Ground Lesson: Aircraft Systems

Objectives:

1. to understand basic aircraft systems for the purposes of aircraft familiarization

Justification:

1. pilot in command authority require full understanding of the systems one is commanding
2. in emergency situations, understanding of aircraft systems will help properly deduce causes
3. familiarity with aircraft systems are required for the private pilot checkride

Schedule:

Activity	Est. Time
Ground	1.5
Total	1.5

Elements Ground:

- powerplant
- fuel, oil, hydraulic systems
- electrical system
- minimum equipment requirements

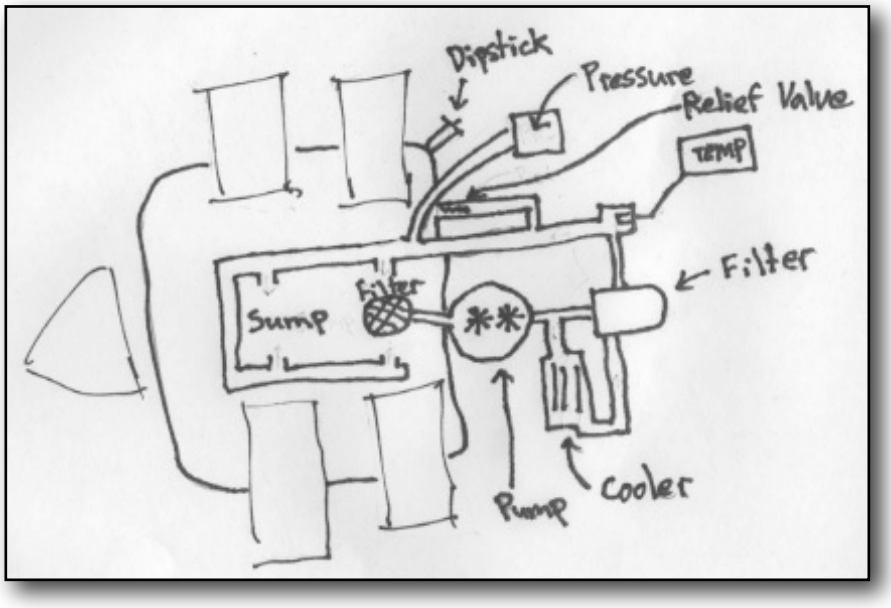
Completion Standards:

1. when the student exhibits knowledge relating to basic aircraft systems relevant to the aircraft being flown

Presentation Ground:

Powerplant

1. *:in small aircraft, includes both the engine and propeller, whose primary purpose is to provide thrust to help move the aircraft through the air*
2. overview
   (1) most small aircraft we will fly use four-stroke piston powered engines
   (2) cylinders contain pistons which produce power to rotate crankshaft which in turn spins the propeller
   (3) piston strokes include: intake, compression, power, exhaust
   (4) on the power stroke, spark plugs are “fired” to ignite the fuel/air mixture
      i. magnetos are what supply the current to create the spark
      ii. for purposes of redundancy and for cleaner burning, there are two magnetos providing current to two spark plugs in each cylinder
      iii. magnetos are self-sustaining once they start, thus they are not dependent on the electrical system
3. oil system
   (1) oil serves 4 main purposes
      i. reduction of friction, engine cooling, removal of contaminants, sealing
   (2) types of oil
      i. high viscosity oils (thicker) flow more slowly, while low viscosity oils (thinner) flow more rapidly
      ii. different “grades” of oils are used for different planes and conditions. See POH for appropriate oil use.
   (3) components
      i. oil pump
      ii. oil cooler
      iii. oil filter
      iv. oil temperature gauge
      v. oil pressure gauge
      vi. pressure relief valve
      vii. oil sump
         (i) wet sump holds all oil at low part of engine
         (ii) dry sump actually pumps out the oil into a separate oil tank



4. cooling system
   (1) :designed to keep the engine temperatures within those limits designed by the manufacturer
   (2) Two types of cooling systems: air cooled and liquid cooled.
      i. the types of aircraft we will mostly be flying are air cooled
   (3) air cooling is least effecting at high power, low airspeed

(4) the cowling, which encases the engine is designed to allow air to flow over and around the engine

i. to make cooling more efficient there are components to aid the direction and speed of heat dissipation

(i) baffles

(ii) cylinder head cooling fins

(iii) cowl flaps

(5) to monitor engine temperatures, CHT (cylinder head temperature) gauge is installed

(6) To help cooling to following can be applied

i. open cowl flaps (if available)

ii. richen mixture

iii. reduce engine power

iv. increase airspeed

5. carburetor

(1) :device used to mix fuel with air to allow proper burning of fuel

(2) components

i. fuel inlet screen

ii. needle valve

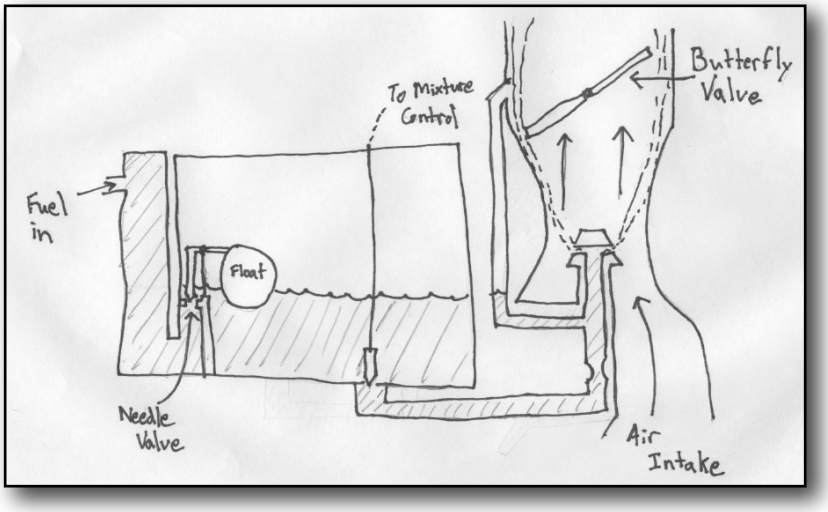
iii. float chamber

iv. venturi

v. air inlet

vi.throttle butterfly

(3) idle cutoff, mixture control, and accelerator pump assist in accurate control of the carburetor



fuel system

1. overview

(1) :system designed to store and deliver fuel to the engine in adequate quantities for all normal flight conditions

(2) depending on the type of aircraft there are two types of systems: gravity-fed, pump-fed

i. pump-fed systems usually have back up electric “boost” pump to force fuel through the lines if necessary, whereas gravity fed doesn’t necessarily have it

ii. in pump-fed systems, after initial start-up, the pump is typically engine driven

(3) drains should always be used to ensure the fuel is free of contaminants, and the correct fuel type is in the tanks

2. fuel types

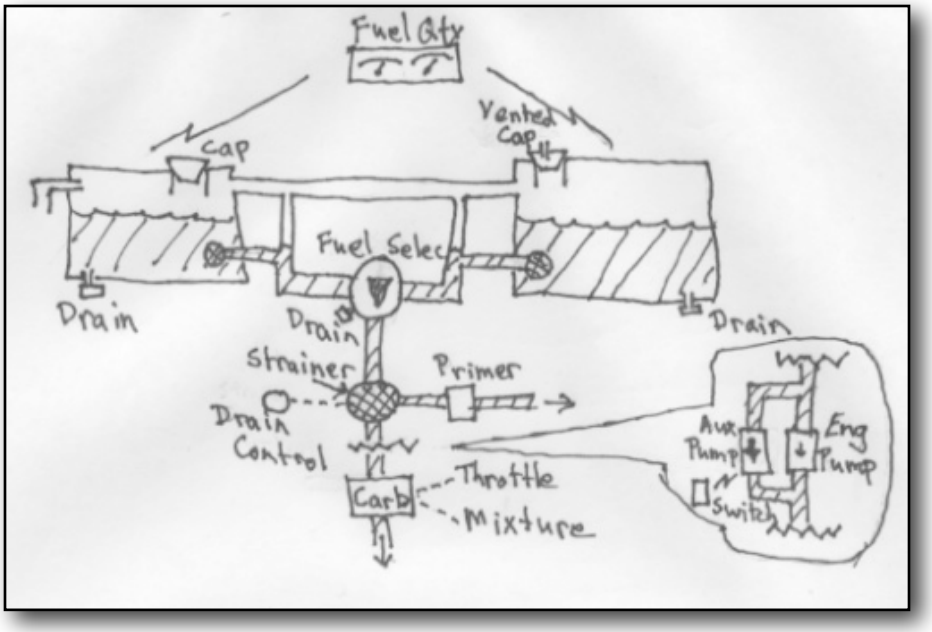
(1) the type of fuel used is essential to proper engine performance, and to avoid engine damage

(2) the grade of fuel (octane) indicates it’s ability to compress without detonating.

Fuel Type	Color
100LL	**blue**
100/130	green
80/87	red
jet fuel	clear

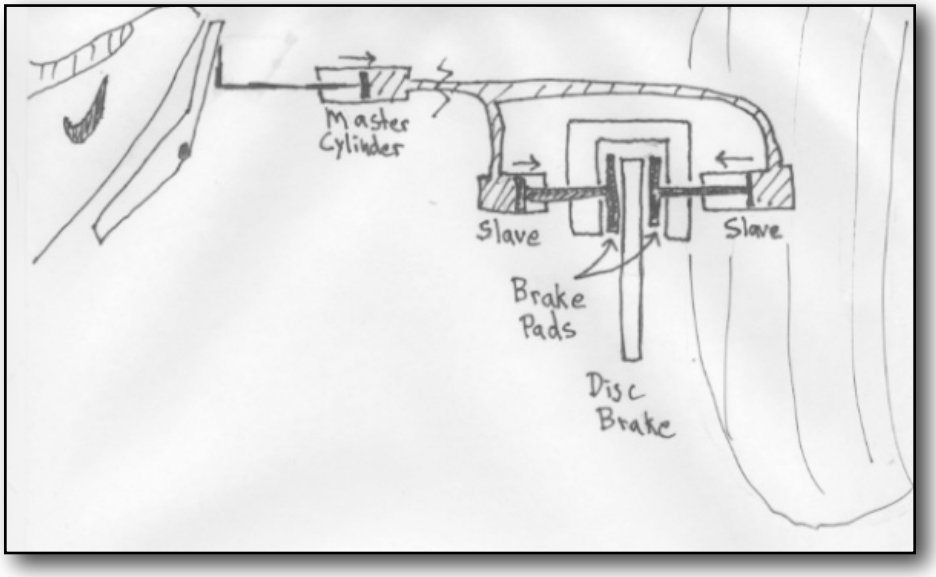
(3) ALWAYS use the grade specified in the POH

3. components
   (1) tanks
   (2) caps (vented)
   (3) fuel quantity gauges
   (4) drain valves
   (5) fuel shutoff
   (6) fuel strainer
   (7) primer



hydraulic system

1. :system which uses incompressible fluid to take a force applied in one location to be applied in a different location
2. overview
   (1) The main systems that use hydraulics are the brakes and retractable gear (on some aircraft)
   (2) most systems have a master cylinder, and slave cylinders
      i. in the case of brakes, you are applying force on the master cylinder, and that force is redirected to the slave cylinder which actuates the brakes



electrical system

1. Overview
   (1) most aircraft use a DC electrical system
   (2) current is provided by the alternator, battery, or external power source
   (3) instruments powered (typical)
      i. some gyros (usually turn coordinator)
      ii. fuel quantity indicators
      iii. starting system
      iv. lights
      v. avionics
      vi. other items as specified in POH
2. Components
   (1) bus bars - distributes electricity

(2) battery - provides initial power
    i. usually lead-acid batteries
    ii. defined by voltage and capacity (amp hours)
(3) alternator - driven by engine, recharges battery
    i. vs. generator:
        (i) pro - lighter, simpler
        (ii) pro - relatively constant charge
        (iii) con - requires battery with some charge
(4) ammeter
(5) master switch
(6) low voltage light