Monocoque Construction

- from French, mono + coque (shell)
- A shell-like fuselage design in which the stressed outer skin is used to support the majority of imposed stresses. Monocoque fuselage design may include bulkheads but not stringers. Skin Former Bulkhead
Semi-Monocoque Construction

- A fuselage design that includes a substructure of bulkheads and/or formers, along with stringers, to support flight loads and stresses imposed on the fuselage.

The Wings

- Generate lift

- Monoplanes
- Biplanes

Wing Parts
The Empennage
- Vertical stabilizer
- Horizontal stabilizer
- Rudder
- Elevator
- Trim devices

Landing Gear
- Conventional Gear
- Tricycle Gear
- Retractable Gear
- Floats
- Skies

Landing Gear
- Landing Gear Struts
- Landing Gear Brake
THE POWERPLANT

Reciprocating Engine Components
- Cylinders
- Crank shaft
- Cam shaft
- Lubrication
- Fuel and Air metering

Working Cylinders
Cylinder

The Four Stroke Operating Cycle
1. Intake
2. Compression
3. Power
4. Exhaust

How to Make Fire

Oxygen
Spark (Heat)
Fuel
Engine Controls

Carburetor

Carburetor Ice

- Due to the effect of vaporization & decrease air pressure in the venturi
- Most Likely to occur when temps are below 70 degrees & Relative Humidity is above 80%
- Causes loss of power
Carb Ice Potential

- Icing (iced and clogged power)
- Gross ice (glide power)
- Surface icing (cruise power)
- Frosting (pressure drop clogging)

Carburetor Heat

- Heat from exhaust is transferred to carburetor
- Less dense air means up to 15% power loss.

Fuel Systems

- Gravity Fed
- Fuel Pump Fed
- Components
  - Tanks, Gauges, Vents, Fuel Selector, Pumps, Strainer, Primer, Sumps
Gravity Fed Systems
• Used in High Wing Airplanes
• Fuel tanks
• Selector Valve
• Strainer
• Primer

Fuel Pump Systems
• Used in Low Wing Airplanes
• Fuel tanks
• Selector Valve
• Strainer
• Primer
• Engine pump
• Electric pump

Fuel Injection
• Used in any Airplane
• Fuel / Air control unit
• Fuel manifold valve
• Fuel discharge nozzles
**Fuel Grades**

- Most common in USA is **100LL**.
- If fuel types are mixed, the colors change to clear.
- Only use approved fuels for your airplane.

<table>
<thead>
<tr>
<th>FUEL TYPE AND GRADE</th>
<th>COLOR OF FUELS</th>
<th>EQUIPMENT COLOR</th>
</tr>
</thead>
<tbody>
<tr>
<td>AVGAS 80</td>
<td>RED</td>
<td>AVGAS</td>
</tr>
<tr>
<td>AVGAS 100</td>
<td>GREEN</td>
<td>AVGAS</td>
</tr>
<tr>
<td>AVGAS-100LL</td>
<td>BLUE</td>
<td>AVGAS</td>
</tr>
<tr>
<td>JET A</td>
<td>COLORLESS OR STRAW</td>
<td>AVGAS</td>
</tr>
</tbody>
</table>

**Fuel Testing**

- Fuel tank sumps
- Strainer (gascolator)

**The Ignition System**

- Dual Ignition
  - Two magnetos
  - Two spark plugs per cylinder
  - Two sets of wires
- Magnetos
  - Engine-driven
  - Generates electricity for spark plug
- Spark Plugs
  - Provide the spark for ignition
**Ignition – Both Magnetos Working**

- Left Magneto
- Right Magneto
- P Leads

**Abnormal Combustion**

- Detonation
  - Uncontrolled, exploding ignition of fuel/air mixture
- Pre-ignition
  - Fuel/air mixture is ignited in advance of the normal, timed firing

**Oil Systems**

- Wet Sump
  - Oil supply within engine
- Dry Sump
  - Oil supply outside of engine
- Components
  - Temperature Gauges
  - Pressure Gauges
  - Filter
  - Filler Cap
  - Dipstick
  - Oil Pump
  - Oil Strainer
  - Pressure Regulator
  - Filter
  - Wet Sump
  - Oil Strainer
  - From Engine
  - To Engine

- Normal
- Detonation
- Pre-ignition
**Engine Cooling**

- Air Cooling
  - Primarily through baffles - heat exchange
  - Fixed cowl
  - Cowl flaps

- Other Methods of Cooling
  - Mixture
  - Rate of Climb/Descent
  - Power Setting

**The Exhaust System**

- Burned gases are guided overboard through the manifold and muffler.
- Exhaust gases can also be used as a source of heat.
  - Cabin heat
  - Carburetor heat

**Propeller Cross Section**

- Spinning Airfoil
- Twisted from root to tip
Propeller Types

**Fixed pitch**
- Efficient at one speed only

**Constant Speed**
- Efficient at all speeds
- Blade angle is variable

Constant Speed Propeller Operation

- Black Handle
  - Throttle
  - Controls Manifold Pressure
- Blue Handle
  - Propeller controller
  - Controls propeller RPM's
- Red Handle
  - Mixture control
  - Controls fuel to air ratio

Electrical Systems Components

- Alternator
  - Supplies AC power that is converted to DC
- Battery
- Ammeter
  - Monitors the electrical system current in Amps
- Loadmeter
  - Monitors the load placed upon the Alternator
Electrical System

- Alternator
- Battery
- Ammeter
- Master Switch
- Circuit protection
  - Breakers
  - Fuses

FAR/AIM

FAR 39.3 - ADs

- FAA's airworthiness directives are legally enforceable rules that apply to the following products:
  - Aircraft
  - Aircraft engines
  - Propellers
  - Appliances

- Compliance is the responsibility of Owners/Operators.
**FAR 43 – Aircraft Maintenance**

- Only FAA approved mechanics can maintain aircraft
- Pilots may only perform preventative maintenance
  
  Part 43 Appendix A, Part C

All maintenance must be written in aircraft logbook

**FAR 91.7 - Airworthiness**

- Airplanes must be airworthy for flight
- The PIC shall determine whether an aircraft is in a condition for safe flight
- The PIC shall discontinue the flight when un-airworthy conditions occur

Airworthiness determined by preflight inspection and review of maintenance records.

**FAR 91.9 – Flight Manual & Markings**

- Pilots must comply with the operating limitations in the approved Airplane Flight Manual
- Approved Airplane Flight Manual must be in the airplane for each flight
FAR 91.203 – Aircraft Certificates
• For each flight, an airplane must have on board a current
  • Airworthiness Certificate
  • Registration Certificate

• Airworthiness Certificate must be displayed at cabin entrance and be visible to passengers or crew

• Think AROW

FAR 91.403 - Maintenance
• Aircraft owners/operators are responsible for maintaining aircraft

FAR 91.405 – Maintenance Required
• Owners/operators shall
  • have their aircraft inspected
  • ensure maintenance records are updated.

• Inoperative equipment shall be repaired by the next required inspection

• Shall ensure that inoperative equipment placards are in place
FAR 91.407 – Operations after Maintenance

- No flights until aircraft is
  - Approved for return to service
  - Aircraft logbook entry is made

- Flight testing may be required
  - Private pilot or higher

WEATHER
Sunlight Angle

- Equatorial region of the earth receives more direct incoming solar radiation than the higher latitudes.
- Temperatures are higher in the equatorial region and decrease with latitude toward both poles.
- Results in a worldwide pattern of prevailing winds, high and low areas of atmospheric pressure, and climatic patterns.

Global Circulation

- Hot air rises over equator and creates Low Pressure
- Air rises and cools, then moves towards the poles before descending
- The Earth’s rotation caused similar patterns at 30° & 60° lines of latitude

Coriolis Effect

- Objects moving in a straight path appear to curve due to the Earth’s rotation.
Pressure Circulations

- **High Pressure**
  - Air sinks towards surface
  - Diverges at surface
  - Moves clockwise (N Hemisphere)

- **Low Pressure**
  - Air rises away from surface
  - Converges at surface
  - Rotates counter clockwise (N Hemisphere)

Knowledge Application

- Pressure gradient force
- Wind flows parallel to the isobars

Winds Aloft Forecast

- Issued: 2x daily
- Direction | Speed | Temperature
- Direction based on True North
- Speed is knots (nautical miles per hour)
Division

- **E6B FLIGHT COMPUTER**

- $8 \div 2 = ?$

- Find 8 on outer scale
- Rotate middle scale and line up the 20 under 8
- Find Black 10 on the inner scale
- Read answer on outer scale.

**Answer = 4**

- **How does it Work?**
- The E6b works on the principle of ratios

$$\frac{8}{2} = \frac{4}{1}$$
Division

$\frac{30}{5.5} = ?$
- Find 30 on outer scale.
- Rotate middle scale and line up the 55 under 30.
- Find Black 10 on the inner scale.
- Read answer on outer scale.

Answer = 5.45

Division

$\frac{4050}{120} = ?$
- Find 4050 on outer scale.
- Rotate middle scale and line up the 12 under 4050.
- Find Black 10 on the inner scale.
- Read answer on outer scale.

Answer = 33.7

End of Lesson
- Visit website for links
- Assignment A2 available online
  - Turn in by end of week
- Quiz A2 is online
  - Turn in online
- Other
  - Practice E6b flight computer problems
  - Complete workbook pages