improve your performance as an instructor by expanding your knowledge of the applicable subject areas. Expanded knowledge will deepen your understanding of these subjects and increase the effectiveness of your instruction.
2. Other resources are appropriate for current or prospective students who are in the process of choosing the path that their flight training will take. These resources can help answer questions about careers vs. personal flying, flight training options, etc.
3. Still other resources are useful to certificated pilots (including flight instructors) as aids in carrying out responsibilities as pilot-in-command and as a means of obtaining employment.

II. The next eight modules summarize the contents of web sites relevant to the following topics:

A. Resources for the student pilot
B. Weather resources
C. Safety resources
D. FAA resources
E. Aviation organizations
F. Commercial aviation companies
G. Aviation employment opportunities
H. Flight simulator manufacturer

16.2 RESOURCES FOR THE STUDENT PILOT

I. Several Internet sites provide excellent information for prospective and active student pilots.

A. These sites are designed to familiarize prospective students with flying and flight training, and to provide useful forums and training tips for students who are in the process of pursuing a certificate or rating.

B. Identify these sites to your current and prospective students and encourage students to visit them.

II. **Student Pilot** (http://www.studentpilot.com)

A. This site offers a variety of information to student pilots, including numerous links to various government and industry web sites.

B. An interactive forum allows students to post questions, comments, or suggestions about flying.

C. A training aids section includes

1. Flight training logbooks that describe the training experiences of several pilots who recently obtained a certificate or rating, including the experiences of one Air Force pilot.
2. A virtual flight school that explains everything from preflighting and ground reference maneuvers to weather report analysis.
3. An FAA test preparation program that allows students to prepare for the private pilot and instrument rating knowledge tests.

D. A reference section includes

1. A directory of several aviation sites
2. A listing of organizations that can assist students during training and help with obtaining financial aid
3. An aviation events calendar
4. An aviation medical examiner (AME) search engine

E. An articles section includes various articles on aviation-related subjects such as safety, medical issues, and news releases.

III. **Student Pilot Network** (http://www.ufly.com)

A. The Student Pilot Network is designed to help aspiring pilots make wise training decisions.

B. A flight school database provides a detailed profile of participating schools in a standardized and searchable format.

1. Prospective students may search this database for a school by location or by use of an advanced search.
    a. The advanced search allows students to locate a school offering specific programs or features, such as a professional pilot program or financial assistance.
2. The standardized format allows for easy comparison among schools.
3. A feature allows a flight school that is not listed in the database to be added by a representative of the company.

C. A discussion forum is available for students and pilots to exchange information and experiences.

D. Learn-to-fly articles cover a wide variety of topics, including

1. Selection of a flight school
2. Pilot career options
3. Financial assistance
4. Employment opportunities
5. Military vs. civilian flying

E. A pilot interview section allows students to learn how other pilots obtained their certificates and jobs.

F. An online store offers a variety of merchandise, from training materials to fun items like gifts and toys.

G. Information on recreational, professional, and military training is available, including a search engine that can be used to find the answers to frequently asked questions.

H. The goal of the Student Pilot Network is to provide accurate and timely information about learning to fly and continuing to pursue aviation after the training stage.

IV. **Be-A-Pilot** (http://www.beapilot.com)

A. Be-A-Pilot is an industry-sponsored marketing program designed to inspire people to "Stop dreaming, start flying."

1. Be-A-Pilot offers a $49 introductory flight that can be redeemed at a participating flight school.
    a. Participating flight schools can be located with a searchable database.
2. The goal of this program is to encourage people to realize their dreams of flying by taking an introductory flight and beginning flying lessons.

B. The Be-A-Pilot web site is an excellent resource for prospective students who are looking for information about learning to fly.

1. The site contains information on learning to fly and the steps to take to begin. It offers articles covering a variety of subjects, from what can be done with a pilot certificate to how much of an investment is required to obtain one.

C. Aviation links are also provided to connect prospective students to other sites of interest.

16.3 WEATHER RESOURCES

I. Many sites on the Internet provide excellent information about current and forecast weather conditions.

A. Due to the vast number of sites available, this discussion is limited to six of the major sites.

B. Identify these sites to your students as an aid in flight planning.

1. Inform your students that, in most cases, these sites are not considered "official" sources of weather information; accordingly, it may still be necessary to obtain an official briefing from a flight service specialist before beginning a flight.

II. **Aviation Weather Center** (http://www.aviationweather.gov)

A. The National Weather Service (NWS) Aviation Weather Center (AWC) products page provides a wealth of weather information to pilots.

B. Aviation products include

1. AIRMETs, convective SIGMETs, domestic SIGMETs, and international SIGMETs
2. Aviation area forecasts
3. NWS and world area forecast system fax products (charts)
4. Low-level and high-level significant weather progs
5. Terminal aerodrome forecasts (TAF)
6. TWEB route forecasts
7. International flight folder documentation programs
8. Winds aloft forecasts
9. Wind/temperature plots
10. Alaska aviation weather
11. Various satellite images, including infrared (IR), visible, and water vapor
12. A national weather radar composite with precipitation tops

    a. Radar observation text reports are also available.

C. Experimental forecast products include

1. Convection forecasts
2. Mountain wave forecast
3. Neural net icing forecast

D. Other interesting products include

1. North American Weather Cameras (Weathernet - University of Michigan) provides access to over 800 weather cameras across North America.

2. An aviation weather calculator converts units of measurement and allows users determine values such as wind chill factor and heat index.

3. An AWC Product Overlays feature allows users to display multiple graphical weather products of their choosing (e.g., radar images, satellite images, AIRMETs, etc.) on a single U.S. map.

III. **Aviation Digital Data Service** (http://adds.aviationweather.gov)

A. This website matches interactive meteorological software with a thorough package of pre- created weather products for use by pilots and meteorologists. The interactive software displays information contained in standard weather products in innovative and helpful formats.

1. New items are summarized in chronological order on a separate page to ease familiarization.
2. The site offers users online help, tip sheets, and feedback pages.

B. Weather products include

1. PIREPs
2. AIRMETs, SIGMETs, and convective SIGMETs
3. METARs
4. TAFs
5. Satellite images
6. Radar images
7. Winds and temperatures aloft
8. IFR conditions
9. Icing
10. Turbulence
11. Convective activity

IV. **Direct User Access Terminal System (DUATS)**

A. DUATS is an FAA-funded, computer-based information system that enables certificated pilots (including student pilots) to obtain weather briefings and to file flight plans via the Internet, without the need to contact a Flight Service Station.

1. Pilots who are required to have a medical certificate to exercise all of their pilot privileges (i.e., pilots who do not have glider or balloon ratings) must also have a current medical certificate to use DUATS.

B. Currently, the FAA offers DUATS service through two private contractors: Data Transformation Corporation (DTC) and DynCorp.

1. You can access DUATS through DTC and DynCorp on the Internet.
   a. DTC website is http://www.duat.com
   b. DynCorp website is http://www.duats.com

C. DUATS gives users full access to all aviation-related National Weather Service (NWS) products, including graphical weather maps.

1. Additionally, DUATS offers flight planning features including
   a. Filing and closing a flight plan
   b. Constructing and printing a flight (nav) log using your own route, VOR, RNAV, and/or airway routing

V. **Flight Brief** (http://www.flightbrief.com)

A. This website is a subscription page, meaning that you must be a member to access the weather information.

B. Flight Brief offers the following:

1. Satellite images
2. National radar images
3. Winds aloft
4. Weather depiction charts
5. Ceiling heights and surface visibilities
6. Current and forecast temperatures

7. Surface analysis charts
8. Precipitation information
9. Severe weather alerts
10. Lightning tracking information

C. A section called AVCAST contains the identical text briefing used by Flight Service Stations and the U.S. military.

VI. **The Weather Channel** (http://www.weather.com)

A. This website offers the same information as seen on the Weather Channel, which may or may not be available from your local cable company.

B. The website offers a special aviation section, which includes

1. Location of the main North American jet stream for the current and up to 5 days in advance
2. Surface, low, mid, and upper wind speeds and directions
3. A national airport overview of IFR/MVFR conditions

VII. **Aviation Weather** (http://www.aviationweather.com)

A. This website provides pilots with a variety of aviation weather services.

B. Some of the services and weather information offered include

1. Convective, domestic, and international SIGMETs
2. METARs
3. TAFs
4. Winds aloft forecasts
5. Area forecasts
6. Mountain wave information
7. Aviation icing maps
8. Alaska weather
9. TWEB routes

C. A database of current conditions at several airports within each state is offered on the main page.

1. Selecting a state brings up a list of airports within that state.
2. The user can click on the desired airport to see the current conditions.

D. There is a section for converting and decoding weather symbols and units of time, temperature, and wind velocity.

E. Keys for decoding AIRMETs, SIGMETs, convective SIGMETs, international SIGMETs, TAFs, and winds aloft plots are also provided.

16.4 SAFETY RESOURCES

I. There are many safety-related web sites on the Internet that pilots can use to enhance the safety of their operations. Most of these sites are based on reports or descriptions of hazardous or potentially hazardous aviation occurrences.

A. By learning from the experiences of others, pilots can lower their own risk of being involved in an accident.

II. **Aviation Safety Reporting System** (http://asrs.arc.nasa.gov)

A. This is the website for the Aviation Safety Reporting System (ASRS). ASRS was established in 1975 by the FAA and is administered by NASA.

B. The ASRS collects, analyzes, and responds to voluntarily submitted aviation safety incident reports with the goal of reducing the likelihood of aviation accidents.

1. Pilots who submit reports of incidents may receive limited immunity from an enforcement action related to the incident on the grounds that the pilot is helping to educate the FAA and the flying public to potential hazards by sharing his/her experiences as described in his/her own words.

C. The site offers a database of selected ASRS reports organized by incident category (e.g., in-flight weather encounters), and links to a larger database of all ASRS reports that can be searched by location, aircraft type, etc.

D. Users can view the current issue and past issues of *Callback*, which is a monthly safety bulletin containing excerpts from ASRS incident reports that are accompanied by supporting commentary.

1. Inform your students that reading *Callback* is one method of learning from others in order to improve the human performance aspect of flying.

E. Pilots can also obtain the ASRS reporting form from the website. This form can be filled out and sent to NASA via U.S. mail.

III. **FAA Office of System Safety** (http://www.asy.faa.gov/)

A. In 1995, FAA Administrator David Hinson challenged the industry to "Zero Accidents" and proposed a new and innovative approach to aviation safety, an approach that is proactive rather than reactive.

1. To support this effort, he created the Office of System Safety. Its primary function is to develop and implement improved tools and processes to facilitate more effective use of safety data, both inside and outside the FAA.

B. Safety data available through the Office of System Safety web site include the following:

1. Users can access databases such as NTSB aviation accident/incident data, FAA ASRS incident data, and near midair collision system data.
2. Additionally, users can view the NTSB's safety recommendations to the FAA with the FAA responses, along with the Bureau of Transportation Statistics (BTS) and Airline Traffic Statistics.

C. The publications section contains several safety products, including materials related to

1. Airport markings
2. Summer weather information
3. New aviation weather formats: METAR/TAF
4. Winter weather information

D. A link is provided to the National Aviation Data Safety Analysis Center (NASDAC) website, where users can access various searchable aviation databases.

E. The Office of System Safety web site also reflects the FAA's participation in the Global Aviation Information Network (GAIN). GAIN's purpose is to promote and facilitate the voluntary collection and sharing of safety information by and among users in the international aviation community for the purpose of improving safety.

1. A link is provided to the GAIN website.

IV. **National Transportation Safety Board (NTSB)** (http://www.ntsb.gov)

A. This site offers information about the history and function of the NTSB, as well as databases of aviation, marine, highway, and railroad incident/accident reports.

1. Incident/accident report databases can be searched using a case-specific query that incorporates data such as the accident date and location, aircraft type, aircraft registration number, etc.
2. The databases can also be viewed according to the month and year in which the incident/accident occurred. The reports begin on January 1, 1962.

V. **Aviation Safety Network** (http://www.aviation-safety.net/)

A. This website offers a detailed database of incidents/accidents from around the world. Whenever possible, information obtained from accident reports (prepared by the NTSB or a foreign agency) and photographs are included.

B. The site has several sections, including

1. Database (brief descriptions of aviation incidents/accidents)
2. Accident reports (official findings)
3. Safety issues (incidents/accidents organized according to causal factors)
4. Statistics
5. Useful links to other web sites
6. Accident specials (detailed analyses of famous accidents)
7. CVR (cockpit voice recorders)/FDR (flight data recorders)
8. Forum (an area for users to voice opinions)

VI. **The Aviation Safety Institute** (http://www.aero-farm.com/asi/asi.htm/)

A. This website provides information about accidents and incidents in aviation. The focus is on incidents rather than accidents.

1. The Aviation Safety Institute seeks to improve safety by learning from operational incidents that, but for one or more missing elements, might have become accidents.
2. This organization takes the investigation of incidents a step further than the NTSB.

VII. **Global Aviation Information Network (GAIN)** (http://www.gainweb.org/index.html)

A. GAIN is a voluntary worldwide infrastructure, privately owned and operated, created to collect, analyze, and disseminate aviation safety information.

B. The organization collects safety data from pilots, controllers, and other aviation-related employees, and then informs the public of the problems and possible solutions.

C. The GAIN website describes the organization's history, mission, and findings.

1. The site is much like a privately-owned FAA or NTSB site.

16.5 FAA RESOURCES

I. The FAA makes a great deal of useful information available to the public via the Internet.

A. Identify the following sites to your students as official sources of information concerning a variety of topics.

II. **FAA Aviation Support and Regulation** (http://www1.faa.gov/RegulatoryAdvisory/).

A. This web site provides over 115 links to information that is useful to the aviation community.

B. The links are separated in the following 12 categories:

1. Access points
2. Primarily for pilots
3. Primarily for mechanics
4. Primarily for aircraft owners
5. The U.S. Code of Federal Regulations
6. Pilot certification
    a. Under this category is a link to Part 61 and 141 frequently asked questions (FAQ) site.
        i. This FAQ site provides detailed answers to commonly asked questions about Part 61 and 141 flight privileges and requirements.
    b. This category provides numerous other links that are valuable to a CFI, such as the knowledge test question banks and the practical tests.
7. Tutorials, periodicals, and FAQs
    a. This category provides links to items such as the current on-line *AIM* and the Designee Update Newsletter.
8. Guidance, reference, advisory
    a. Links to items such as the index of FAA Advisory Circulars, knowledge test guides, and the National Runway Safety Program.
9. FAA organizations
    a. This category provides links to locate FAA offices or web sites in a particular area, such as a Flight Standards District Office (FSDO).
10. FAA designations
11. FAA initiatives and programs in the news
12. Aviation forms

III. **FAA Office of Aviation Medicine** (http://www.cami.jccbi.gov)

A. This site is an excellent resource for aeromedical information.
B. An aviation medical examiner (AME) search directory is also available at this site.

IV. **Orlando FSDO Web Site** (www2.faa.gov/fsdo/orl)

A. The Orlando FSDO web site is typical of many FSDO websites. It has a variety of useful features and information, including

1. Links to many other FAA and industry web sites
2. Information about scheduling initial CFI check rides, including a list of common deficiencies found in initial CFI applicants
    a. The Orlando FSDO is one of many that participates in the FAA's CFI Special Emphasis Program (CFI/ESP). The ultimate goal of the program is to drastically reduce the number of accidents and incidents occurring during flight training activities.
    b. For more information on the CFI Special Emphasis Program, visit: http://www2.faa.gov/fsdo/orl/findings.cfm
3. Information about how to obtain a U.S. pilot certificate based on a foreign certificate/license
4. A list of designated examiners in the district
5. Flight advisories for transient pilots, covering concerns unique to central Florida (e.g., restricted airspace around Kennedy Space Center)
6. Information for the general public, such as instructions on how to report low-flying aircraft

B. Additionally, the Orlando FSDO is a registration site for the FAA Safety Center and Production Studio located at the Lakeland Linder Regional Airport in Lakeland, FL.

1. Throughout the year, the FAA Safety Center is host to numerous safety seminars encompassing all aspects of aviation. Industry, organizations, and individuals are encouraged to attend and participate in as many safety seminars as possible. Nearly all seminars are free of charge and walk-ins are gladly welcomed, space permitting.
2. To view a schedule of the various seminars offered, as well as to process an online registration form, visit: http://www1.faa.gov/fsdo/orl/register/register.cfm.
3. For an overview of the Lakeland FAA Safety Center and Production studio, including a virtual "Photo-Tour", visit: http://www.faaproductionstudios.com/.

16.6 AVIATION ORGANIZATIONS ON THE INTERNET

I. Many outstanding aviation-related organizations have sites on the Internet.

A. While we have selected only a few for this lesson, you and your students are encouraged to fully explore the range of aviation organizations accessible via the Internet.

II. **Aircraft Owners and Pilots Association (AOPA)** (http://www.aopa.org)

A. The Aircraft Owners and Pilots Association, a not-for-profit organization dedicated to promoting general aviation, was incorporated on May 15, 1939. From the start, AOPA has worked to keep general aviation fun, safe, and affordable.

1. AOPA conveys important information about general aviation-related issues to pilots and the general public alike; this information is available to anyone who accesses AOPA's site.
   a. Additionally, AOPA offers flight training information to prospective student pilots, a CFI directory to assist prospective students in finding a flight instructor, and numerous other pages to encourage the growth of aviation.
2. A special "members only" section provides information that is tailored to pilots and AOPA members, such as aviation weather, flight planning tools, an airport directory, and a member forum.
   a. Users must be members of AOPA in order to access this section of the site.
3. The *AOPA Project Pilot* Instructor Program has been established to reach out to CFIs and their students. By supporting CFIs and providing materials, the *AOPA Project Pilot* Instructor Program assists CFIs and their students through the flight training process.

III. **The Experimental Aircraft Association (EAA)** (http://www.eaa.org)

A. The EAA is a growing and diverse organization of members with a wide range of aviation interests and backgrounds. The organization focuses on people, offering the opportunity to make new aviation friends and form relationships while encouraging the sharing of information, stories, and enthusiasm.

B. Programs and benefits include

1. Publications. EAA publishes magazines for each of its three divisions (the Vintage Aircraft Division, the International Aerobatics Club (IAC), and the Warbirds of America), each focusing on a specific type of aircraft or activity.
2. Education and competition. EAA's annual AirVenture air show in Oshkosh, WI, features more than 500 educational forums, workshops, and seminars presented by the top names in aviation. AirVenture also includes competition judging for the best aircraft in a variety of different categories, from design and restoration to actual construction.
3. Dedication to the future. The EAA Aviation Foundation was established in 1962 and is dedicated to the education, history, and development of sport aviation.
4. Young Eagles Program. One of the foundation's most important efforts is the Young Eagles Program, created to give a free flight experience to young people, primarily ages 8 through

17.

5. Youth scholarships. The foundation, which cosponsors AirVenture, also administers an extensive scholarship program for young people interested in aviation-related careers.

IV. **National Association of Flight Instructors (NAFI)** (http://www.nafinet.org)

A. NAFI is an affiliate of the EAA that is dedicated to "raising and maintaining the professional standing of the flight instructor in the aviation community."

B. NAFI offers the opportunity for flight instructors to apply for "Master CFI" industry accreditation, which gives them visibility and credibility as quality instructors. Master CFI accreditation encourages participation and leadership in all aspects of aviation education and communication development.

C. The NAFI website contains information that is useful to CFIs and their students.

1. For example, NAFI members can be included in a searchable CFI directory that can be used by prospective students to find an instructor.

V. **The Ninety-Nines, Inc.** (http://www.ninety-nines.org)

A. The Ninety-Nines is an international organization of licensed women pilots from 35 countries. The organization was founded in 1929 by 99 licensed women pilots.

B. Today, Ninety-Nines are

1. Professional pilots for airlines, industry, and government
2. Pilots who teach and pilots who fly for pleasure
3. Pilots who are technicians and mechanics

VI. **Women in Aviation International** (http://www.wiai.org)

A. Women in Aviation International (WAI) is dedicated to the encouragement and advancement of women in all aviation career fields and interests.

B. WAI offers educational outreach programs to educators, aviation industry members, and young people.

C. The WAI website contains information on aviation events, news, education, and careers.

1. An online shop is also available.

16.7 COMMERCIAL AVIATION COMPANIES

I. Numerous commercial aviation websites offer a variety of services to pilots and aviation enthusiasts, including news, forums, searchable databases, image libraries, and online shopping.

A. We have listed just a few of the many sites available.

II. **AVweb** (http://www.avweb.com)

A. AVweb is an Internet aviation magazine and news service.

B. Various pages include topics on aeromedical factors, aviation law, databases, insurance, and many more.

III. **Landings** (http://www.landings.com)

A. Landings is a website that provides a variety of services and information sources to pilots.

B. This website has many searchable databases that aid the general aviation pilot. Some of these databases include

1. Aviation designated examiners database
2. Certificated A&P and medical examiners databases

3. Approximate airport distance database

C. This site offers forums where a pilot can ask "real" questions and get "real" answers from true professionals. Some of the forums include

1. Maintenance
2. Medicine
3. Aviation law
4. Aerobatics/soaring

IV. **Sporty's** (www.sportys.com)

A. This website offers

1. Information and resources for individuals interested in taking flight lessons
2. Products ranging from pilot training and reference materials to unique items that show your love for flying

16.8 AVIATION EMPLOYMENT OPPORTUNITIES

I. We have listed two of the many websites that exist for the purpose of finding employment or advertising job openings in the aviation industry.

II. **The Flight Instructor's Homepage** (http://www.ilsapproach.com/)

A. This site has information for commercial pilots and flight instructors who are seeking employment.

B. There is an active message board where all interested pilots can share their ideas about the current and future aviation employment climate.

C. This site includes a list of links to other aviation websites whose contents range from weather information to image libraries.

III. **Aviation Employment** (http://www.aviationemployment.com)

A. This website is an online job search engine specializing in aerospace and aviation jobs. Job search categories include

1. Aerospace/aviation engineering
2. Aviation/maintenance and technical jobs
3. Management/executive aviation jobs
4. Miscellaneous aviation jobs
5. Pilot jobs

16.9 FLIGHT SIMULATOR MANUFACTURERS

I. Flight simulators, flight training devices, and personal computer-based aviation training devices (PCATDs) have become increasingly common flight training tools, especially at larger flight schools.

A. We have listed the websites for two of the most popular general aviation simulator manufacturers.

II. **Frasca International** (http://www.frasca.com)

A. The Frasca website provides information about flight simulator upgrades, new models, and FAA requirements, as well as other information services.

B. The site also offers a customer list so users can see which schools and aviation companies are using Frasca simulators.

III. **Elite Simulation Solutions** (http://www.flyelite.com)

A. Elite Simulation Solutions produces aerodynamically and visually accurate PCATD software for all levels of flight training, from beginning instrument students to ATPs.

B. Some of the aircraft simulators offered include

1. Cessna 172R/H2P
2. Piper Archer III
3. Piper Arrow IV
4. Cessna 182S
5. Mooney M20J
6. Bonanza A36
7. King Air B200
8. MD-81