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Forces and Motion

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FORCE ?

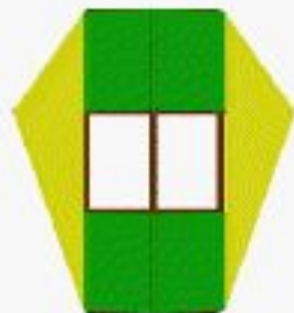
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What is it?

Why is it important?

What does it do ?

How does it work?



Examples ?





Forces

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Objects generate forces.

(objects are solid, liquid, or gas)

Forces cause motion.

Forces produce **acceleration**.

An object's mass **resists** motion.

(for the same force, heavier object accelerates less)

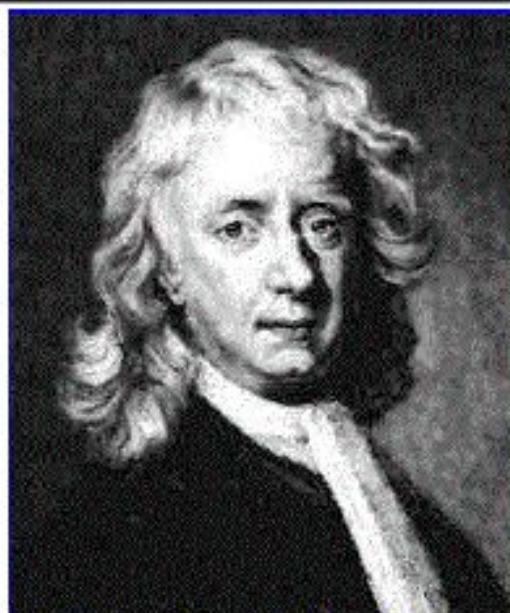
Forces come in pairs.





Newton's Laws of Motion

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"Every object persists in its state of rest or uniform motion in a straight line unless it is compelled to change that state by forces impressed on it."

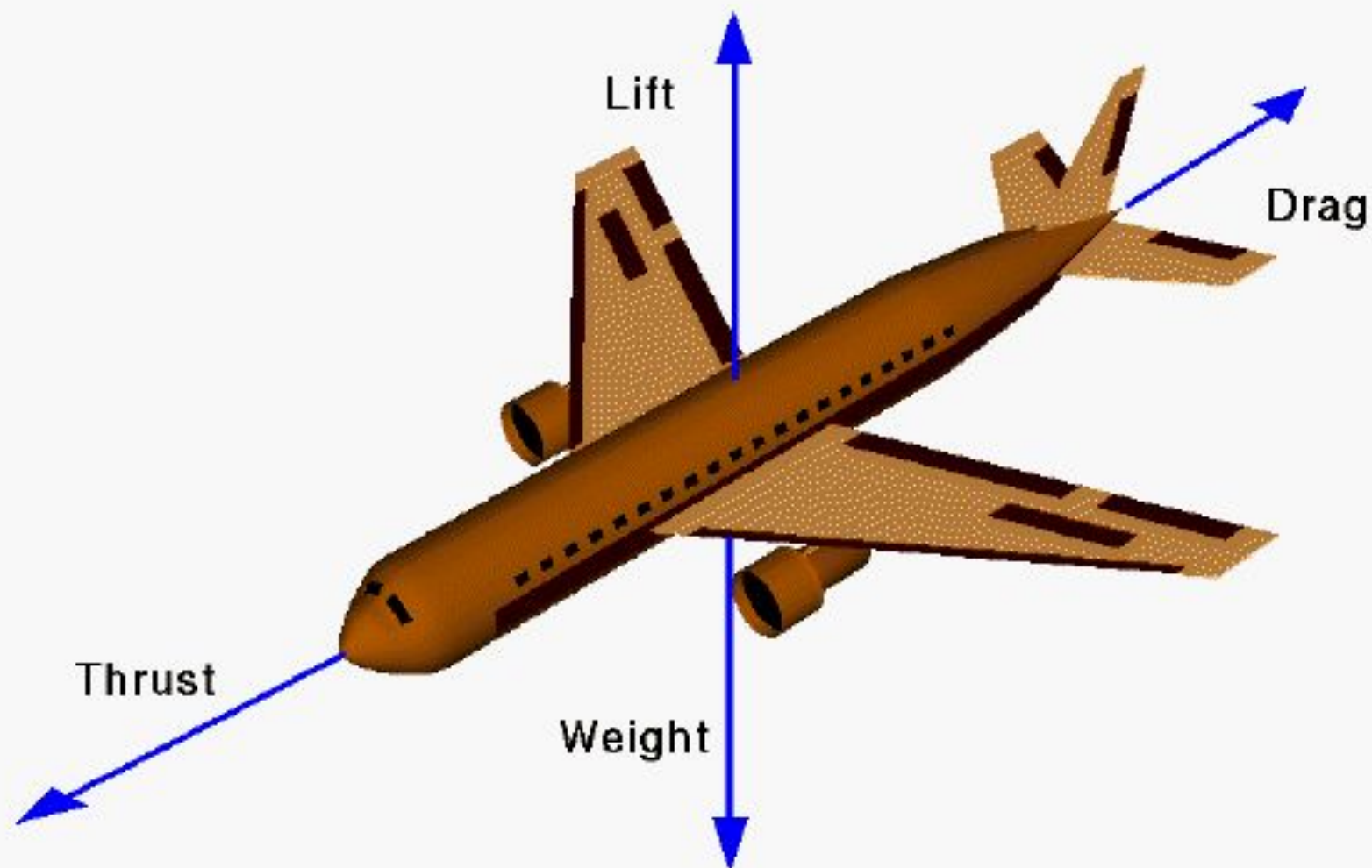
"Force is equal to the change in momentum (mV) per change in time. (For a constant mass, force equals mass times acceleration. $F = m a$)"

"For every action, there is an equal and opposite re-action."



Four Forces on an Airplane

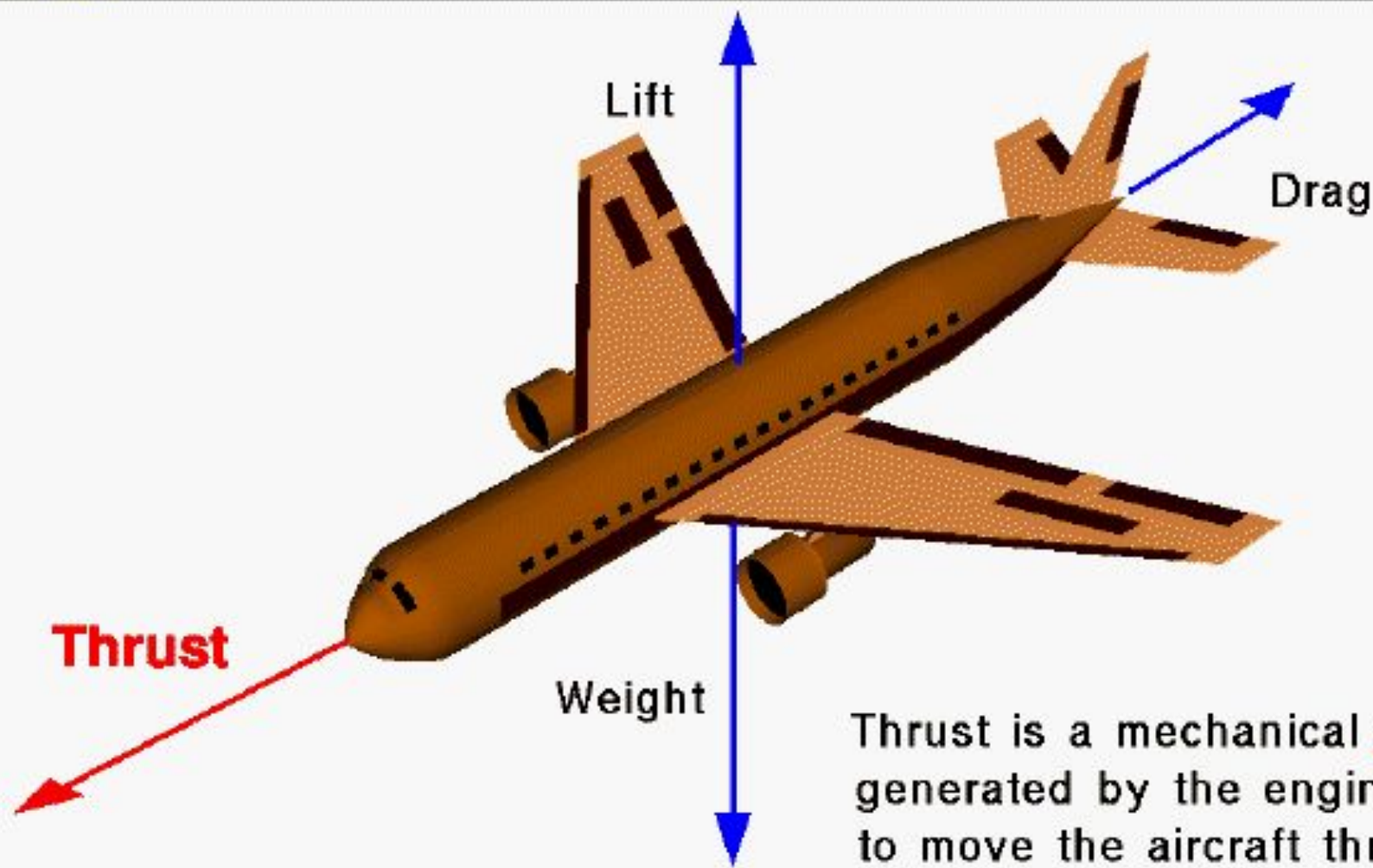
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What is Thrust?

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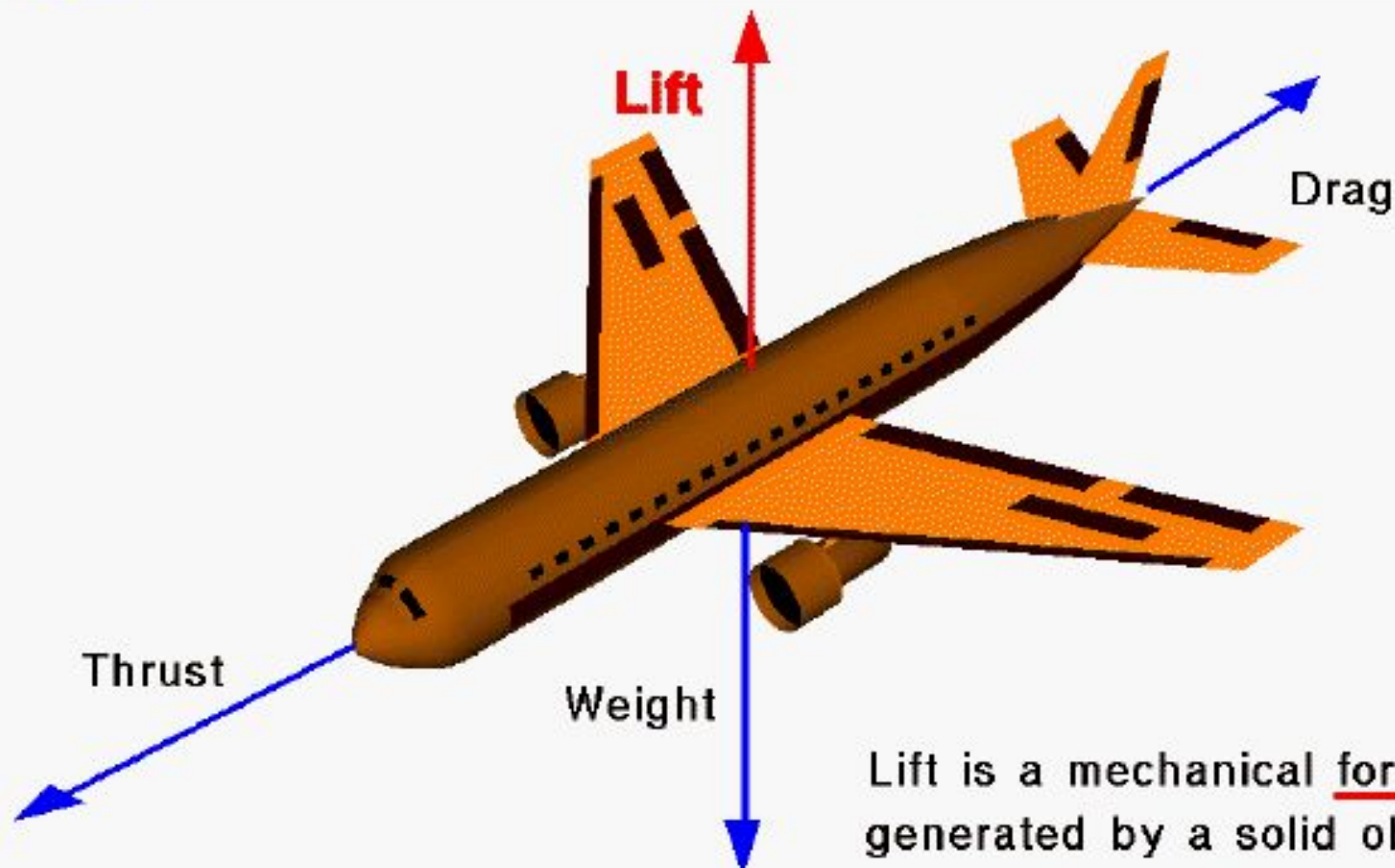


Thrust is a mechanical force generated by the engines to move the aircraft through the air.



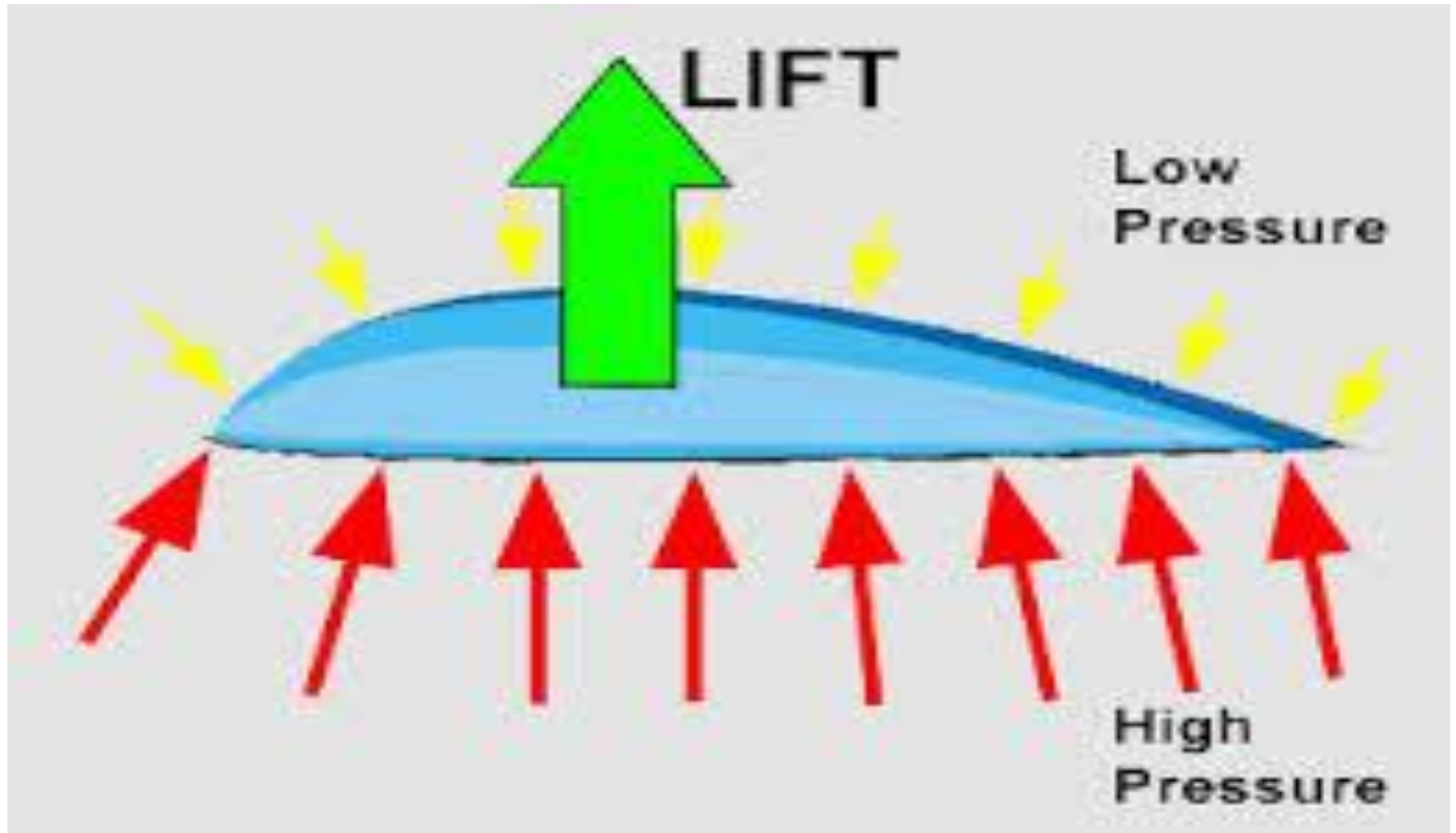
What is Lift ?

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Lift is a mechanical force generated by a solid object moving through a fluid.

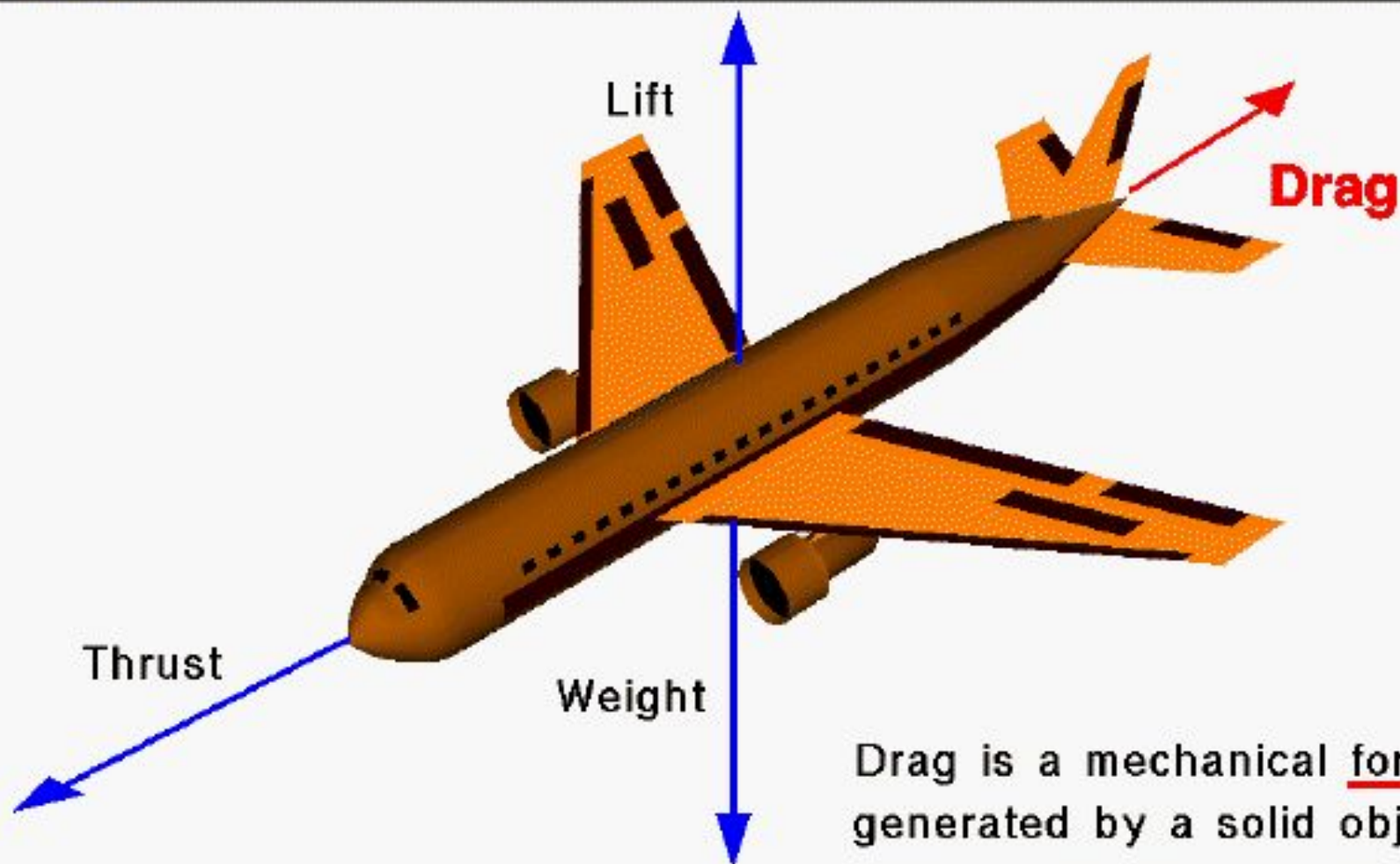
Lift





What is Drag?

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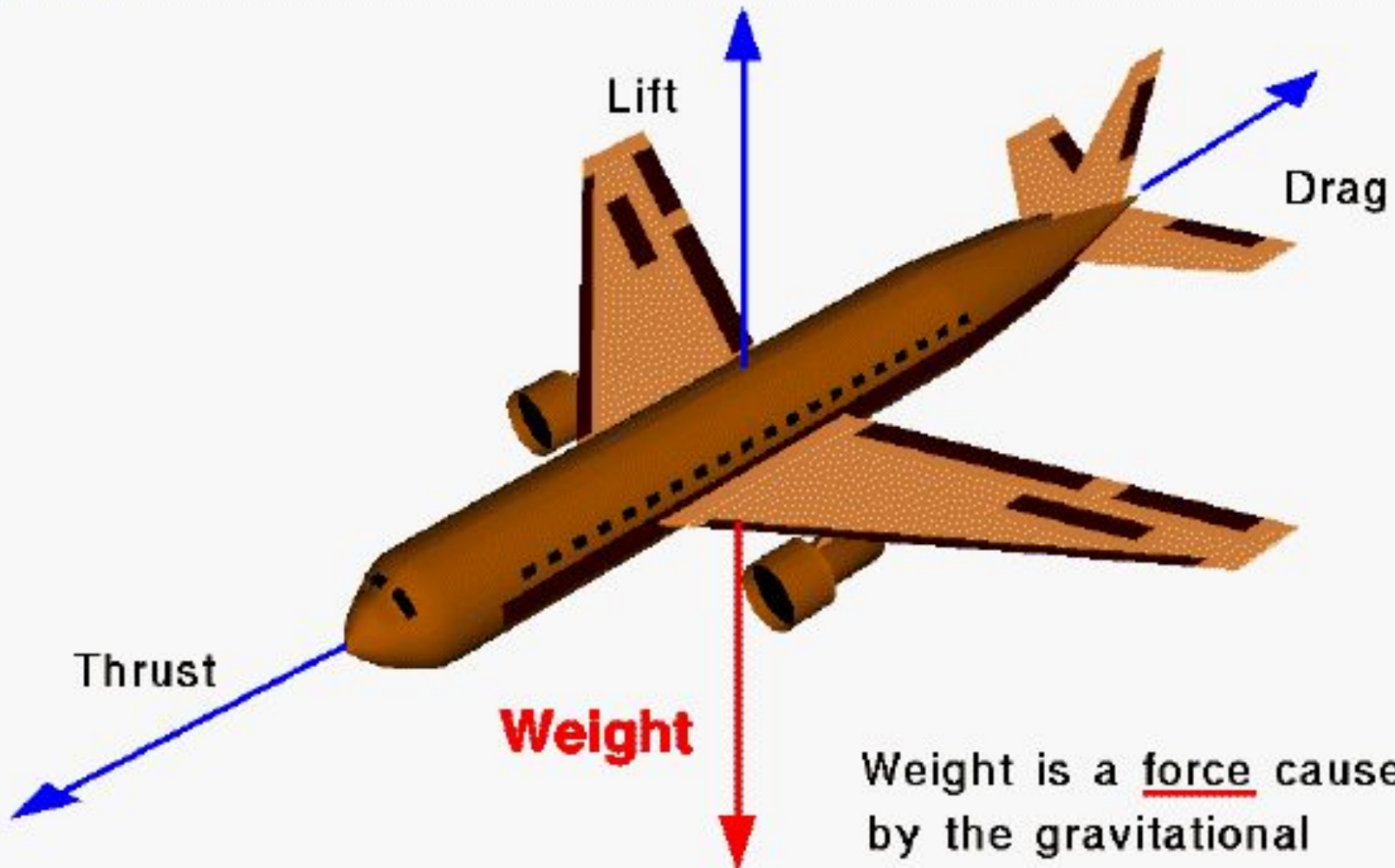


Drag is a mechanical force generated by a solid object moving through a fluid.



What is Weight?

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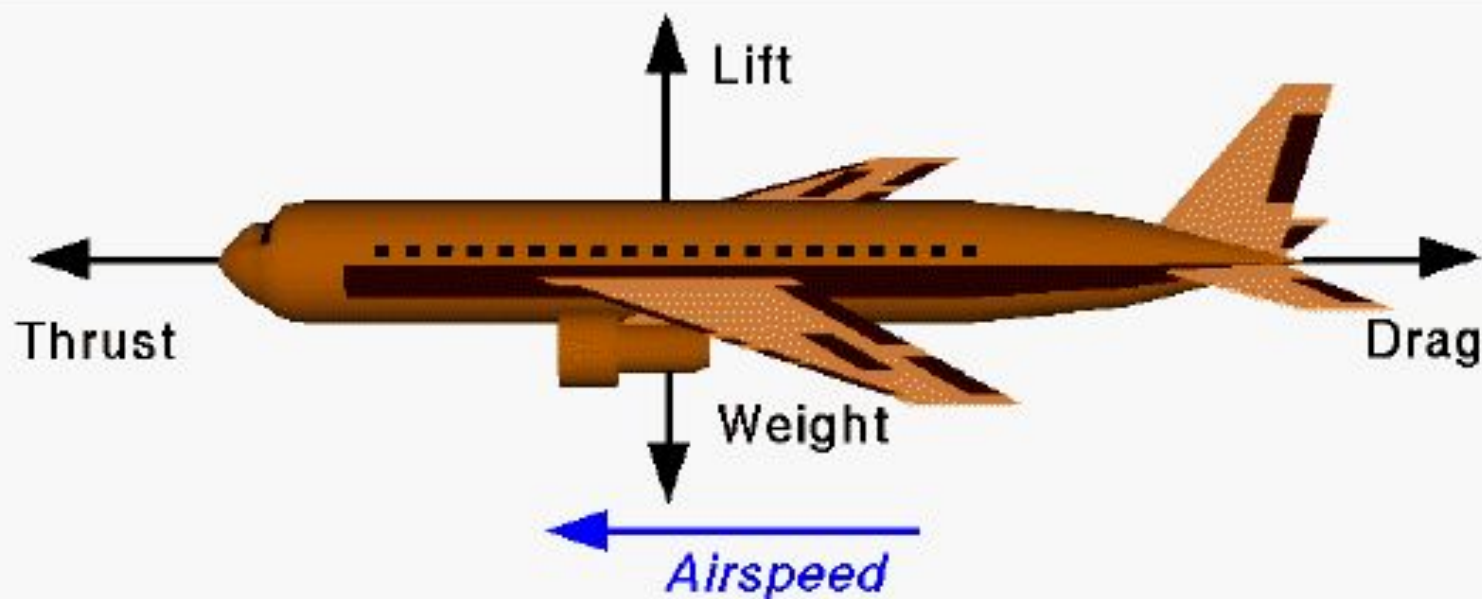


Weight is a force caused by the gravitational attraction of the Earth.



Cruise – Balanced Forces

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$\text{Lift} = \text{Weight}$

$\text{Thrust} = \text{Drag}$

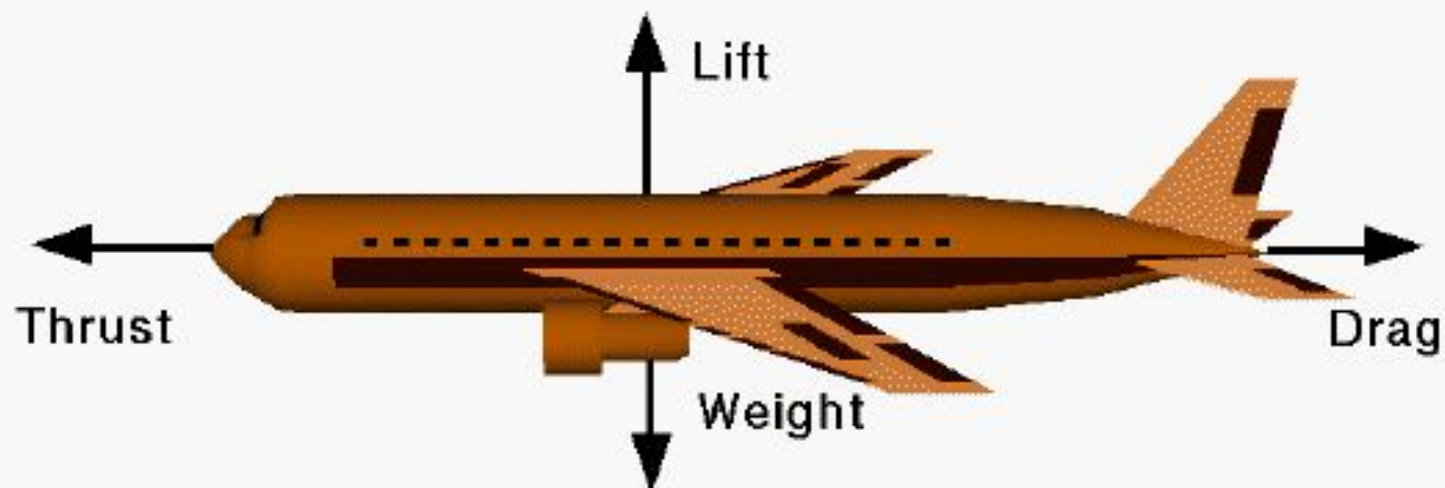
Airplane moves in a straight line at constant airspeed.



Simplified Aircraft Motion

Unbalanced Forces

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Flight Condition	Effect
$\text{Lift} > \text{Weight}$	Plane Rises
$\text{Weight} > \text{Lift}$	Plane Falls
$\text{Drag} > \text{Thrust}$	Plane Slows
$\text{Thrust} > \text{Drag}$	Plane Accelerates



On-Line Educational Resources

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Aerodynamics:

<http://www.grc.nasa.gov/WWW/K-12/airplane>

Wright Brothers:

<http://wright.nasa.gov/>

Aero Activities:

<http://www.grc.nasa.gov/WWW/K-12/aerores.htm>

Help:

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