# PRIVATE PILOT COURSE

## AERODYNAMICS OF FLIGHT

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# FOUR FORCES OF FLIGHT

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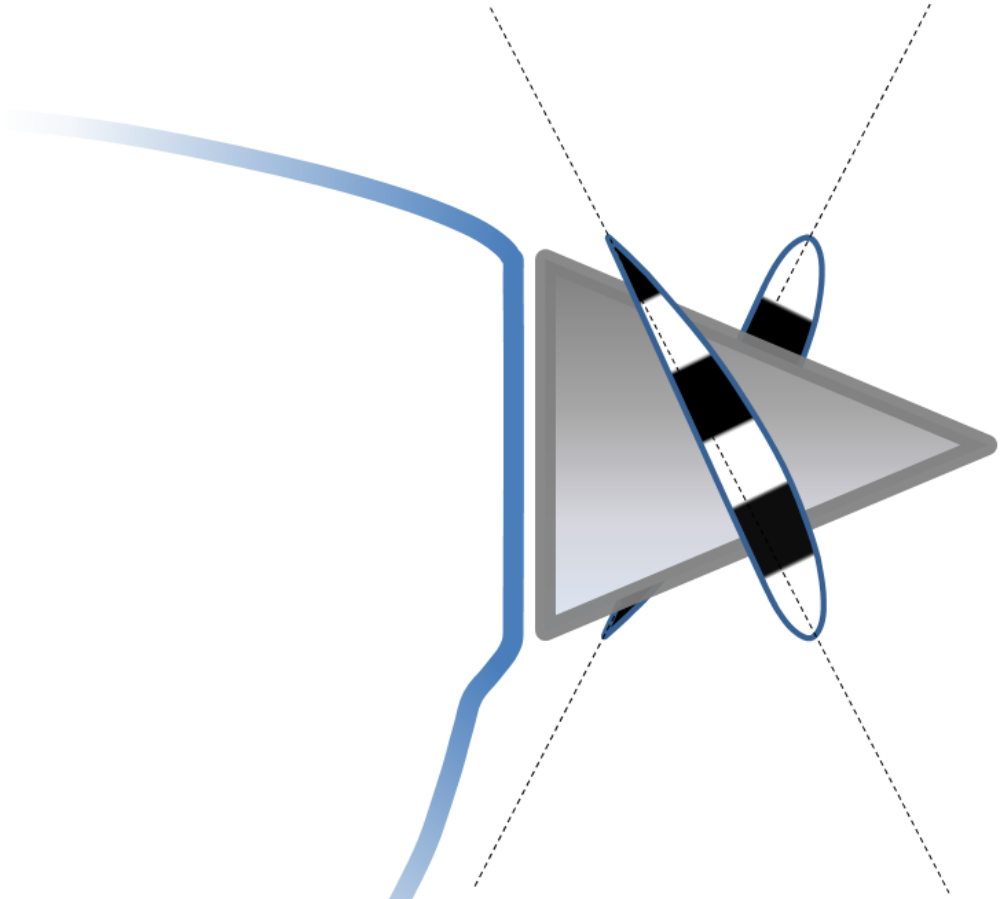
# FOUR FORCES OF FLIGHT

When are the four forces that act on an airplane in equilibrium?

a) During unaccelerated flight.
b) When the aircraft is at rest on the ground.
c) When the aircraft is accelerating.

# THRUST



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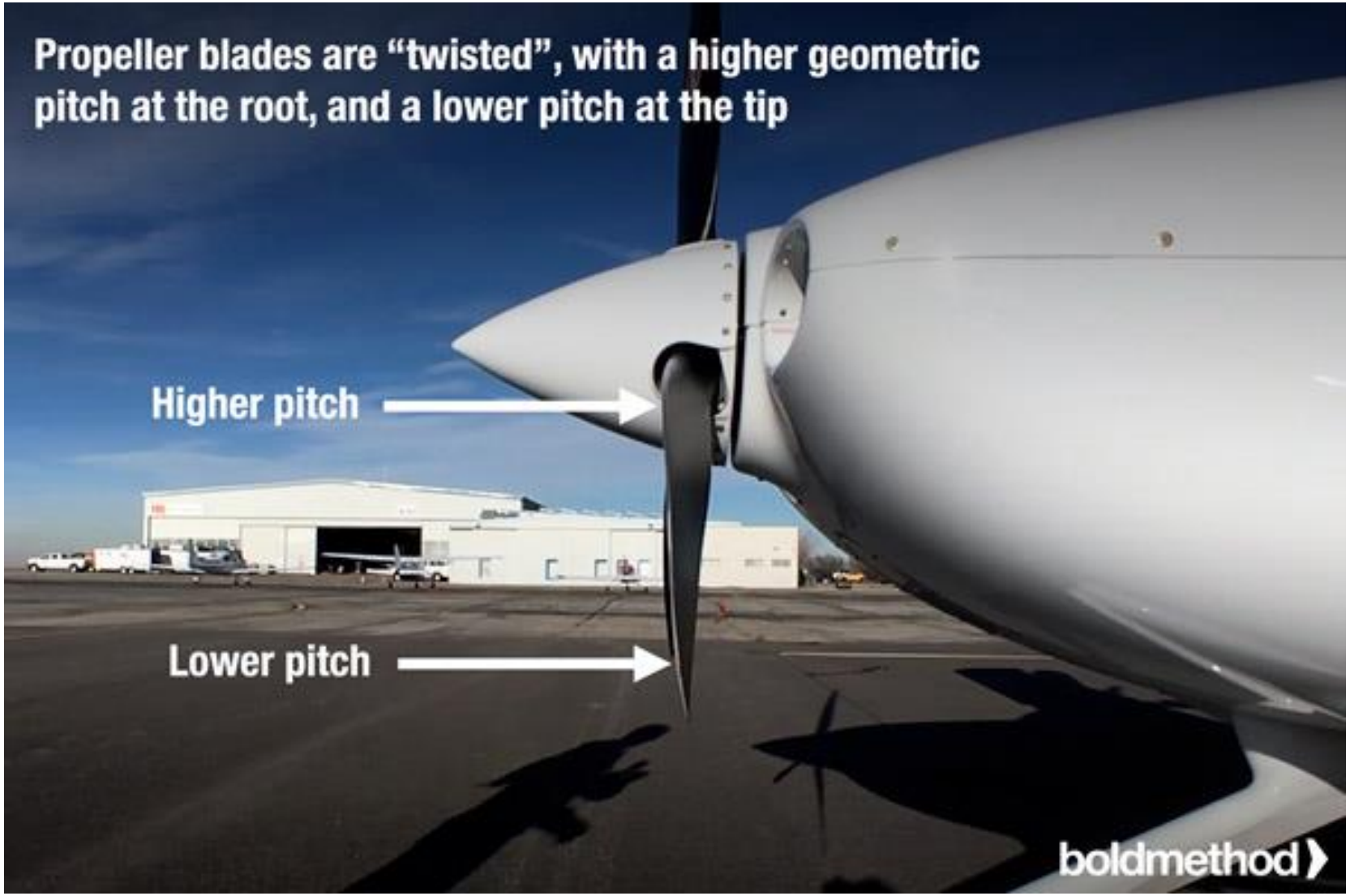
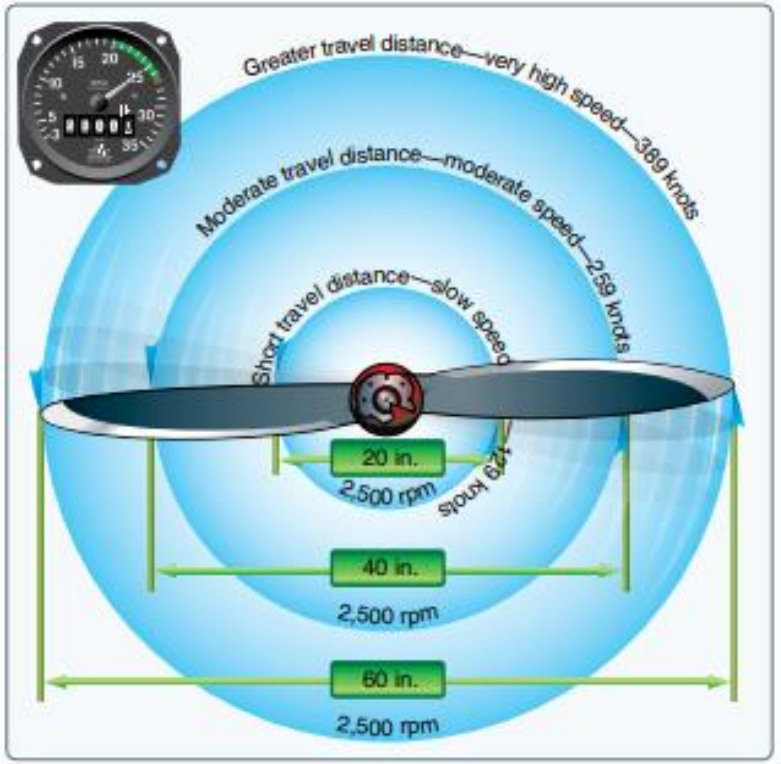
# THRUST

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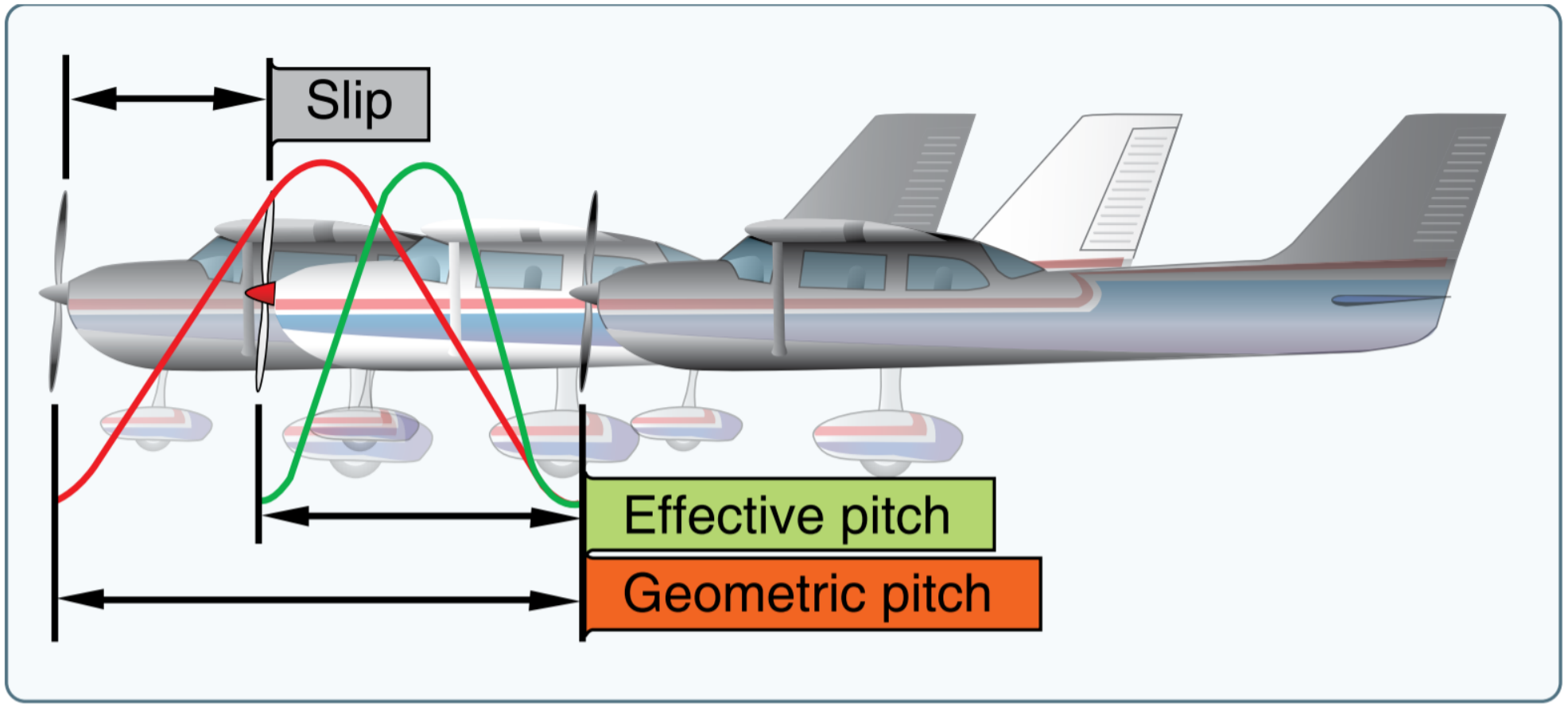
# THRUST

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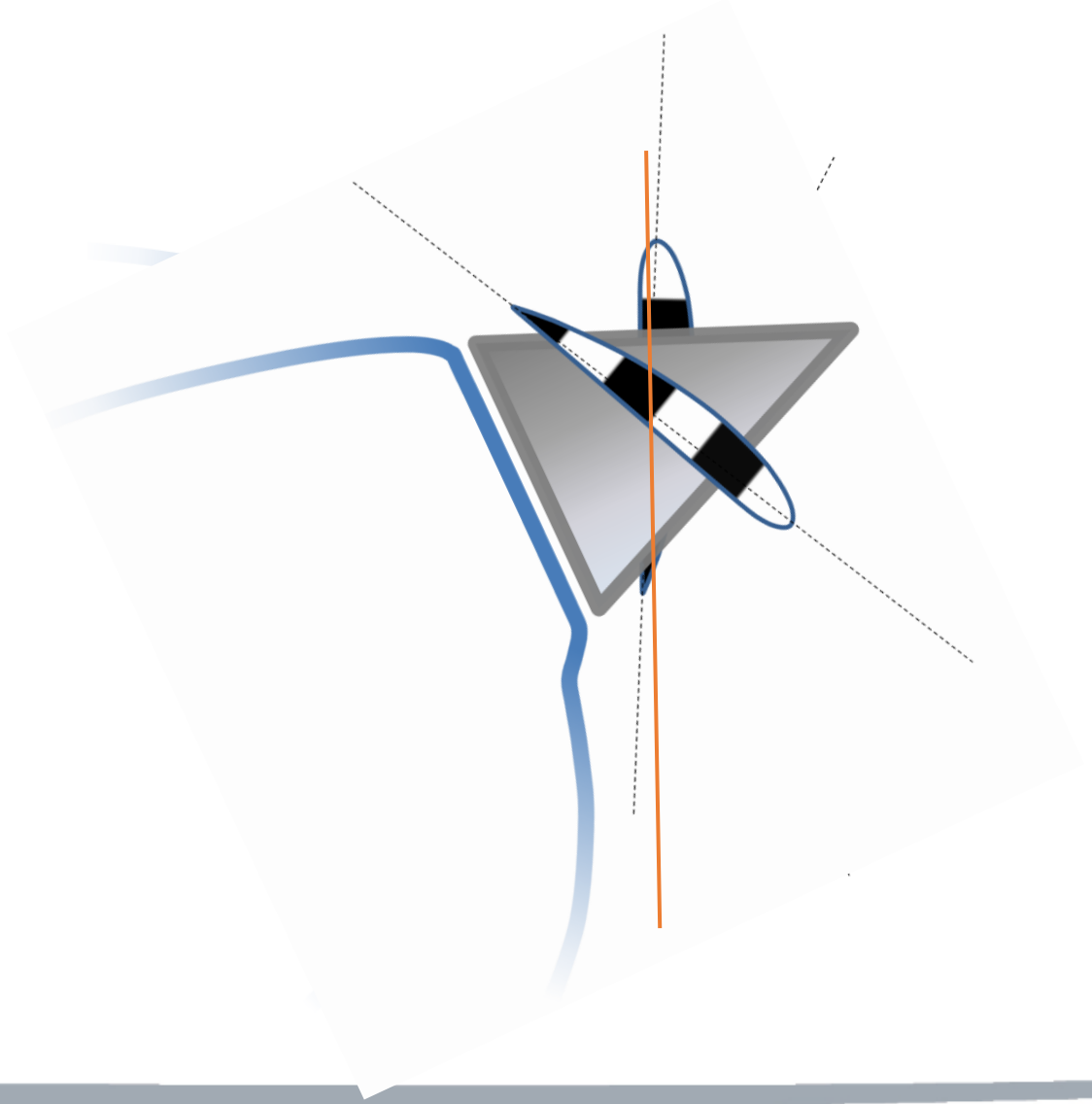
# P-FACTOR

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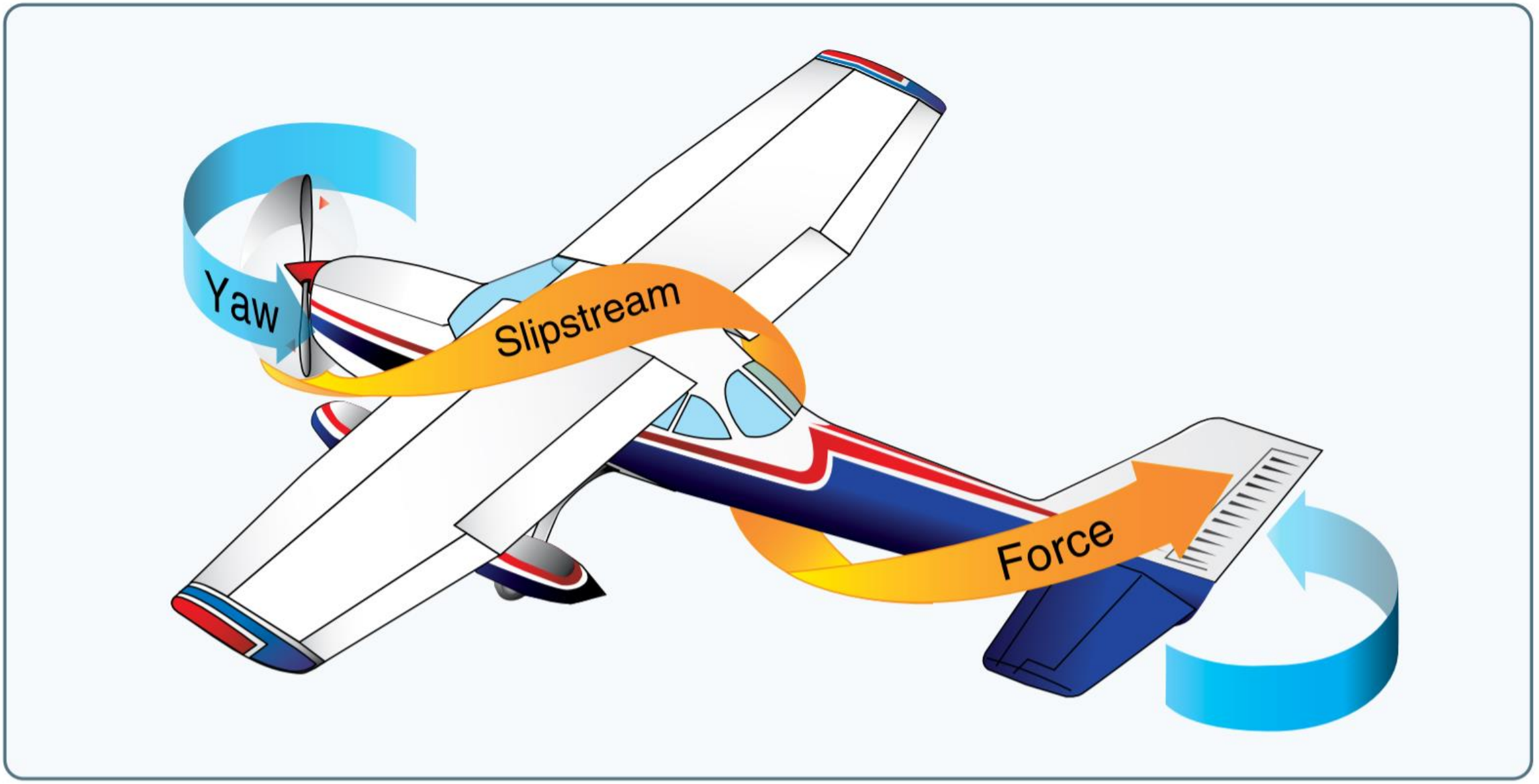
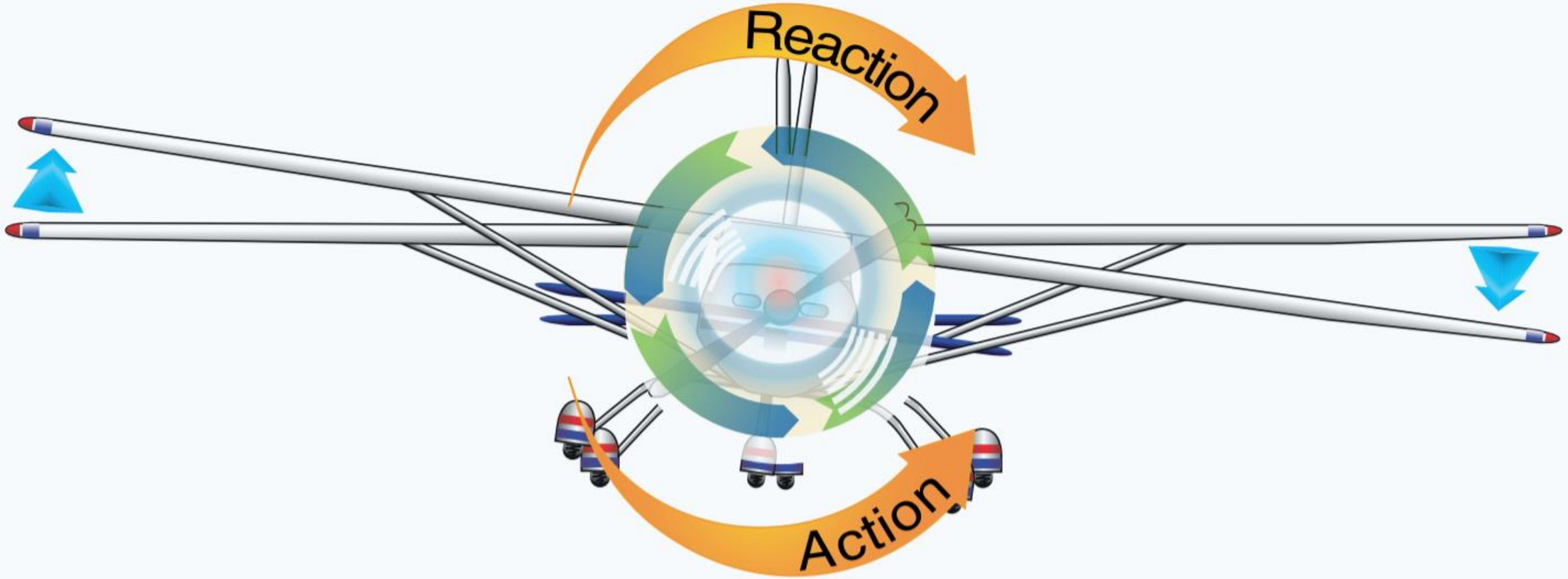
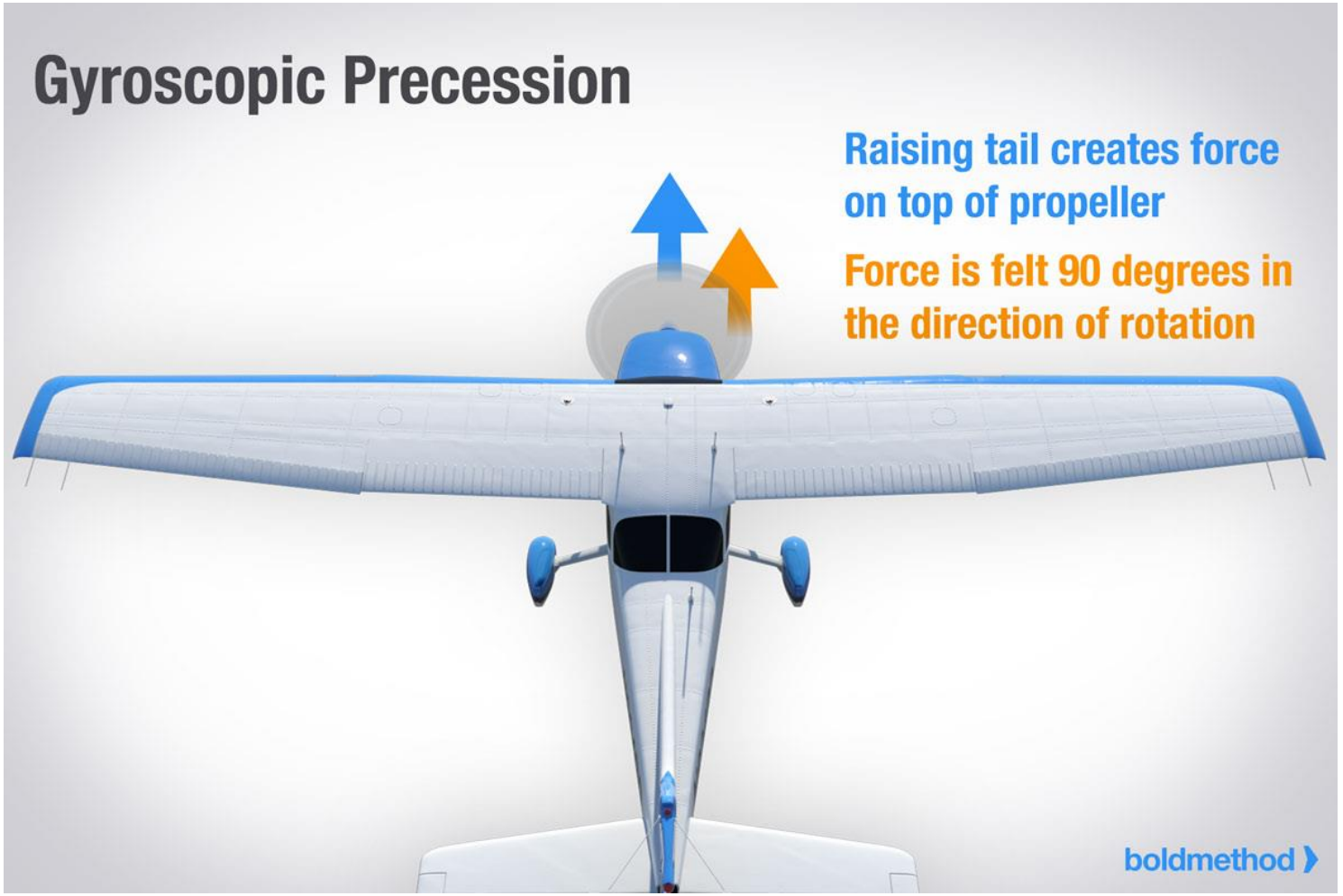
# LEFT TURNING TENDENCIES



# LEFT TURNING TENDENCIES



# LEFT TURNING TENDENCIES

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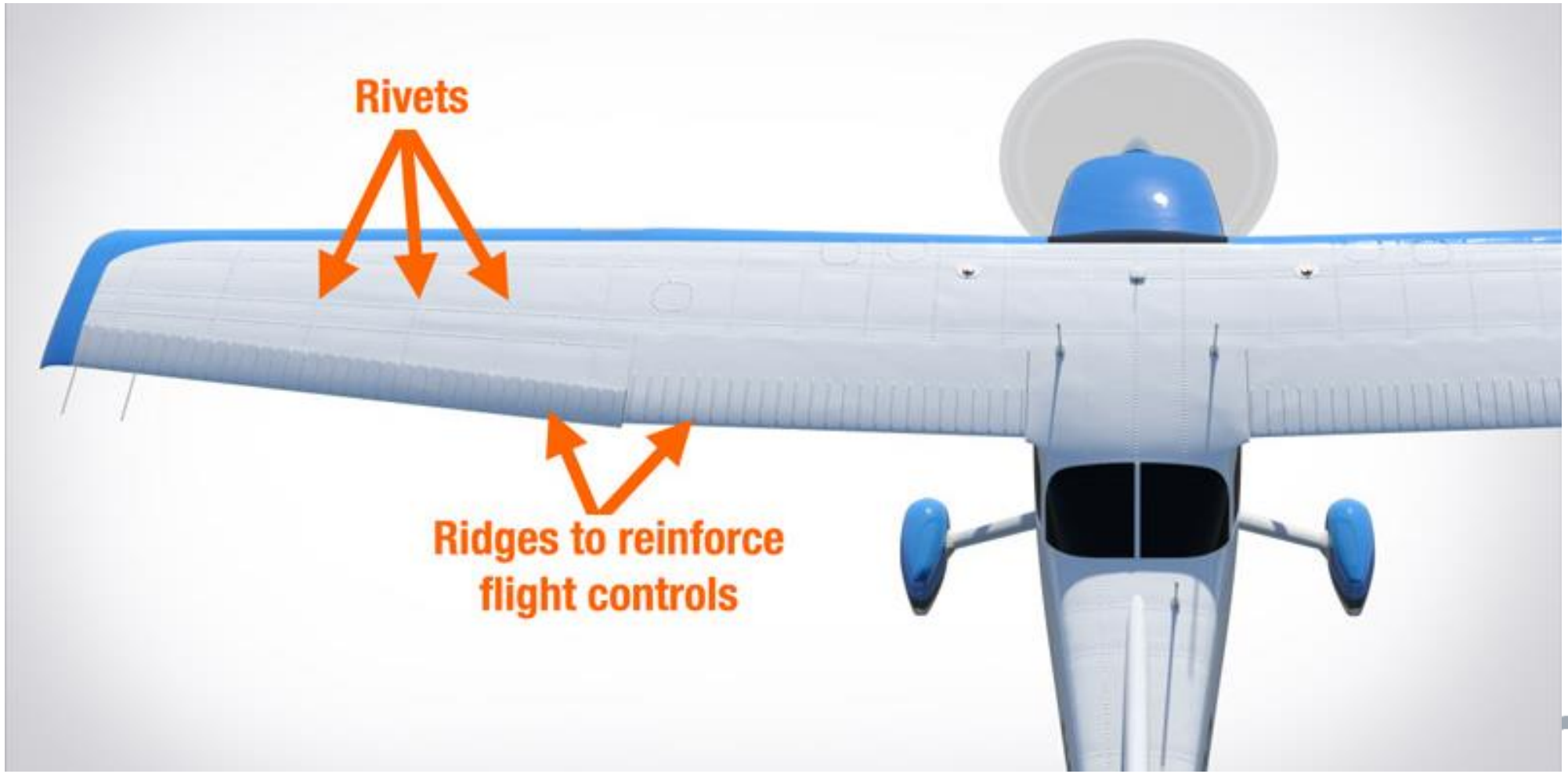
# 3 TYPES OF PARASITE DRAG

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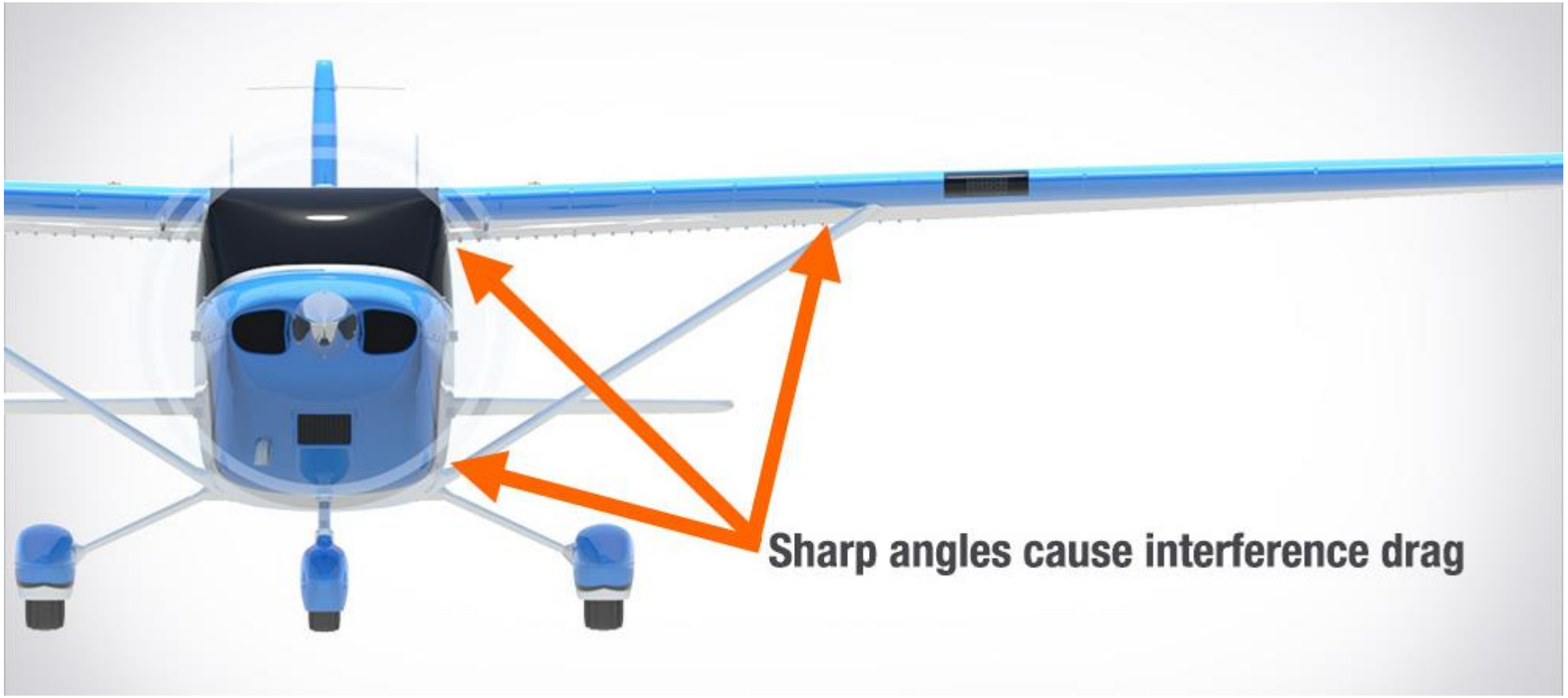
# INTERFERENCE DRAG

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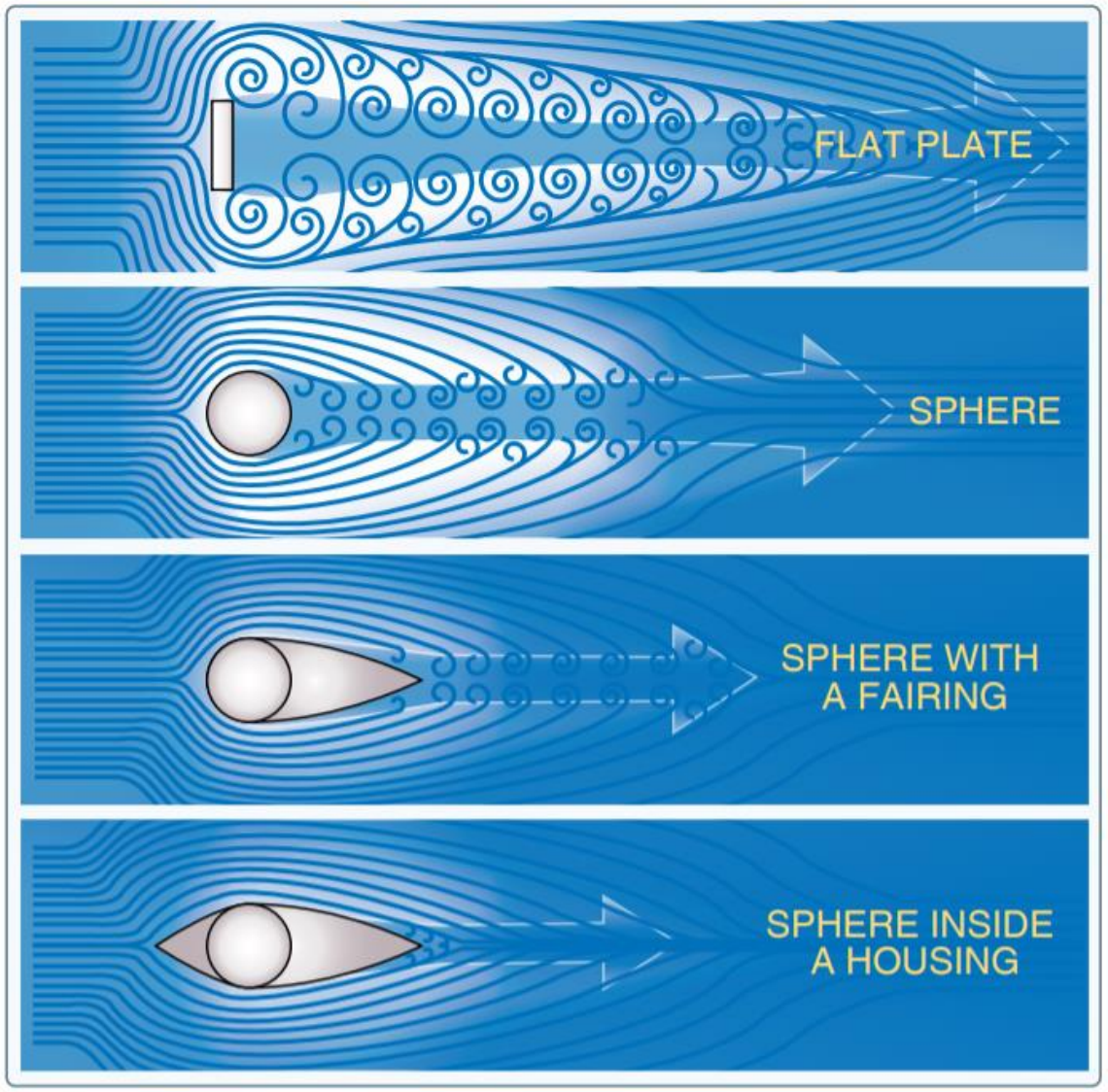
# FORM DRAG



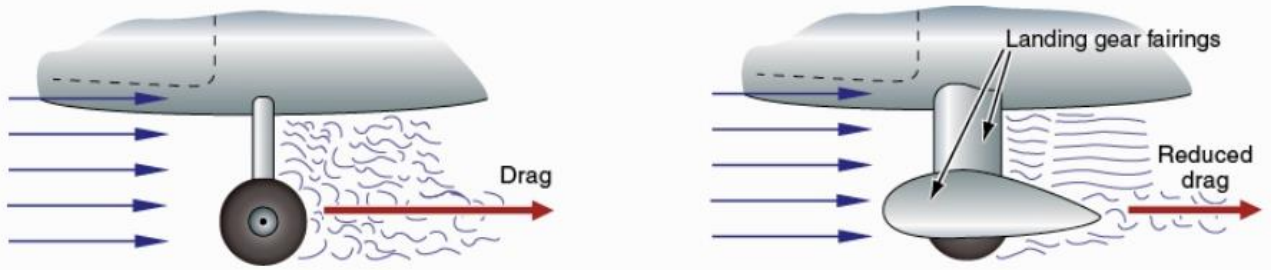




**Figure 1-38** Streamlining reduces form drag.

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# SKIN FRICTION DRAG


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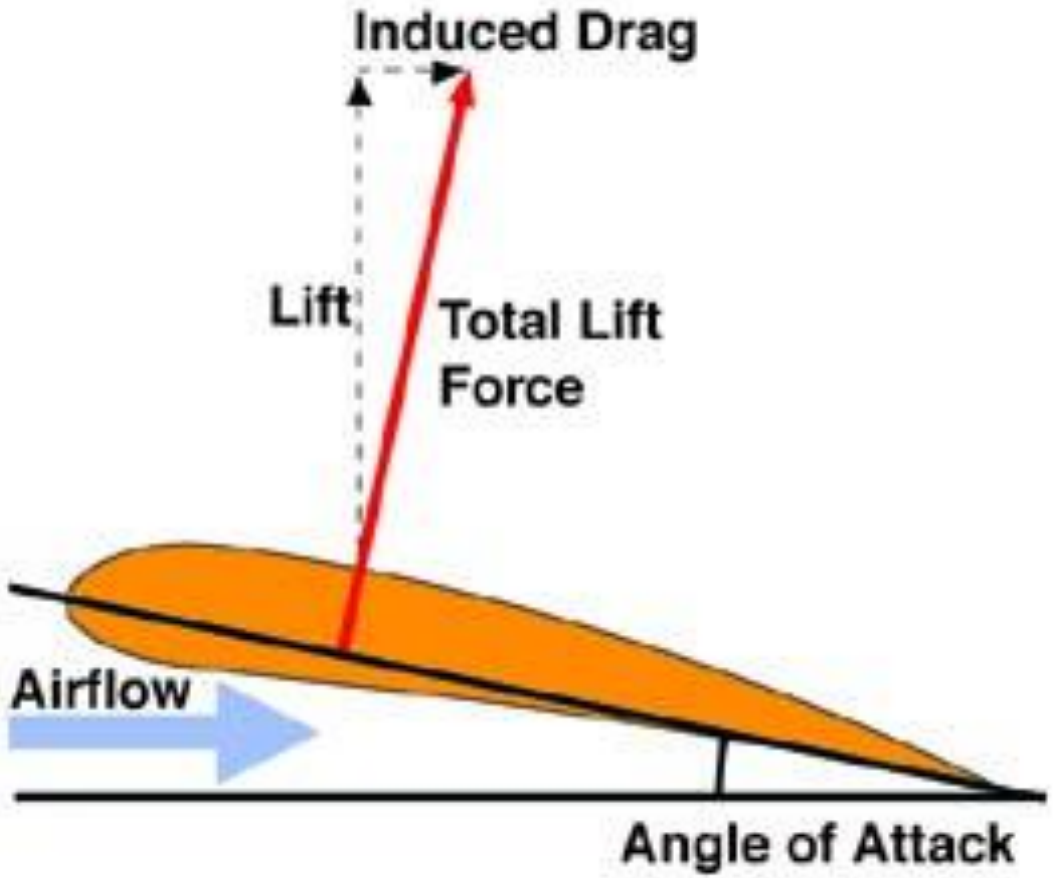
# INDUCED DRAG

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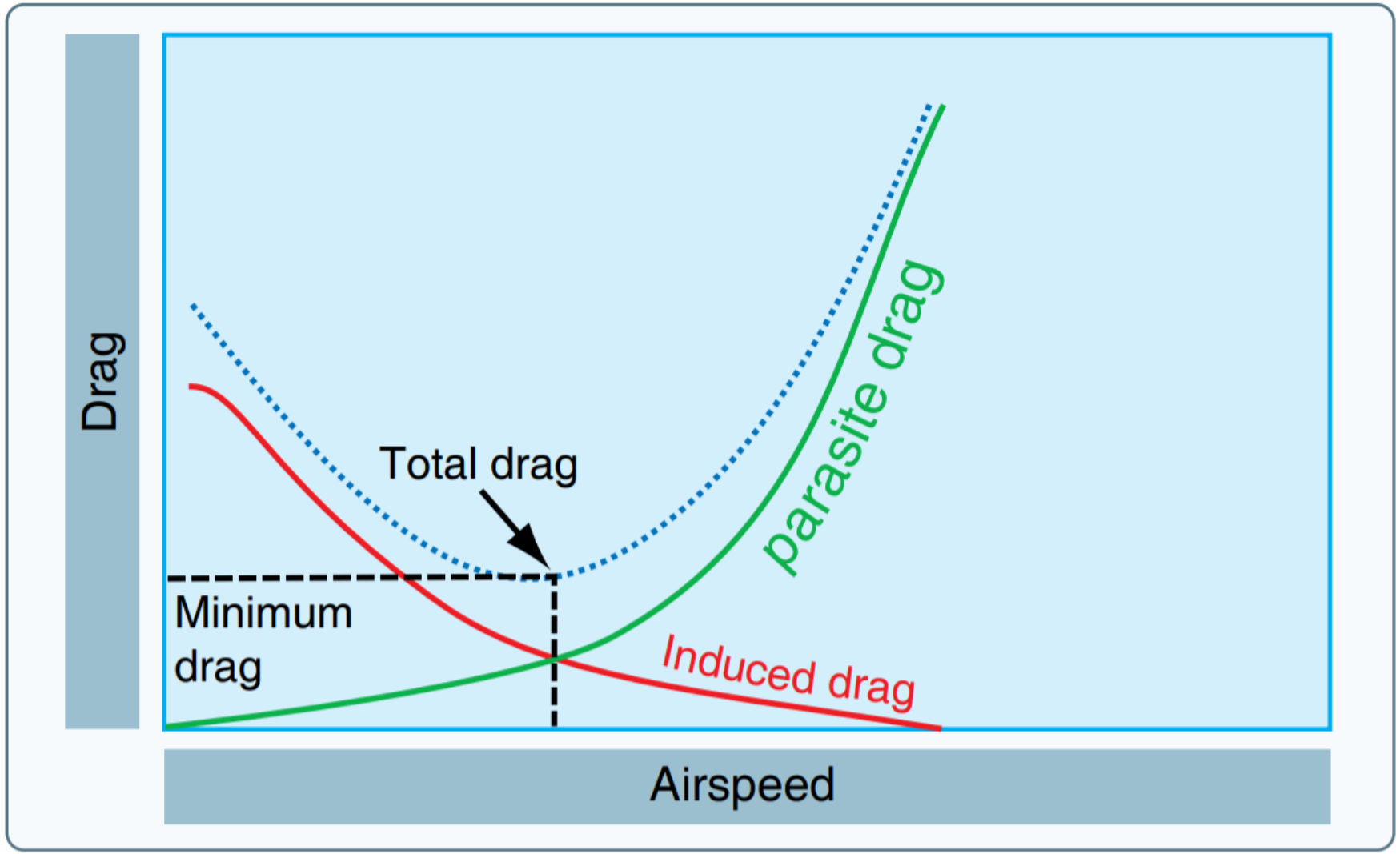
# TOTAL DRAG

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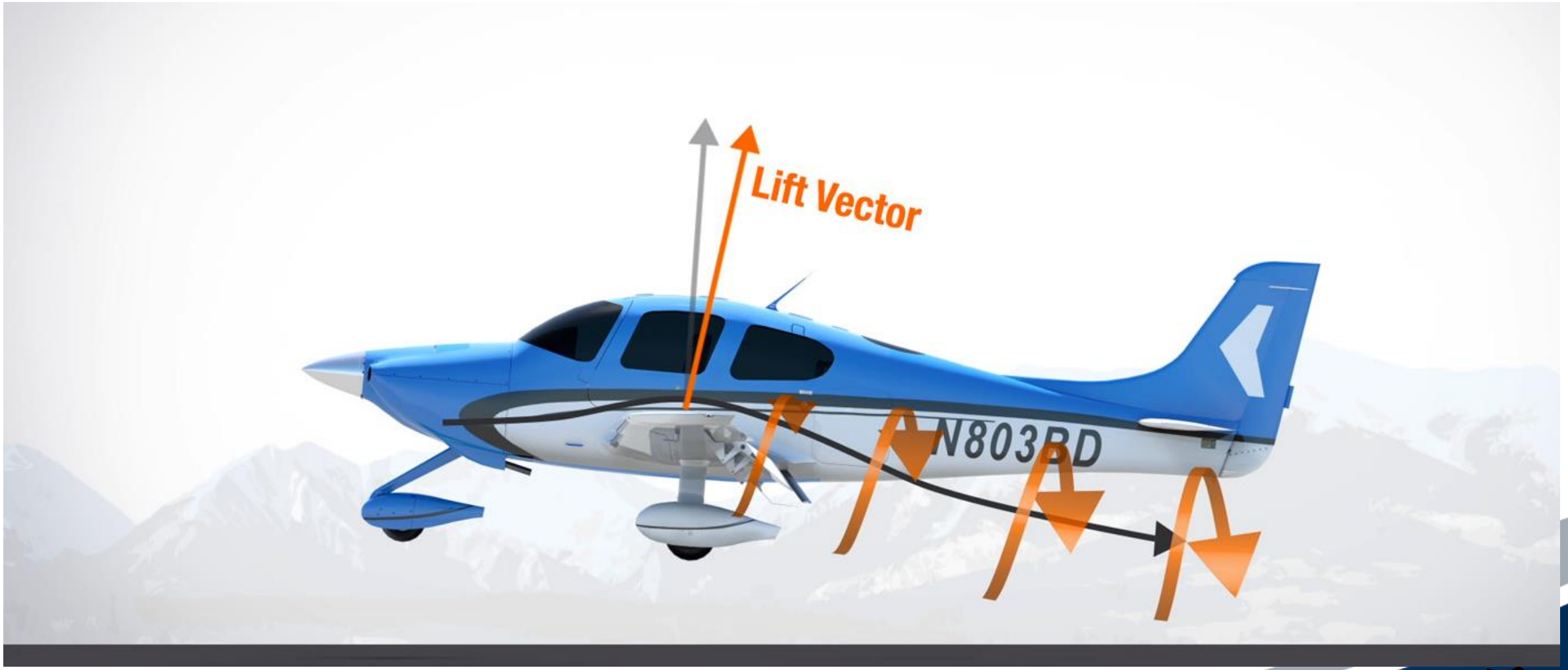
# GROUND EFFECT

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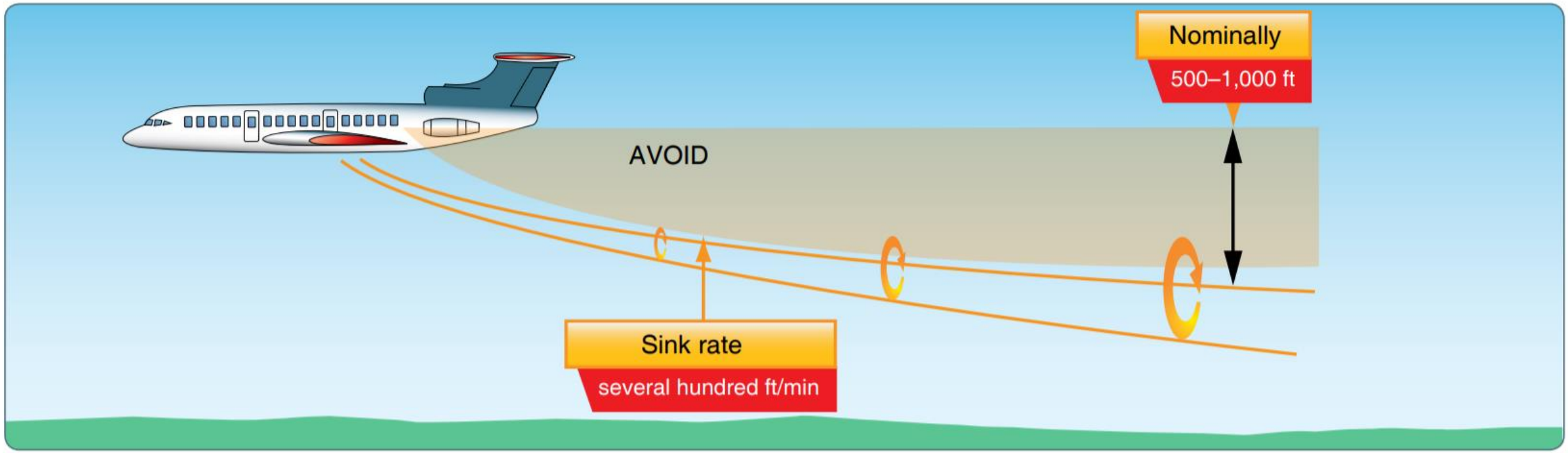
# WAKE TURBULENCE

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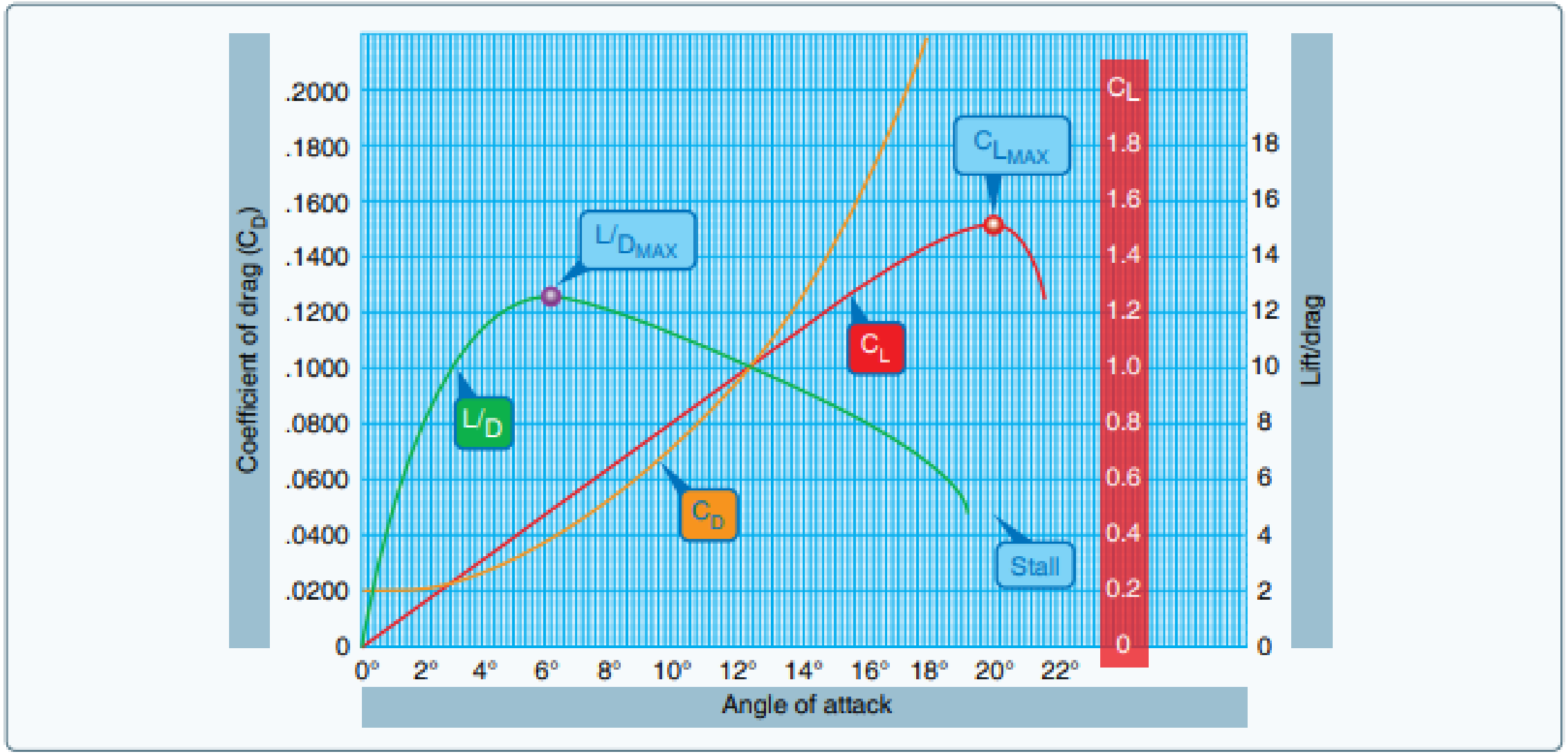
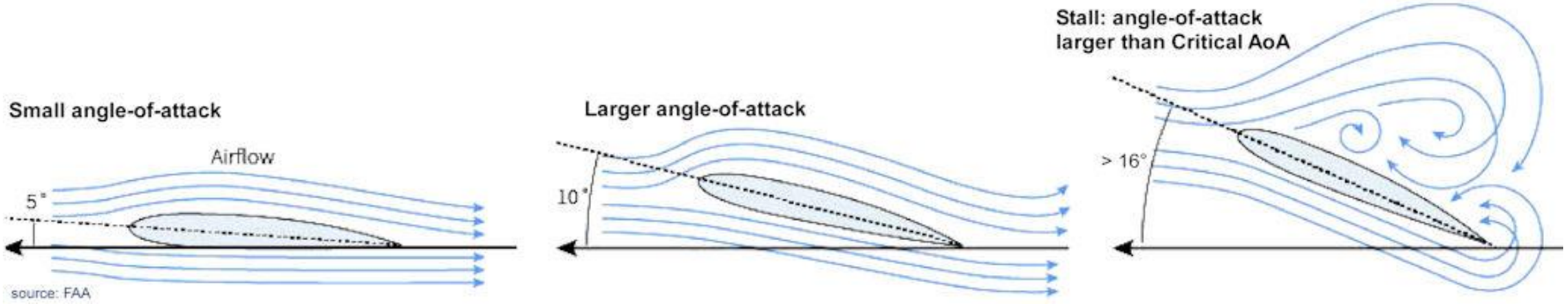
# LIFT


Coefficient of drag ($C_D$)
.2000
.1800
.1600
.1400
.1200
.1000
.0800
.0600
.0400
.0200
0
$C_L$
1.8
1.6
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0
18
16
14
12
10
8
6
4
2
0
Lift/drag
$L/D_{MAX}$
$C_{L_{MAX}}$
$L/D$
$C_L$
$C_D$
Stall
0°
2°
4°
6°
8°
10°
12°
14°
16°
18°
20°
22°
Angle of attack

# STALLS

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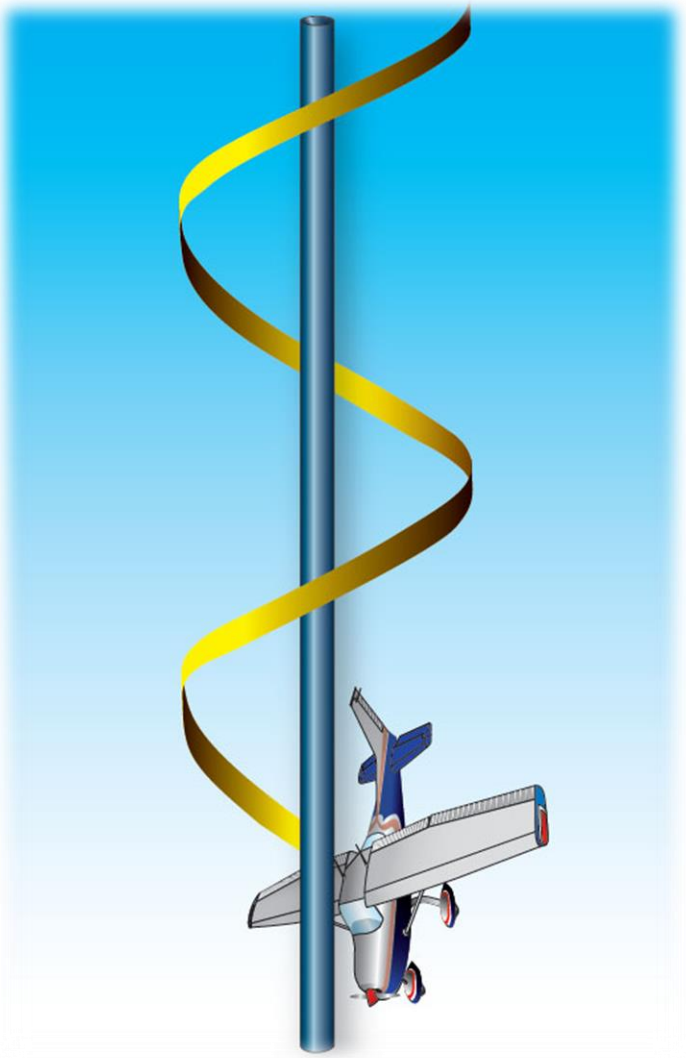
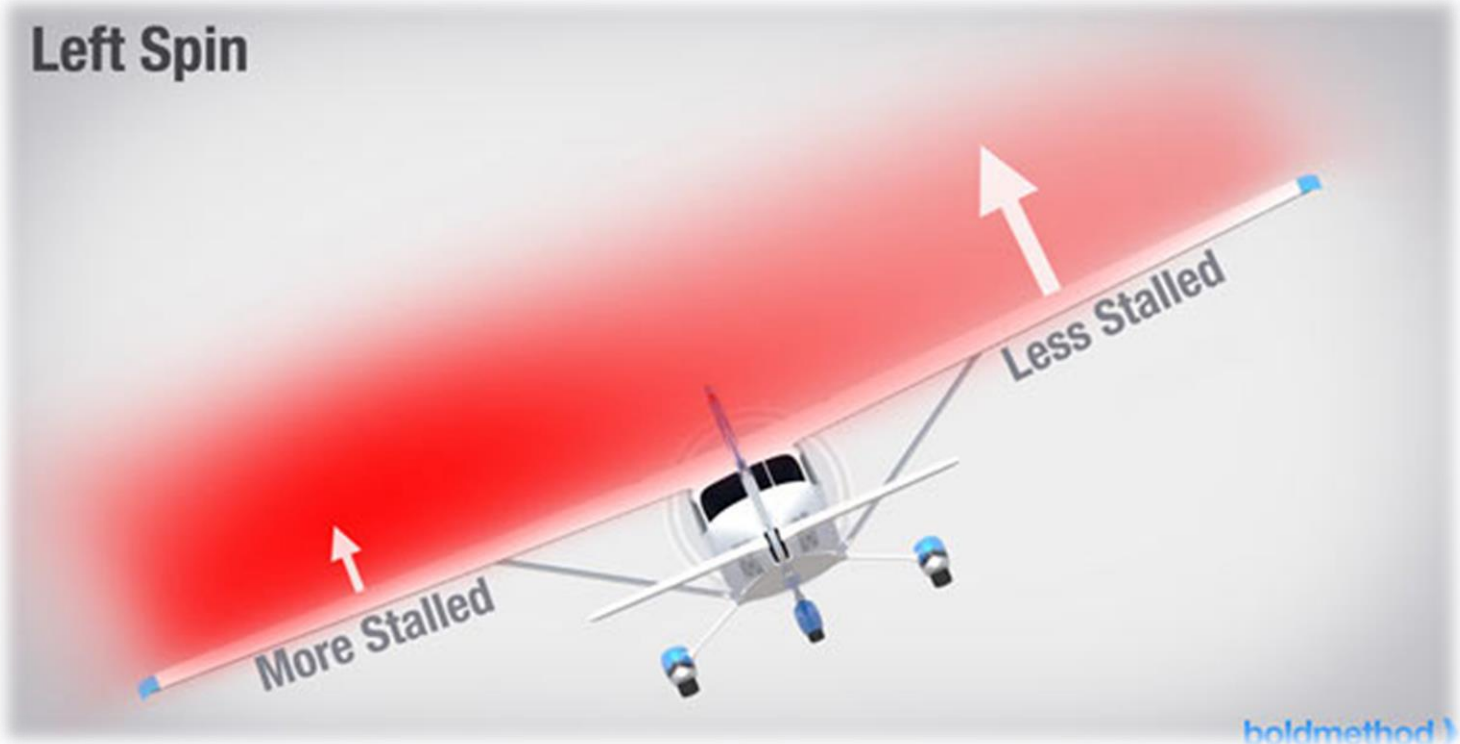
sportys

# SPINS



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# STABILITY

An airplane said to be inherently stable will require less effort to control.

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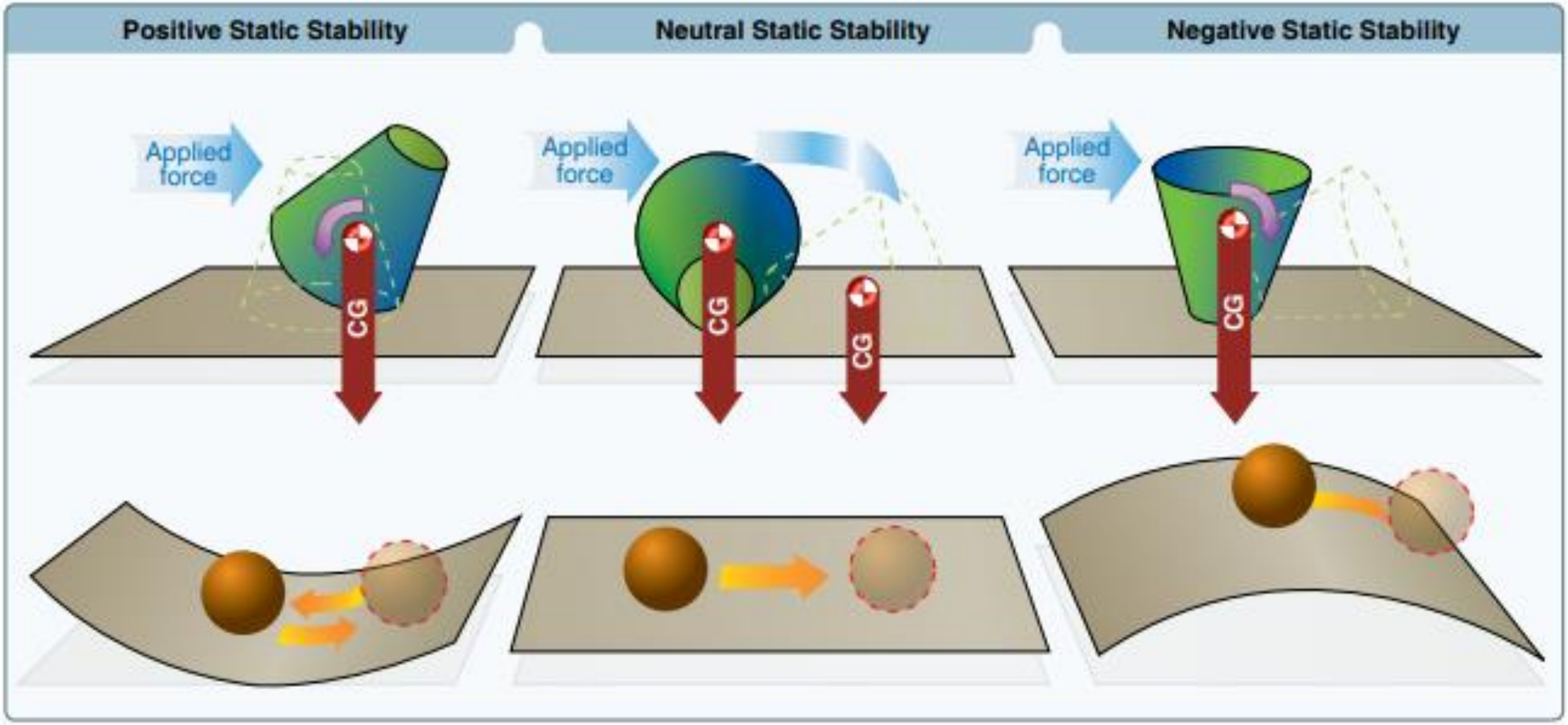
# STATIC STABILITY

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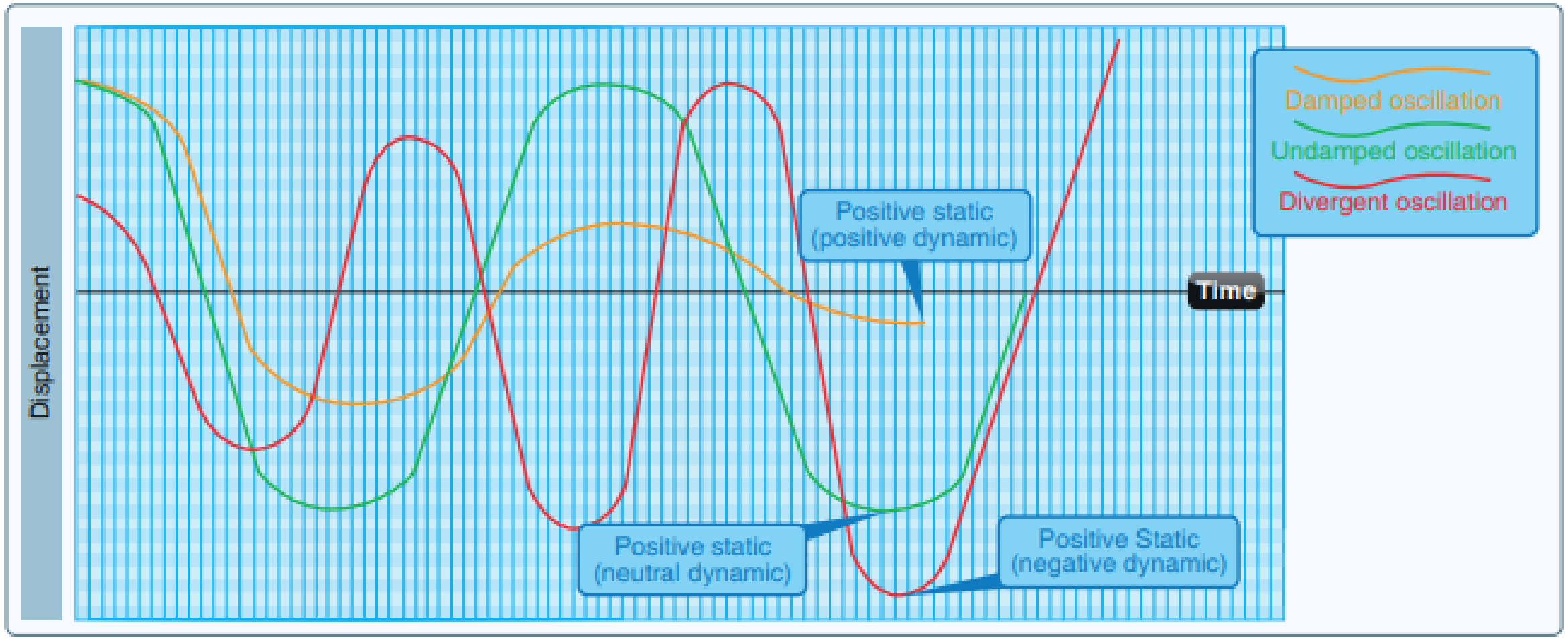
# DYNAMIC STABILITY

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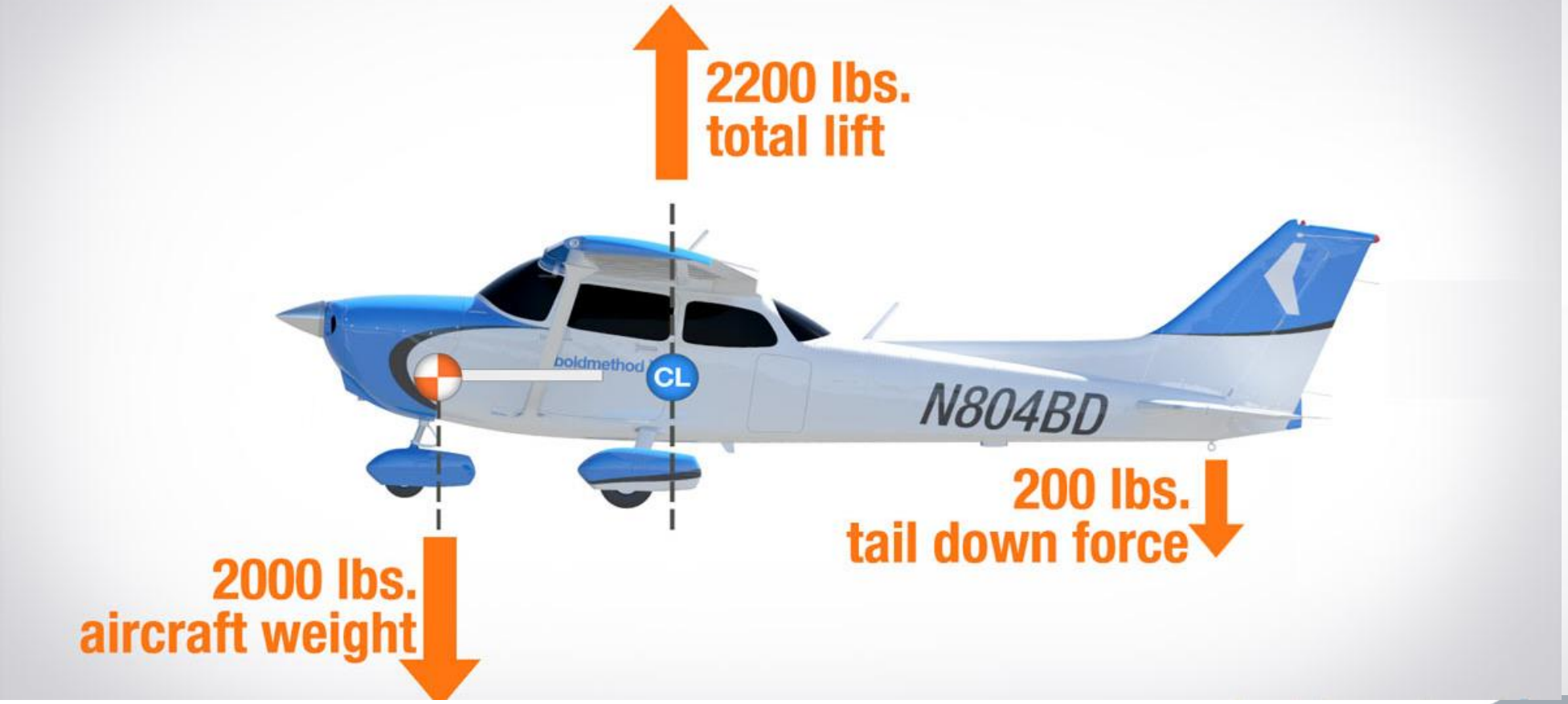
# LONGITUDINAL STABILITY

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# LATERAL STABILITY

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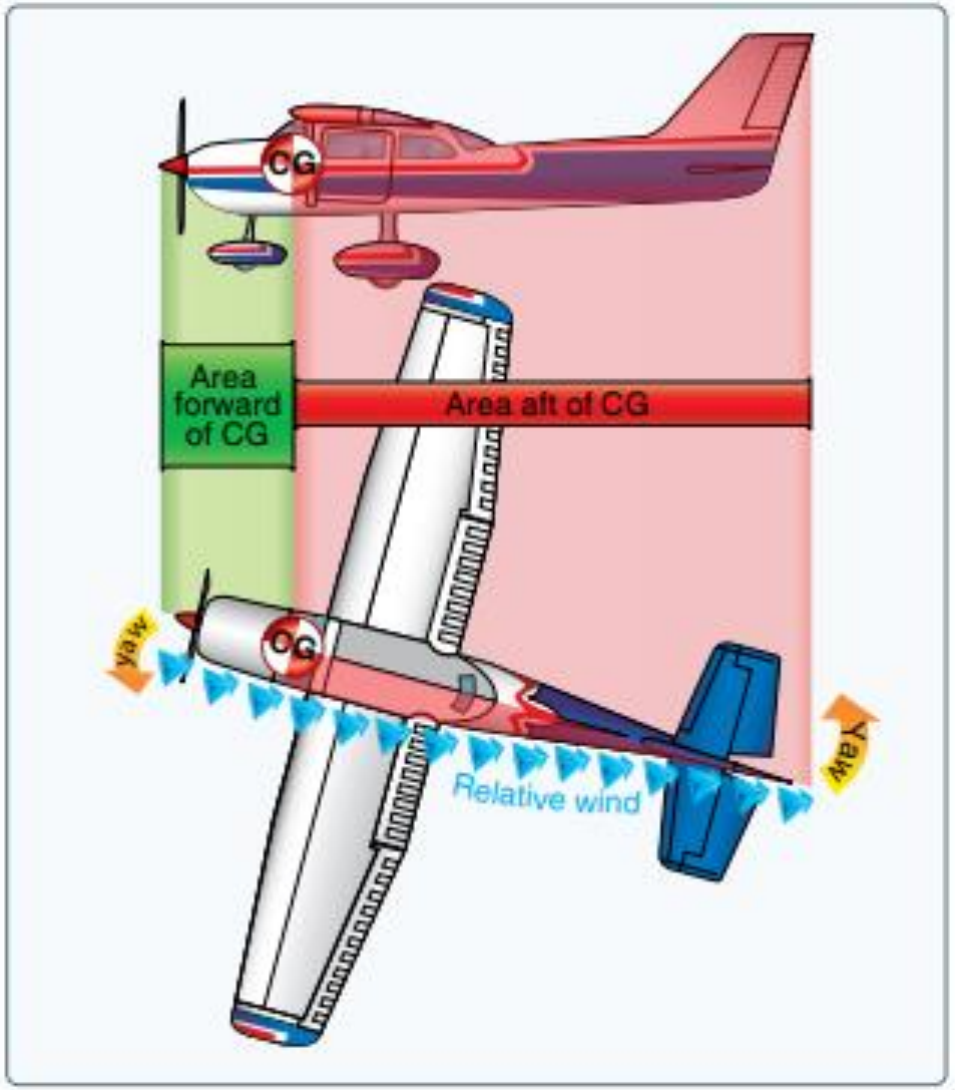
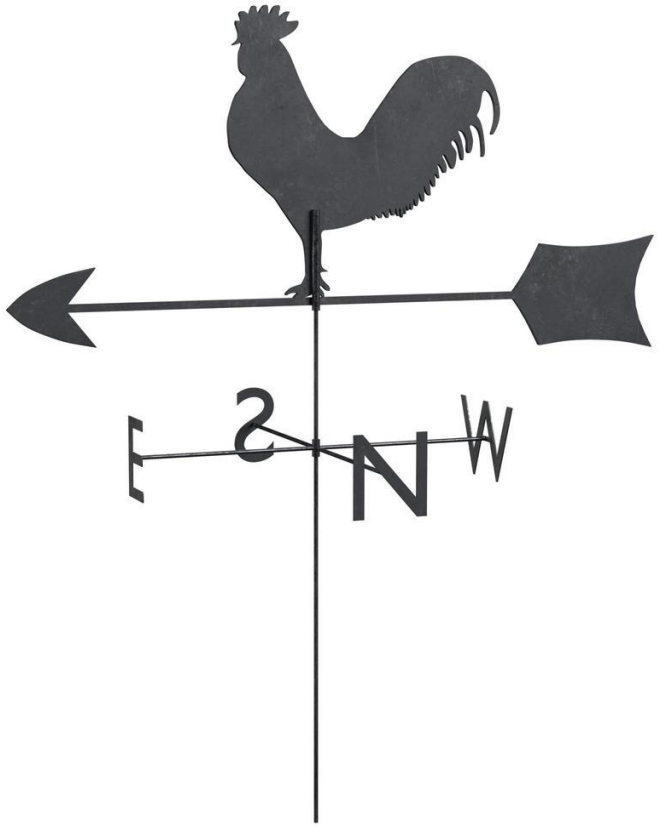
# DIRECTIONAL STABILITY

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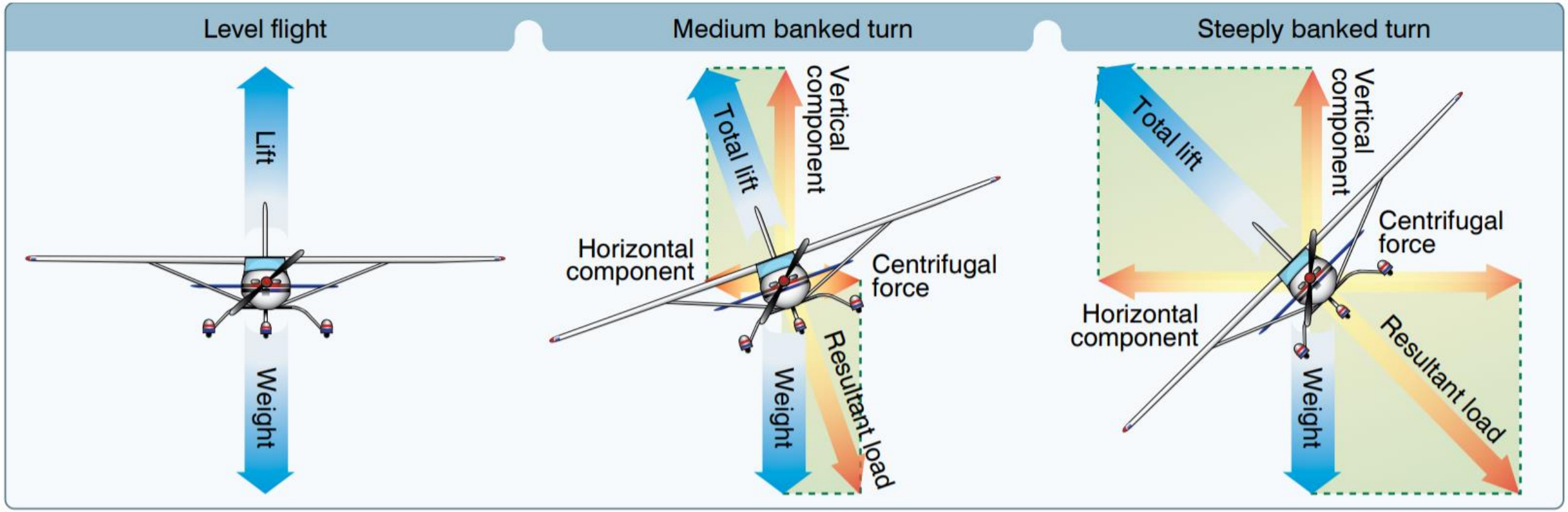
# FORCES IN TURNS

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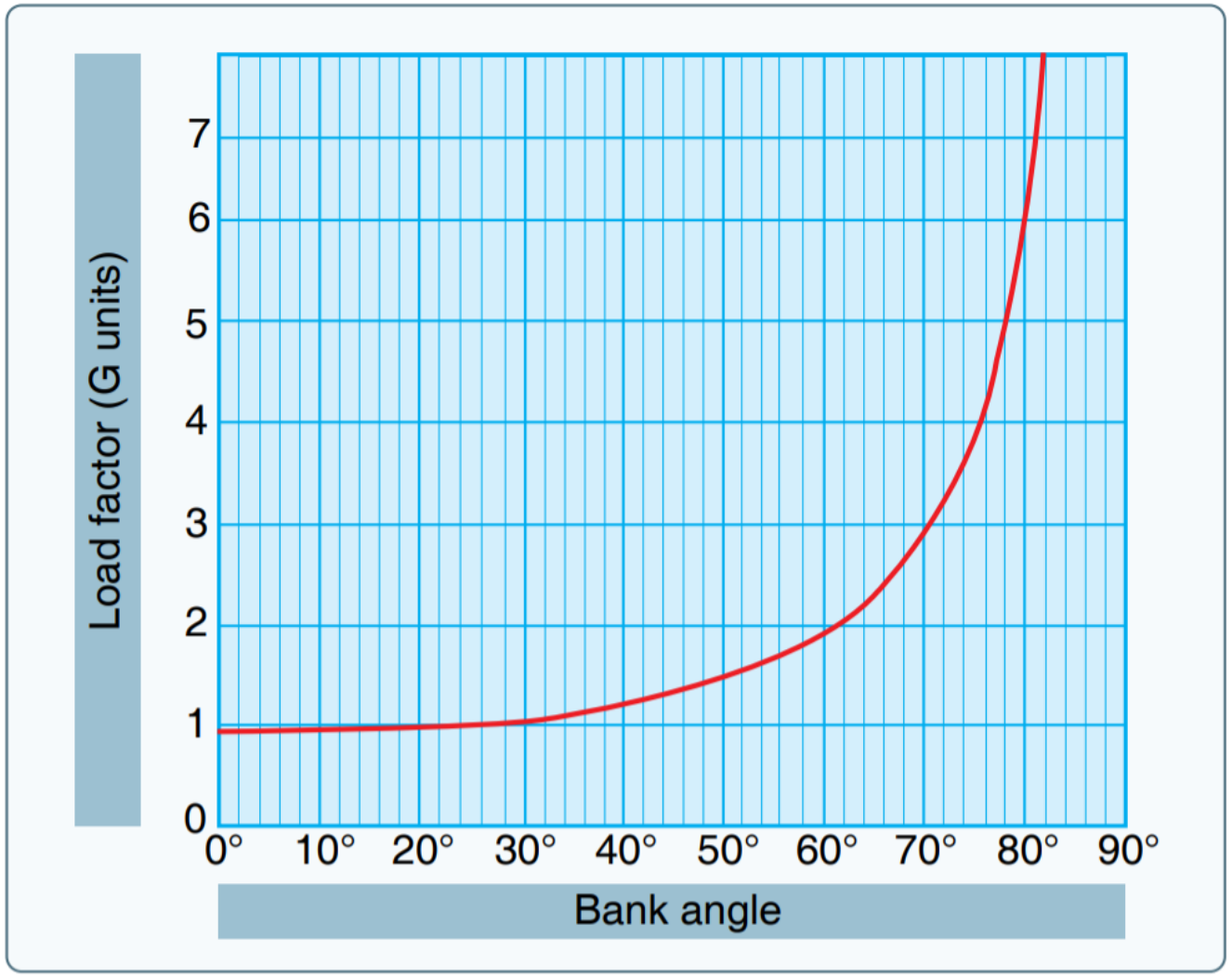
# LOAD FACTOR




If an airplane weighs 3,300 pounds, what approximate weight would the airplane structure be required to support during a 30° banked turn while maintaining altitude

- 1,200 pounds
- 3,960 pounds
- 3,100 pounds

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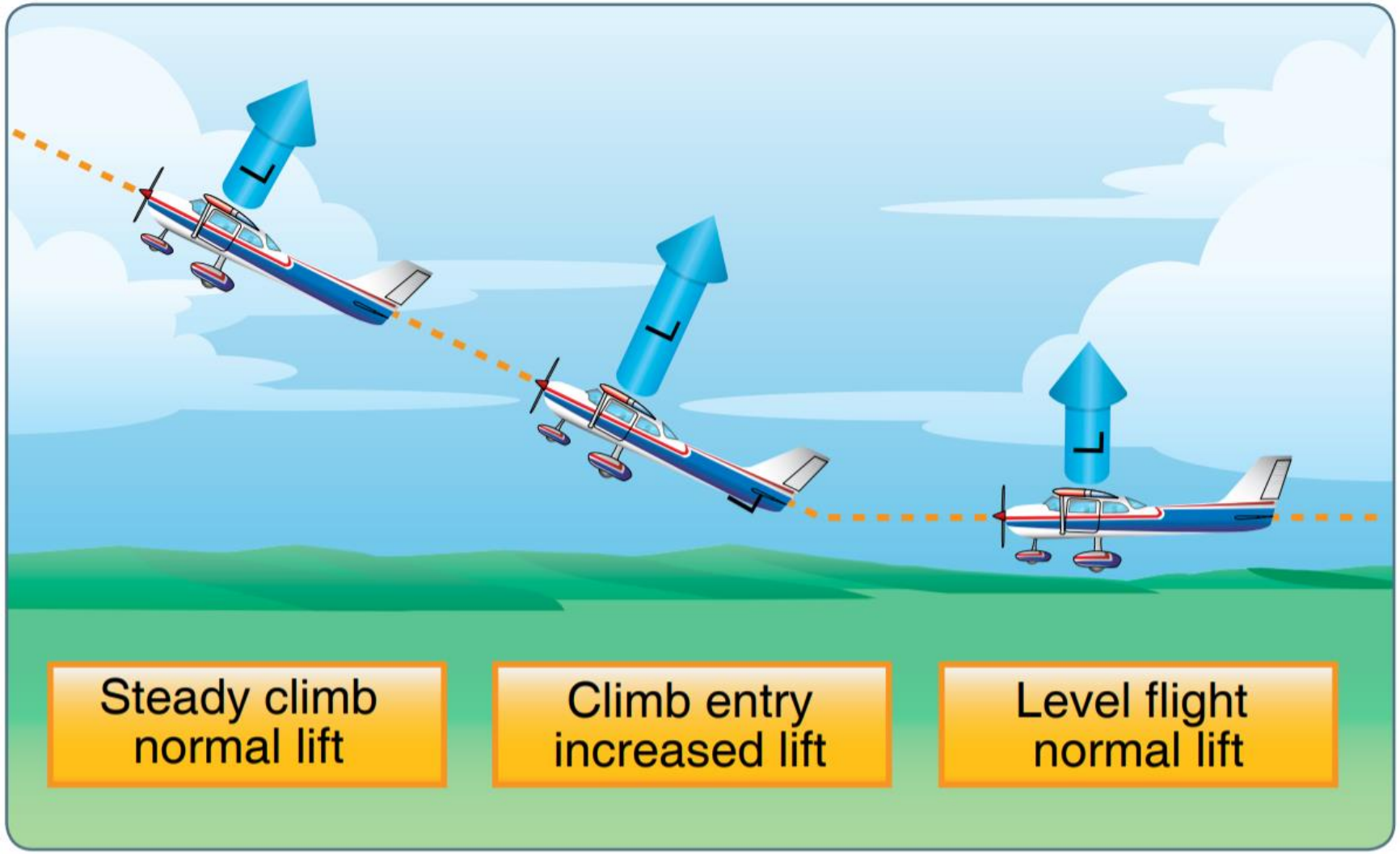
# FORCES IN CLIMBS

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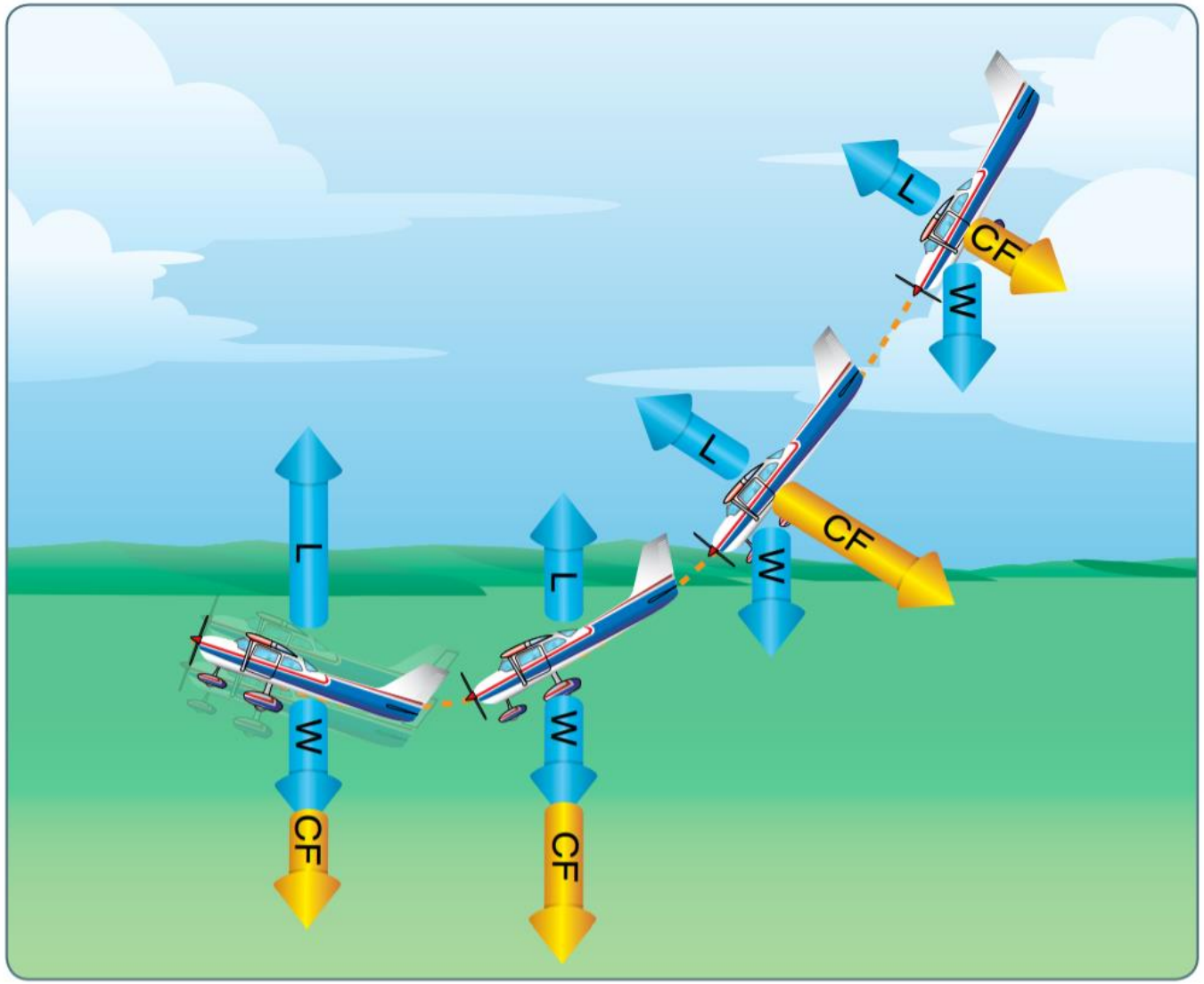
# FORCES IN DESCENTS

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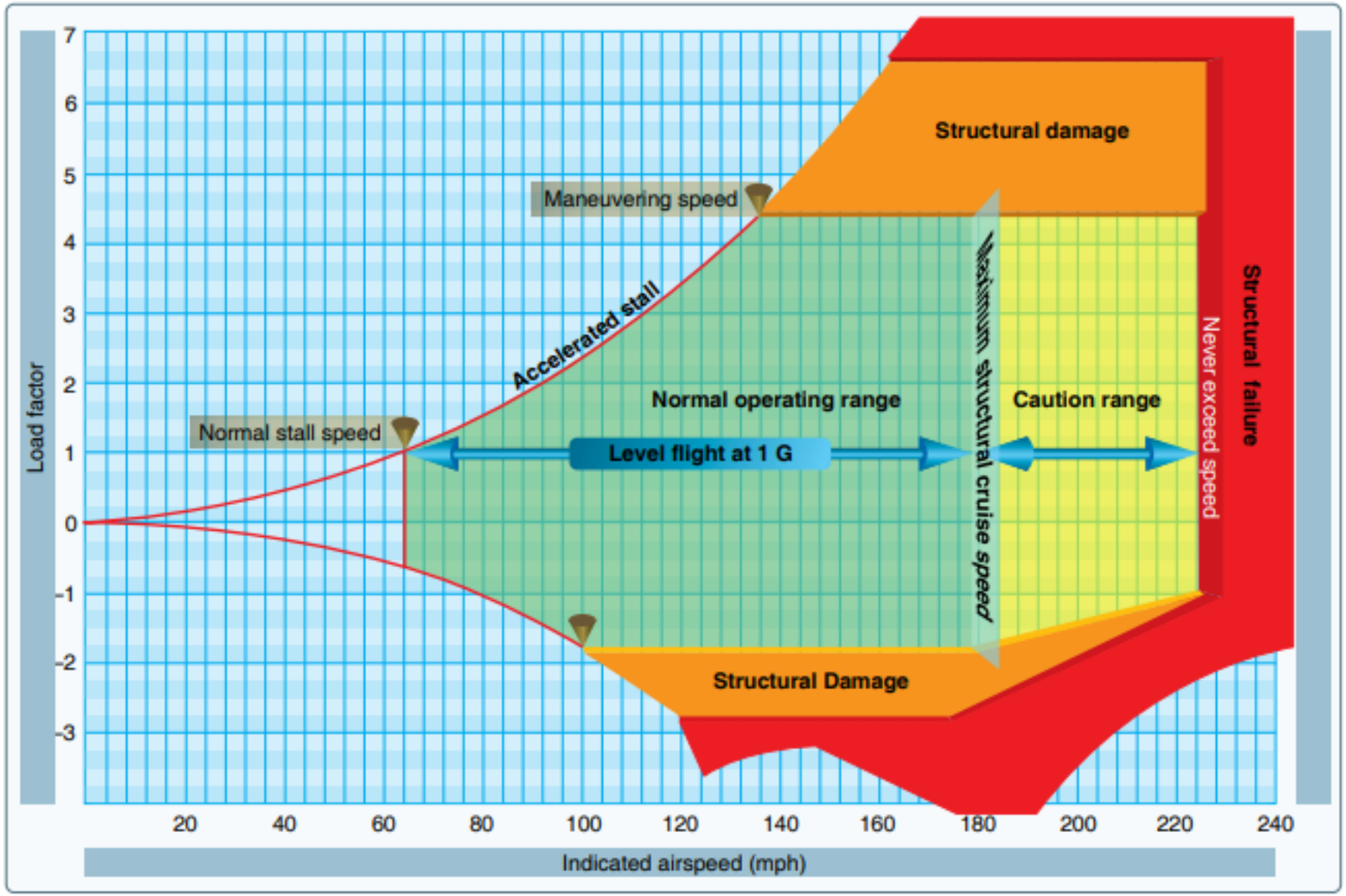
# Vg DIAGRAM

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