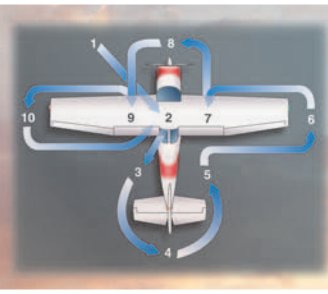
Chapter 2

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.

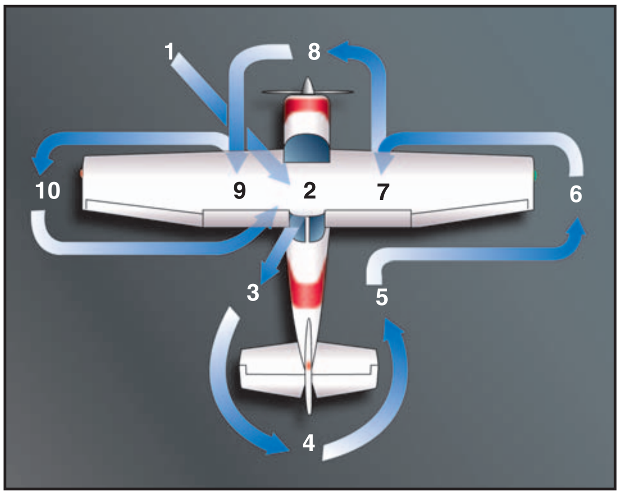


Figure 2-2. Preflight inspection.

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.

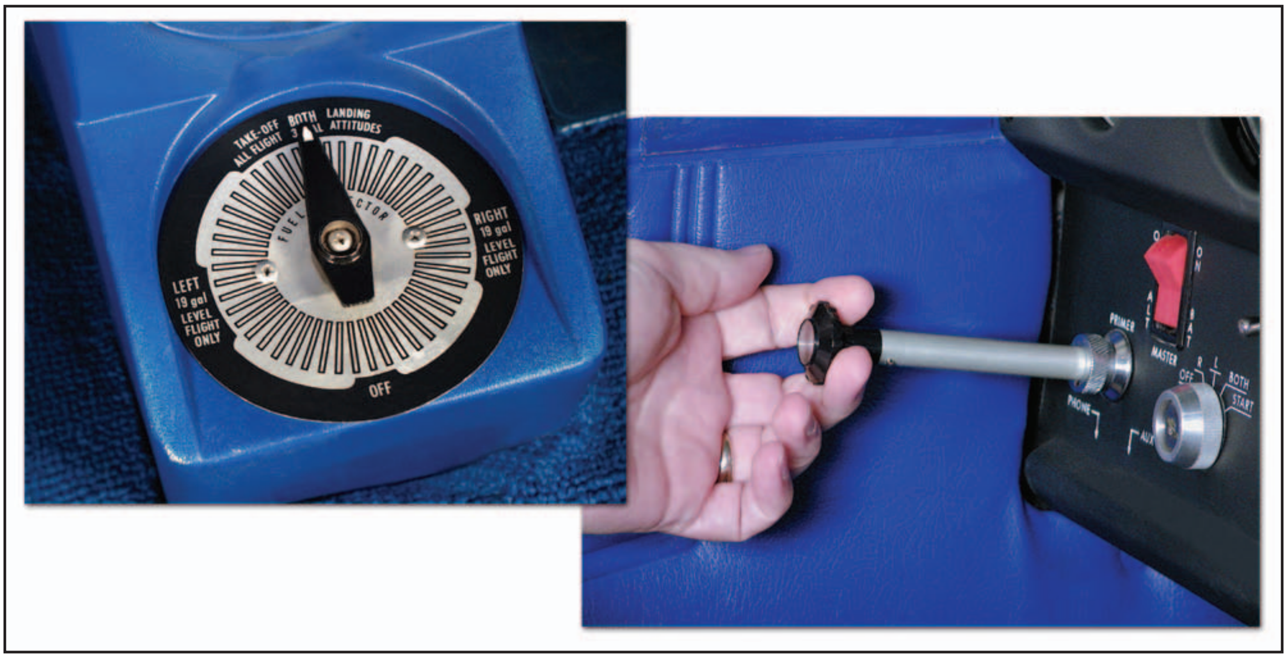


Figure 2-4. Fuel selector and primer.

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.

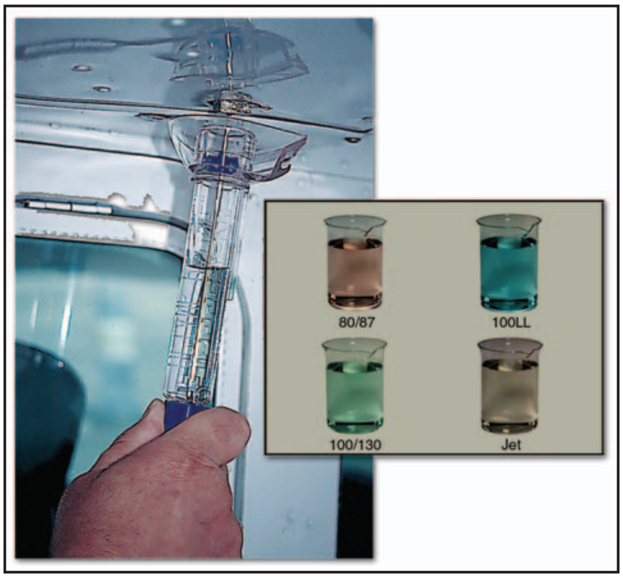


Figure 2-7. Aviation fuel types, grades, and colors.

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.

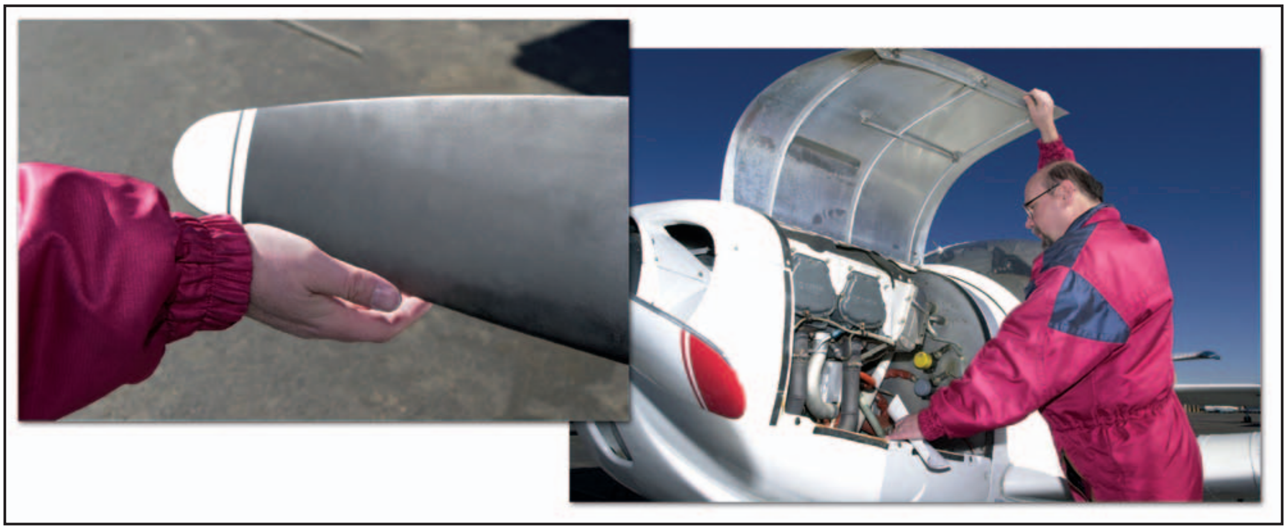


Figure 2-8. Check the propeller and inside the cowling.