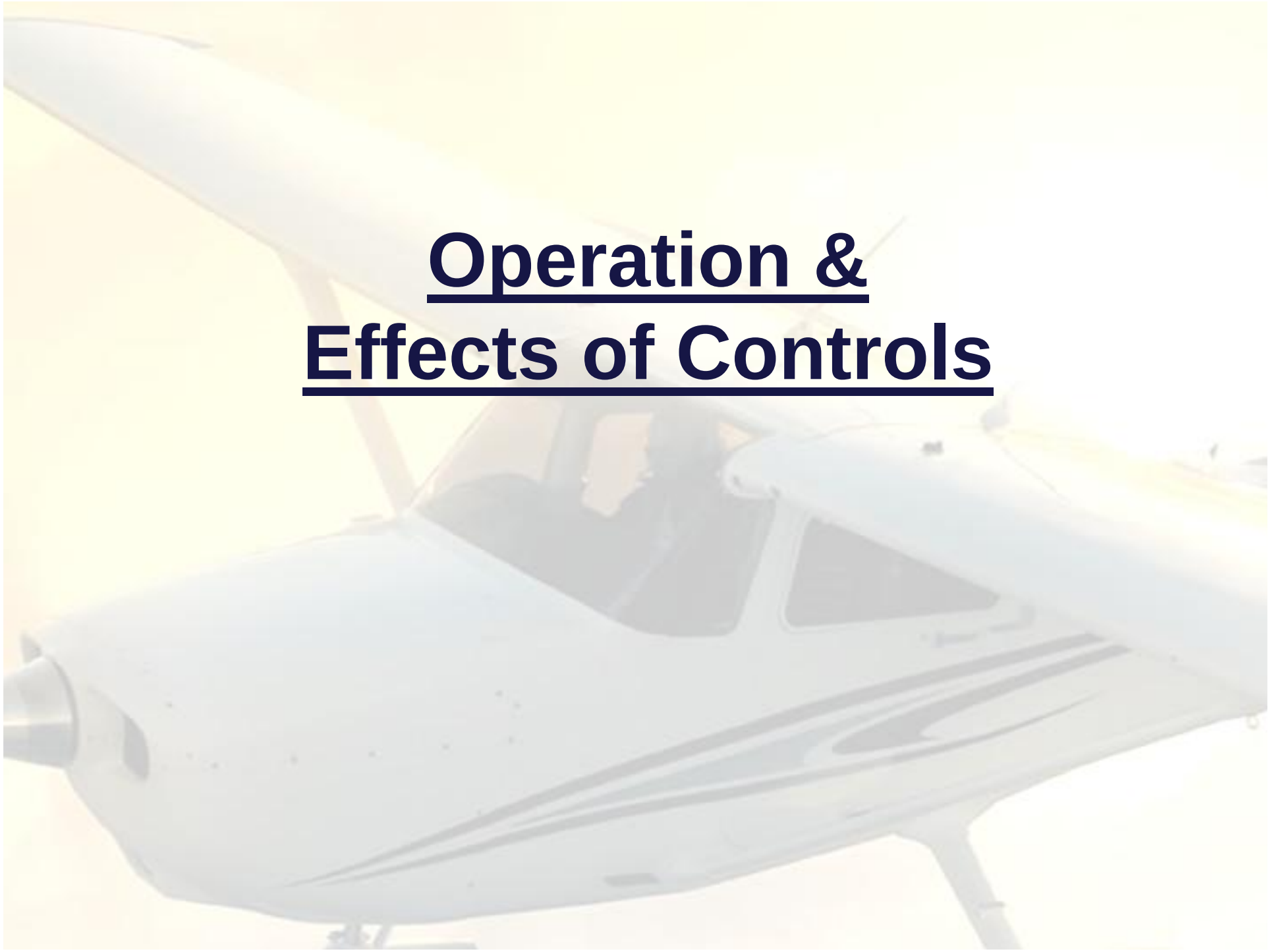


Operation & Effects of Controls

Effects of Controls

Aim

To teach the student the effect on the aeroplane of movement of the ***flying controls*** and the correct method of handling the aeroplane's ***ancillary controls***.

Objectives:

At the end of this briefing the student should be able to….

1. Describe with the aid of a model, how lift is generated on an aerofoil and state the two methods by which the pilot may vary lift in flight.

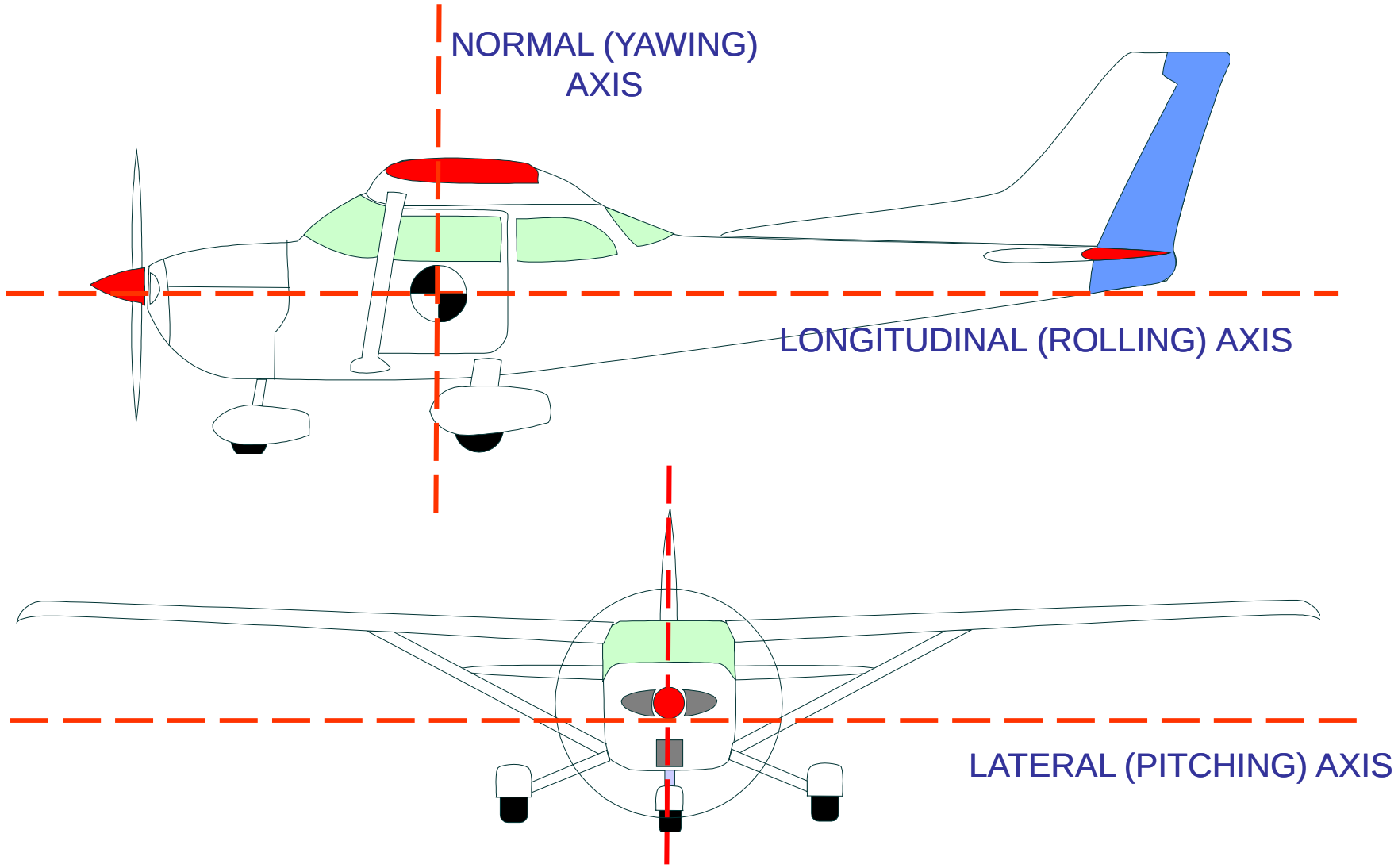
2. Using the model, show the three planes of movement and their axis.

3. State the primary and secondary effects of Rudder, Elevator and Aileron.

4. Explain the function and use of –

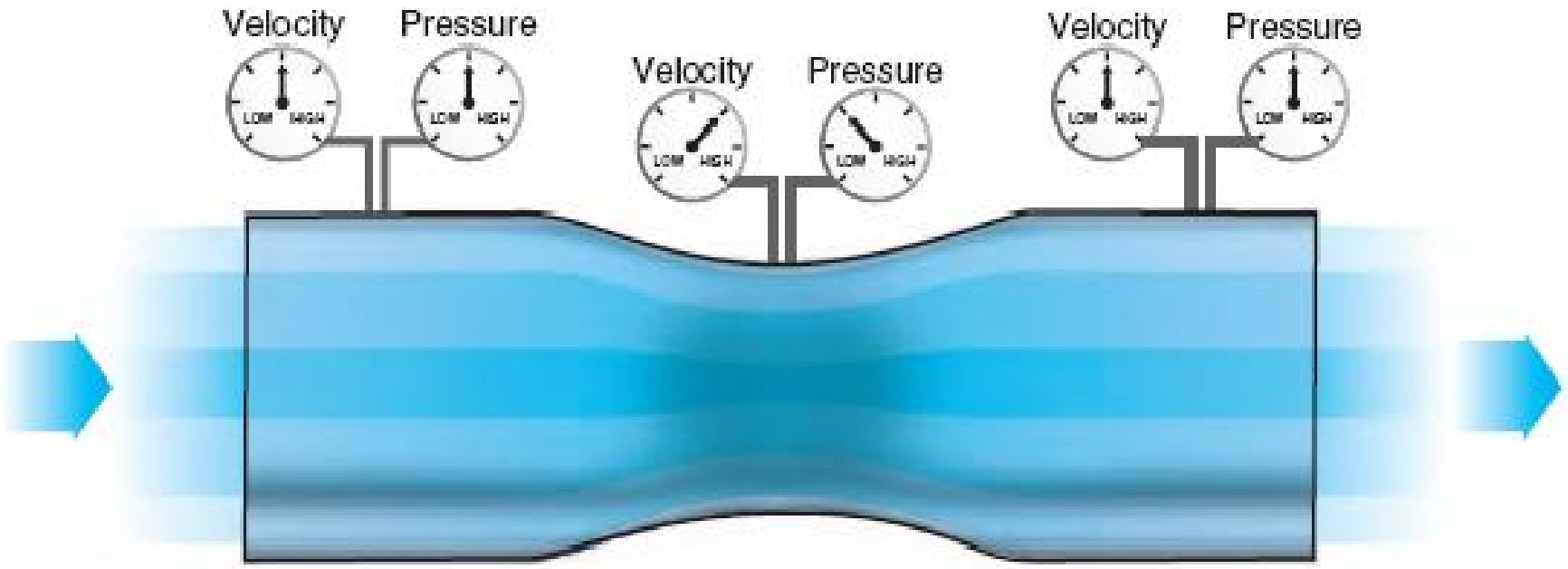
    Trims
    Flaps
    Mixture Control

“Flight” & “Ancillary” Controls

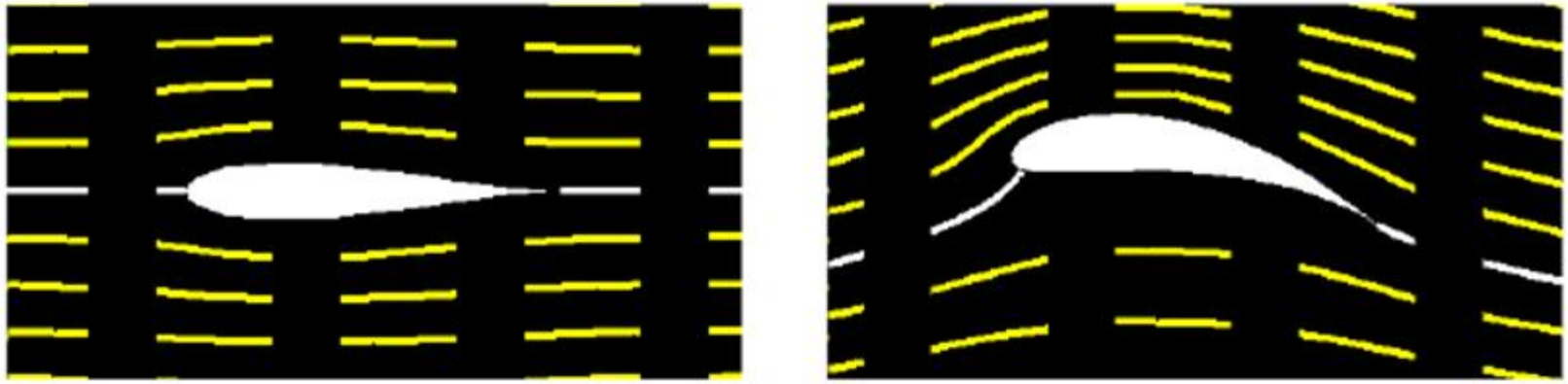

NORMAL (YAWING)
AXIS
LONGITUDINAL (ROLLING) AXIS
LATERAL (PITCHING) AXIS

Lift – Bernoulli's Theorem

Constant Energy Flow



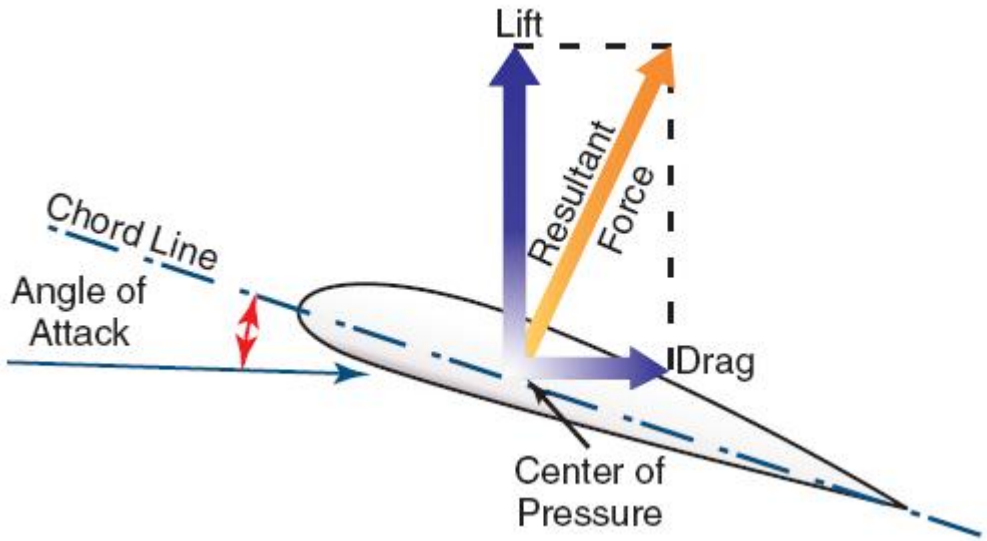
Downwash



Aerofoil

Definitions…..

- **Relative Airflow**- airflow relative to the wing, opposite to flight path.
- **Chord Line**- an imaginary line joining the leading edge to the trailing edge.
- **Angle of Attack**- the angle formed between the Relative Airflow and the Chord line.
- **Camber** – curvature of the wing. Asymmetry between top and bottom of an aerofoil
- **Lift force**- aerodynamic force produced by an aerofoil perpendicular to the relative airflow. Acts through a point called the centre of pressure.

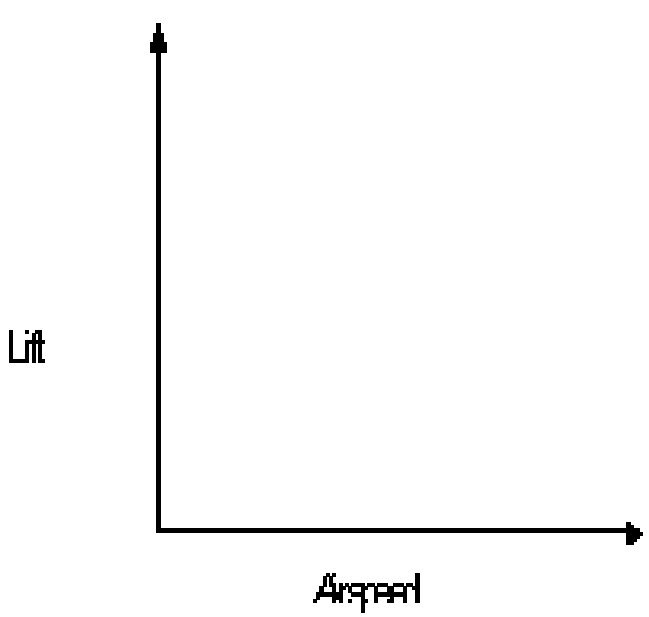


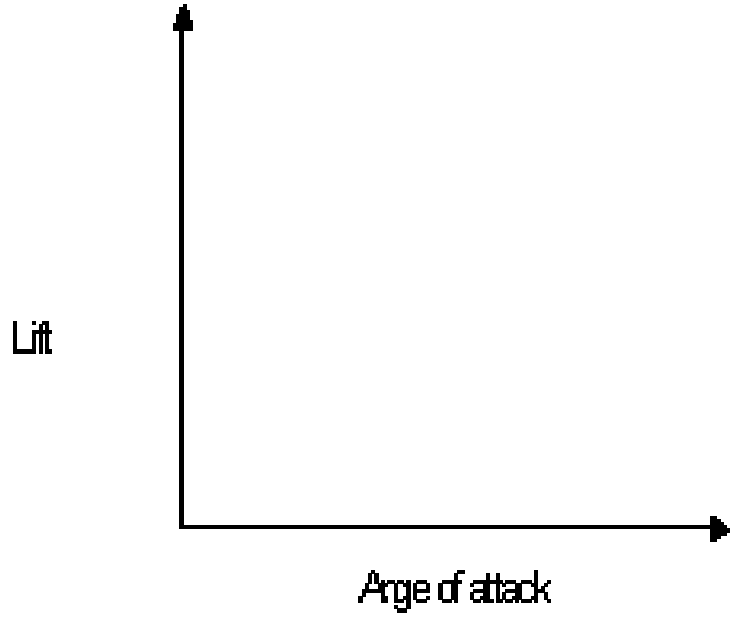
Lift

$$\text{Lift} = C_L \ \tfrac{1}{2} \rho \ V^2 \ S$$

Two methods that the pilot can change the amount of lift produced-

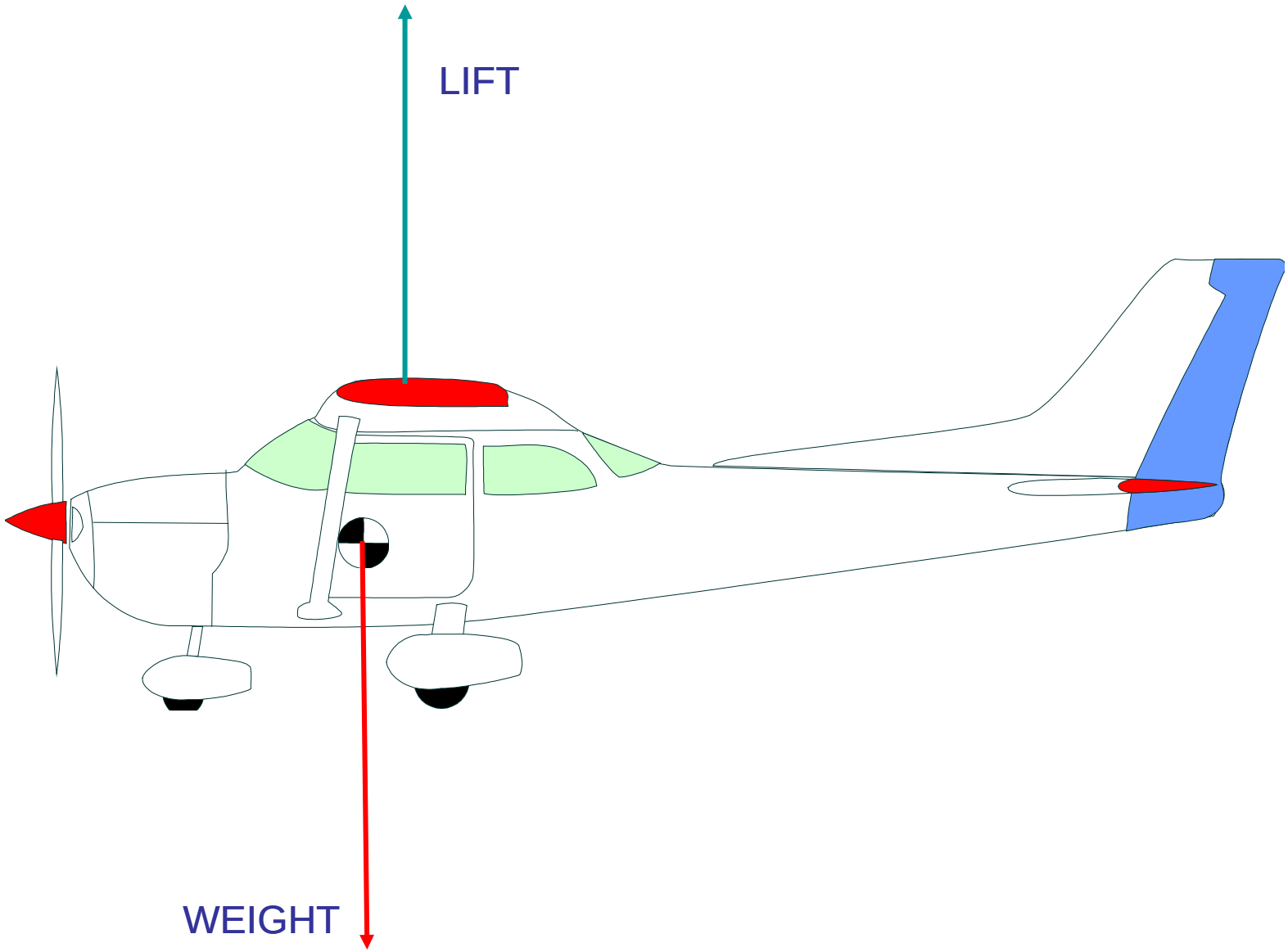
- Increase speed (**V**)
- Increase a the angle of attack (Camber) (C_L)

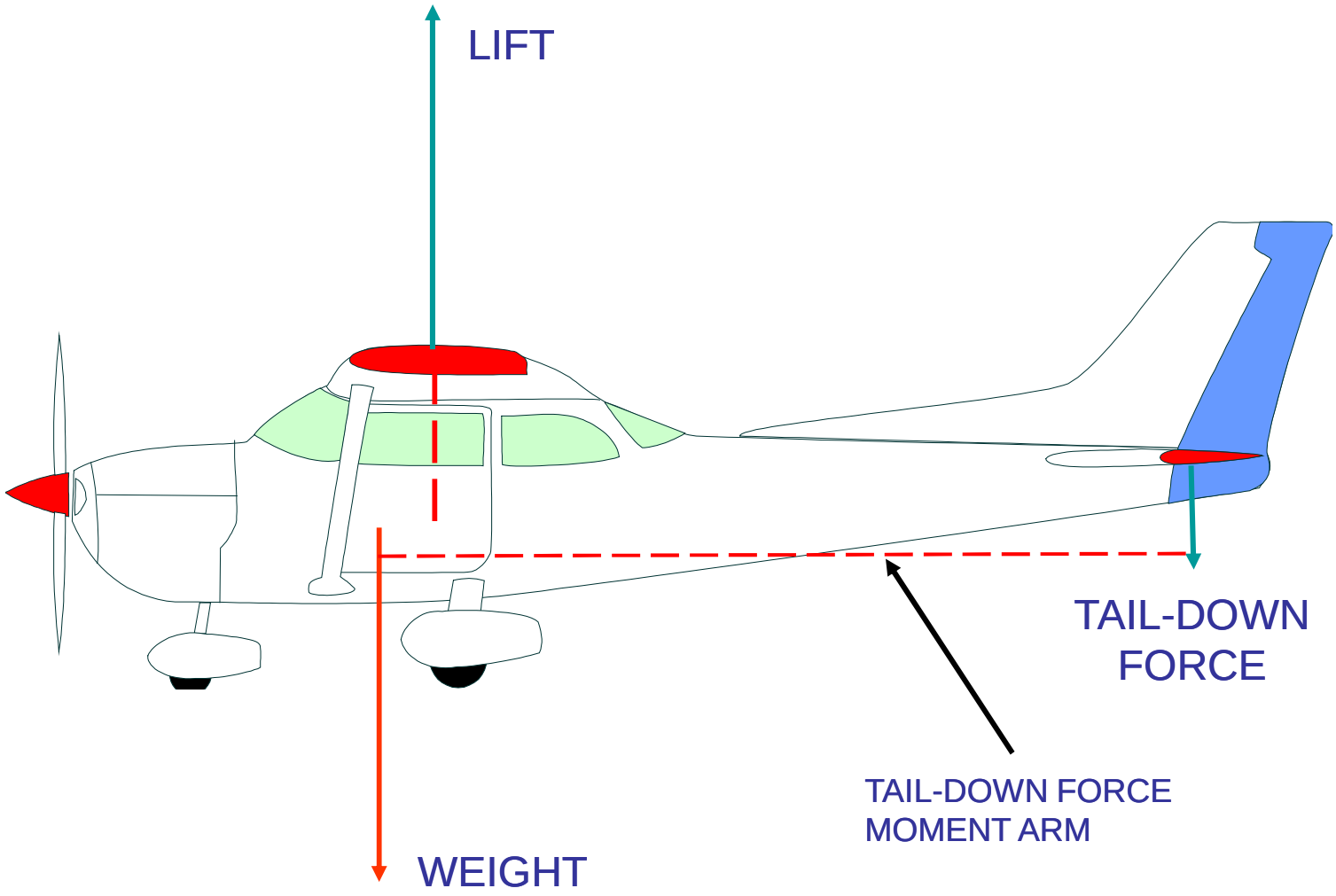


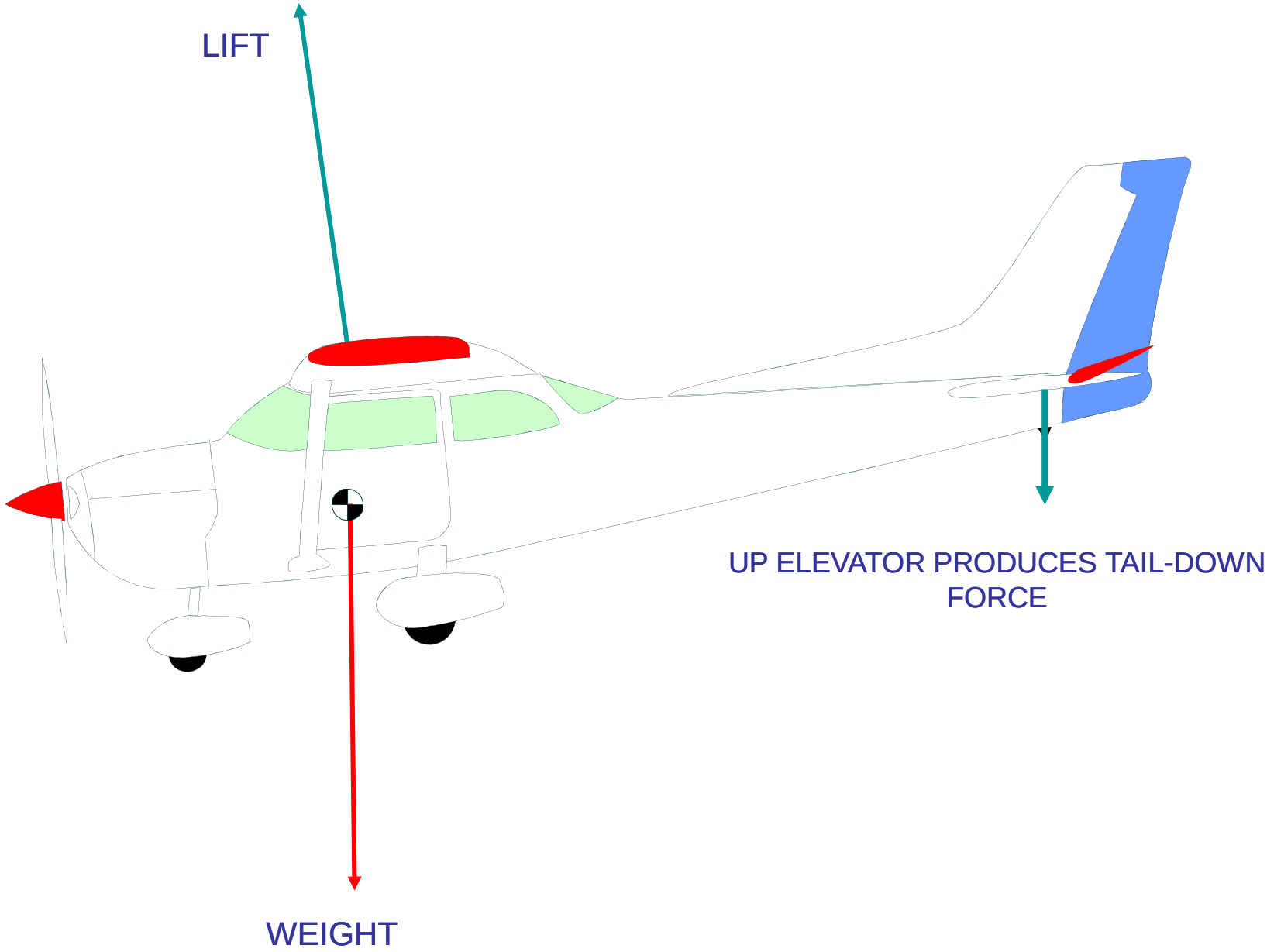


FLIGHT CONTROLS

ELEVATORS

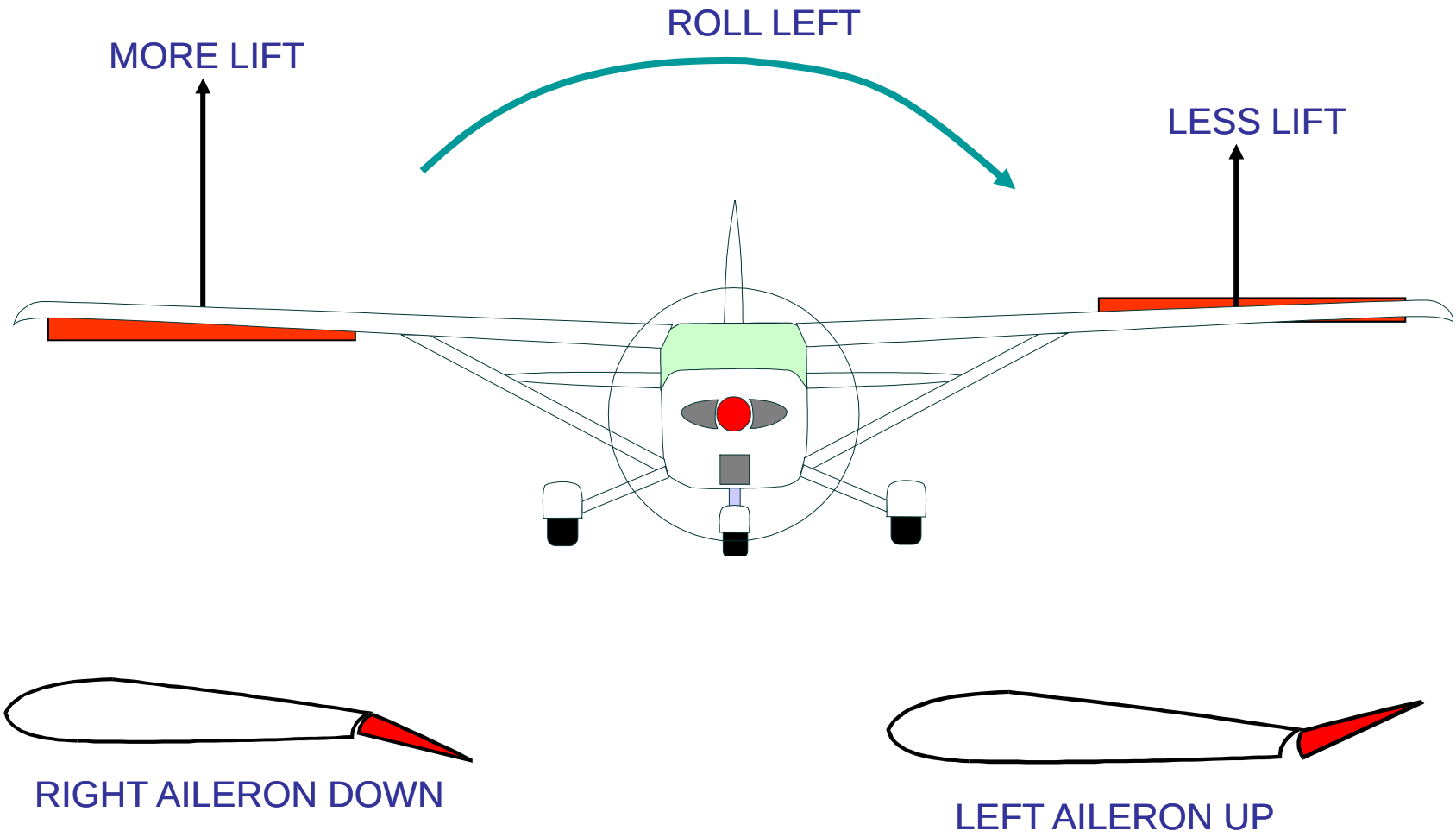

LIFT
WEIGHT

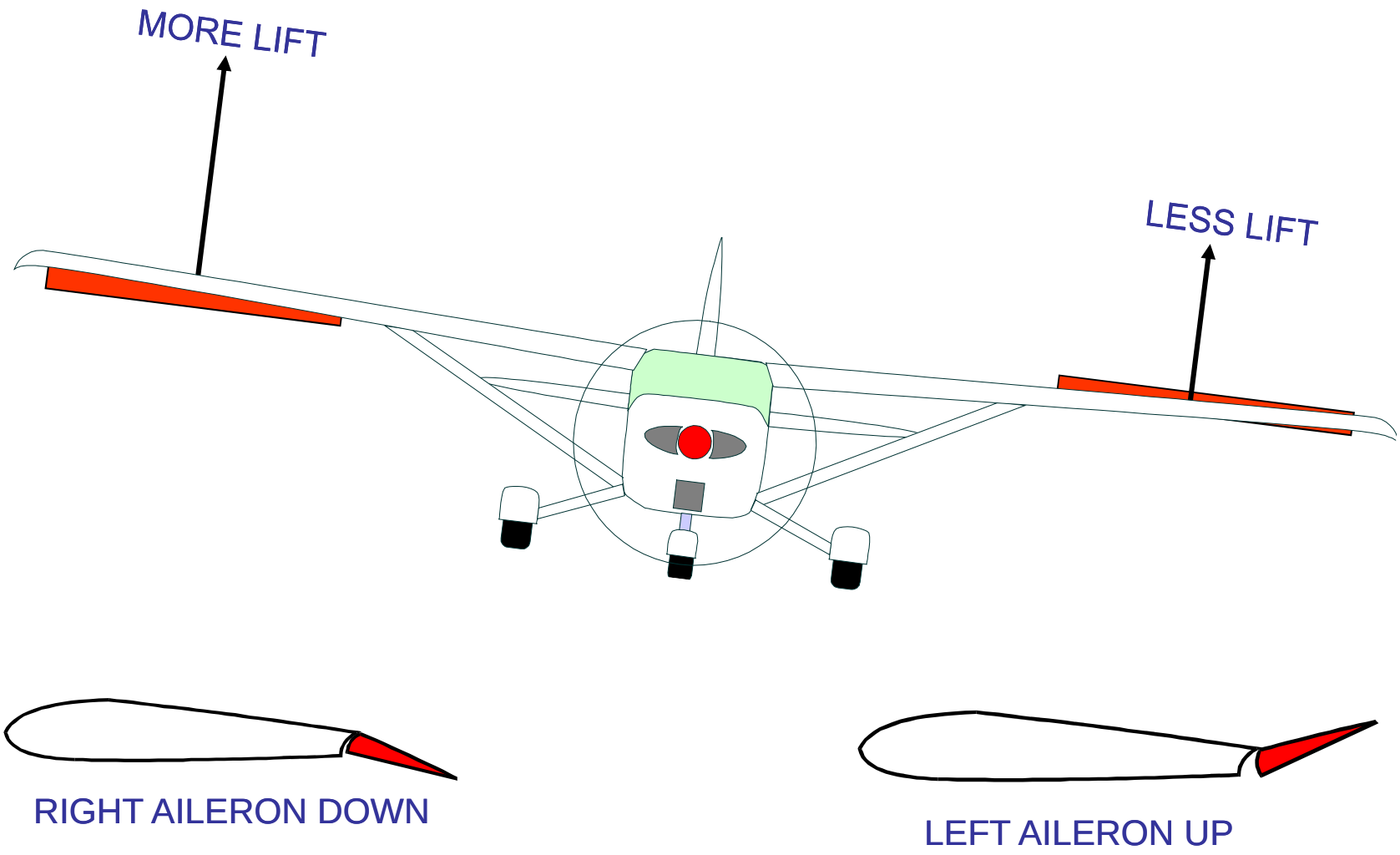

LIFT
TAIL-DOWN
FORCE
TAIL-DOWN FORCE
MOMENT ARM
WEIGHT

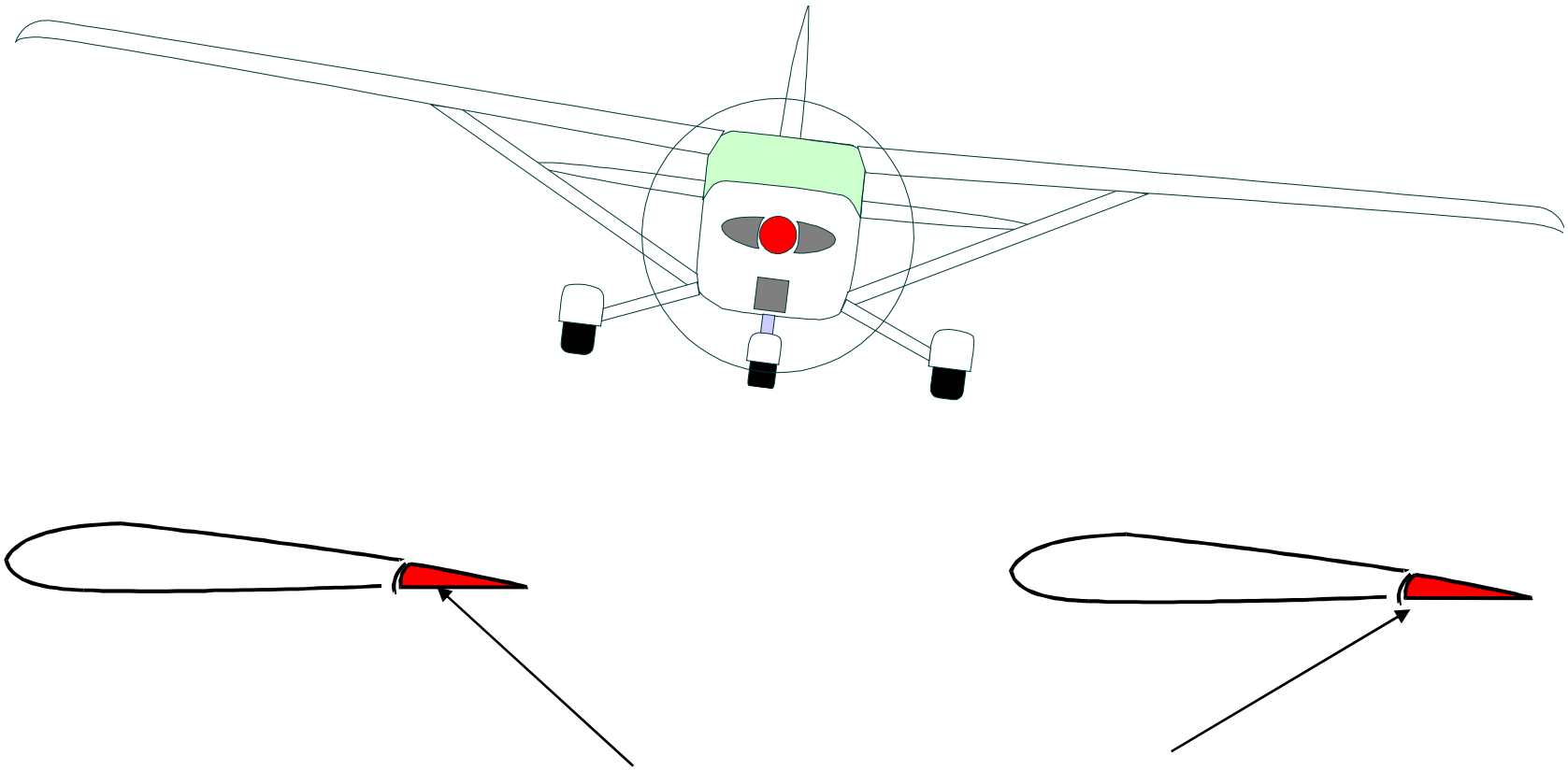

LIFT
UP ELEVATOR PRODUCES TAIL-DOWN FORCE
WEIGHT

Control	Primary effect	Secondary effect
Elevator	Pitch	Nil

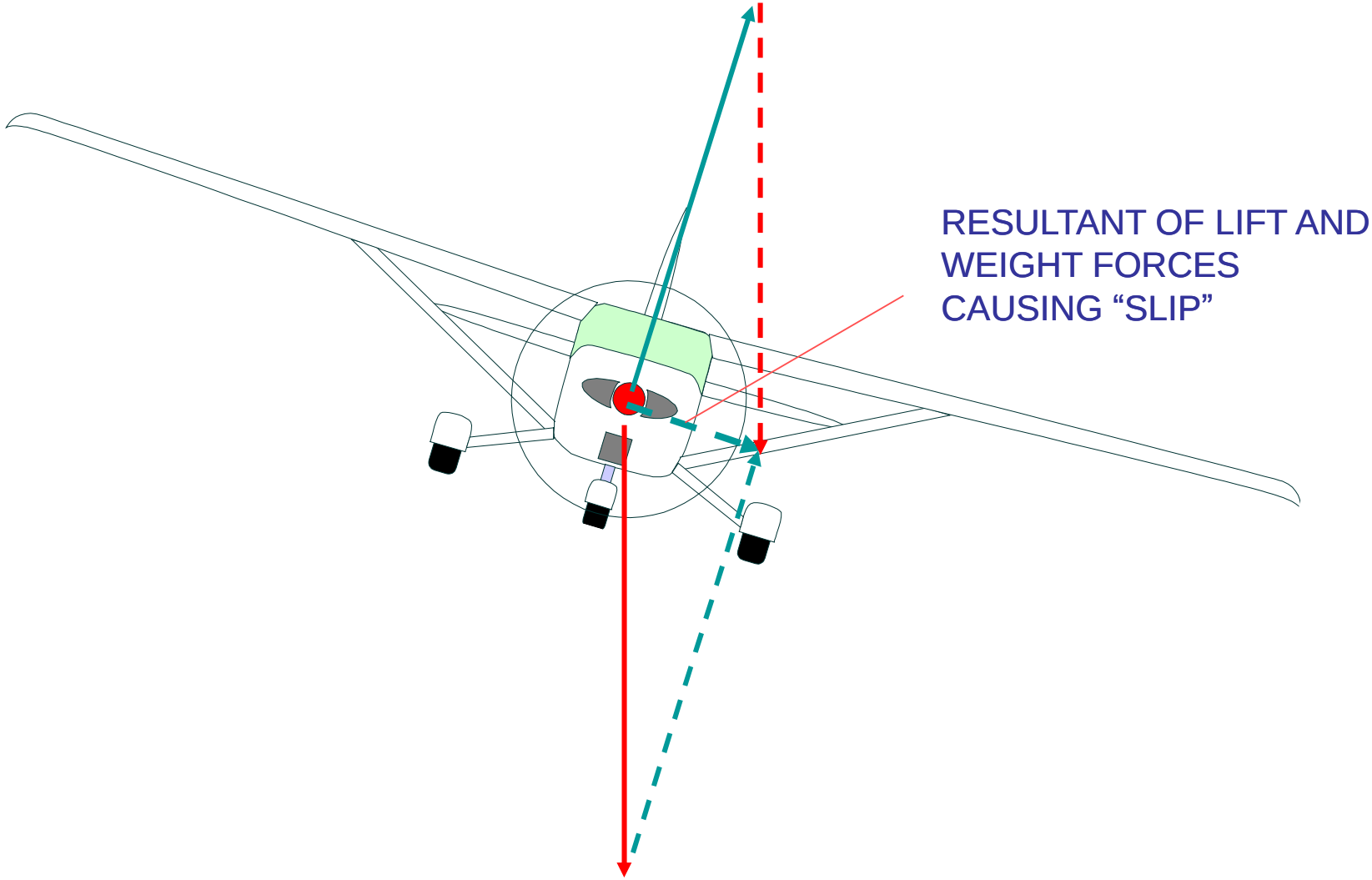
AILERONS


ROLL LEFT
MORE LIFT
LESS LIFT
RIGHT AILERON DOWN
LEFT AILERON UP


MORE LIFT
LESS LIFT
RIGHT AILERON DOWN
LEFT AILERON UP

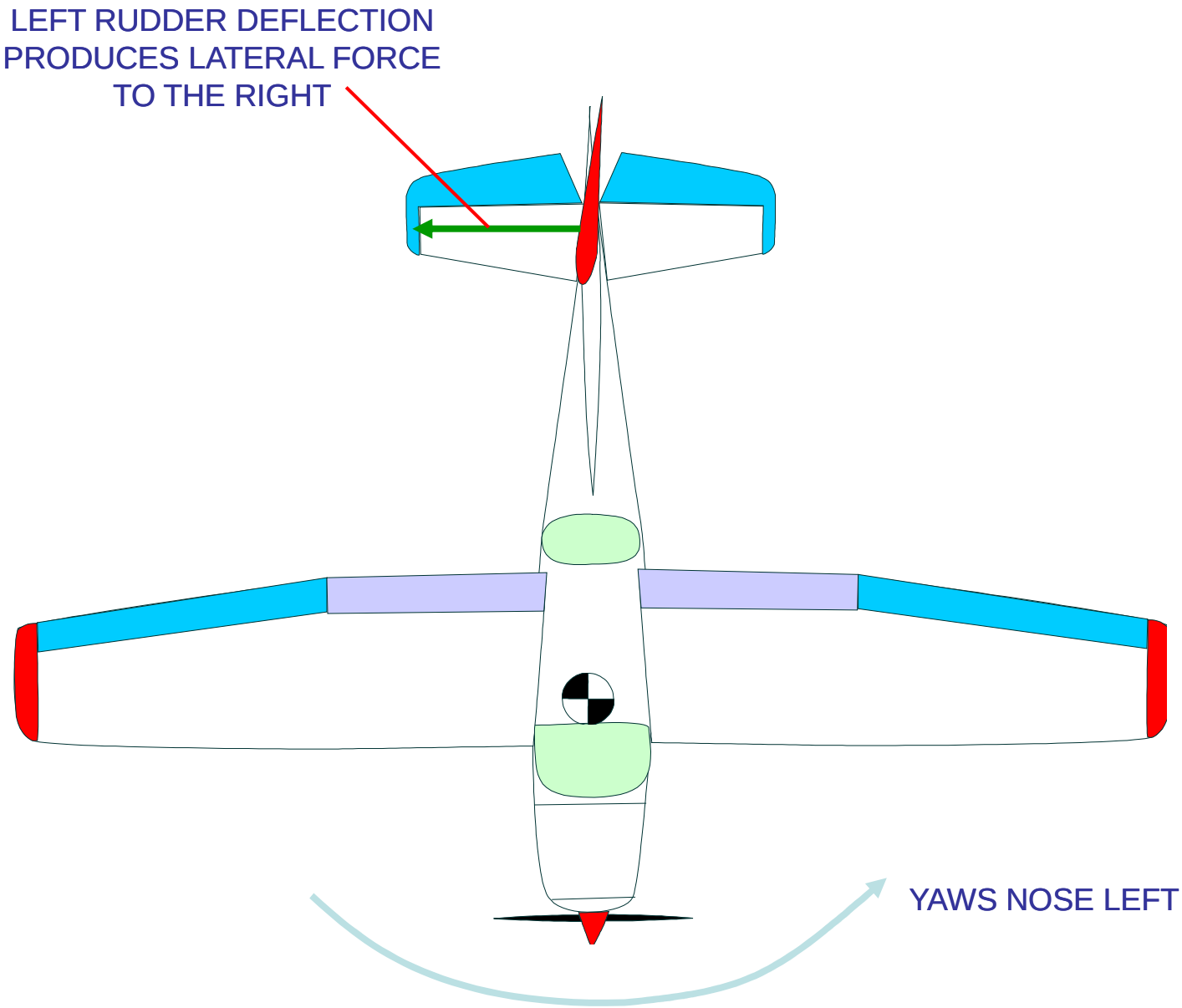


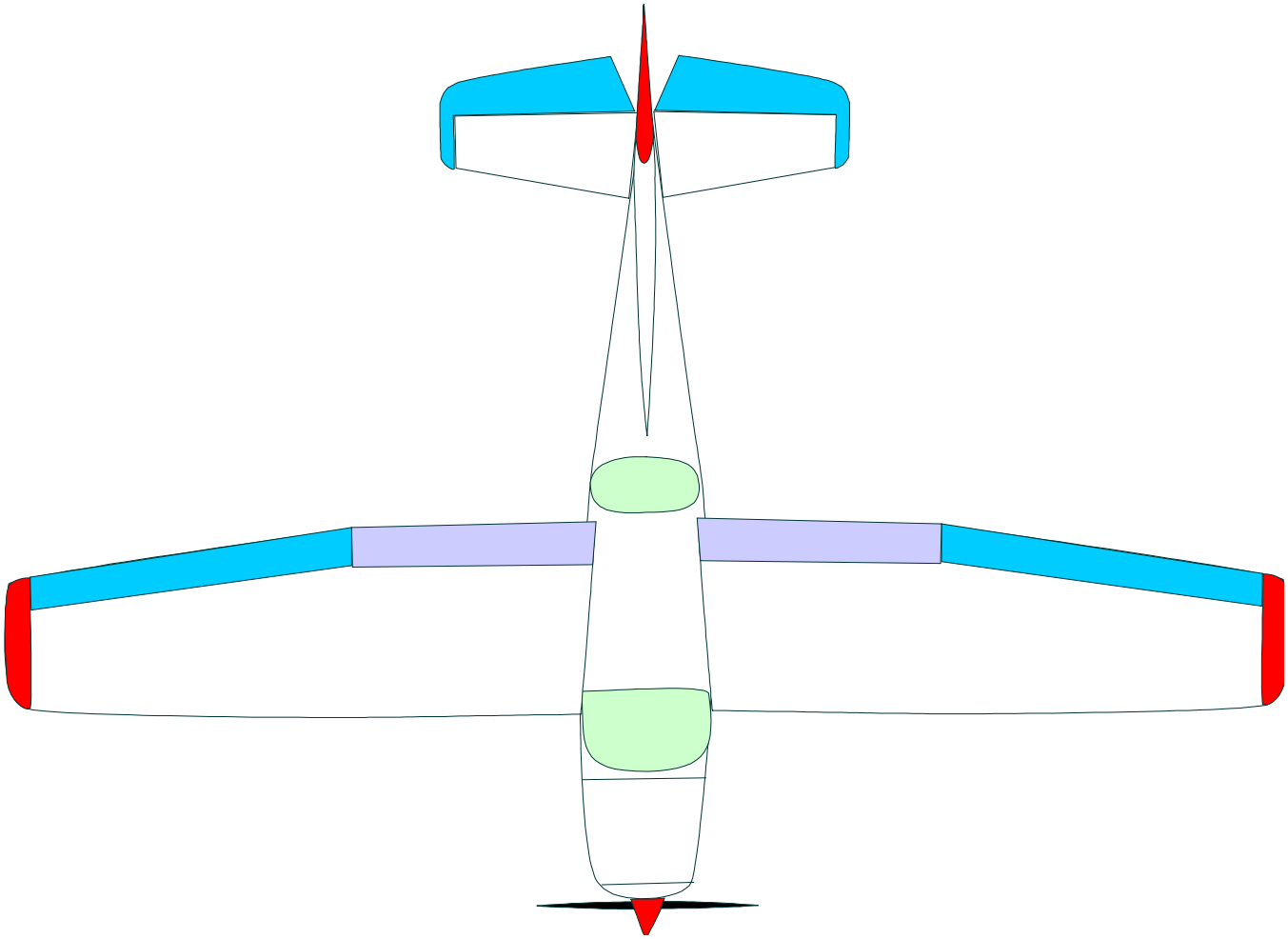
AILERONS NEUTRAL – ROLL STOPPED


RESULTANT OF LIFT AND
WEIGHT FORCES
CAUSING “SLIP”

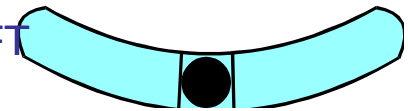
Control	Primary effect	Secondary effect
Aileron	Roll	Yaw

RUDDER

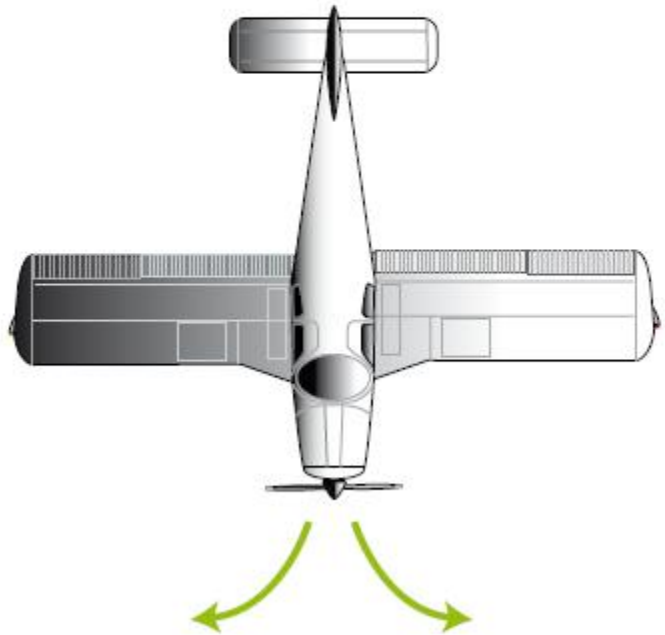

LEFT RUDDER DEFLECTION
PRODUCES LATERAL FORCE
TO THE RIGHT
YAWS NOSE LEFT



RUDDER IS USED TO
BALANCE THE AIRCRAFT

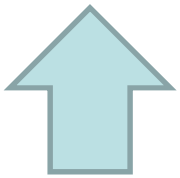


Control	Primary effect	Secondary effect
Rudder	Yaw	Roll

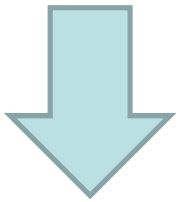


EFFECT OF AIRSPEED

The effectiveness of all three primary controls is affected by airspeed



IAS



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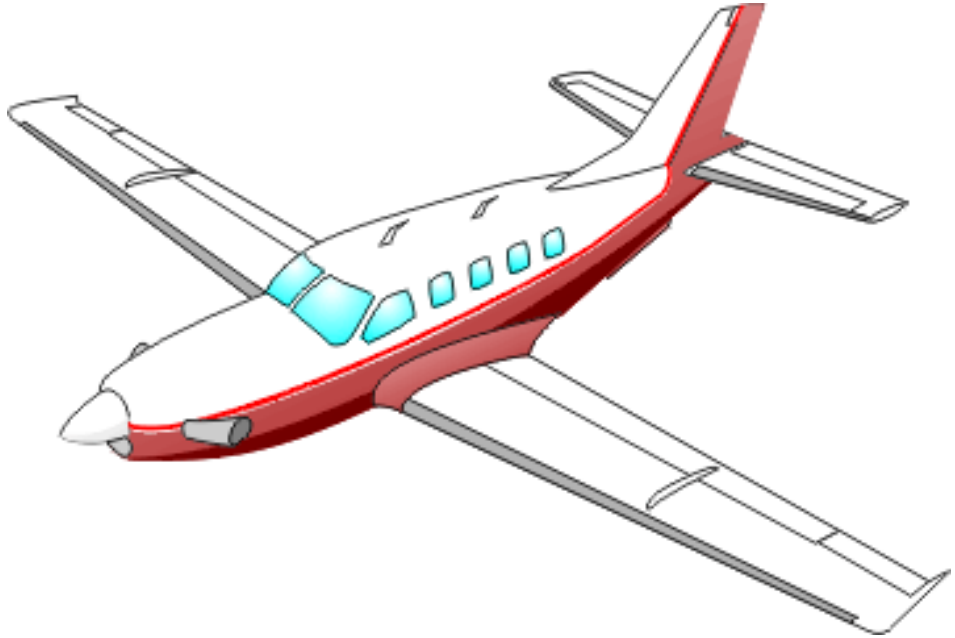
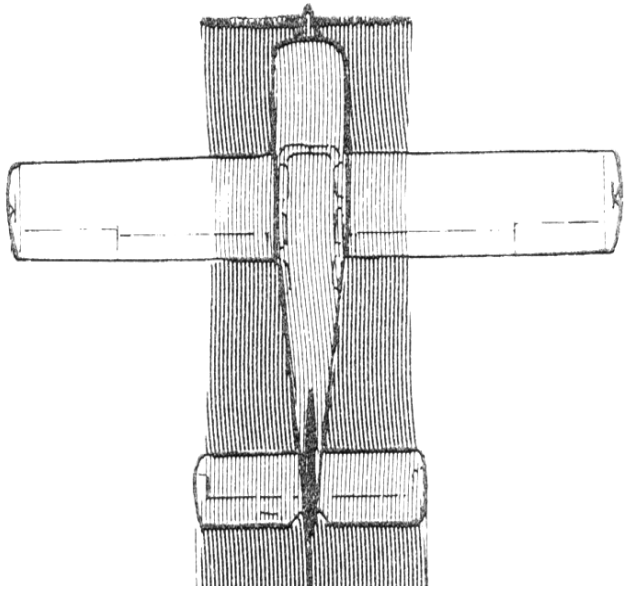
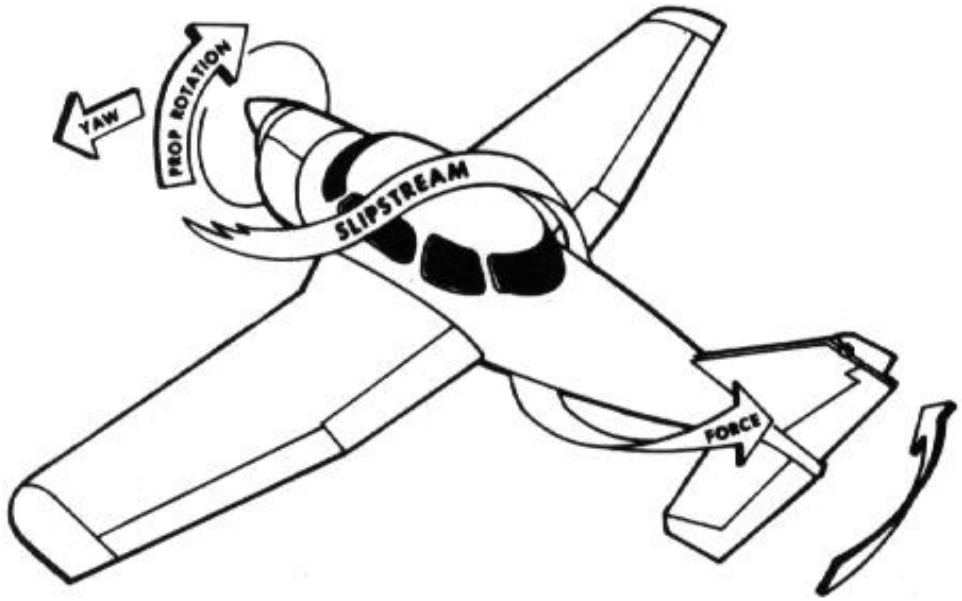


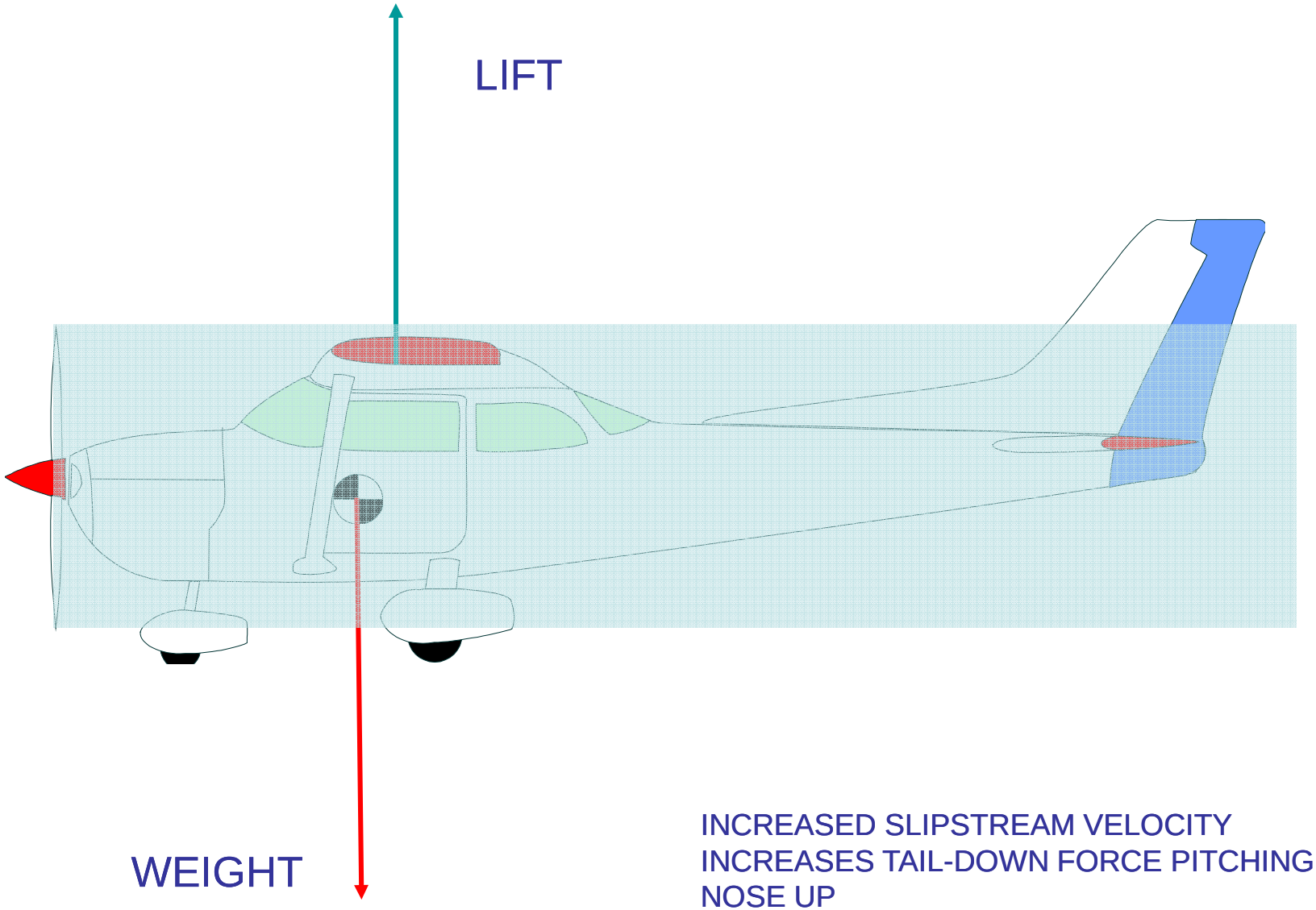
SLIPSTREAM EFFECT

ONLY ELEVATOR & RUDDER ARE AFEFCTED BY SLIP STREAM





POWER CHANGES

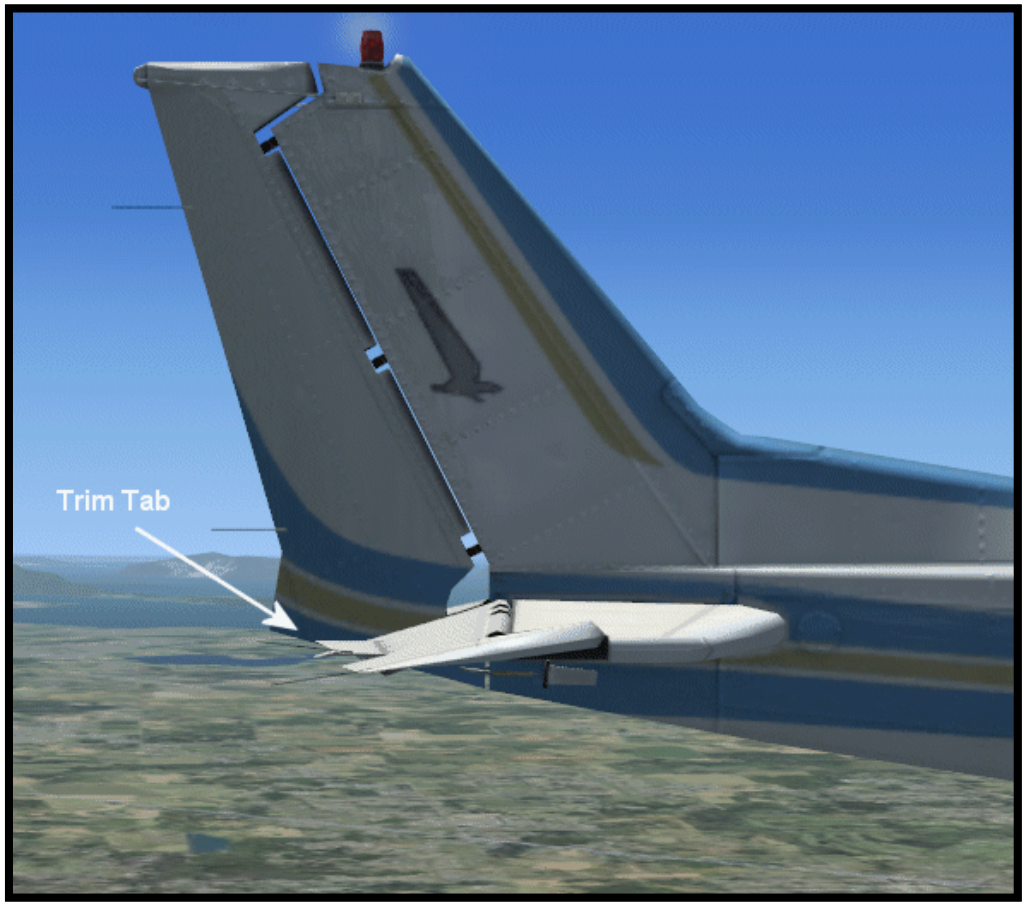


INCREASED SLIPSTREAM VELOCITY
INCREASES TAIL-DOWN FORCE PITCHING
NOSE UP

Effect of Power

ELEVATOR TRIM

Attitude must be kept constant with the primary control whilst trimming



FLAPS

Effect of Flap

- Lift increases, Drag increases
- Flaps extended- nose pitches up ↑
- Flaps Retracted- nose pitches down ↓

CARBY HEAT

CARBURETTOR ICE.

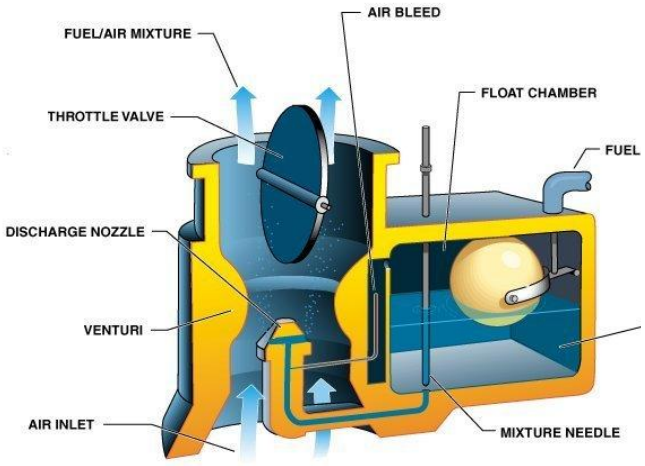
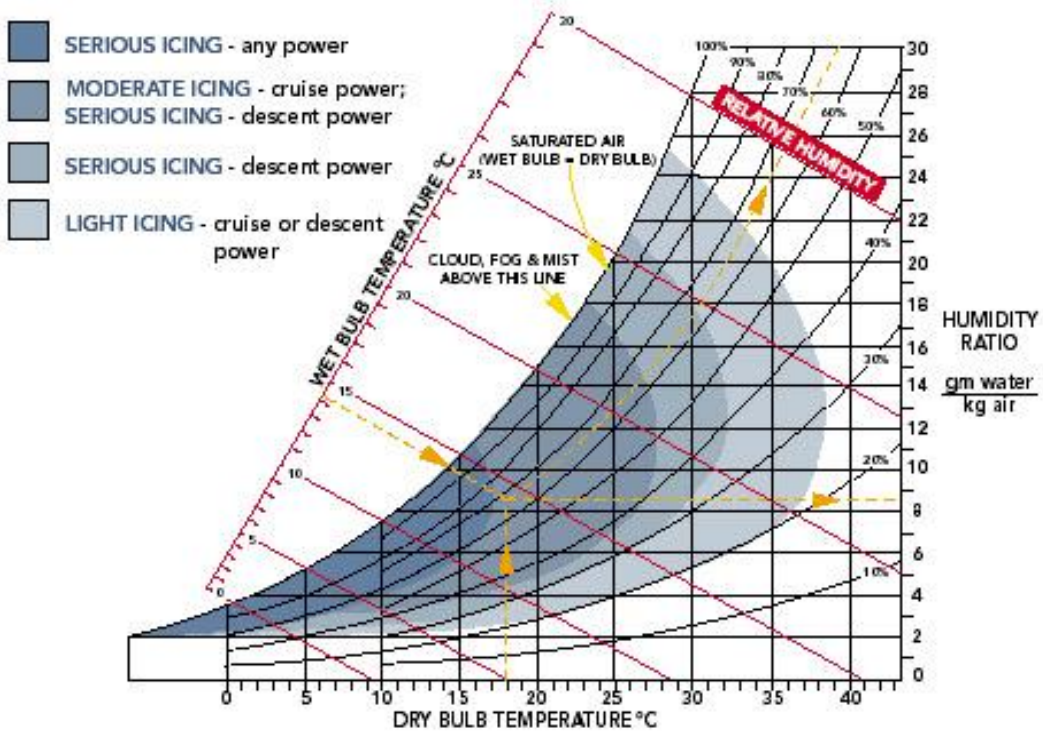


FIG 2-25

Guided Flight Discovery Private Pilot Manual



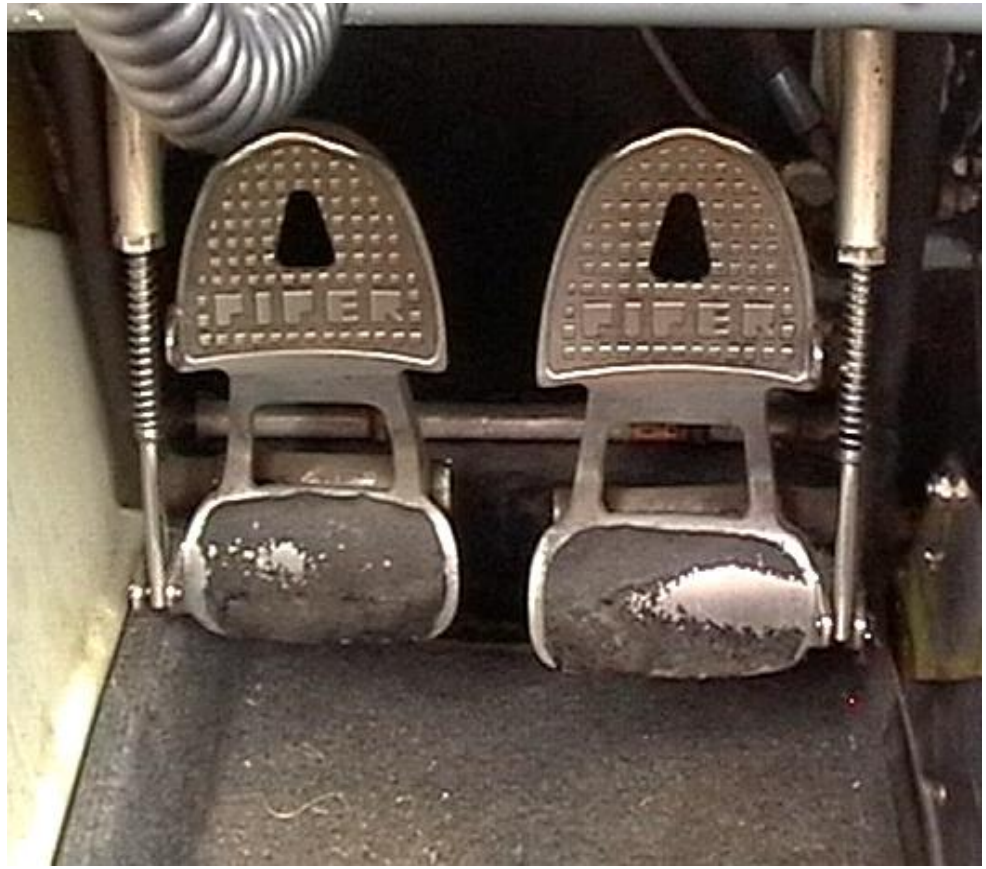
Throttle Ice, Fuel Evaporation Ice, Impact Ice

TAXIING

TAXING AND BRAKING

TAXIING TECHNIQUES

- Aeroplane Inertia
- Use of Brakes
- Use of Power
- Use of Controls
- Effect of Wind on taxiing
- Instrument Checks

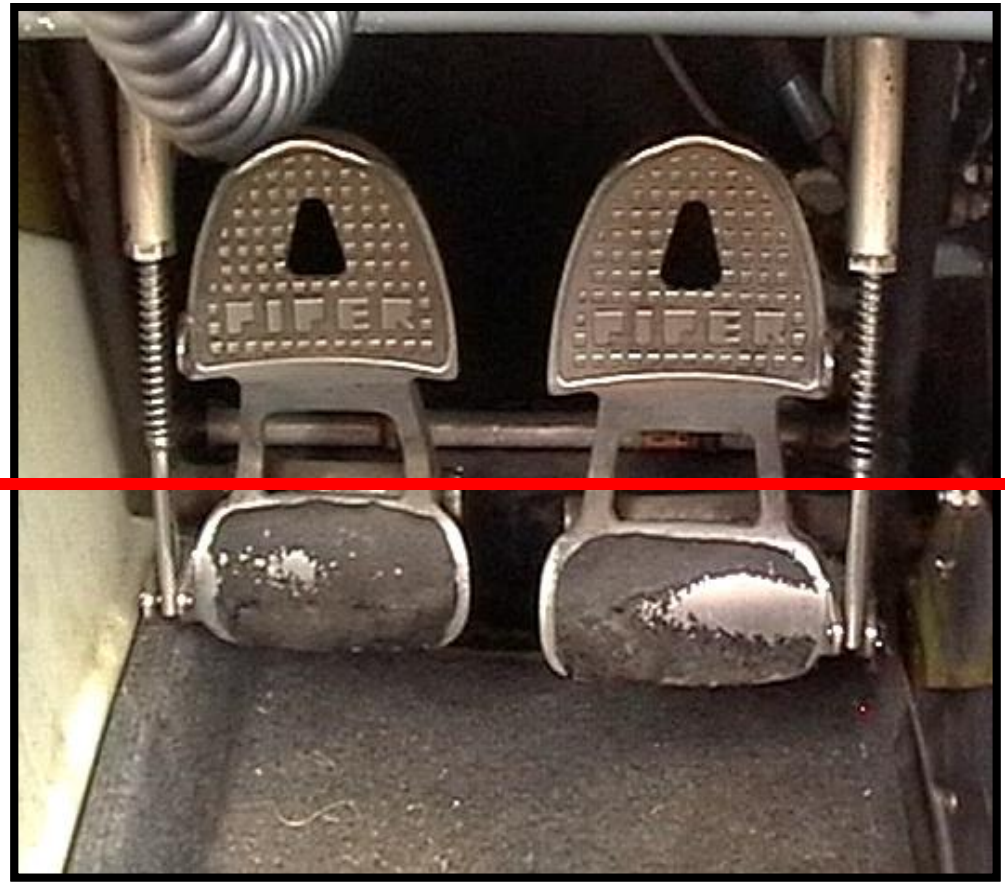


TAXING AND BRAKING

BRAKING

Toes to the stoppers and apply even pressure.

Differential Braking



RUDDER PEDALS

Heals to the floor, push left to turn left, push right to turn right.

Don’t ride the brakes and taxi at a fast walking pace only

Other Controls

Airmanship

To fly safely, efficiently, considerately

- Smooth/Gentle operation of controls
- Handover/Takeover
- Report other traffic
- Training area boundaries

- Actions in the event of airsickness

Effects of Controls

Aim

To operate the aircraft's primary and the use of the aircrafts ancillary controls.

Objectives:

At the end of this briefing the student should be able to….

1. Describe with the aid of a model, how lift is generated on an aerofoil and state the two methods by which the pilot may vary lift in flight.

2. Explain using the model, the three planes of movement and their axis.

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    Flaps
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