Aircraft Systems



Hydraulic systems

- Incompressible fluid is forced through a hydraulic line to a piston
- Piston moves whatever needs to be moved



Hydraulic Brakes

- Hydraulic lines connect brake pedals to brake calipers
- Toe pedals applies pressure to the fluid, which in turn closes the brake caliper



Landing gear

- Tricycle landing gear common on trainers
- Nosewheels can be steerable or free-catering
- Retractable landing gear
 - Electronic or hydraulically actuated

Electricity is like a water hose



Electrical system

- Basic circuit:
 - Voltage (pressure)
 - Current (volume)
 - Resistance/load (anything impeding the flow of water)

Circuit vs Water

Voltage = Current × Resistance (V = I × R)











Light Aircraft Electrical Systems

- Direct current systems are common in most training airplanes
- Cessna usually have 28V electrical systems
- Batteries: Capacity measured in amp-hours (17 amp-hours means 17 amps for 1 hour, or visa-versa)



Generating Electricity: Generators

- DC current is induced by the spinning magnet
- Current is proportional to the speed of the spin



Generating Electricity: Alternators

- A generator that produces AC, a conversion is then done to DC using a rectifier
- Has more consistent current output at low RPMs
- Voltage must be higher than the battery to charge it
 - $\,\circ\,$ At 24V battery with a 28V alternator is

common



Electrical Components

- Contactors/Relays/Solenoid
 - Essentially a "remote switch"
 - Avoids all the current to have to pass through the physical switch
- Master switch
 - Left half for alternator master
 - Right half for battery master
- Bus bars: efficient way of connecting may components to power
- Overcurrent protection
 - Circuit breakers can be reset
 - Fuses are consumable

Electrical Instrumentation



- Ammeter: Is the alternator is producing sufficient power for the current load?
 A discharge on the ammeter indicates a draw from the battery
- Load meter: Shows a percentage of the load placed on the alternator/generator
- Low voltage warning light

Electrical Problems

- Alternator failure
 - Discharge on the ammeter, meaning we're drawing from the battery
 - $\circ\,$ Eventually a LOW VOLTS illumination



Environmental Systems

- Fresh air vents
- Heated air vents, potential source of CO

Figure 7-8. Cabin Heating, Ventilating and Defrosting System.



Deice and Anti-ice system

- Airplanes can be certified for flight into known icing (FIKI)
 - \circ See 91.527
 - $\circ~\mbox{Most}$ training aircraft are not FIKI certified
- Pitot heat (deice and anti-ice)
- Windscreen defrost can also be used

Deicing Systems

- Deicing "boots": pneumatic boots used to break off ice
- Cirrus aircraft use a "weeping wing"
 - TKS fluid (a ethylene-glycol liquid) is force out of a porous membrane on the leading edge
- Ground-based deicing

