



Aviation Merit Badge

Troop 344 & 9344
Pemberville, OH

Aviation MB Requirements



1. Do the following:

- a. Define "aircraft." Describe some kinds and uses of aircraft today. Explain the operation of piston, turboprop, and jet engines.
- b. Point out on a model airplane the forces that act on an airplane in flight.
- c. Explain how an airfoil generates lift, how the primary control surfaces (ailerons, elevators, and rudder) affect the airplane's attitude, and how a propeller produces thrust.
- d. Demonstrate how the control surfaces of an airplane are used for takeoff, straight climb, level turn, climbing turn, descending turn, straight descent, and landing.
- e. Explain the following: the sport pilot, the recreational pilot and the private pilot certificates; the instrument rating.

Aviation MB Requirements



2. Do TWO of the following:

- a. Take a flight in an aircraft, with your parent's permission. Record the date, place, type of aircraft, and duration of flight, and report on your impressions of the flight.
- b. Under supervision, perform a preflight inspection of a light airplane.
- c. Obtain and learn how to read an aeronautical chart. Measure a true course on the chart. Correct it for magnetic variation, compass deviation, and wind drift to determine a compass heading.
- d. Using one of many flight simulator software packages available for computers. "fly" the course and heading you established in requirement 2c or another course you have plotted.
- e. Explain the purposes and functions of the various instruments found in a typical single-engine aircraft: attitude indicator, heading indicator, altimeter, airspeed indicator, turn and bank indicator, vertical speed indicator, compass, navigation (GPS and VOR) and communication radios, tachometer, oil pressure gauge, and oil temperature gauge.
- f. Create an original poster of an aircraft instrument panel. Include and identify the instruments and radios discussed in requirement 2e.

Aviation MB Requirements



3. Do ONE of the following:

- a. a. Build and fly a fuel-driven or battery powered electric model airplane. Describe safety rules for building and flying model airplanes Tell safety rules for use of glue, paint, dope, plastics, fuel, and battery pack.
- b. b. Build a model FPG-9. Get others in your troop or patrol to make their own model, then organize a competition to test the precision of flight and landing of the models.

Aviation MB Requirements



4. Do ONE of the following:

- a. Visit an airport. After the visit, report on how the facilities are used, how runways are numbered, and how runways are determined to be "active."
- b. Visit a Federal Aviation Administration facility control tower, terminal radar control facility, air route traffic control center, or Flight Standards District Office. (Phone directory listings are under U.S. Government Offices, Transportation Department, Federal Aviation Administration. Call in advance.) Report on the operation and your impressions of the facility.
- c. Visit an aviation museum or attend an air show. Report on your impressions of the museum or show.

Aviation MB Requirements



5. Find out about three career opportunities in aviation. Pick one and find out the education, training, and experience required for this profession. Discuss this with your counselor, and explain why this profession might interest you.



Requirement 1a

1. a. Define "aircraft." Describe some kinds and uses of aircraft today. Explain the operation of piston, turboprop, and jet engines.



What Is An Aircraft

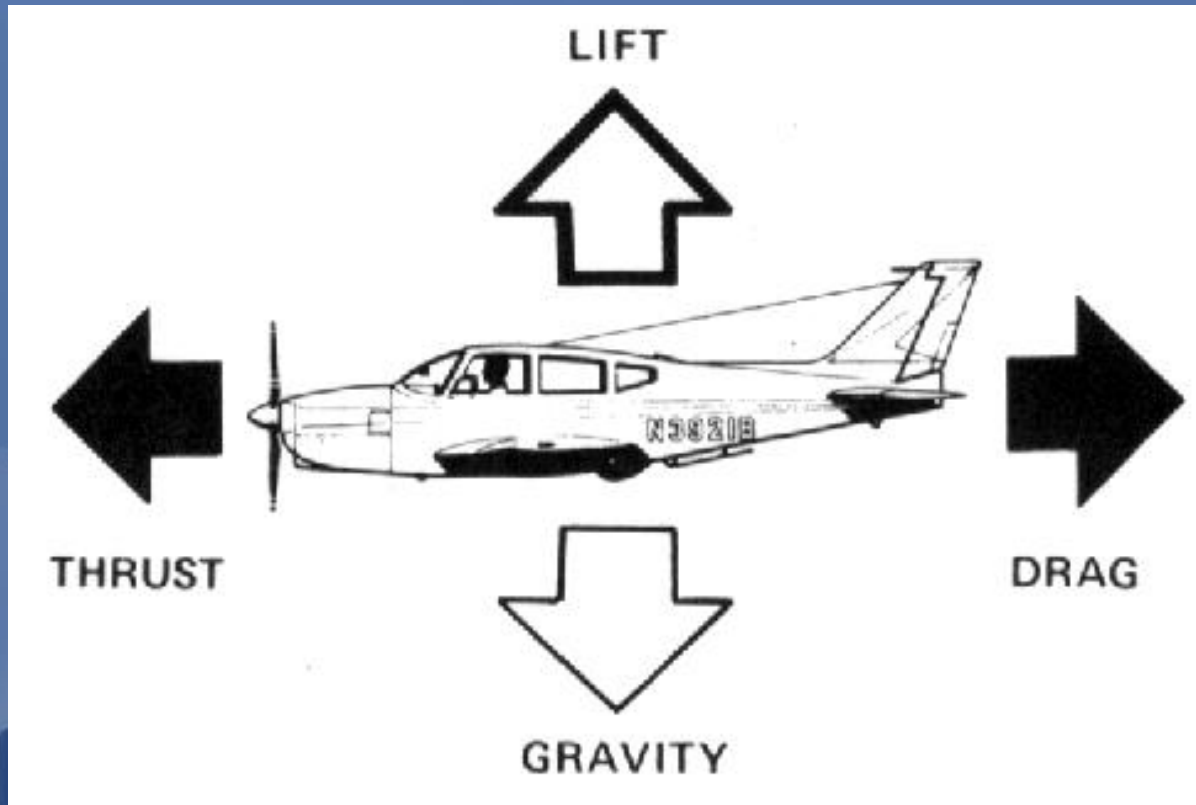
- An aircraft is a vehicle that can fly by being supported by the air
- Two main types are lighter than air vehicles and heavier than air vehicles
- Aircraft can also be powered and unpowered
- Aircraft can also be manned or unmanned

Requirement 1b

1. b. Point out on a model airplane the forces that act on an airplane in flight.

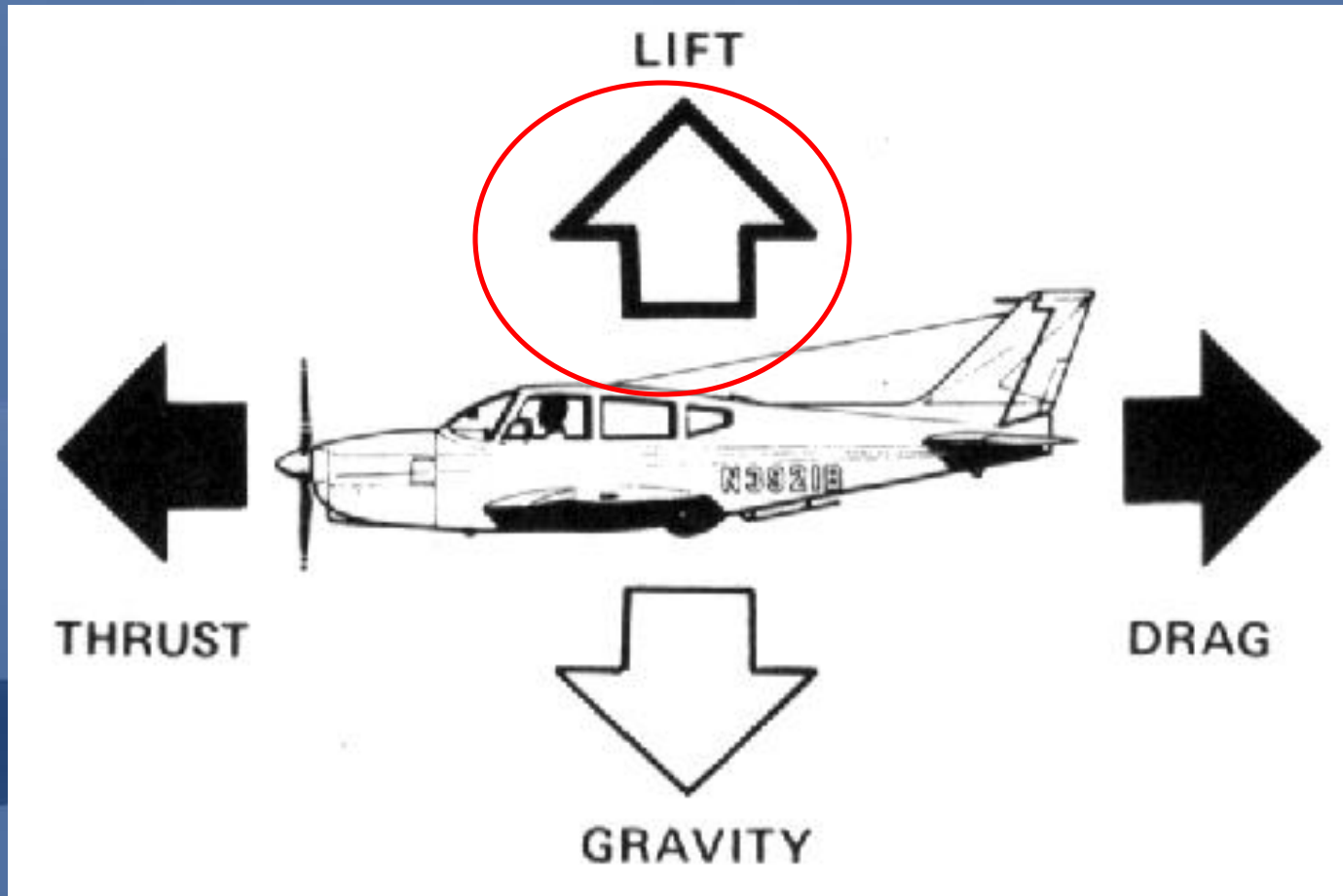


Forces on an Airplane



Flight is the result of the balance of these forces

How is Lift Created?



Lighter Than Air Aircraft



Lift is created by hot air or gases less dense than air.

Heavier Than Air Aircraft

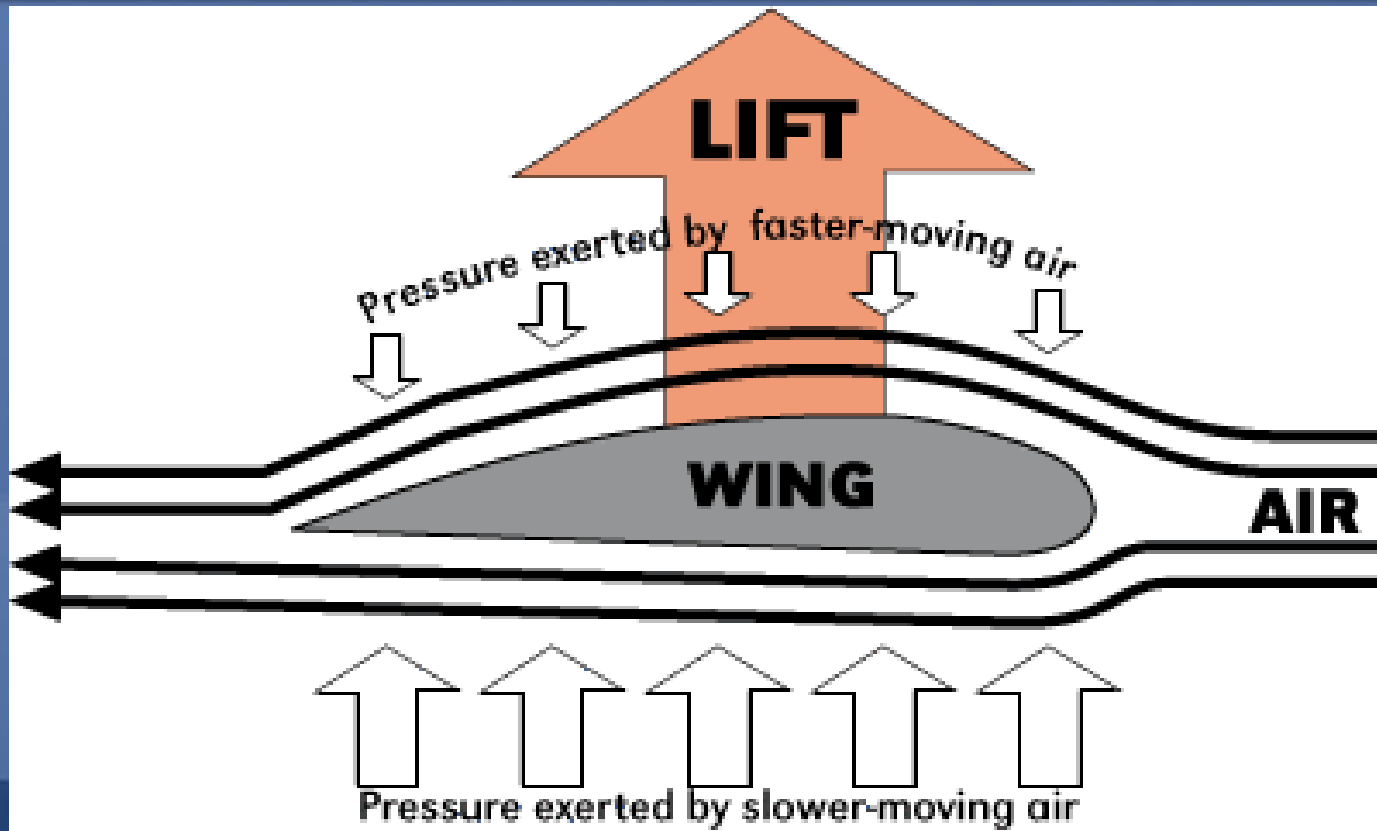


Wings Produce Lift

Requirement 1c

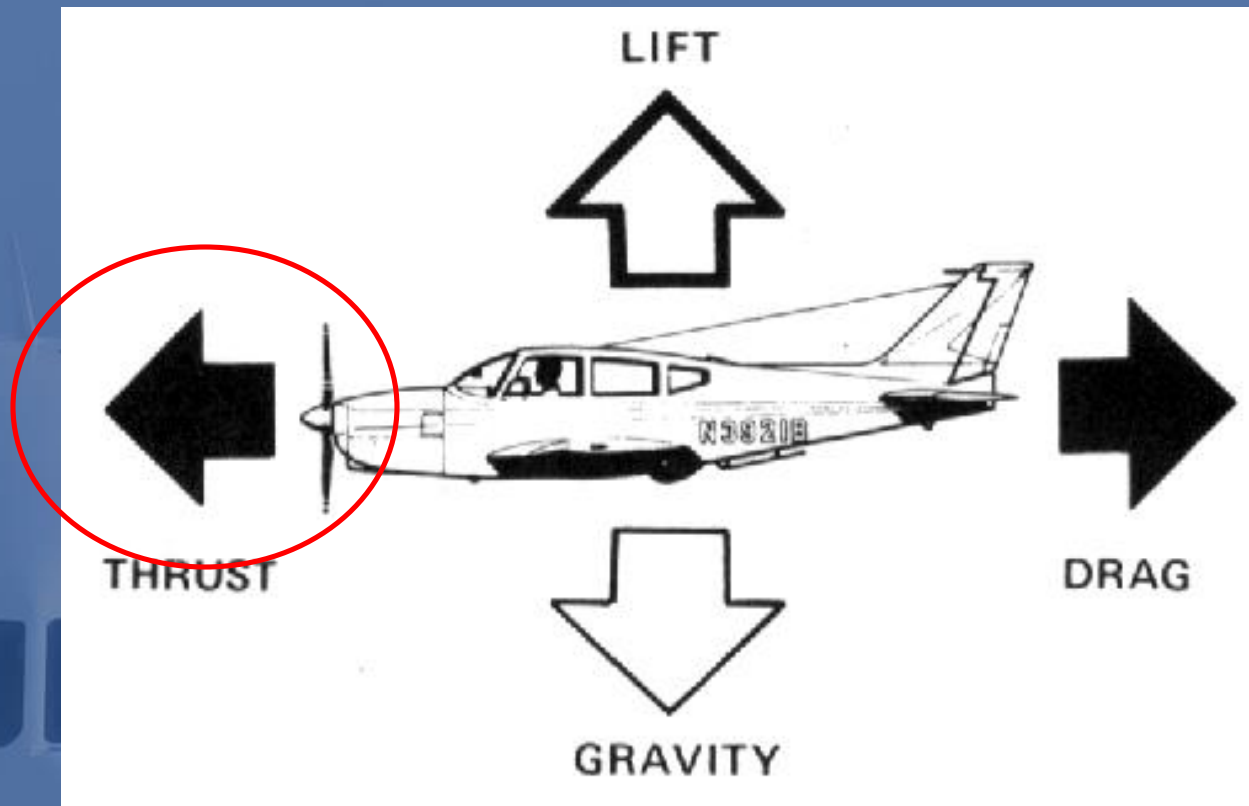
1. c. Explain how an airfoil generates lift, how the primary control surfaces (ailerons, elevators, and rudder) affect the airplane's attitude, and how a propeller produces thrust.

How Do Wings Produce Lift



Bernoulli's Principle

How is Thrust Created?



Un-Powered Aircraft



No Thrust

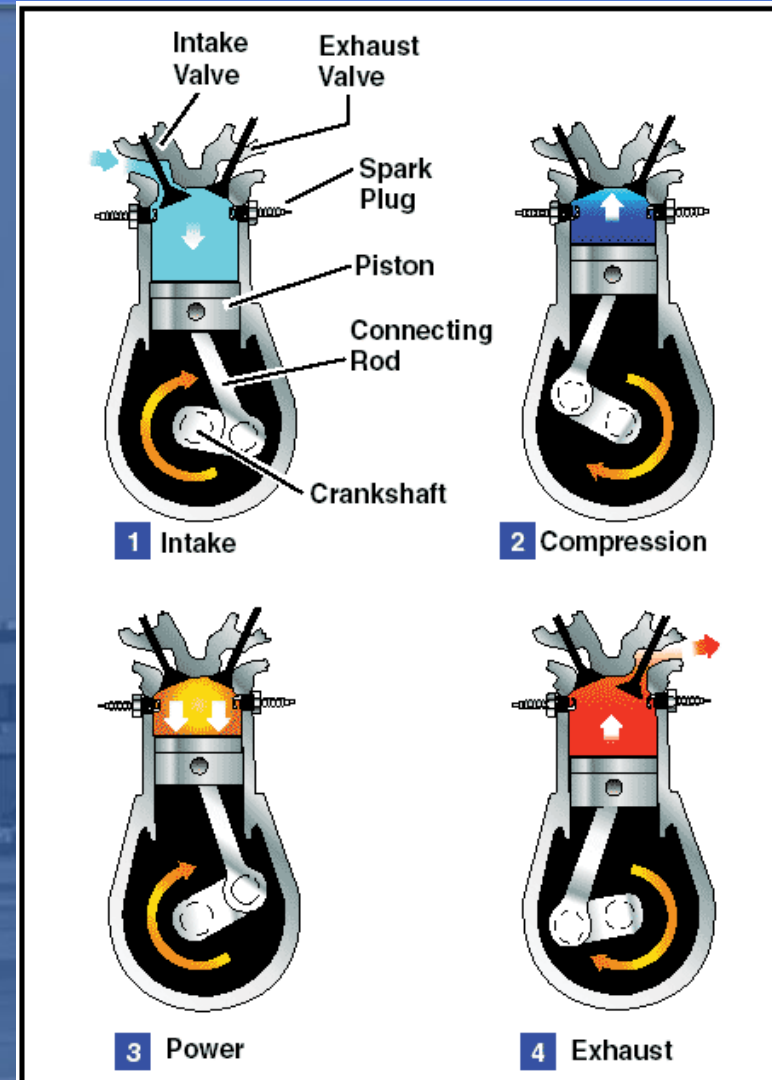
Powered Aircraft



Thrust is Created By the Powerplant

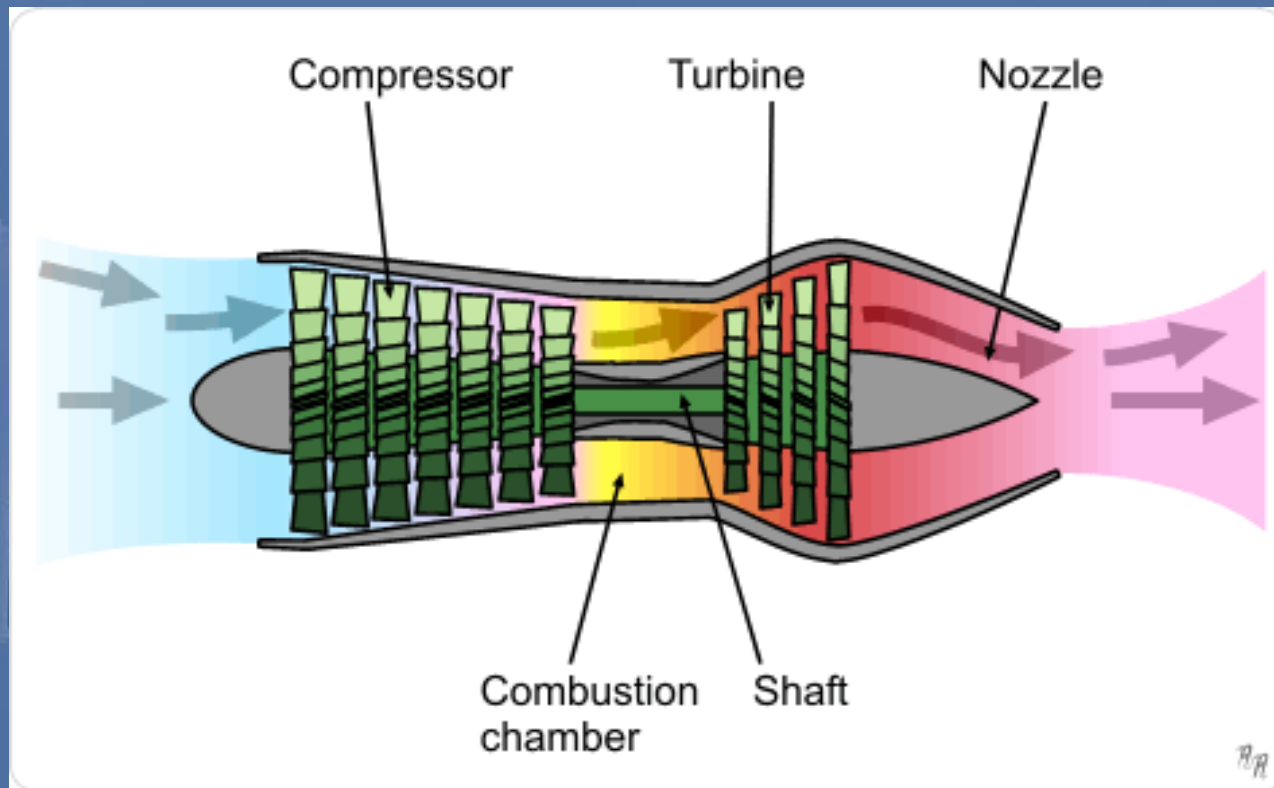
Types of Powerplants

- Piston Prop Engines
 - Similar to a car engine
 - Thrust is produced by propeller



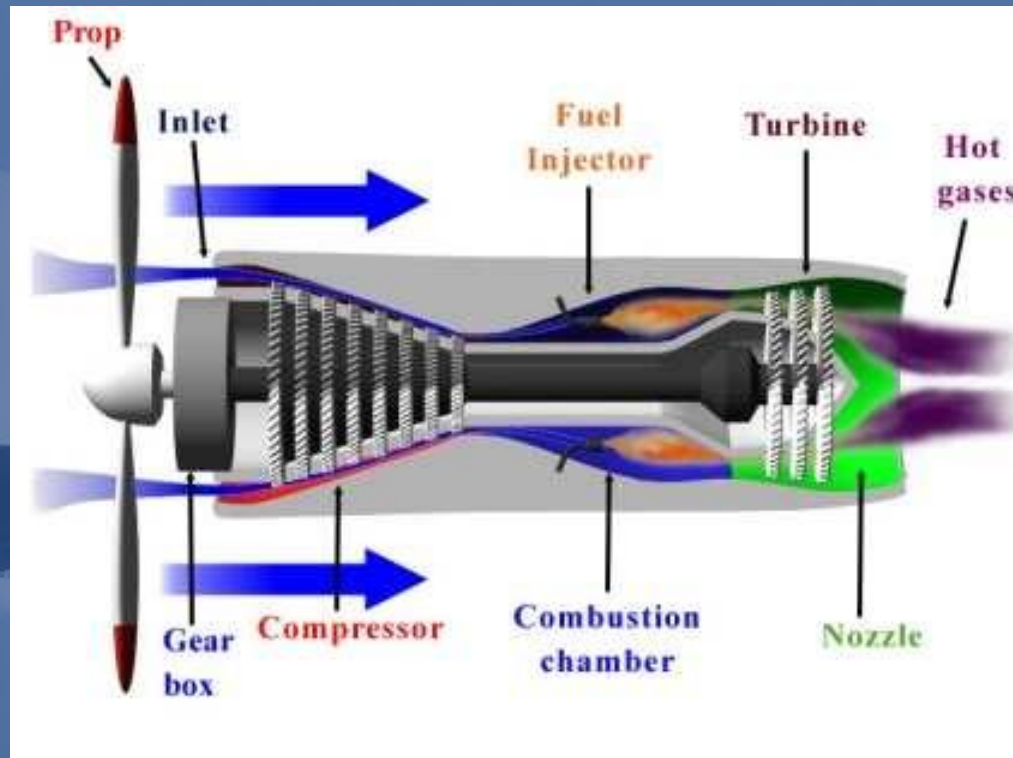
Types of Powerplants

- Jet Engines
 - Thrust is produced by jet exhaust

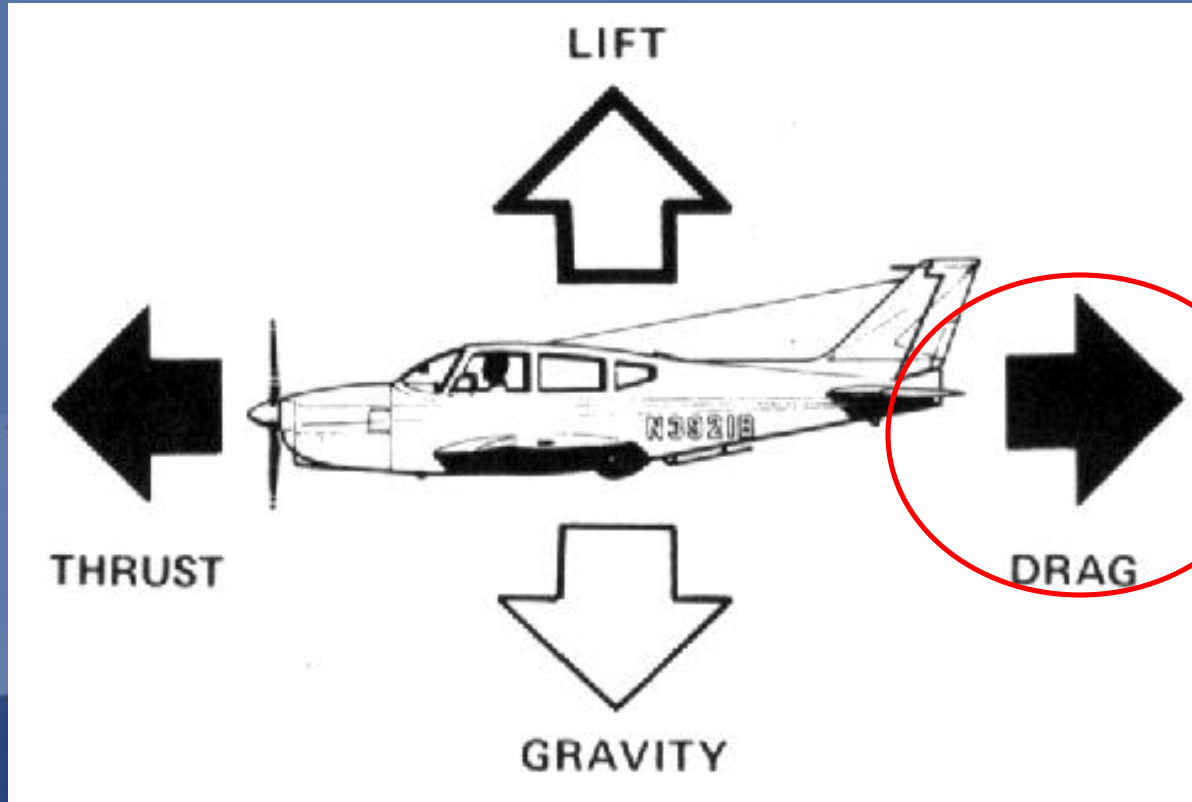


Types of Powerplants

- Turboprop Engines
 - Mix of propeller and jet engine
 - Thrust is produced mostly by propeller



How is Drag Created?



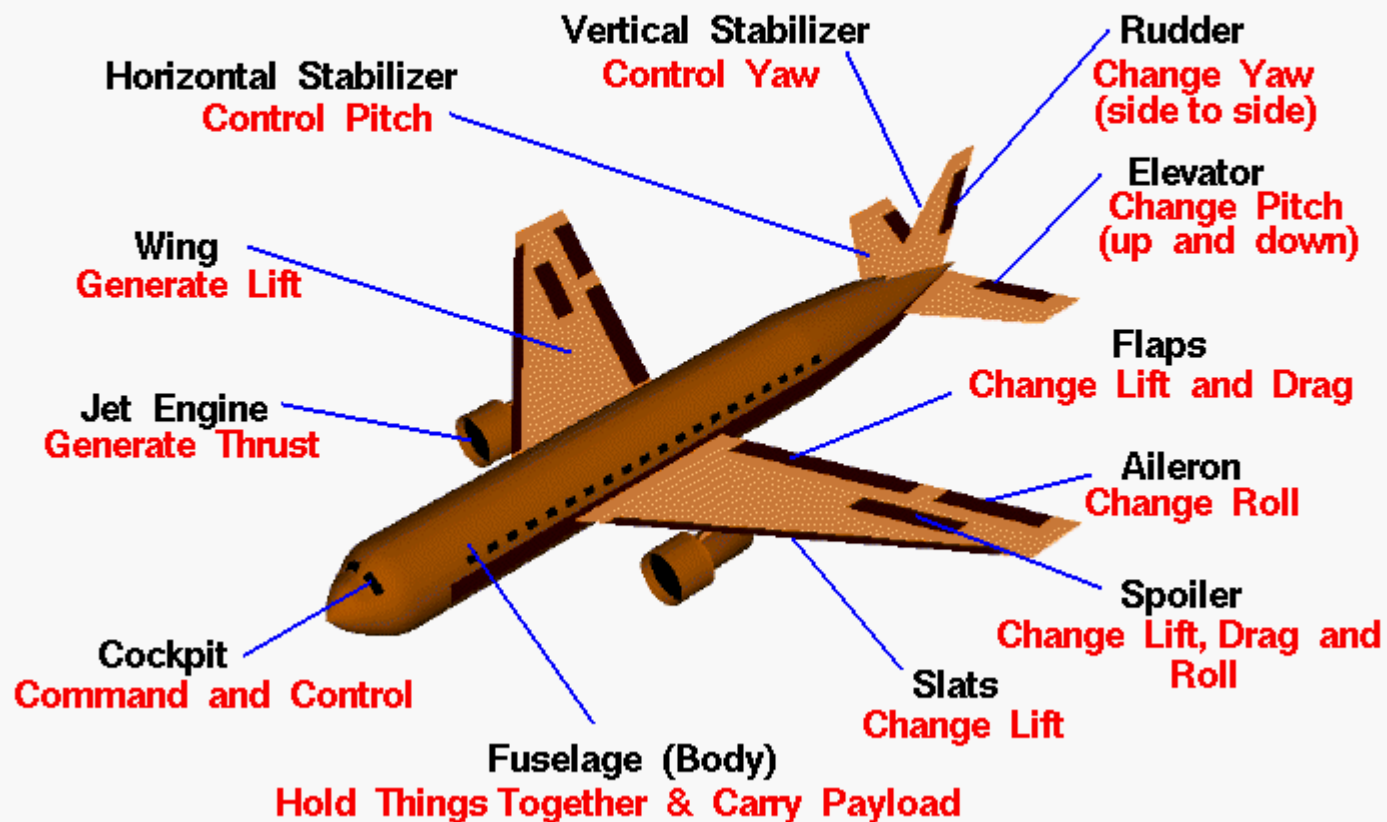
Caused by Flow Over Surfaces

How are Aircraft Controlled?

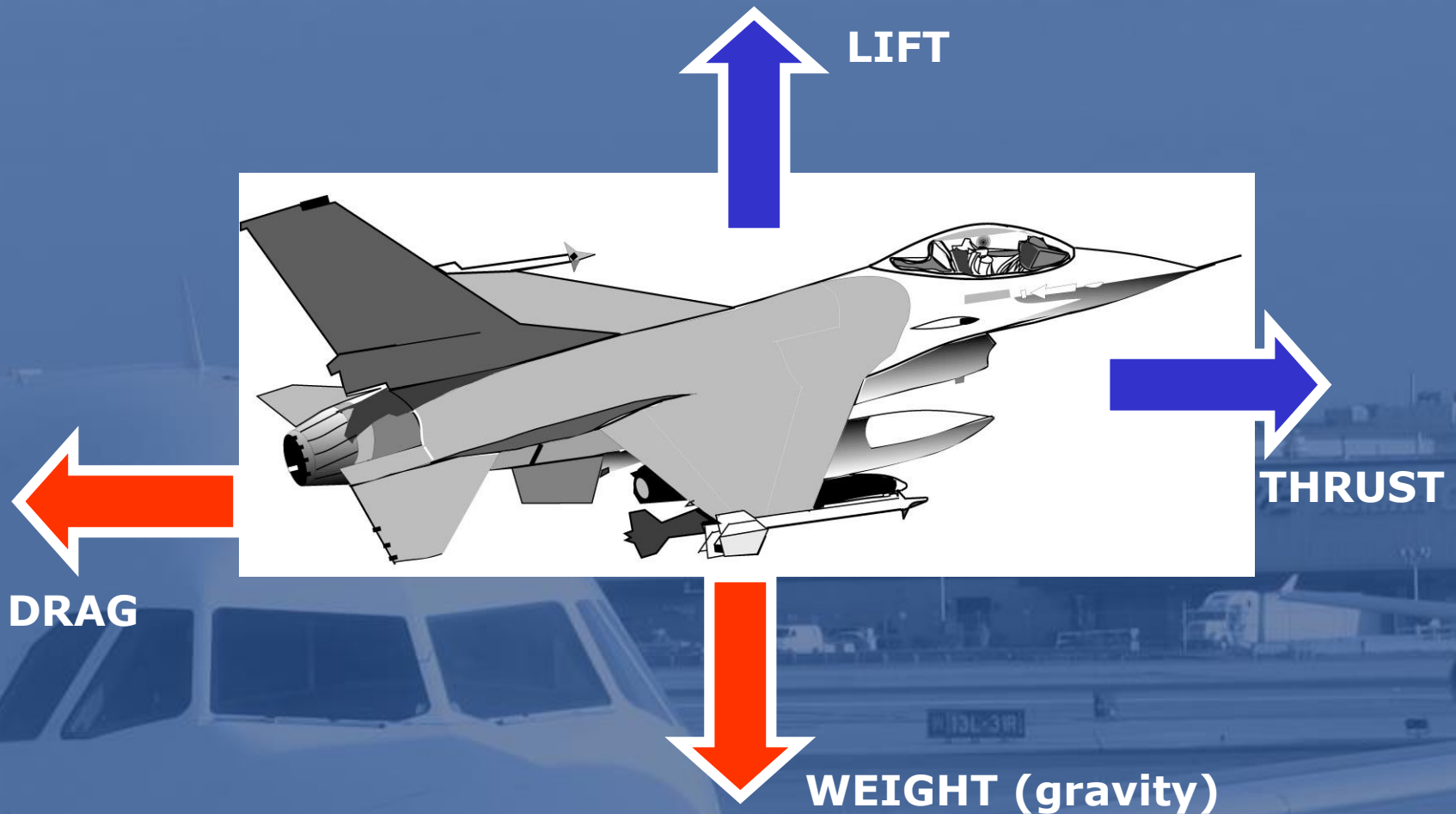


Airplane Parts Definitions and Function

Glenn
Research
Center



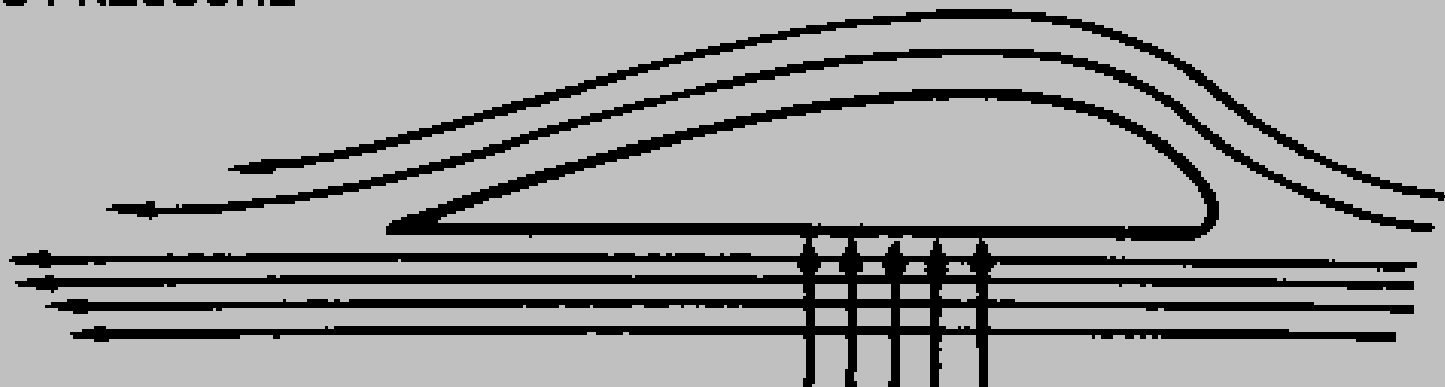
Forces Acting on Aircraft



How an Airfoil Works ?

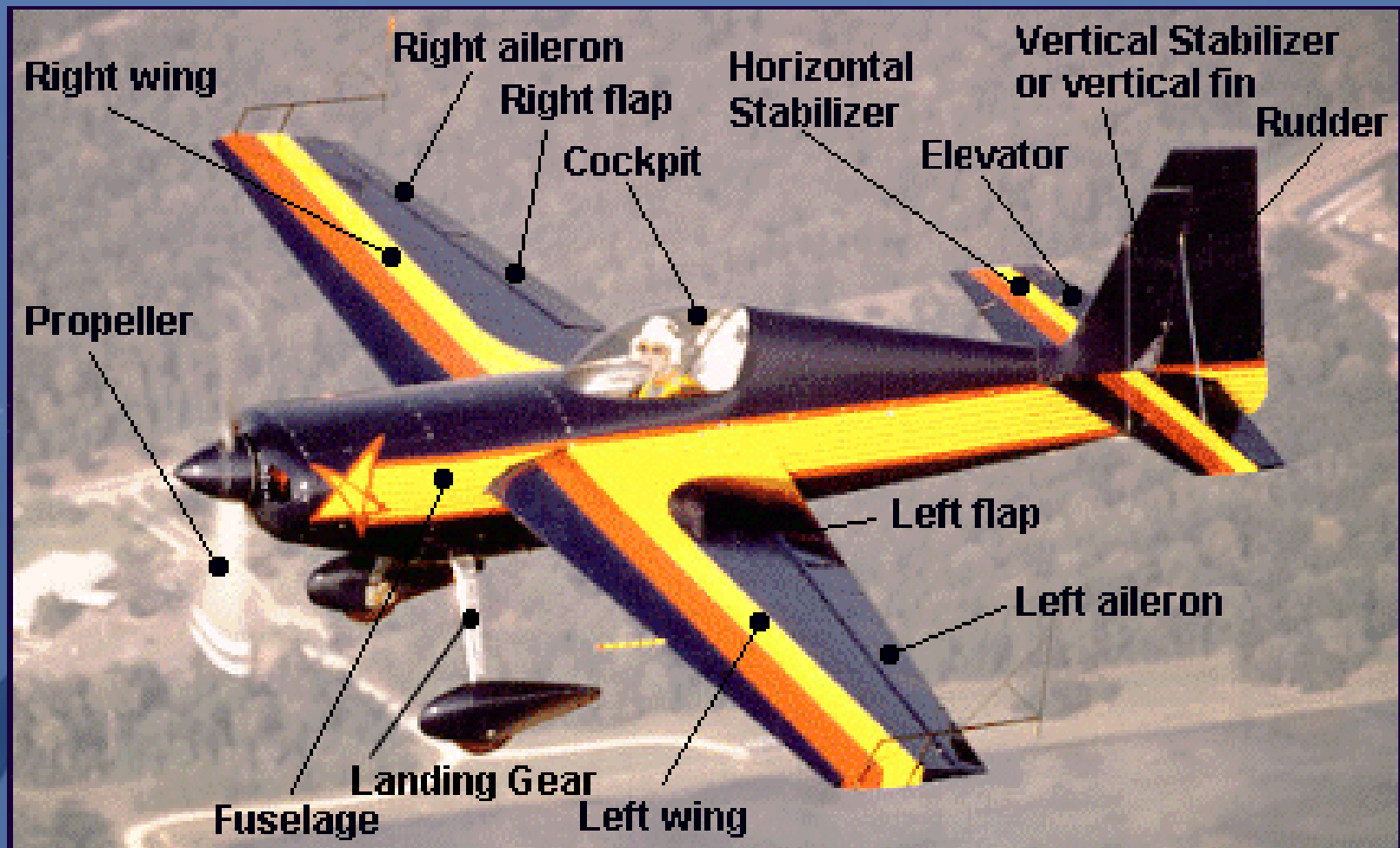
- Bernoulli's Principle

**FASTER MOVING AIR ...
... LESS PRESSURE**



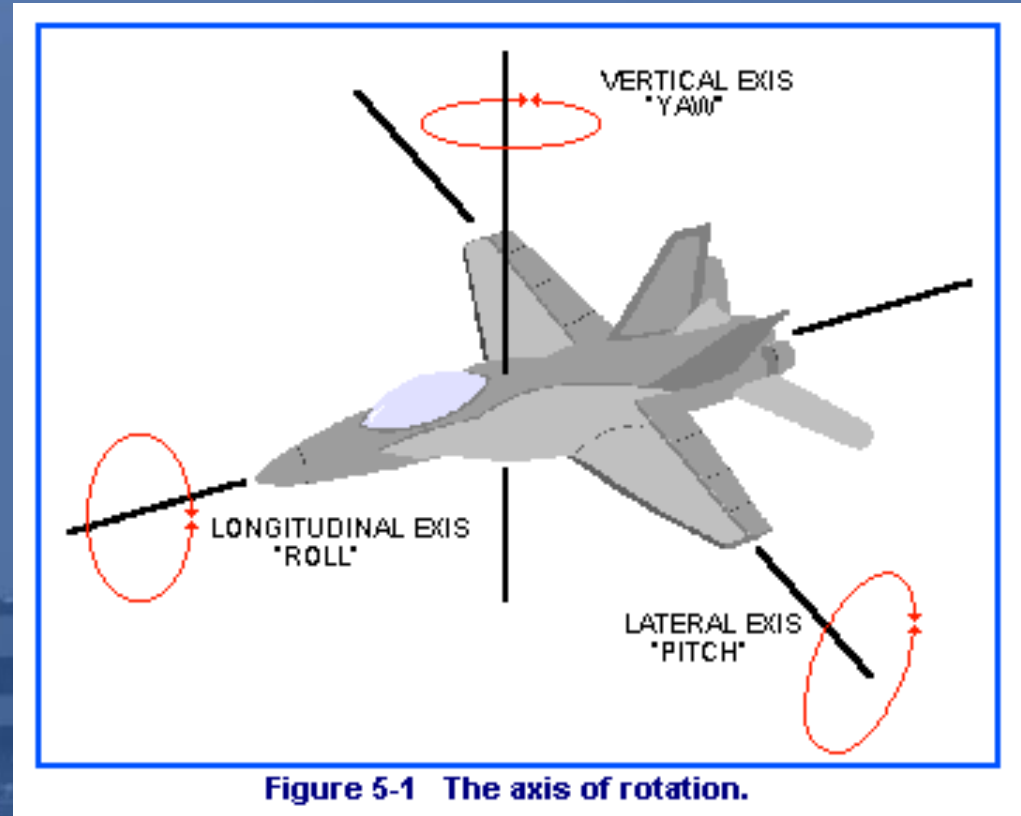
SLOWER MOVING AIR MORE PRESSURE

How Do Control Surfaces Work ?



Directional Control

- YAW - rudders
- PITCH - elevators
- ROLL - ailerons



YAW

- **Rudder** – The foot pedals are connected by means of wires or hydraulics to the rudder of the tail section. The rudder is the vertical part of the tail that can move from side to side.

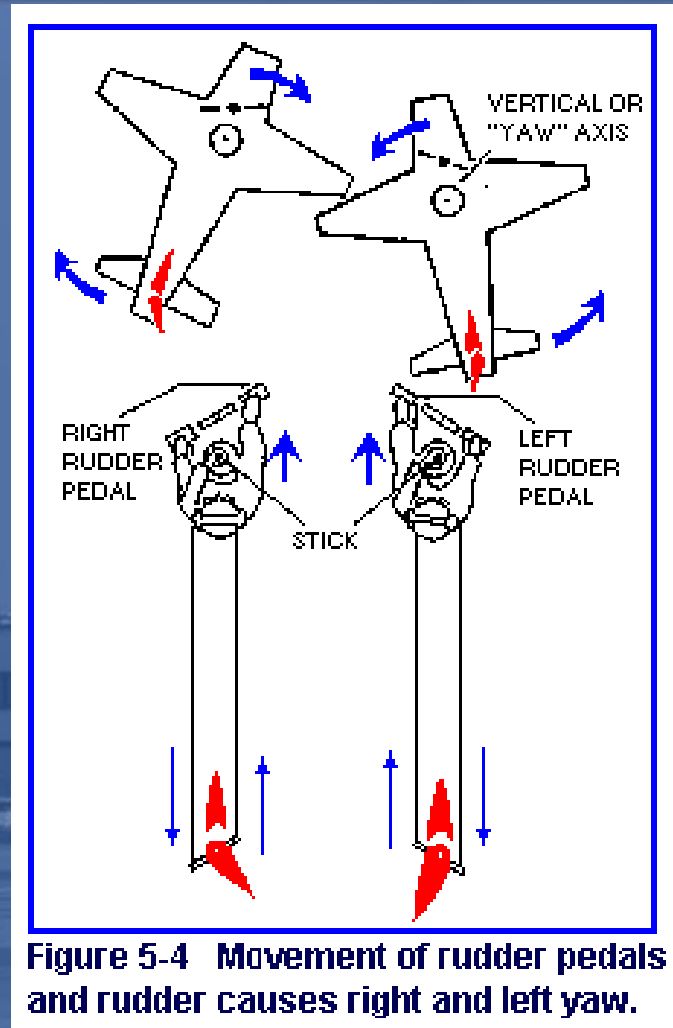


Figure 5-4 Movement of rudder pedals and rudder causes right and left yaw.

ROLL

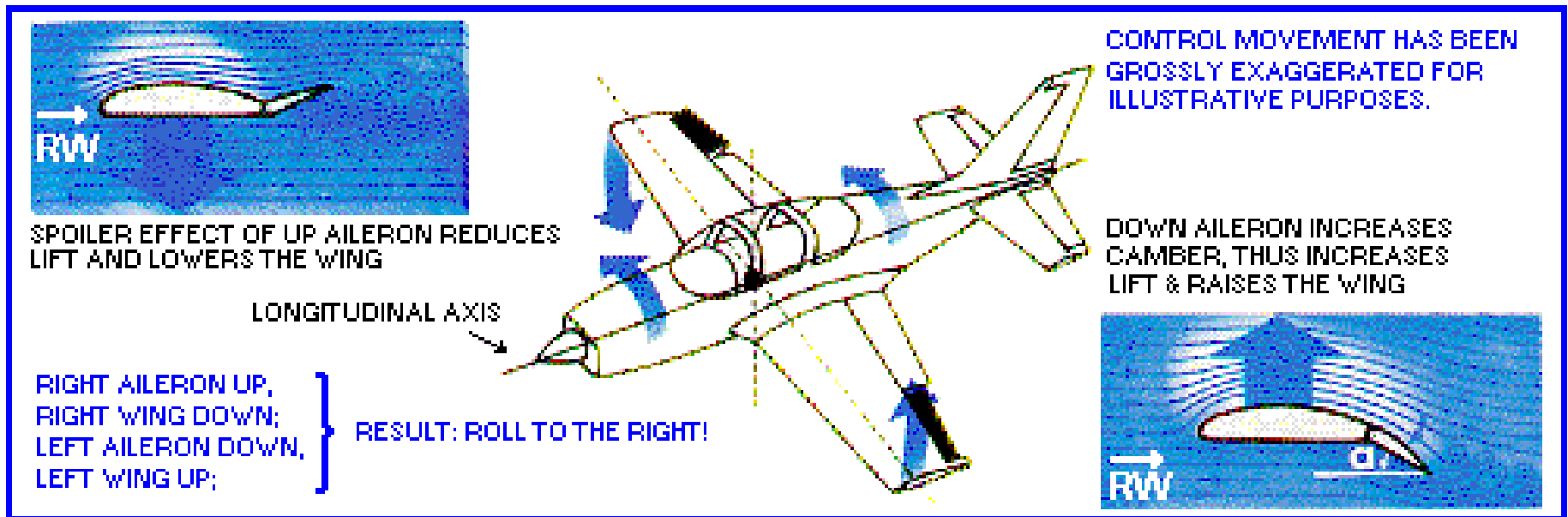


Figure 5-2 Actions of ailerons to produce roll to the right.

- Ailerons – The stick is connected by means of wires or hydraulics to the wings' ailerons. By turning the stick, the pilot can change the positions of the ailerons.

PITCH

- Elevators – The stick (joy stick) is connected by means of wires or hydraulics to the tail section's elevators. By moving the stick, the pilot can change the position of the elevators.

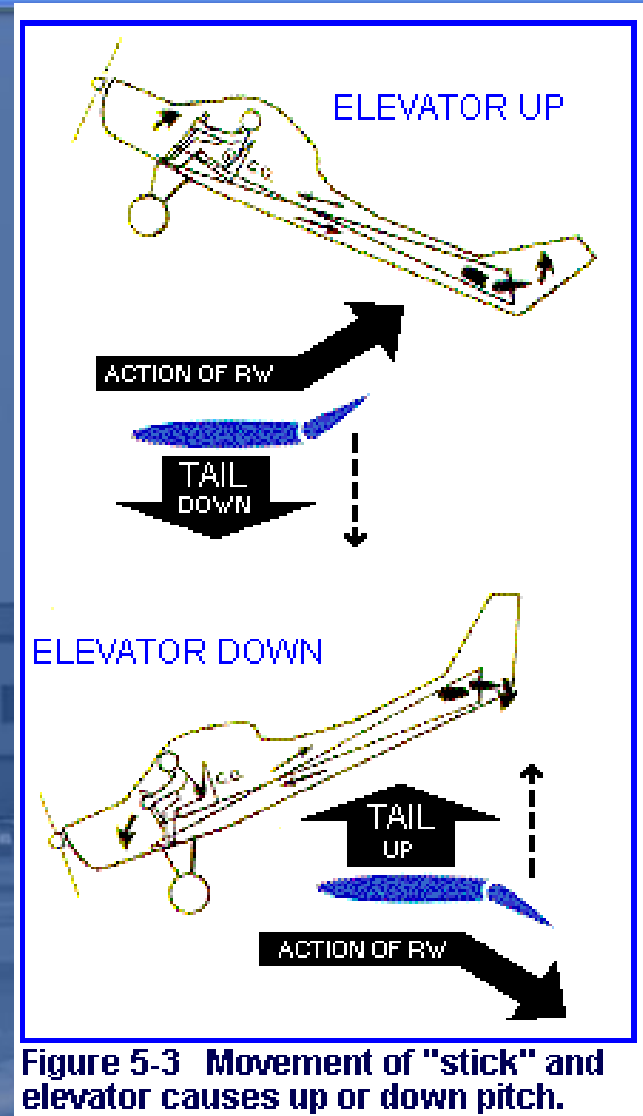


Figure 5-3 Movement of "stick" and elevator causes up or down pitch.

Requirement 1d

1. d. Demonstrate how the control surfaces of an airplane are used for takeoff, straight climb, level turn, climbing turn, descending turn, straight descent, and landing.

Takeoff & Climb

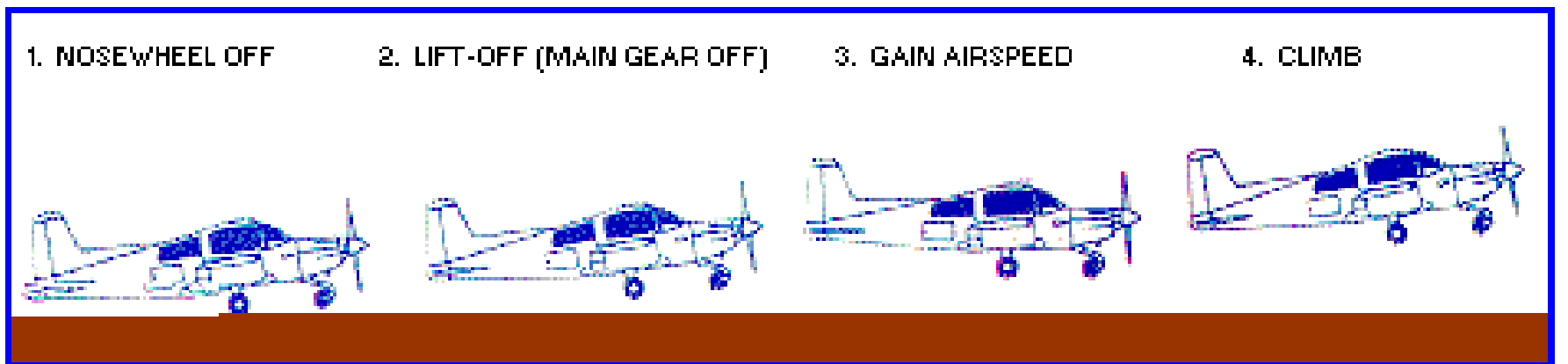


Figure 5-6 Stages of a takeoff.

Landing

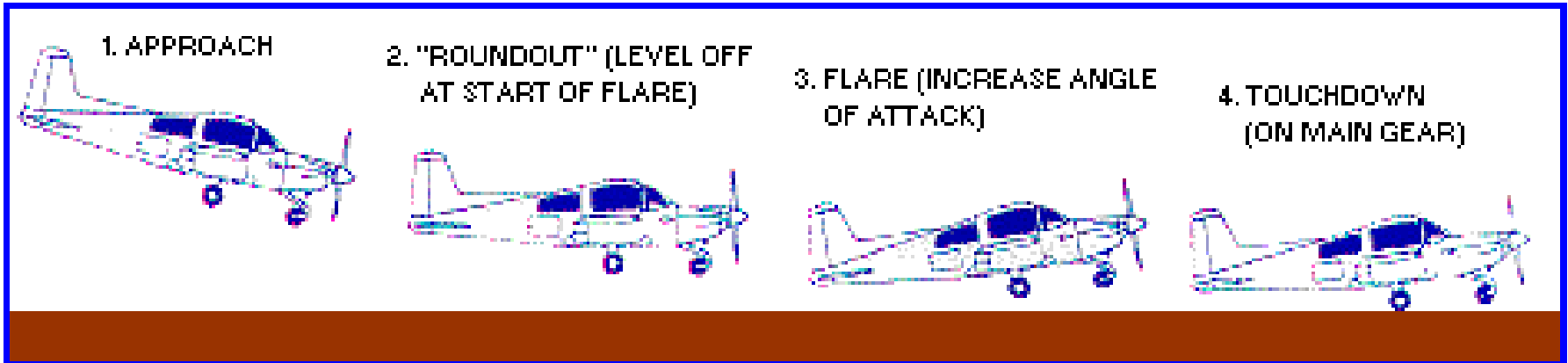


Figure 5-7 Stages of a landing.

Requirement 1e

1. e. Explain the following: the sport pilot, the recreational pilot and the private pilot certificates; the instrument rating.

Types of Pilot Certificates

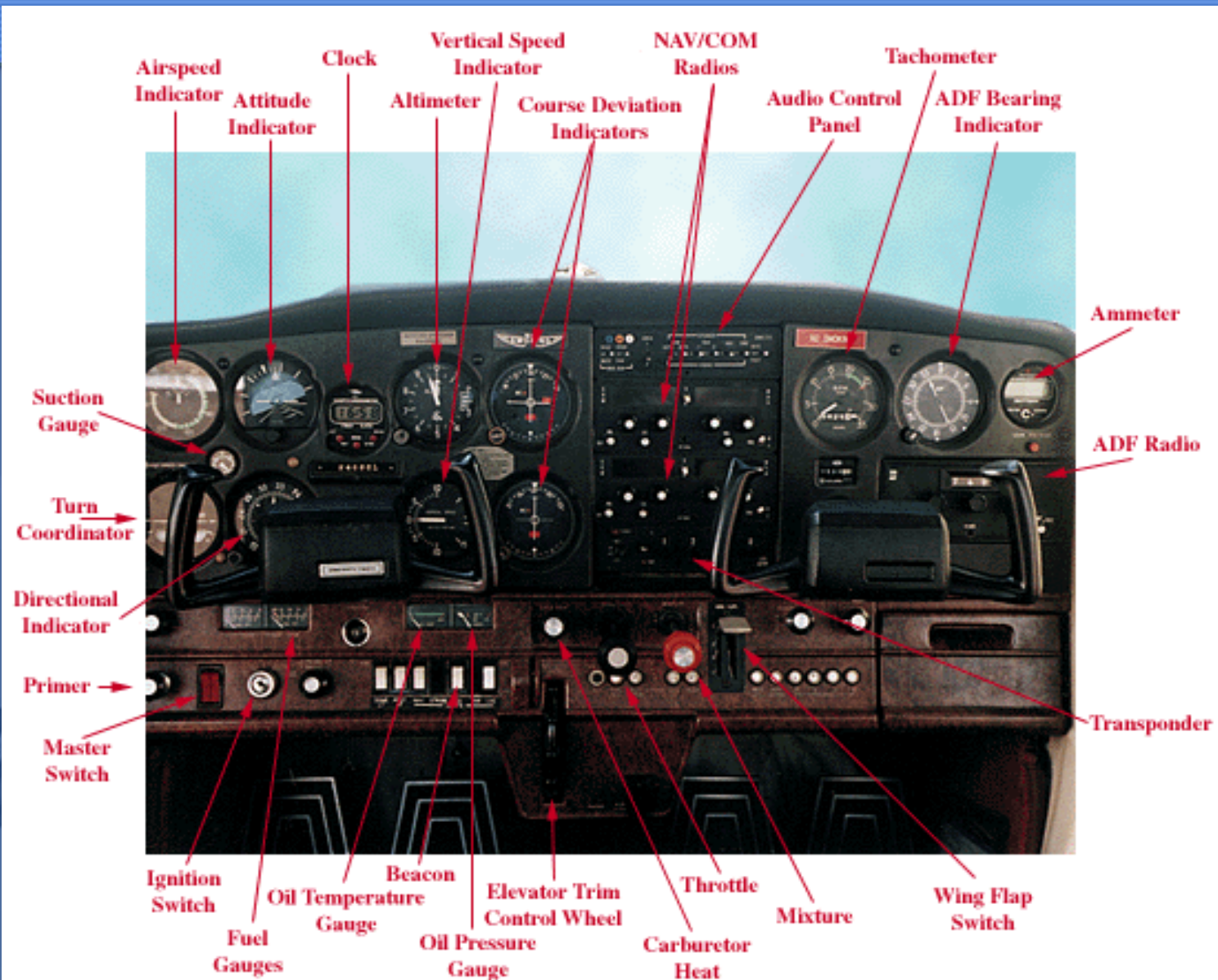
- Sport
 - Cannot carry more than one passenger, authorized to fly only light-sport aircraft during the daytime only
- Recreational
 - May fly aircraft of up to 180 horsepower (130 kW) and 4 seats in the daytime for pleasure only
- Private
 - May fly for pleasure or personal business. Private pilots cannot be paid, compensated to fly, or hired by any operator.
- Instrument Rating
 - An add-on to the private pilot certificate that allows the pilot to fly in limited visibility conditions

Requirement 2

2. Do TWO of the following:

- a. Take a flight in an aircraft, with your parent's permission. Record the date, place, type of aircraft, and duration of flight, and report on your impressions of the flight.
- b. Under supervision, perform a preflight inspection of a light airplane.
- c. Obtain and learn how to read an aeronautical chart. Measure a true course on the chart. Correct it for magnetic variation, compass deviation, and wind drift to determine a compass heading.
- d. Using one of many flight simulator software packages available for computers. "fly" the course and heading you established in requirement 2c or another course you have plotted.
- e. Explain the purposes and functions of the various instruments found in a typical single-engine aircraft: attitude indicator, heading indicator, altimeter, airspeed indicator, turn and bank indicator, vertical speed indicator, compass, navigation (GPS and VOR) and communication radios, tachometer, oil pressure gauge, and oil temperature gauge.
- f. Create an original poster of an aircraft instrument panel. Include and identify the instruments and radios discussed in requirement 2e.

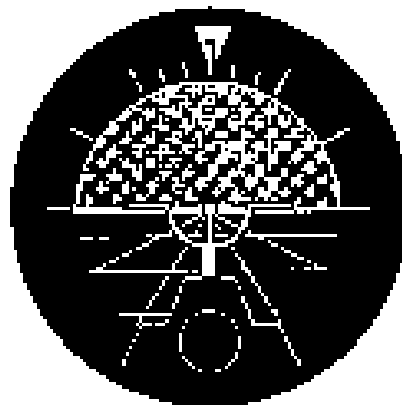
Instruments



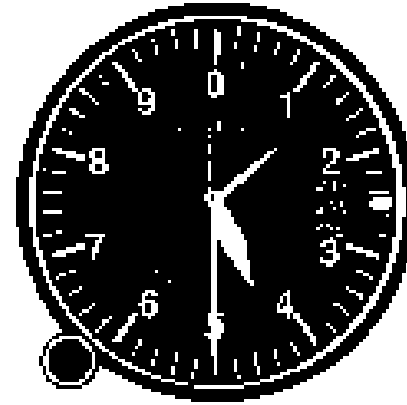
Instruments



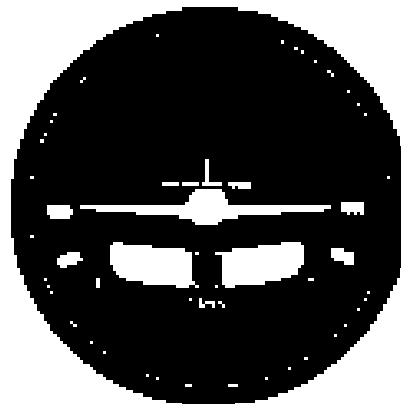
1. AIRSPEED INDICATOR



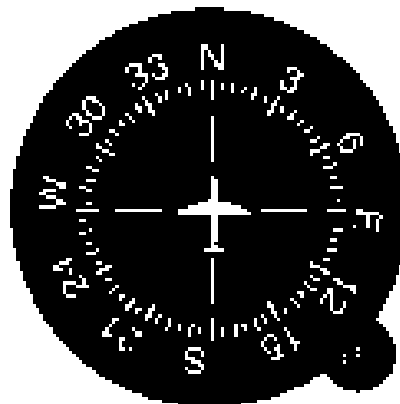
2. ATTITUDE INDICATOR



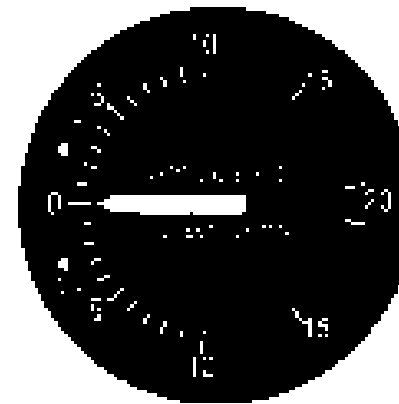
3. ALTIMETER



4. TURN COORDINATOR



5. HEADING INDICATOR



6. VERTICAL SPEED INDICATOR

3. b. Build a model FPG-9. Get others in your troop or patrol to make their own model, then organize a competition to test the precision of flight and landing of the models.

Model FPG-9



- See handout for template and instructions.

Requirement 4

4. Do ONE of the following:

- a. Visit an airport. After the visit, report on how the facilities are used, how runways are numbered, and how runways are determined to be "active."
- b. Visit a Federal Aviation Administration facility control tower, terminal radar control facility, air route traffic control center, or Flight Standards District Office. (Phone directory listings are under U.S. Government Offices, Transportation Department, Federal Aviation Administration. Call in advance.) Report on the operation and your impressions of the facility.
- c. Visit an aviation museum or attend an air show. Report on your impressions of the museum or show.

Requirement 5

5. Find out about three career opportunities in aviation. Pick one and find out the education, training, and experience required for this profession. Discuss this with your counselor, and explain why this profession might interest you.

Job Opportunities

- Careers with the Airlines
- Landing Facilities
- Engineering Research & Development
- General Aviation
- Government Aviation
- Aerospace Industries
- Military Aerospace (USAF, USN, USMC, USA, NOAA)
- National Aeronautics & Space Administration (NASA)