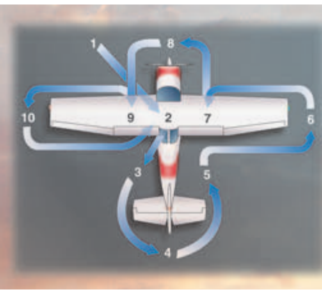
# Chapter 2

# Ground Operations




## VISUAL INSPECTION

The accomplishment of a safe flight begins with a careful visual inspection of the airplane. The purpose of the preflight visual inspection is twofold: to determine that the airplane is legally airworthy, and that it is in condition for safe flight. The airworthiness of the airplane is determined, in part, by the following certificates and documents, which must be on board the airplane when operated. [Figure 2-1]

- Airworthiness certificate.
- Registration certificate.
- FCC radio station license, if required by the type of operation.
- Airplane operating limitations, which may be in the form of an FAA-approved Airplane Flight Manual and/or Pilot's Operating Handbook (AFM/POH), placards, instrument markings, or any combination thereof.

Airplane logbooks are not required to be kept in the airplane when it is operated. However, they should be inspected prior to flight to show that the airplane has had required tests and inspections. Maintenance records for the airframe and engine are required to be kept. There may also be additional propeller records.

At a minimum, there should be an annual inspection within the preceding 12-calendar months. In addition, the airplane may also be required to have a 100-hour inspection in accordance with Title14 of the Code of Federal Regulations (14 CFR) part 91, section 91.409(b).

If a transponder is to be used, it is required to be inspected within the preceding 24-calendar months. If the airplane is operated under instrument flight rules (IFR) in controlled airspace, the pitot-static system is also required to be inspected within the preceding 24-calendar months.

The emergency locator transmitter (ELT) should also be checked. The ELT is battery powered, and the battery replacement or recharge date should not be exceeded.

Airworthiness Directives (ADs) have varying compliance intervals and are usually tracked in a separate area of the appropriate airframe, engine, or propeller record.

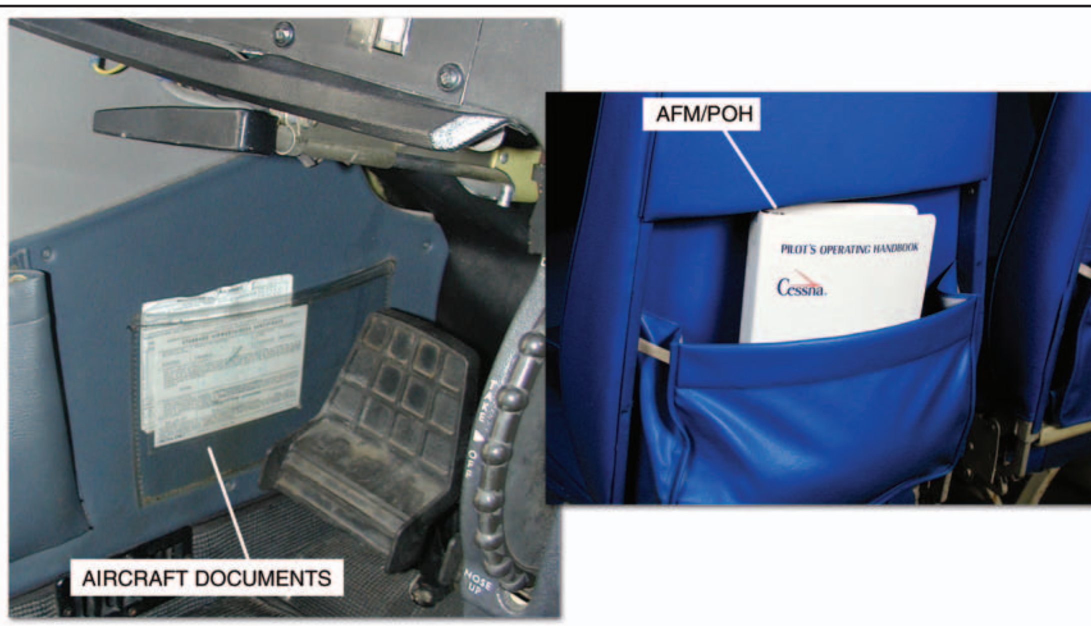



**Figure 2-1. Aircraft documents and AFM/POH.**

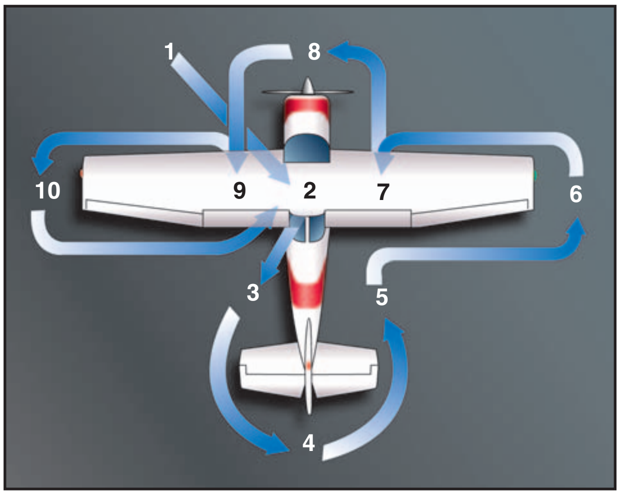



Figure 2-2. Preflight inspection.

The determination of whether the airplane is in a condition for safe flight is made by a preflight inspection of the airplane and its components. [Figure 2-2] The preflight inspection should be performed in accordance with a printed checklist provided by the airplane manufacturer for the specific make and model airplane. However, the following general areas are applicable to all airplanes.

The preflight inspection of the airplane should begin while approaching the airplane on the ramp. The pilot should make note of the general appearance of the airplane, looking for obvious discrepancies such as a landing gear out of alignment, structural distortion, skin damage, and dripping fuel or oil leaks. Upon reaching the airplane, all tiedowns, control locks, and chocks should be removed.

## INSIDE THE COCKPIT

The inspection should start with the cabin door. If the door is hard to open or close, or if the carpeting or seats are wet from a recent rain, there is a good chance that the door, fuselage, or both are misaligned. This may be a sign of structural damage.

The windshield and side windows should be examined for cracks and/or crazing. Crazing is the first stage of delamination of the plastic. Crazing decreases visibility, and a severely crazed window can result in near zero visibility due to light refraction at certain angles to the sun.

The pilot should check the seats, seat rails, and seat belt attach points for wear, cracks, and serviceability. The seat rail holes where the seat lock pins fit should


Figure 2-3. Inside the cockpit.


Figure 2-4. Fuel selector and primer.

also be inspected. The holes should be round and not oval. The pin and seat rail grips should also be checked for wear and serviceability.

Inside the cockpit, three key items to be checked are: (1) battery and ignition switches—off, (2) control column locks—*removed*, (3) landing gear control—*down and locked.* [Figure 2-3]

The fuel selectors should be checked for proper operation in all positions—including the OFF position. Stiff selectors, or ones where the tank position is hard to find, are unacceptable. The primer should also be exercised. The pilot should feel resistance when the primer is both pulled out and pushed in. The primer should also lock securely. Faulty primers can interfere with proper engine operation. [Figure 2-4] The engine controls should also be manipulated by slowly moving each through its full range to check for binding or stiffness.

The airspeed indicator should be properly marked, and the indicator needle should read zero. If it does not, the instrument may not be calibrated correctly. Similarly, the vertical speed indicator (VSI) should also read zero when the airplane is on the ground. If it does not, a small screwdriver can be used to zero the instrument. The VSI is the only flight instrument that a pilot has the prerogative to adjust. All others must be adjusted by an FAA certificated repairman or mechanic.

The magnetic compass is a required instrument for both VFR and IFR flight. It must be securely mounted, with a correction card in place. The instrument face must be clear and the instrument case full of fluid. A cloudy instrument face, bubbles in the fluid, or a partially filled case renders the instrument unusable. [Figure 2-5]

The gyro driven attitude indicator should be checked before being powered. A white haze on the inside of


Figure 2-5. Airspeed indicator, VSI, and magnetic compass.

Figure 2-6. Wing and tail section inspection.

the glass face may be a sign that the seal has been breached, allowing moisture and dirt to be sucked into the instrument.

The altimeter should be checked against the ramp or field elevation after setting in the barometric pressure. If the variation between the known field elevation and the altimeter indication is more than 75 feet, its accuracy is questionable.

The pilot should turn on the battery master switch and make note of the fuel quantity gauge indications for comparison with an actual visual inspection of the fuel tanks during the exterior inspection.

## OUTER WING SURFACES AND TAIL SECTION

The pilot should inspect for any signs of deterioration, distortion, and loose or missing rivets or screws, especially in the area where the outer skin attaches to the airplane structure. [Figure 2-6] The pilot should look along the wing spar rivet line—from the wingtip to the fuselage—for skin distortion. Any ripples and/or waves may be an indication of internal damage or failure.

Loose or sheared aluminum rivets may be identified by the presence of black oxide which forms rapidly when the rivet works free in its hole. Pressure applied to the skin adjacent to the rivet head will help verify the loosened condition of the rivet.

When examining the outer wing surface, it should be remembered that any damage, distortion, or malformation of the wing leading edge renders the airplane unairworthy. Serious dents in the leading edge, and disrepair of items such as stall strips, and deicer boots can cause the airplane to be aerodynamically unsound. Also, special care should be taken when examining the wingtips. Airplane wingtips are usually fiberglass. They are easily damaged and subject to cracking. The pilot should look at stop drilled cracks for evidence of crack progression, which can, under some circumstances, lead to in-flight failure of the wingtip.

The pilot should remember that fuel stains anywhere on the wing warrant further investigation—no matter how old the stains appear to be. Fuel stains are a sign of probable fuel leakage. On airplanes equipped with integral fuel tanks, evidence of fuel leakage can be found along rivet lines along the underside of the wing.

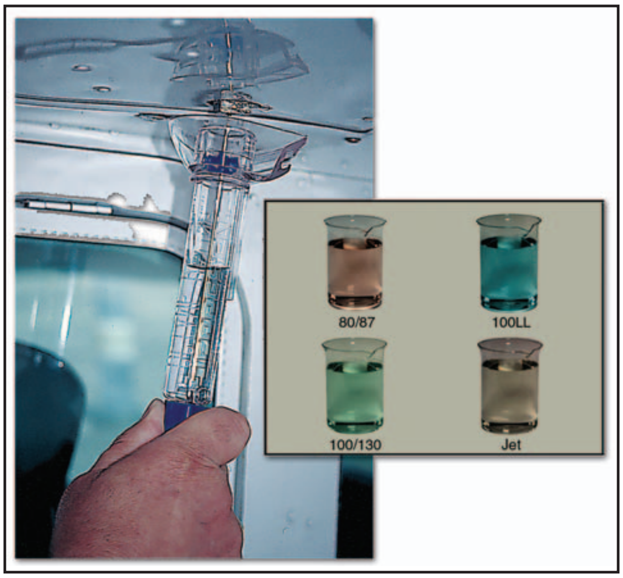



**Figure 2-7. Aviation fuel types, grades, and colors.**

## FUEL AND OIL

Particular attention should be paid to the fuel quantity, type and grade, and quality. [Figure 2-7] Many fuel tanks are very sensitive to airplane attitude when attempting to fuel for maximum capacity. Nosewheel strut extension, both high as well as low, can significantly alter the attitude, and therefore the fuel capacity. The airplane attitude can also be affected laterally by a ramp that slopes, leaving one wing slightly higher than another. Always confirm the fuel quantity indicated on the fuel gauges by visually inspecting the level of each tank.

The type, grade, and color of fuel are critical to safe operation. The only widely available aviation gasoline (AVGAS) grade in the United States is low-lead 100-octane, or 100LL. AVGAS is dyed for easy recognition of its grade and has a familiar gasoline scent. Jet-A, or jet fuel, is a kerosene-based fuel for turbine powered airplanes. It has disastrous consequences when inadvertently introduced into reciprocating airplane engines. The piston engine operating on jet fuel may start, run, and power the airplane, but will fail because the engine has been destroyed from detonation.

Jet fuel has a distinctive kerosene scent and is oily to the touch when rubbed between fingers. Jet fuel is clear or straw colored, although it may appear dyed when mixed in a tank containing AVGAS. When a few drops of AVGAS are placed upon white paper, they evaporate quickly and leave just a trace of dye. In comparison, jet fuel is slower to evaporate and leaves an oily smudge. Jet fuel refueling trucks and dispensing equipment are marked with JET-A placards in white letters on a black background. Prudent pilots will supervise fueling to ensure that the correct tanks are filled with the right quantity, type, and grade of fuel. The pilot should always ensure that the fuel caps have been securely replaced following each fueling.

Engines certificated for grades 80/87 or 91/96 AVGAS will run satisfactorily on 100LL. The reverse is not true. Fuel of a lower grade/octane, if found, should never be substituted for a required higher grade. Detonation will severely damage the engine in a very short period of time.

Automotive gasoline is sometimes used as a substitute fuel in certain airplanes. Its use is acceptable only when the particular airplane has been issued a supplemental type certificate (STC) to both the airframe and engine allowing its use.

Checking for water and other sediment contamination is a key preflight element. Water tends to accumulate in fuel tanks from condensation, particularly in partially filled tanks. Because water is heavier than fuel, it tends to collect in the low points of the fuel system. Water can also be introduced into the fuel system from deteriorated gas cap seals exposed to rain, or from the supplier's storage tanks and delivery vehicles. Sediment contamination can arise from dust and dirt entering the tanks during refueling, or from deteriorating rubber fuel tanks or tank sealant.

The best preventive measure is to minimize the opportunity for water to condense in the tanks. If possible, the fuel tanks should be completely filled with the proper grade of fuel after each flight, or at least filled after the last flight of the day. The more fuel there is in the tanks, the less opportunity for condensation to occur. Keeping fuel tanks filled is also the best way to slow the aging of rubber fuel tanks and tank sealant.

Sufficient fuel should be drained from the fuel strainer quick drain and from each fuel tank sump to check for fuel grade/color, water, dirt, and smell. If water is present, it will usually be in bead-like droplets, different in color (usually clear, sometimes muddy), in the bottom of the sample. In extreme cases, do not overlook the possibility that the entire sample, particularly a small sample, is water. If water is found in the first fuel sample, further samples should be taken until no water appears. Significant and/or consistent water or sediment contamination are grounds for further investigation by qualified maintenance personnel. Each fuel tank sump should be drained during preflight and after refueling.

The fuel tank vent is an important part of a preflight inspection. Unless outside air is able to enter the tank as fuel is drawn out, the eventual result will be fuel gauge malfunction and/or fuel starvation. During the preflight inspection, the pilot should be alert for any signs of vent tubing damage, as well as vent blockage. A functional check of the fuel vent system can be done simply by opening the fuel cap. If there is a rush of air when the fuel tank cap is cracked, there could be a serious problem with the vent system.

The oil level should be checked during each preflight and rechecked with each refueling. Reciprocating airplane engines can be expected to consume a small amount of oil during normal operation. If the consumption grows or suddenly changes, qualified maintenance personnel should investigate. If line service personnel add oil to the engine, the pilot should ensure that the oil cap has been securely replaced.

## LANDING GEAR, TIRES, AND BRAKES

Tires should be inspected for proper inflation, as well as cuts, bruises, wear, bulges, imbedded foreign object, and deterioration. As a general rule, tires with cord showing, and those with cracked sidewalls are considered unairworthy.

Brakes and brake systems should be checked for rust and corrosion, loose nuts/bolts, alignment, brake pad wear/cracks, signs of hydraulic fluid leakage, and hydraulic line security/abrasion.

An examination of the nose gear should include the shimmy damper, which is painted white, and the torque link, which is painted red, for proper servicing and general condition. All landing gear shock struts should also be checked for proper inflation.

## ENGINE AND PROPELLER

The pilot should make note of the condition of the engine cowling. [Figure 2-8] If the cowling rivet heads reveal aluminum oxide residue, and chipped paint surrounding and radiating away from the cowling rivet heads, it is a sign that the rivets have been rotating until the holes have been elongated. If allowed to continue, the cowling may eventually separate from the airplane in flight.

Certain engine/propeller combinations require installation of a prop spinner for proper engine cooling. In these cases, the engine should not be operated unless the spinner is present and properly installed. The pilot should inspect the propeller spinner and spinner mounting plate for security of attachment, any signs of chafing of propeller blades, and defects such as cracking. A cracked spinner is unairworthy.

The propeller should be checked for nicks, cracks, pitting, corrosion, and security. The propeller hub should be checked for oil leaks, and the alternator/generator drive belt should be checked for proper tension and signs of wear.

When inspecting inside the cowling, the pilot should look for signs of fuel dye which may indicate a fuel leak. The pilot should check for oil leaks, deterioration of oil lines, and to make certain that the oil cap, filter, oil cooler and drain plug are secure. The exhaust system should be checked for white stains caused by exhaust leaks at the cylinder head or cracks in the stacks. The heat muffs should also be checked for general condition and signs of cracks or leaks.

The air filter should be checked for condition and secure fit, as well as hydraulic lines for deterioration and/or leaks. The pilot should also check for loose or foreign objects inside the cowling such as bird nests, shop rags, and/or tools. All visible wires and lines should be checked for security and condition. And lastly, when the cowling is closed, the cowling fasteners should be checked for security.

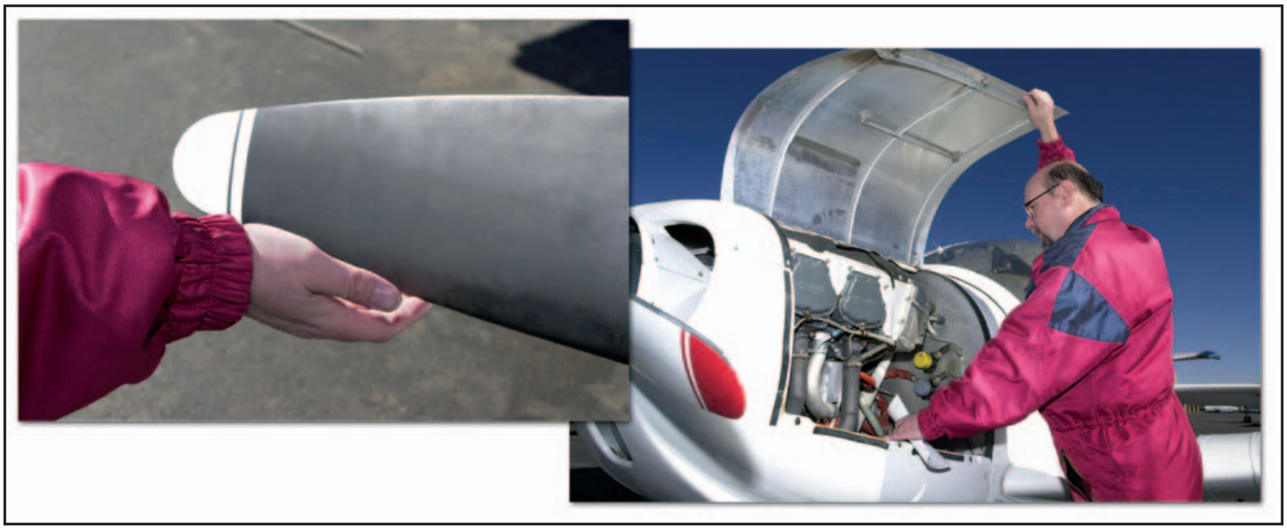


**Figure 2-8. Check the propeller and inside the cowling.**

## COCKPIT MANAGEMENT

After entering the airplane, the pilot should first ensure that all necessary equipment, documents, checklists, and navigation charts appropriate for the flight are on board. If a portable intercom, headsets, or a hand-held global positioning system (GPS) is used, the pilot is responsible for ensuring that the routing of wires and cables does not interfere with the motion or the operation of any control.

Regardless of what materials are to be used, they should be neatly arranged and organized in a manner that makes them readily available. The cockpit and cabin should be checked for articles that might be tossed about if turbulence is encountered. Loose items should be properly secured. All pilots should form the habit of good housekeeping.

The pilot must be able to see inside and outside references. If the range of motion of an adjustable seat is inadequate, cushions should be used to provide the proper seating position.

When the pilot is comfortably seated, the safety belt and shoulder harness (if installed) should be fastened and adjusted to a comfortably snug fit. The shoulder harness must be worn at least for the takeoff and landing, unless the pilot cannot reach or operate the controls with it fastened. The safety belt must be worn at all times when the pilot is seated at the controls.

If the seats are adjustable, it is important to ensure that the seat is locked in position. Accidents have occurred as the result of seat movement during acceleration or pitch attitude changes during takeoffs or landings. When the seat suddenly moves too close or too far away from the controls, the pilot may be unable to maintain control of the airplane.

14 CFR part 91 requires the pilot to ensure that each person on board is briefed on how to fasten and unfasten his/her safety belt and, if installed, shoulder harness. This should be accomplished before starting the engine, along with a passenger briefing on the proper use of safety equipment and exit information. Airplane manufacturers have printed briefing cards available, similar to those used by airlines, to supplement the pilot's briefing.

## GROUND OPERATIONS

It is important that a pilot operates an airplane safely on the ground. This includes being familiar with standard hand signals that are used by ramp personnel. [Figure 2-9]

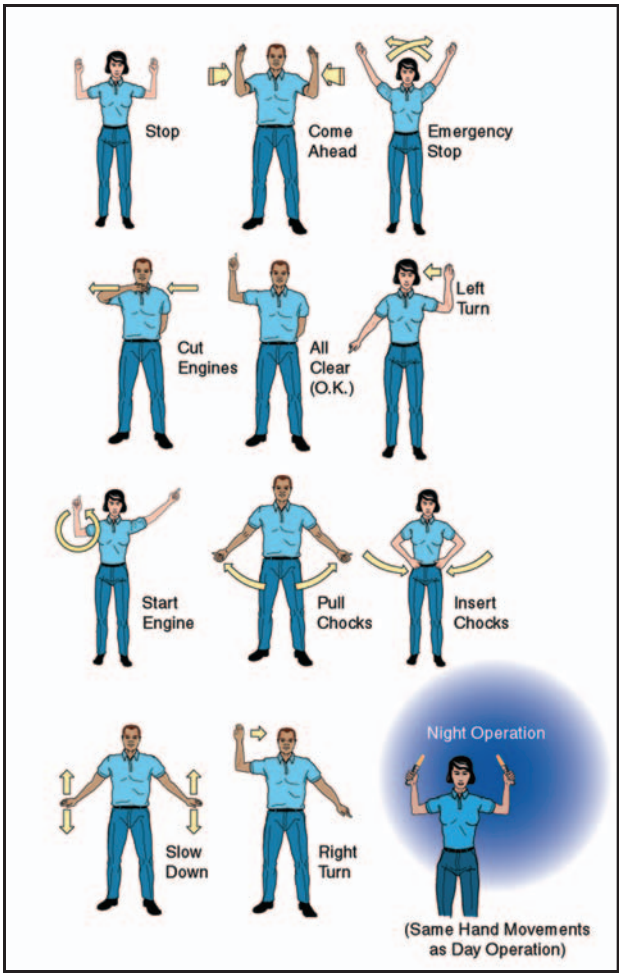



**Figure 2-9. Standard hand signals.**

## ENGINE STARTING

The specific procedures for engine starting will not be discussed here since there are as many different methods as there are different engines, fuel systems, and starting conditions. The before engine starting and engine starting checklist procedures should be followed. There are, however, certain precautions that apply to all airplanes.

Some pilots have started the engine with the tail of the airplane pointed toward an open hangar door, parked automobiles, or a group of bystanders. This is not only discourteous, but may result in personal injury and damage to the property of others. Propeller blast can be surprisingly powerful.

When ready to start the engine, the pilot should look in all directions to be sure that nothing is or will be in the vicinity of the propeller. This includes nearby persons and aircraft that could be struck by the propeller blast or the debris it might pick up from the ground. The anticollision light should be turned on prior to engine start, even during daytime operations. At night, the position (navigation) lights should also be on.

The pilot should always call "CLEAR" out of the side window and wait for a response from persons who may be nearby before activating the starter.

When activating the starter, one hand should be kept on the throttle. This allows prompt response if the engine falters during starting, and allows the pilot to rapidly retard the throttle if revolutions per minute (r.p.m.) are excessive after starting. A low r.p.m. setting (800 to 1,000) is recommended immediately following engine start. It is highly undesirable to allow the r.p.m. to race immediately after start, as there will be insufficient lubrication until the oil pressure rises. In freezing temperatures, the engine will also be exposed to potential mechanical distress until it warms and normal internal operating clearances are assumed.

As soon as the engine is operating smoothly, the oil pressure should be checked. If it does not rise to the manufacturer's specified value, the engine may not be receiving proper lubrication and should be shut down immediately to prevent serious damage.

Although quite rare, the starter motor may remain on and engaged after the engine starts. This can be detected by a continuous very high current draw on the ammeter. Some airplanes also have a starter engaged warning light specifically for this purpose. The engine should be shut down immediately should this occur.

Starters are small electric motors designed to draw large amounts of current for short periods of cranking. Should the engine fail to start readily, avoid continuous starter operation for periods longer than 30 seconds without a cool down period of at least 30 seconds to a minute (some AFM/POH specify even longer). Their service life is drastically shortened from high heat through overuse.

## HAND PROPPING

Even though most airplanes are equipped with electric starters, it is helpful if a pilot is familiar with the procedures and dangers involved in starting an engine by turning the propeller by hand (hand propping). Due to the associated hazards, this method of starting should be used only when absolutely necessary and when proper precautions have been taken.

An engine should not be hand propped unless two people, both familiar with the airplane and hand propping techniques, are available to perform the procedure. The person pulling the propeller blades through directs all activity and is in charge of the procedure. The other person, thoroughly familiar with the controls, must be seated in the airplane with the brakes set. As an additional precaution, chocks may be placed in front of the main wheels. If this is not feasible, the airplane's tail may be securely tied. Never allow a person unfamiliar with the controls to occupy the pilot's seat when hand propping. The procedure should never be attempted alone.

When hand propping is necessary, the ground surface near the propeller should be stable and free of debris. Unless a firm footing is available, consider relocating the airplane. Loose gravel, wet grass, mud, oil, ice, or snow might cause the person pulling the propeller through to slip into the rotating blades as the engine starts.

Both participants should discuss the procedure and agree on voice commands and expected action. To begin the procedure, the fuel system and engine controls (tank selector, primer, pump, throttle, and mixture) are set for a normal start. The ignition/magneto switch should be checked to be sure that it is OFF. Then the descending propeller blade should be rotated so that it assumes a position slightly above the horizontal. The person doing the hand propping should face the descending blade squarely and stand slightly less than one arm's length from the blade. If a stance too far away were assumed, it would be necessary to lean forward in an unbalanced condition to reach the blade. This may cause the person to fall forward into the rotating blades when the engine starts.

The procedure and commands for hand propping are:

- Person out front says, "GAS ON, SWITCH OFF, THROTTLE CLOSED, BRAKES SET."
- Pilot seat occupant, after making sure the fuel is ON, mixture is RICH, ignition/magneto switch is OFF, throttle is CLOSED, and brakes SET, says, "GAS ON, SWITCH OFF, THROTTLE CLOSED, BRAKES SET."
- Person out front, after pulling the propeller through to prime the engine says, "BRAKES AND CONTACT."
- Pilot seat occupant checks the brakes SET and turns the ignition switch ON, then says, "BRAKES AND CONTACT."

The propeller is swung by forcing the blade downward rapidly, pushing with the palms of both hands. If the blade is gripped tightly with the fingers, the person's body may be drawn into the propeller blades should the engine misfire and rotate momentarily in the opposite direction. As the blade is pushed down, the person should step backward, away from the propeller. If the engine does not start, the propeller should not be repositioned for another attempt until it is certain the ignition/magneto switch is turned OFF.

The words CONTACT (mags ON) and SWITCH OFF (mags OFF) are used because they are significantly different from each other. Under noisy conditions or high winds, the words CONTACT and SWITCH OFF are less likely to be misunderstood than SWITCH ON and SWITCH OFF.

When removing the wheel chocks after the engine starts, it is essential that the pilot remember that the propeller is almost invisible. Incredible as it may seem, serious injuries and fatalities occur when people who have just started an engine walk or reach into the propeller arc to remove the chocks. Before the chocks are removed, the throttle should be set to idle and the chocks approached from the rear of the propeller. Never approach the chocks from the front or the side.

The procedures for hand propping should always be in accordance with the manufacturer's recommendations and checklist. Special starting procedures are used when the engine is already warm, very cold, or when flooded or vapor locked. There will also be a different starting procedure when an external power source is used.

## TAXIING

The following basic taxi information is applicable to both nosewheel and tailwheel airplanes.

Taxiing is the controlled movement of the airplane under its own power while on the ground. Since an airplane is moved under its own power between the parking area and the runway, the pilot must thoroughly understand and be proficient in taxi procedures.

An awareness of other aircraft that are taking off, landing, or taxiing, and consideration for the right-of-way of others is essential to safety. When taxiing, the pilot's eyes should be looking outside the airplane, to the sides, as well as the front. The pilot must be aware of the entire area around the airplane to ensure that the airplane will clear all obstructions and other aircraft. If at any time there is doubt about the clearance from an object, the pilot should stop the airplane and have someone check the clearance. It may be necessary to have the airplane towed or physically moved by a ground crew.

It is difficult to set any rule for a single, safe taxiing speed. What is reasonable and prudent under some conditions may be imprudent or hazardous under others. The primary requirements for safe taxiing are positive control, the ability to recognize potential hazards in time to avoid them, and the ability to stop or turn where and when desired, without undue reliance on the brakes. Pilots should proceed at a cautious speed on congested or busy ramps. Normally, the speed should be at the rate where movement of the airplane is dependent on the throttle. That is, slow enough so when the throttle is closed, the airplane can be stopped promptly. When yellow taxiway centerline stripes are provided, they should be observed unless necessary to clear airplanes or obstructions.

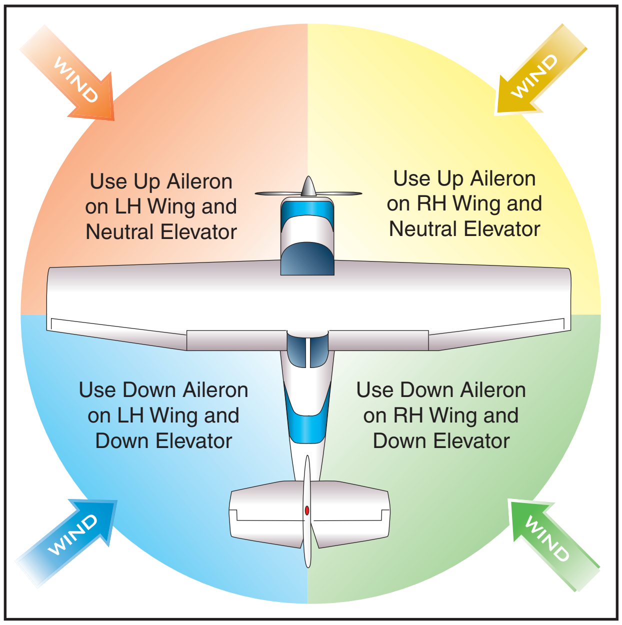



**Figure 2-10. Flight control positions during taxi.**

When taxiing, it is best to slow down before attempting a turn. Sharp, high-speed turns place undesirable side loads on the landing gear and may result in an uncontrollable swerve or a ground loop. This swerve is most likely to occur when turning from a downwind heading toward an upwind heading. In moderate to high-wind conditions, pilots will note the airplane's tendency to weathervane, or turn into the wind when the airplane is proceeding crosswind.

When taxiing at appropriate speeds in no-wind conditions, the aileron and elevator control surfaces have little or no effect on directional control of the airplane. The controls should not be considered steering devices and should be held in a neutral position. Their proper use while taxiing in windy conditions will be discussed later. [Figure 2-10]

Steering is accomplished with rudder pedals and brakes. To turn the airplane on the ground, the pilot should apply rudder in the desired direction of turn and use whatever power or brake that is necessary to control the taxi speed. The rudder pedal should be held in the direction of the turn until just short of the point where the turn is to be stopped. Rudder pressure is then released or opposite pressure is applied as needed.

More engine power may be required to start the airplane moving forward, or to start a turn, than is required to keep it moving in any given direction. When using additional power, the throttle should immediately be retarded once the airplane begins moving, to prevent excessive acceleration.

When first beginning to taxi, the brakes should be tested for proper operation as soon as the airplane is put in motion. Applying power to start the airplane moving forward slowly, then retarding the throttle and simultaneously applying pressure smoothly to both brakes does this. If braking action is unsatisfactory, the engine should be shut down immediately.

The presence of moderate to strong headwinds and/or a strong propeller slipstream makes the use of the elevator necessary to maintain control of the pitch attitude while taxiing. This becomes apparent when considering the lifting action that may be created on the horizontal tail surfaces by either of those two factors. The elevator control in nosewheel-type airplanes should be held in the neutral position, while in tailwheel-type airplanes it should be held in the aft position to hold the tail down.

Downwind taxiing will usually require less engine power after the initial ground roll is begun, since the wind will be pushing the airplane forward. [Figure 2-11] To avoid overheating the brakes when taxiing downwind, keep engine power to a minimum. Rather than continuously riding the brakes to control speed, it is better to apply brakes only occasionally. Other than sharp turns at low speed, the throttle should always be at idle before the brakes are applied. It is a common student error to taxi with a power setting that requires controlling taxi speed with the brakes. This is the aeronautical equivalent of driving an automobile with both the accelerator and brake pedals depressed.

When taxiing with a quartering headwind, the wing on the upwind side will tend to be lifted by the wind unless the aileron control is held in that direction (upwind aileron UP). [Figure 2-12] Moving the aileron into the UP position reduces the effect of the wind striking that wing, thus reducing the lifting action. This control movement will also cause the downwind aileron to be placed in the DOWN position, thus a small amount of lift and drag on the downwind wing, further reducing the tendency of the upwind wing to rise.

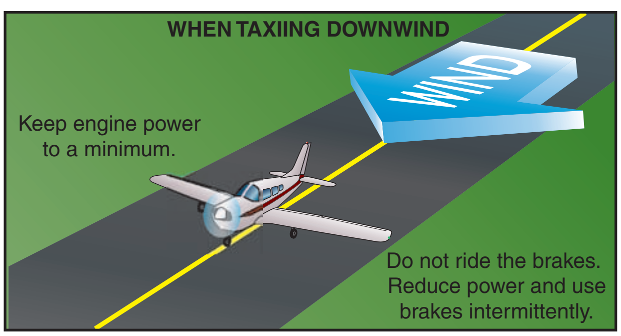



**Figure 2-11. Downwind taxi.**

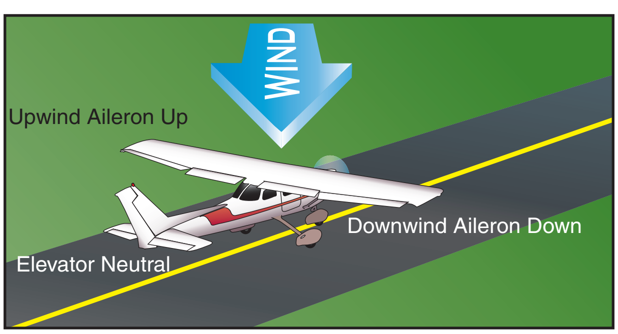



**Figure 2-12. Quartering headwind.**

When taxiing with a quartering tailwind, the elevator should be held in the DOWN position, and the upwind aileron, DOWN. [Figure 2-13] Since the wind is striking the airplane from behind, these control positions reduce the tendency of the wind to get under the tail and the wing and to nose the airplane over.

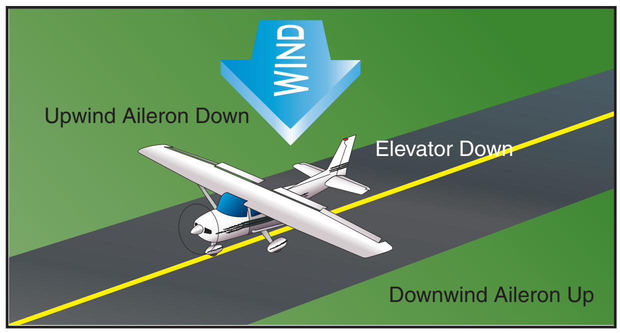



**Figure 2-13. Quartering tailwind.**

The application of these crosswind taxi corrections helps to minimize the weathervaning tendency and ultimately results in making the airplane easier to steer.

Normally, all turns should be started using the rudder pedal to steer the nosewheel. To tighten the turn after full pedal deflection is reached, the brake may be applied as needed. When stopping the airplane, it is advisable to always stop with the nosewheel straight ahead to relieve any side load on the nosewheel and to make it easier to start moving ahead.

During crosswind taxiing, even the nosewheel-type airplane has some tendency to weathervane. However,

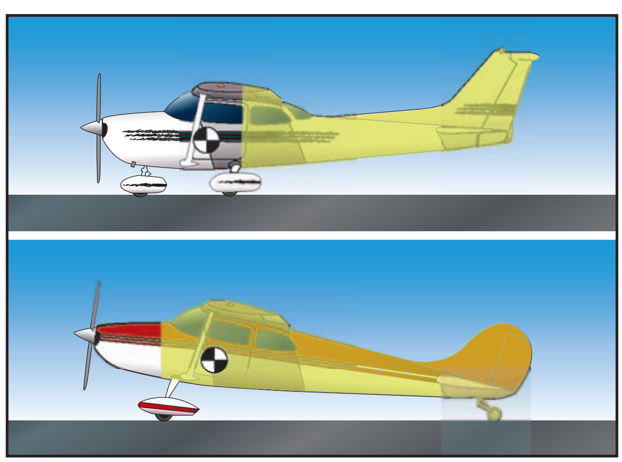


**Figure 2-14. Surface area most affected by wind.**

the weathervaning tendency is less than in tailwheel-type airplanes because the main wheels are located farther aft, and the nosewheel's ground friction helps to resist the tendency. [Figure 2-14] The nosewheel linkage from the rudder pedals provides adequate steering control for safe and efficient ground handling, and normally, only rudder pressure is necessary to correct for a crosswind.

## BEFORE TAKEOFF CHECK

The before takeoff check is the systematic procedure for making a check of the engine, controls, systems, instruments, and avionics prior to flight. Normally, it is performed after taxiing to a position near the takeoff end of the runway. Taxiing to that position usually allows sufficient time for the engine to warm up to at least minimum operating temperatures. This ensures adequate lubrication and internal engine clearances before being operated at high power settings. Many engines require that the oil temperature reach a minimum value as stated in the AFM/POH before high power is applied.

Air-cooled engines generally are closely cowled and equipped with pressure baffles that direct the flow of air to the engine in sufficient quantities for cooling in flight. On the ground, however, much less air is forced through the cowling and around the baffling. Prolonged ground operations may cause cylinder overheating long before there is an indication of rising oil temperature. Cowl flaps, if available, should be set according to the AFM/POH.

Before beginning the before takeoff check, the airplane should be positioned clear of other aircraft. There should not be anything behind the airplane that might be damaged by the prop blast. To minimize overheating during engine runup, it is recommended that the airplane be headed as nearly as possible into the wind. After the airplane is properly positioned for the runup, it should be allowed to roll forward slightly so that the nosewheel or tailwheel will be aligned fore and aft.

During the engine runup, the surface under the airplane should be firm (a smooth, paved, or turf surface if possible) and free of debris. Otherwise, the propeller may pick up pebbles, dirt, mud, sand, or other loose objects and hurl them backwards. This damages the propeller and may damage the tail of the airplane. Small chips in the leading edge of the propeller form stress risers, or lines of concentrated high stress. These are highly undesirable and may lead to cracks and possible propeller blade failure.

While performing the engine runup, the pilot must divide attention inside and outside the airplane. If the parking brake slips, or if application of the toe brakes is inadequate for the amount of power applied, the airplane could move forward unnoticed if attention is fixed inside the airplane.

Each airplane has different features and equipment, and the before takeoff checklist provided by the airplane manufacturer or operator should be used to perform the runup.

## AFTER LANDING

During the after-landing roll, the airplane should be gradually slowed to normal taxi speed before turning off the landing runway. Any significant degree of turn at faster speeds could result in ground looping and subsequent damage to the airplane.

To give full attention to controlling the airplane during the landing roll, the after-landing check should be performed only after the airplane is brought to a complete stop clear of the active runway. There have been many cases of the pilot mistakenly grasping the wrong handle and retracting the landing gear, instead of the flaps, due to improper division of attention while the airplane was moving. However, this procedure may be modified if the manufacturer recommends that specific after-landing items be accomplished during landing rollout. For example, when performing a short-field landing, the manufacturer may recommend retracting the flaps on rollout to improve braking. In this situation, the pilot should make a positive identification of the flap control and retract the flaps.

## CLEAR OF RUNWAY

Because of different features and equipment in various airplanes, the after-landing checklist provided by the manufacturer should be used. Some of the items may include:

- Flaps . . . . . . . . . . . . . . . Identify and retract
- Cowl flaps . . . . . . . . . . . . . . . . . . . . . Open
- Propeller control . . . . . . . . . . . Full increase
- Trim tabs . . . . . . . . . . . . . . . . . . . . . . . . Set

## PARKING

Unless parking in a designated, supervised area, the pilot should select a location and heading which will prevent the propeller or jet blast of other airplanes from striking the airplane broadside. Whenever possible, the airplane should be parked headed into the existing or forecast wind. After stopping on the desired heading, the airplane should be allowed to roll straight ahead enough to straighten the nosewheel or tailwheel.

## ENGINE SHUTDOWN

Finally, the pilot should always use the procedures in the manufacturer's checklist for shutting down the engine and securing the airplane. Some of the important items include:

- Set the parking brakes ON.
- Set throttle to IDLE or 1,000 r.p.m. If turbocharged, observe the manufacturer's spool down procedure.
- Turn ignition switch OFF then ON at idle to check for proper operation of switch in the OFF position.
- Set propeller control (if equipped) to FULL INCREASE.
- Turn electrical units and radios OFF.
- Set mixture control to IDLE CUTOFF.
- Turn ignition switch to OFF when engine stops.
- Turn master electrical switch to OFF.
- Install control lock.

## POSTFLIGHT

A flight is never complete until the engine is shut down and the airplane is secured. A pilot should consider this an essential part of any flight.

## SECURING AND SERVICING

After engine shutdown and deplaning passengers, the pilot should accomplish a postflight inspection. This includes checking the general condition of the aircraft. For a departure, the oil should be checked and fuel added if required. If the aircraft is going to be inactive, it is a good operating practice to fill the tanks to the top to prevent water condensation from forming. When the flight is completed for the day, the aircraft should be hangared or tied down and the flight controls secured.