

Model Airplane Flight School

Mercer County Radio Control Society

And

Mercer County Library System

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Model Airplane Flight School

Course Presenters



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Model Airplane Flight School

Topic 1 – Airplanes and Flight

Airplanes! Airplanes! They Come In Many Sizes

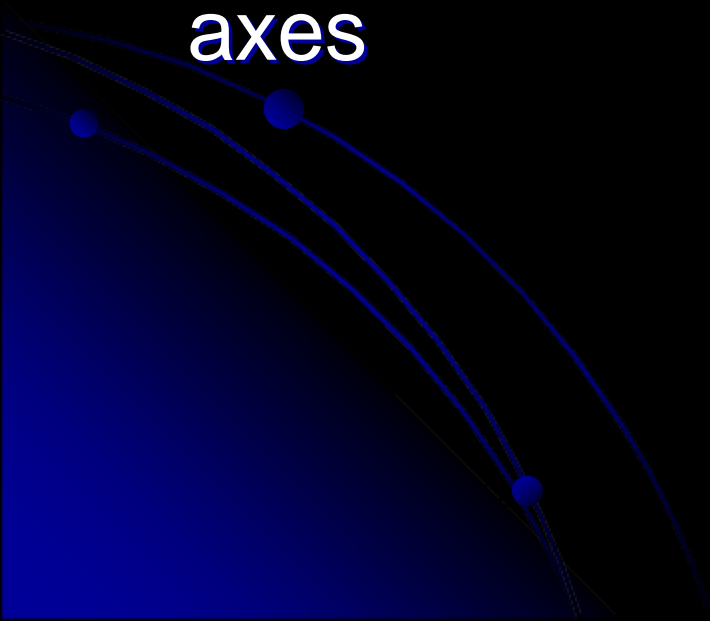


They Come In Many Shapes

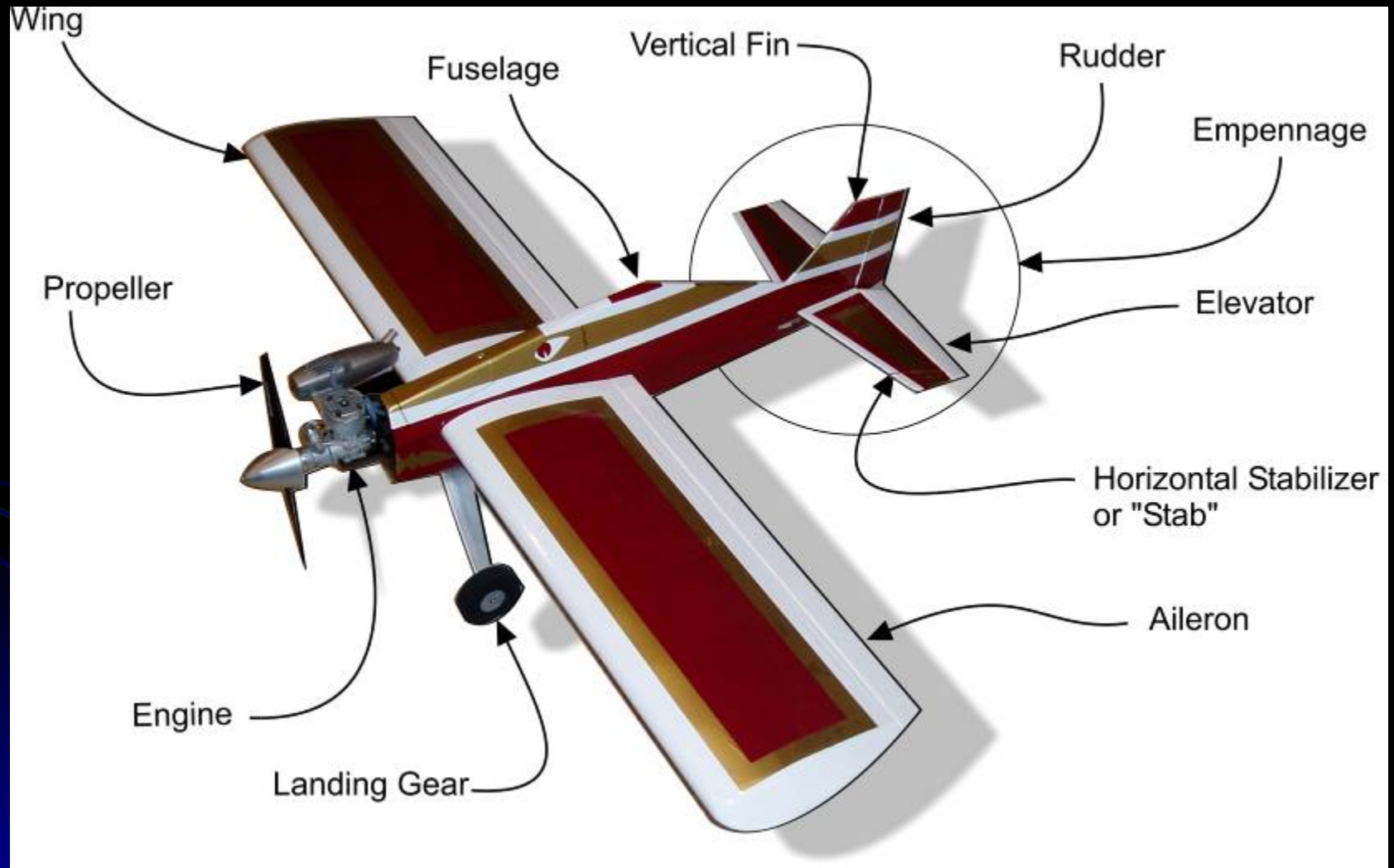


All Have Common Elements

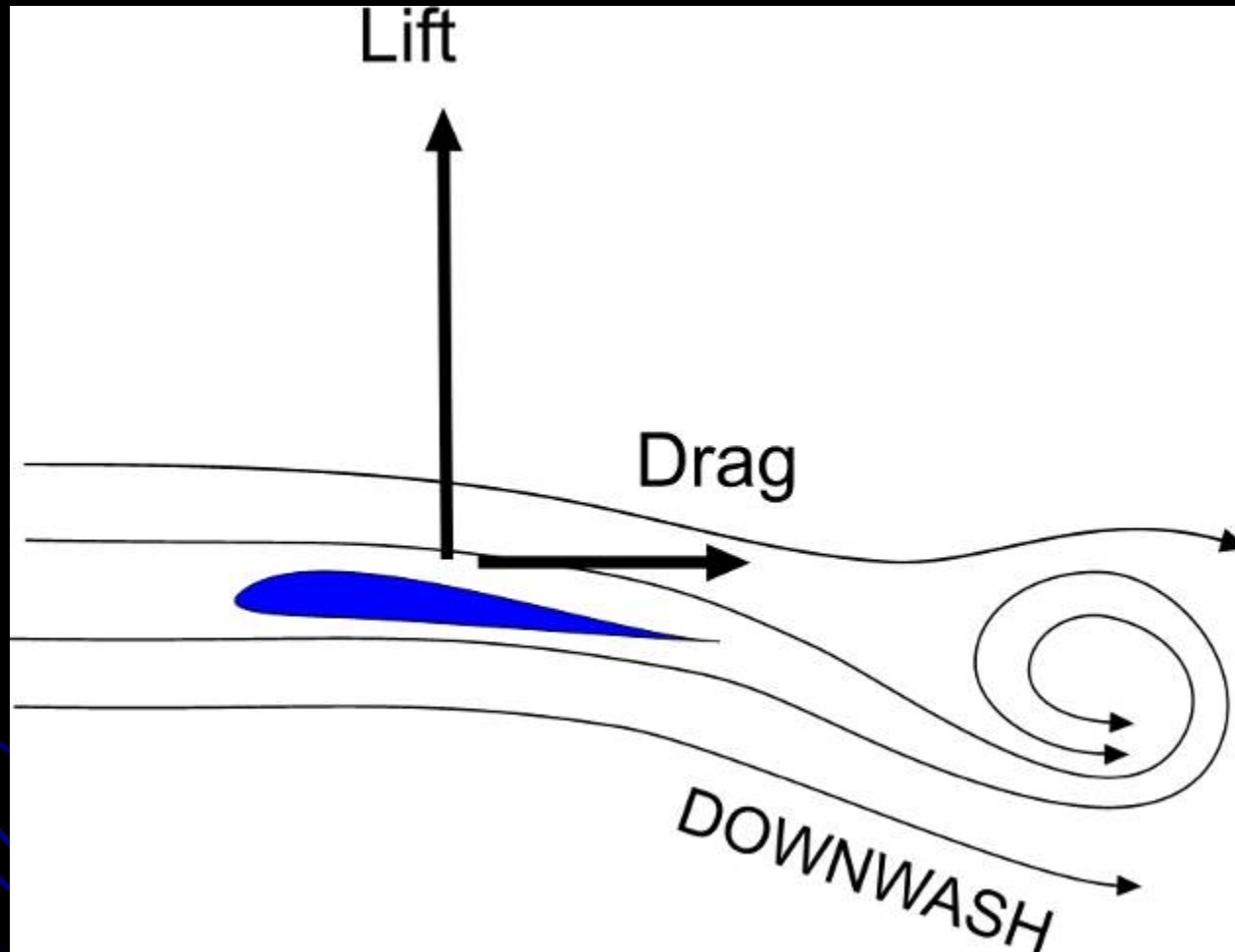
- One or more wings to provide lift
- A way to produce motion through the air and airflow over the wings
- A method to control orientation in three axes



Parts of an Airplane



Lift

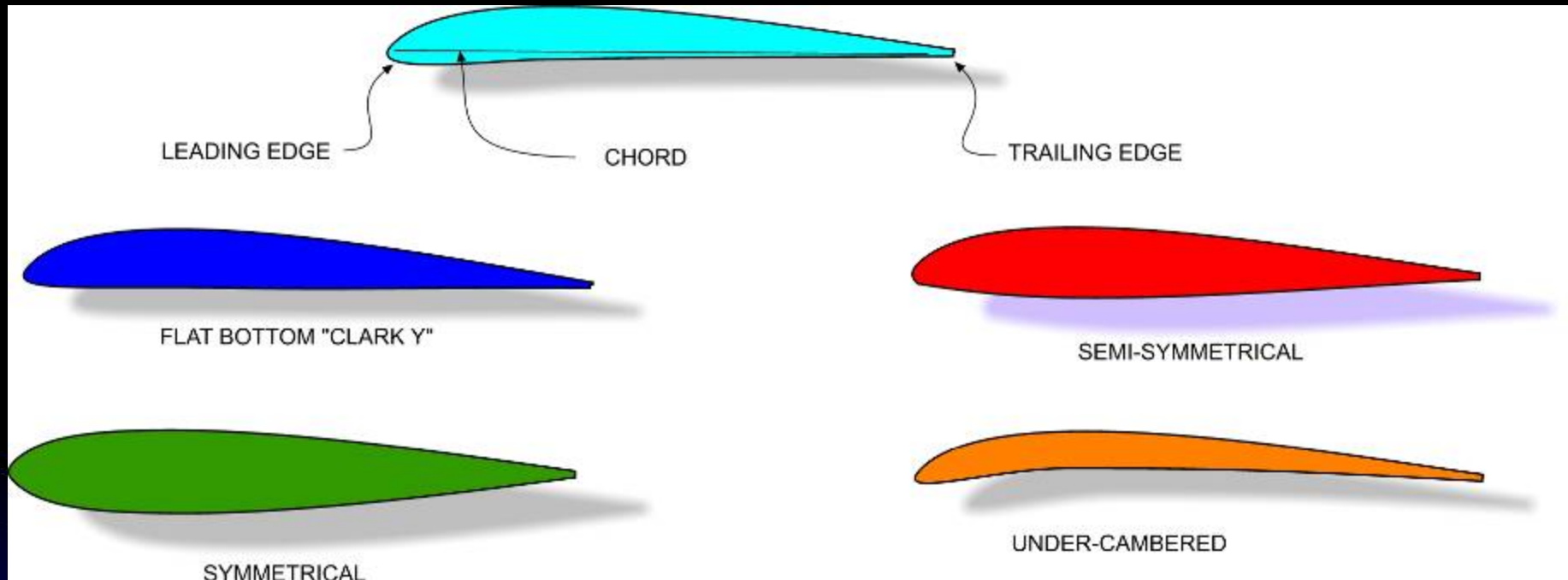


- Wing and tail produce lift required to balance weight
- Wings change direction of airflow, producing lift, drag, and downwash

Wings Provide Lift When Air Flows Across Their Surfaces



Airfoil Types and Terminology



- Flat bottom – Has good trainer flight characteristics, prefers to fly upright
- Semi-symmetrical – Sport aerobatics, can fly inverted
- Fully symmetrical – Extreme aerobatics, flies inverted as easily as upright
- Under-cambered – Vintage airplanes, difficult to build

Drag

- Drag is a downside of creating lift – You can't have lift without it.
- Engine thrust overcomes drag.
- Drag can be reduced by streamlining
 - Wheel pants
 - Cowling around engine
 - Smooth surface
 - No supporting struts, wires, etc.
 - Good flying technique reduces drag too

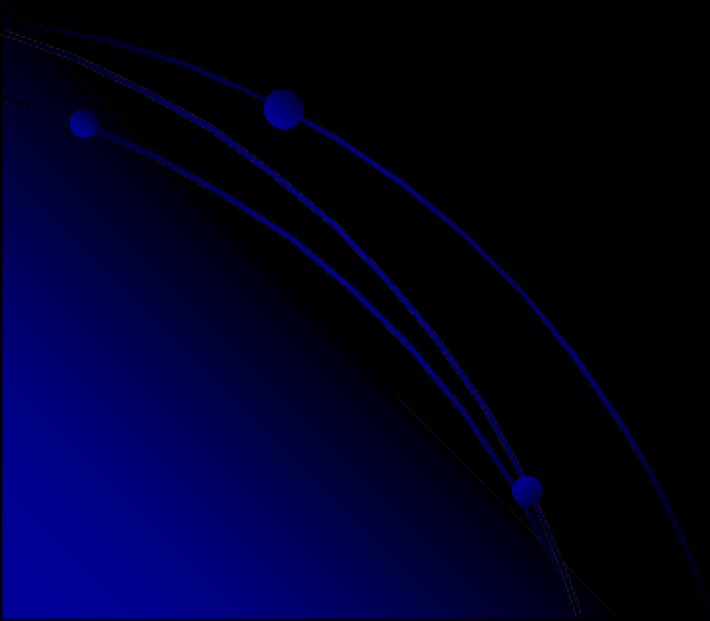
Drag



- All surfaces produce drag as air flows over them.
- Streamlining and smooth shapes reduce drag.

Thrust

- Thrust is needed to balance weight and drag
- It also influences rate of climb
- The pilot controls thrust with throttle



Thrust



- A power source is needed to cause forward motion.
- Gravity works as a power source too!

Wing Shapes and Sizes

- Wing span is length of wing, wing-tip to wing-tip
- Wings can have different shapes looking down (planform)
 - Straight – common on trainers
 - Tapered – common on aerobatic
 - Thin and long (“high aspect ratio”) – common on gliders.
 - Elliptical – some racers and fighters
- Wings can be mounted in different positions:
 - High wing – very stable; common on trainers
 - Low wing – less stable; common on aerobatic planes
 - Shoulder wing – in between!

Wing Shapes



Straight for stability and lift



Tapered for high-performance aerobatics



Elliptical for uniform lift across wing



Long for low-speed, low drag

Wing Locations



High for stability and visibility



Low for ease of access and structural design



Mid for lower drag, but hard to design



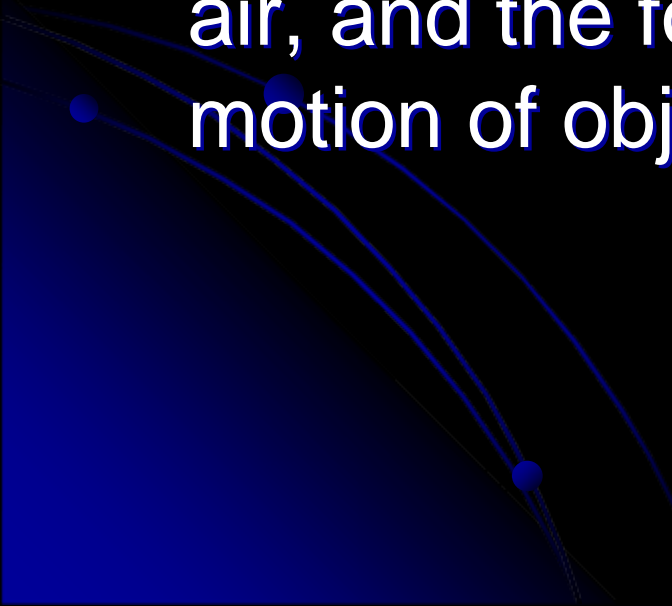
Gull for lower drag, shorter gear

Wing Locations (Cont.)

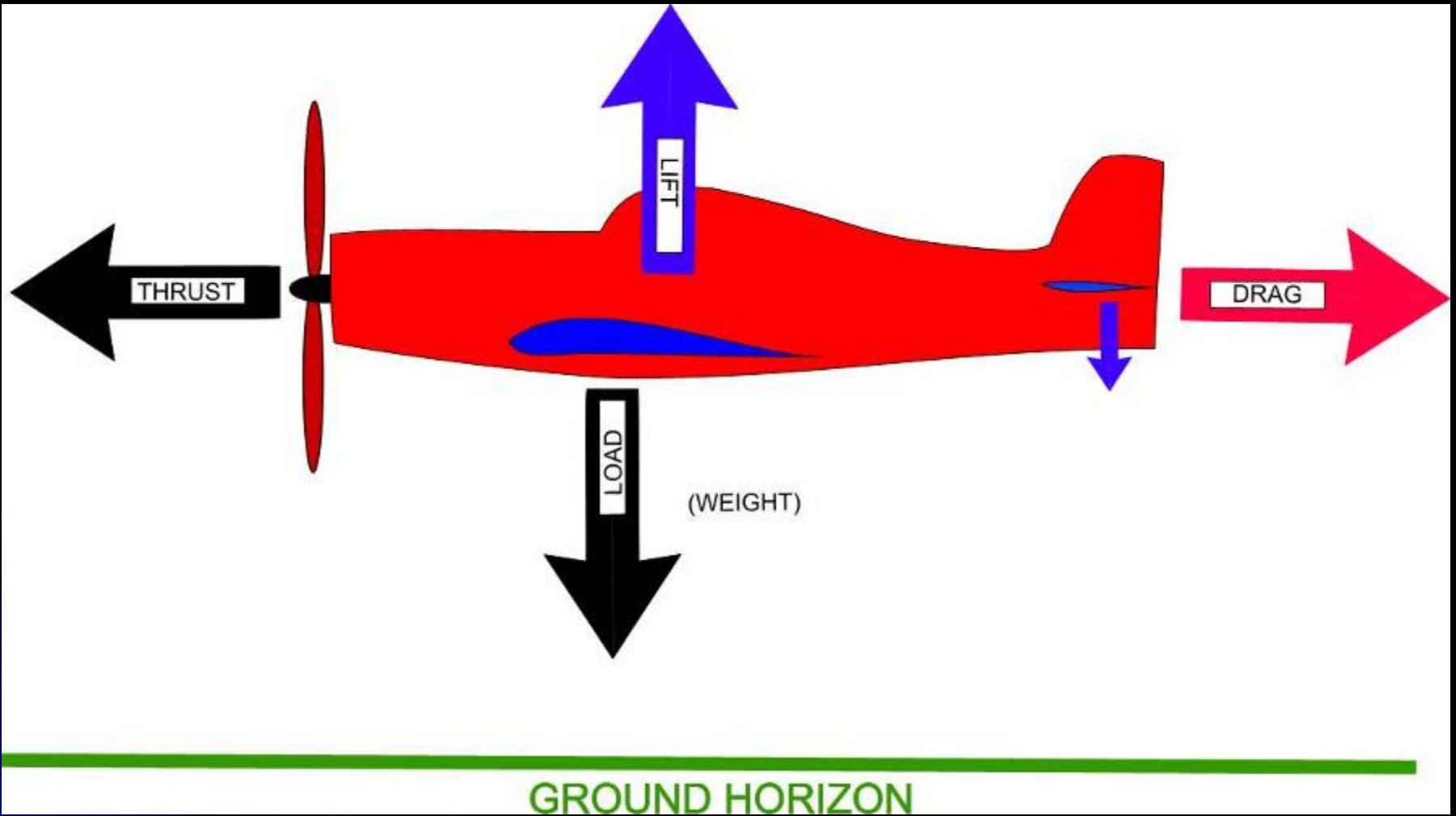


- Or several places if:
 - You want lots of lift,
 - Lots of drag, and
 - You like to build wings.

Definition of Aerodynamics

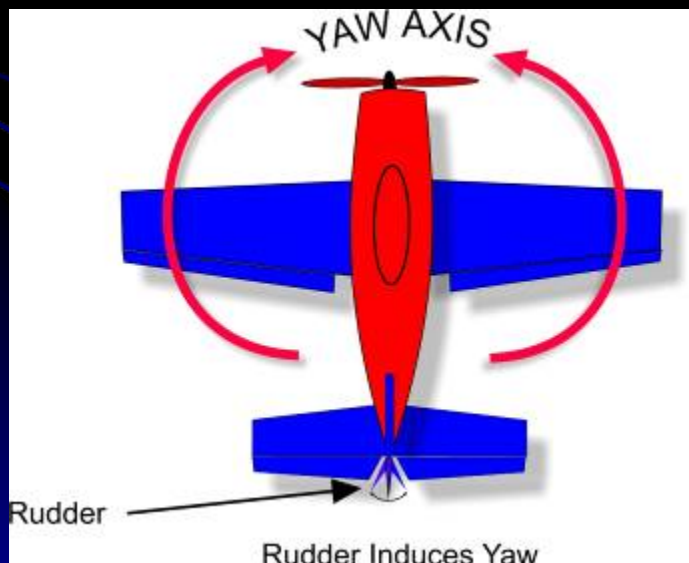
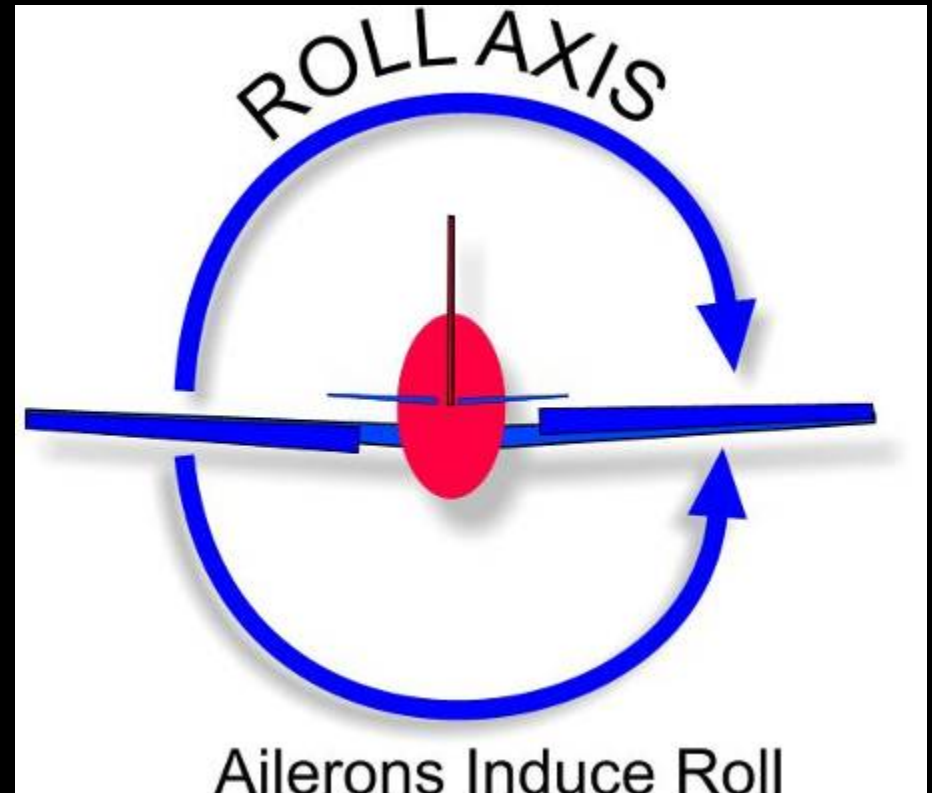
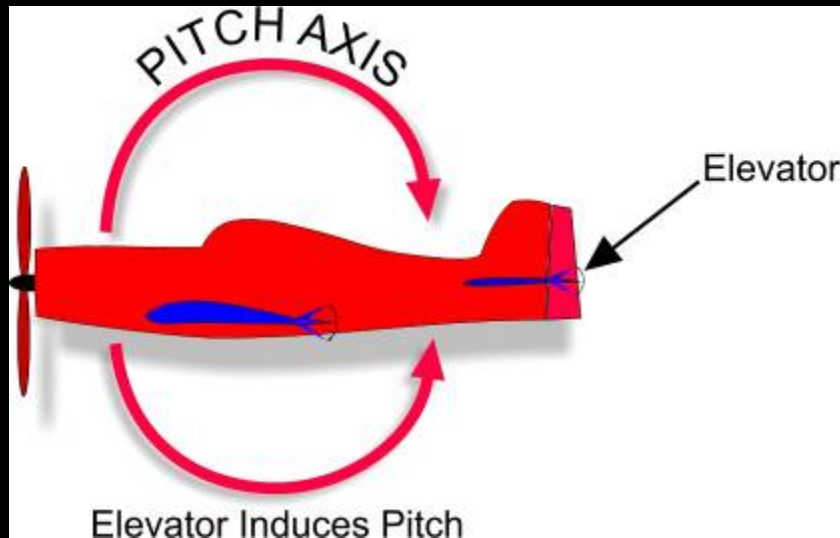
- “Aero” means AIR
 - “Dynamics” means the effect of forces on an object’s motion
 - Aerodynamics is the study of the effect of air, and the forces it produces, on the motion of objects.
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Forces on an Airplane



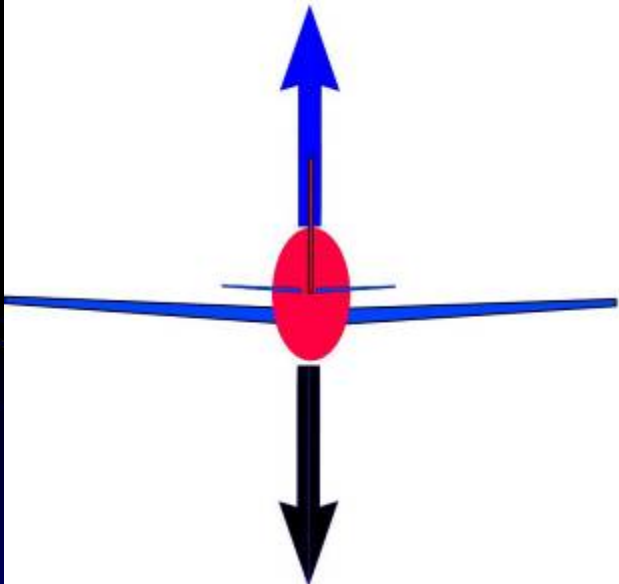
Thrust overcomes drag, lift overcomes weight

Axes and Flight Controls

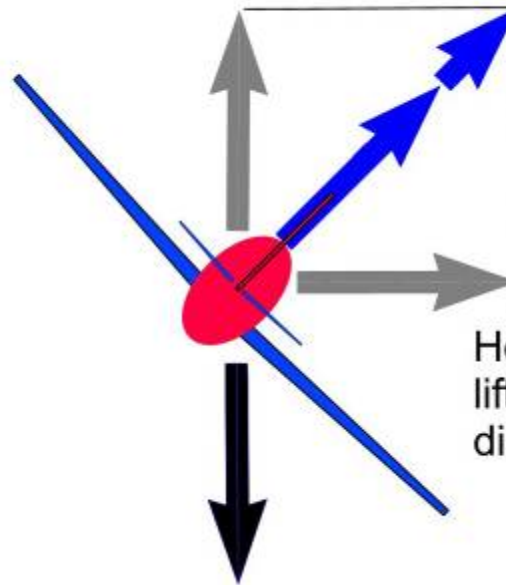


Using Lift to turn

Straight & Level: Lift Balances Weight:



In a banking-turn, more lift needed to balance weight.

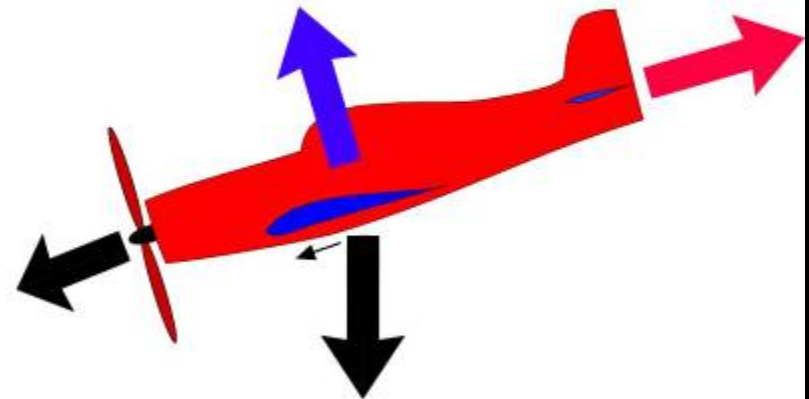
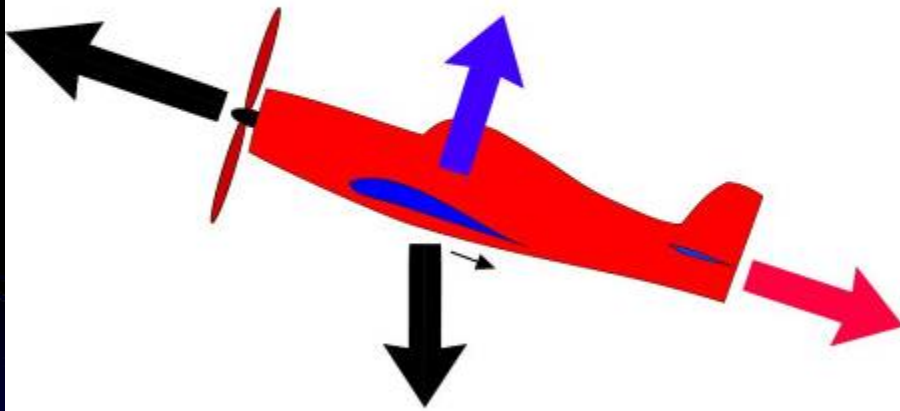


Horizontal component of lift causes plane to change direction.

Weight is Balanced by Lift

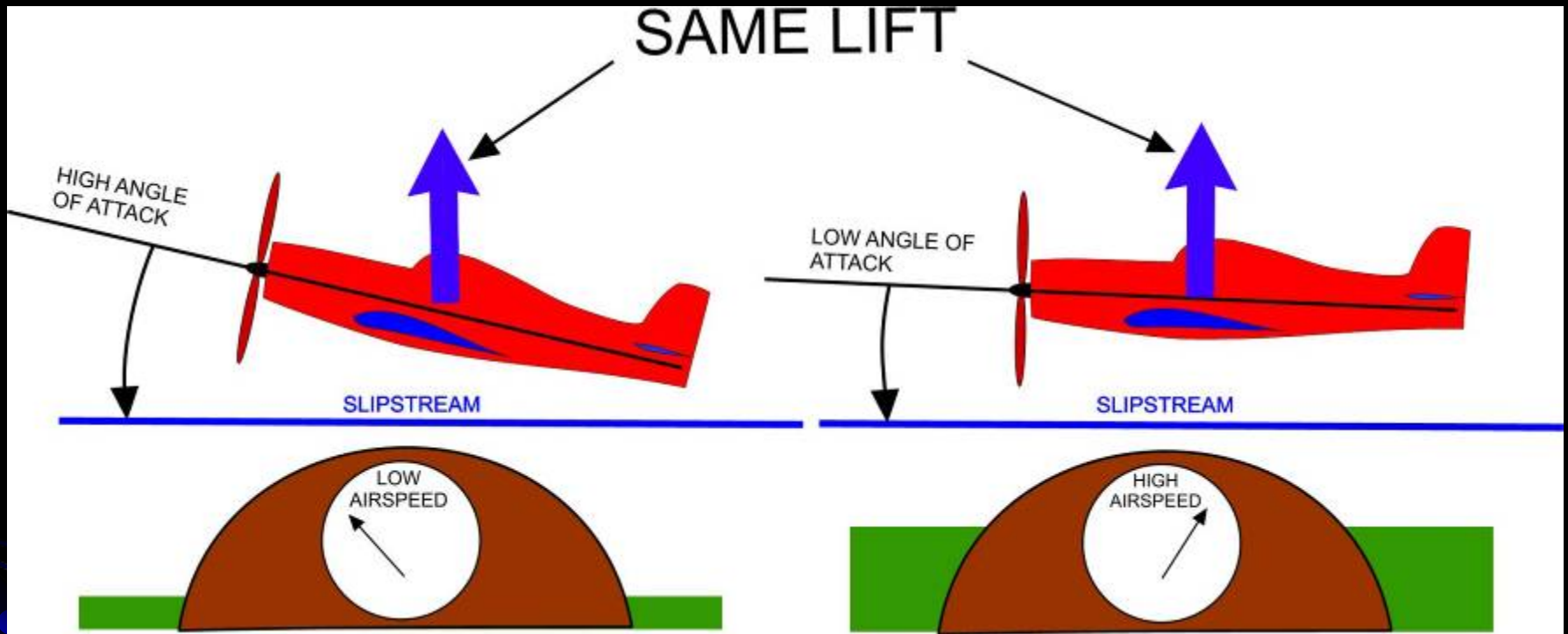
Climbing: More thrust to balance rearward pull of weight

Descending: Less thrust needed because of forward pull of weight



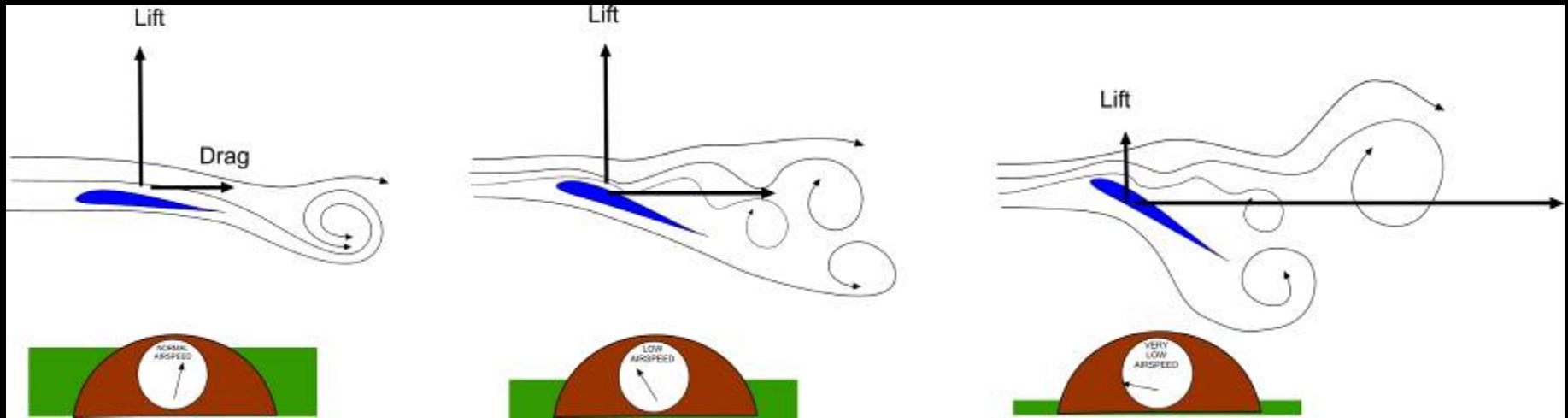
- It swings back when you climb ... you need more power!
- It swings forward when you descend ... you throttle-back!

Changing Speed



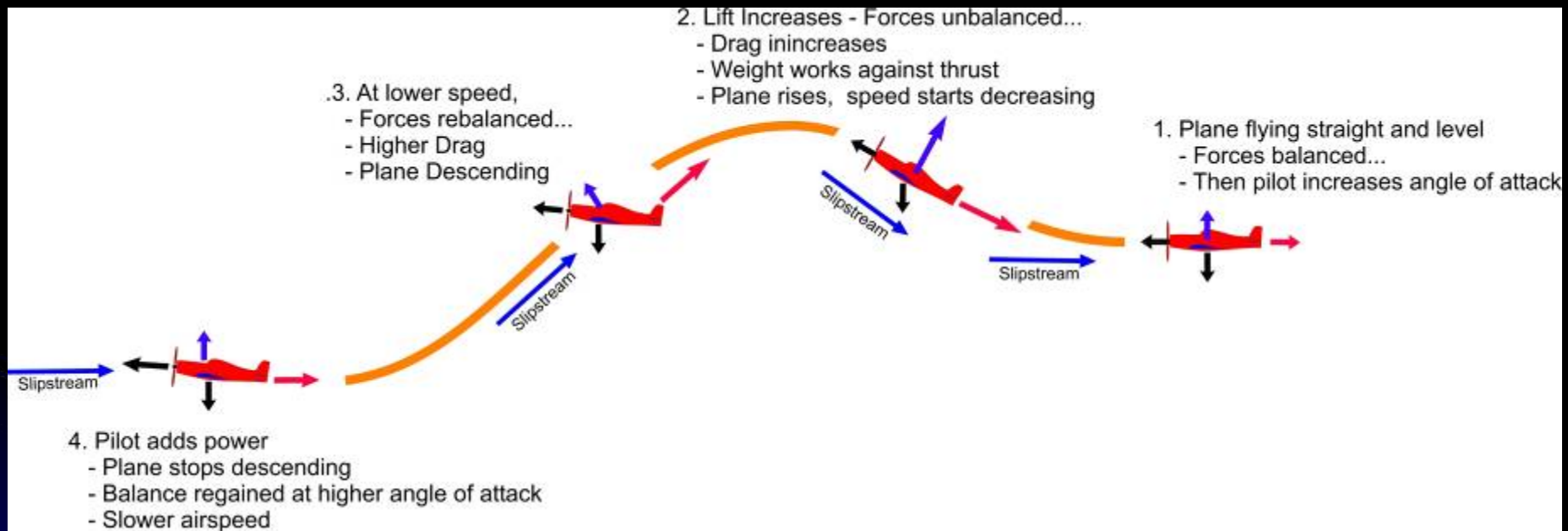
- Pilot controls “angle of attack” which determines airspeed.
- Whether the airplane ascends or descends depends on thrust (throttle).

Aerodynamic Stall



- A stall doesn't mean that the engine quits
- A stall is a loss of lift caused by too great an angle of attack
- Above a critical angle of attack, a full stall occurs

Slow Flight



Flight Maneuvers

- Straight and level flight
 - Maintains constant altitude with moderate power
 - A wide speed range possible
 - Rudder (yaw) or crab (heading offset) can compensate for wind drift
 - Straight and level flight is one of the hardest maneuvers to do well!
- Climb
 - Used for increasing altitude
 - It is important to avoid an aerodynamic stall
 - A higher power setting will compensate for weight pulling back
- Descend
 - Used for decreasing altitude
 - A lower power setting will compensate for weight pulling forward
- Turn
 - Wings are tipped to the side
 - Lift angle shifts away from vertical
 - Increased angle of attack produces more lift to keep weight balanced
 - Increased power compensates for increased drag
 - It is important to avoid an “accelerated stall”

Key Terms to Remember

- Lift
- Drag
- Thrust
- Weight
- Rudder
- Elevator
- Aileron
- Throttle
- Wing
- Stabilizer
- Fuselage
- Aerodynamic stall
- Pitch
- Roll
- Yaw
- Bank
- Airfoil
- Planform
- Empennage