

Forces in Flight

Objective

To understand the effects of the balance of forces on the airplane in different scenarios, and how turning tendencies impact the control of the airplane.

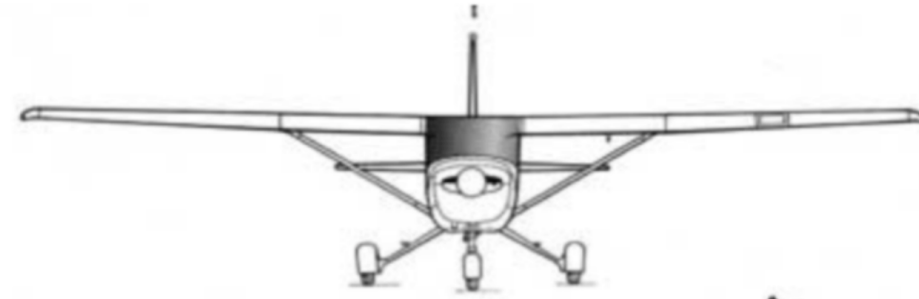
Motivation

Helps a student develop an intuitive understanding of the turning forces present when flying so they can better anticipate and compensate for these forces.

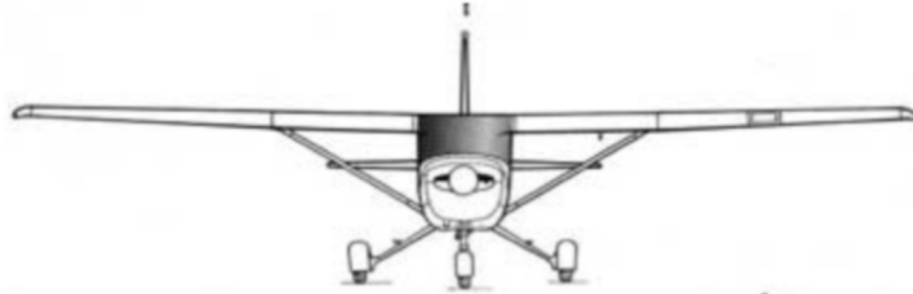
Overview

- Turning tendencies, torque
- Forces in flight
- Forces in straight and level
- Forces in a climb
- Forces in a decent
- Acceleration in a turn
- Forces in a turn
- Adverse yaw

Turning Tendencies

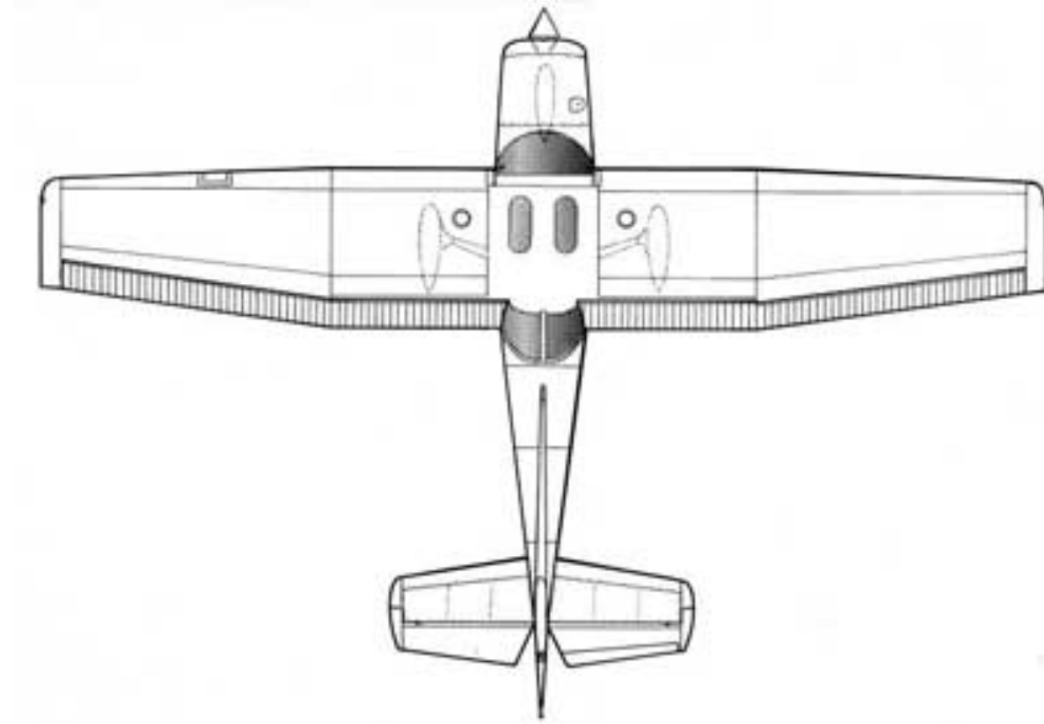


Turning Tendencies: #1 Torque



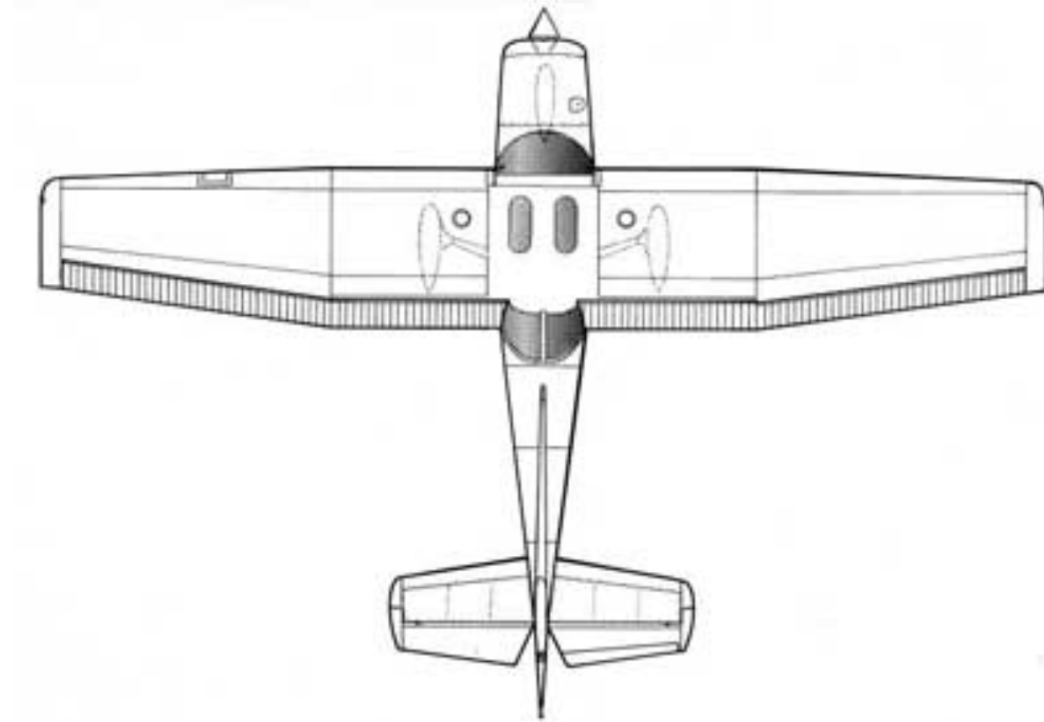
Newton's 3rd law, tendency to roll aircraft to left

Turning Tendencies: #2 Propeller Slipstream

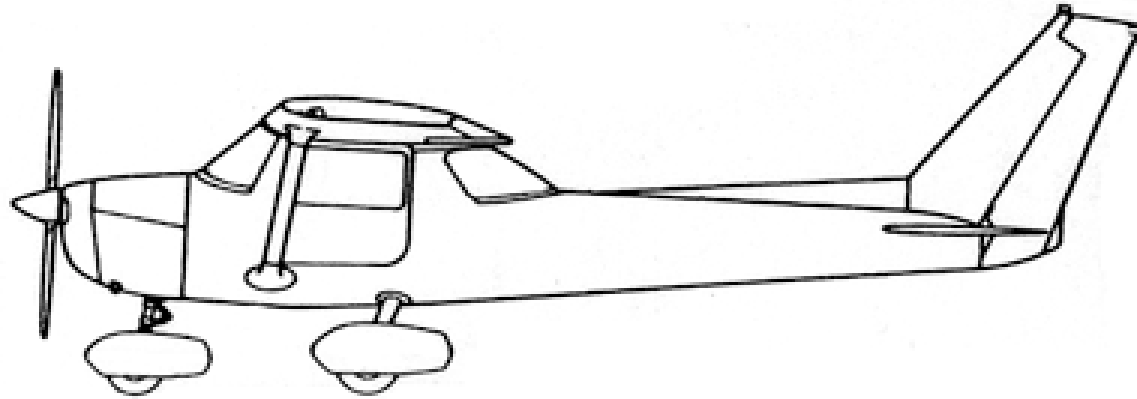


Turning Tendencies: #3 Gyroscopic Precession

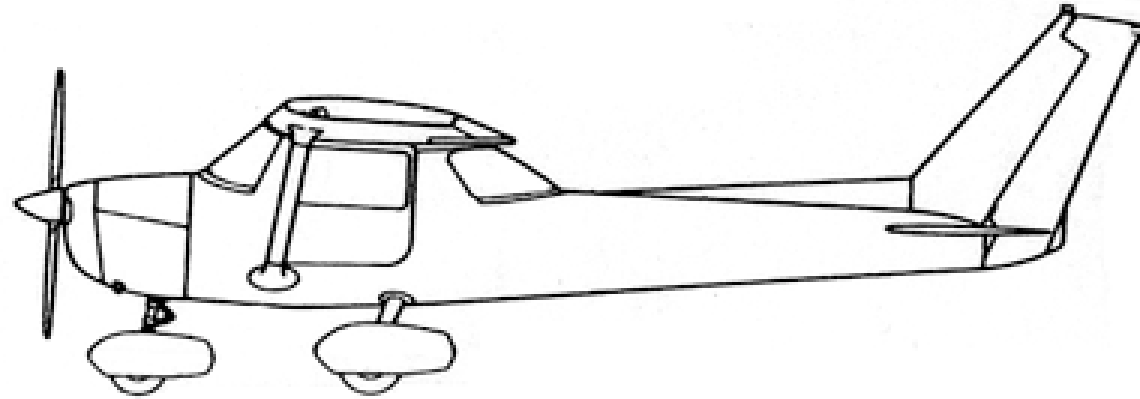
Turning Tendencies: #3 Gyroscopic Precession



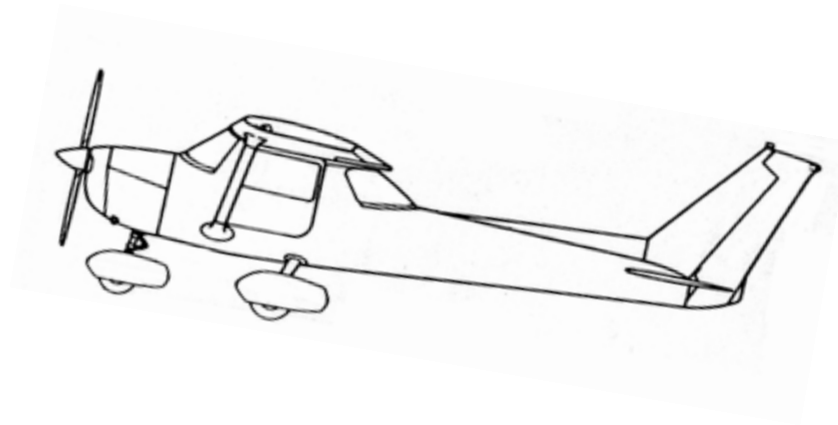
Turning Tendencies: #4 P-Factor



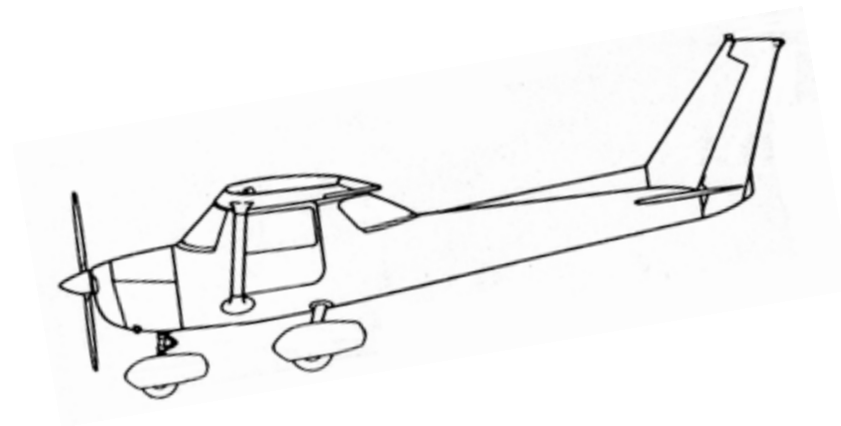
Forces in Flight: S&L



Forces in a Climb



Forces in a Descent



Turns - Centripetal Acceleration

Force is proportional to acceleration

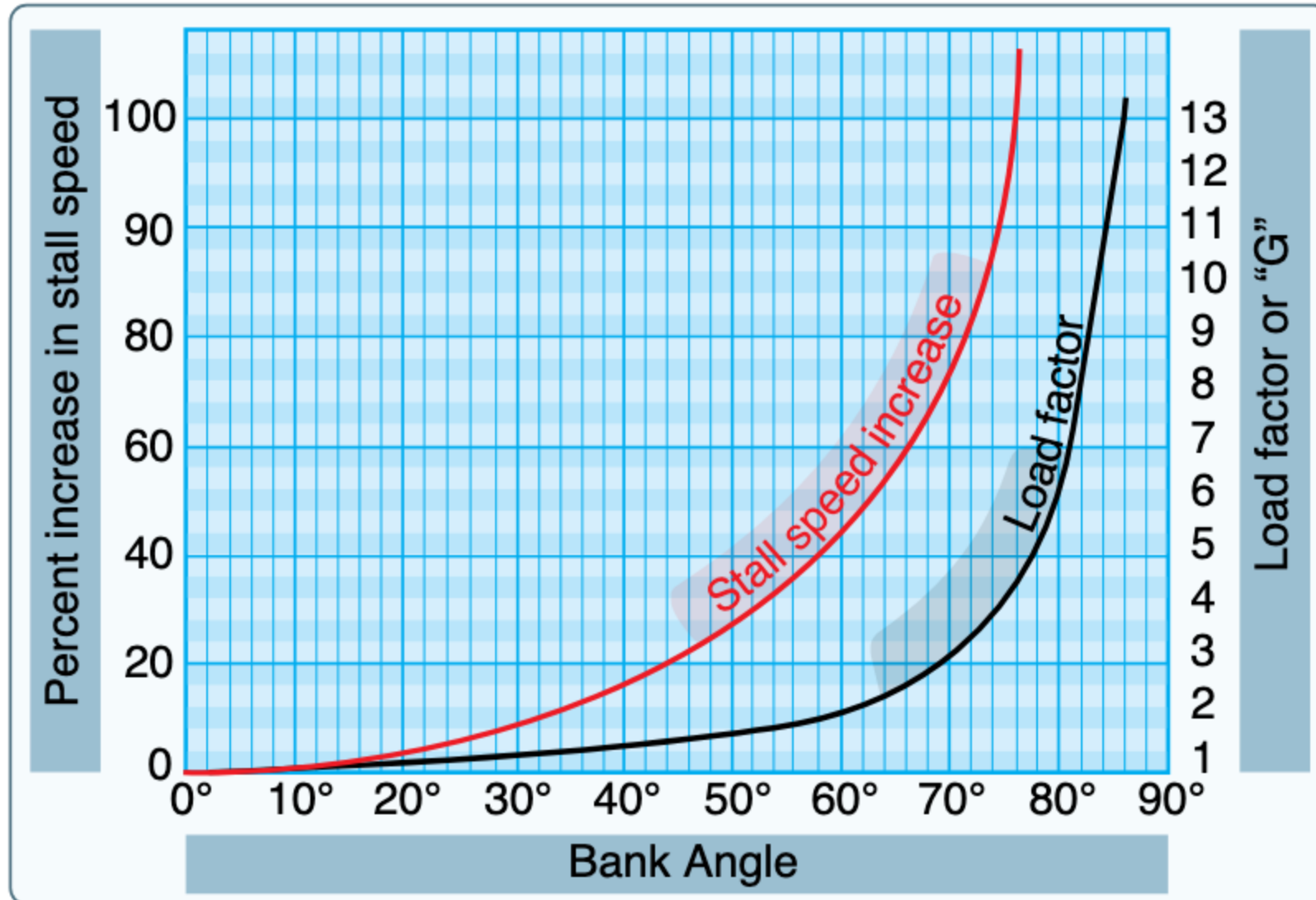
Forces in a Turn

S&L, Medium Bank, Steep Bank

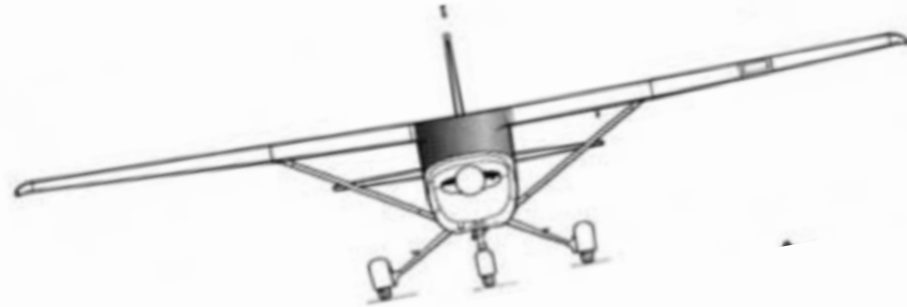
Forces in a turn widget

Load Factor = Lift force / Weight force

Load Fa



Adverse Yaw - Initial Turn

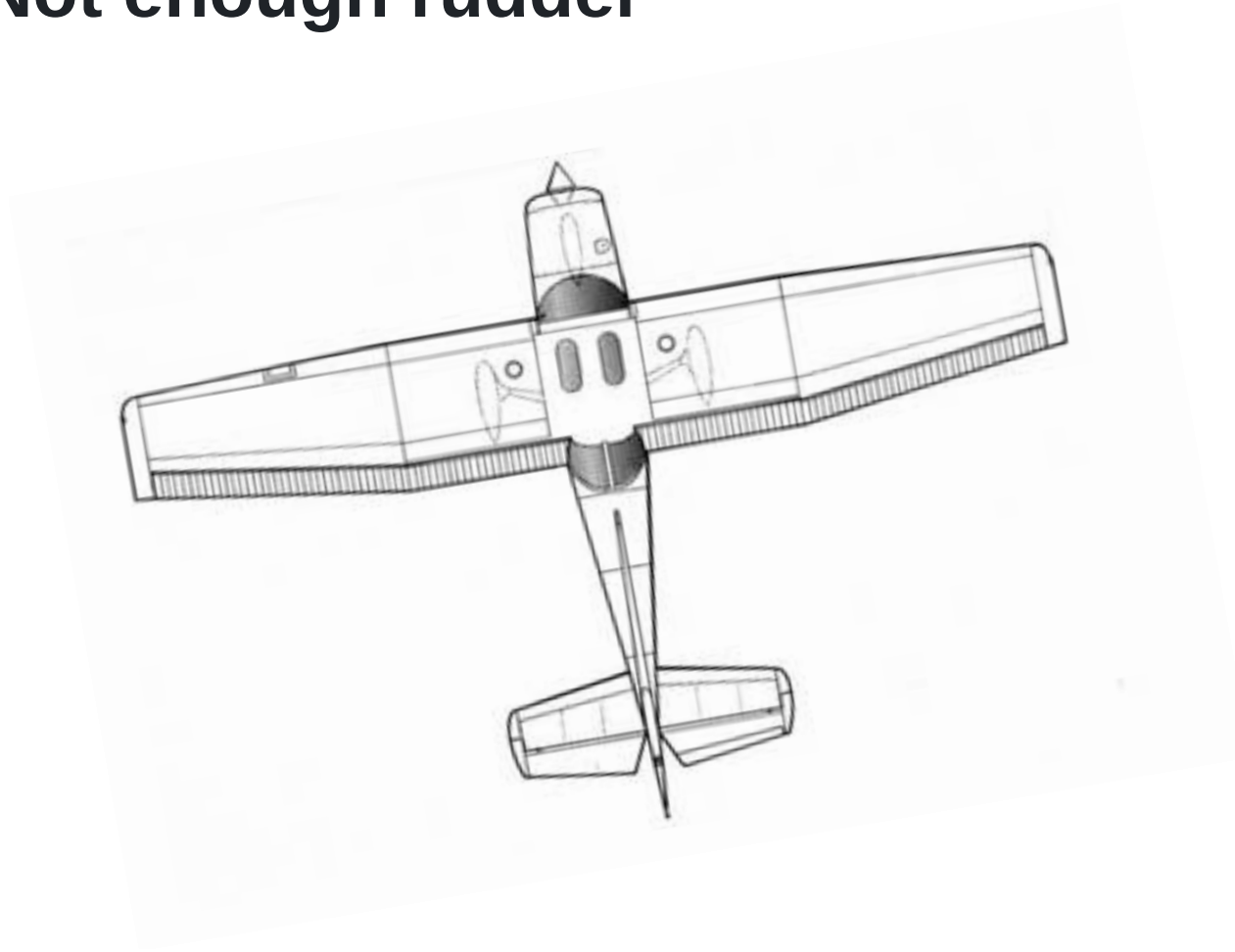


Adverse Yaw - Established in the Turn

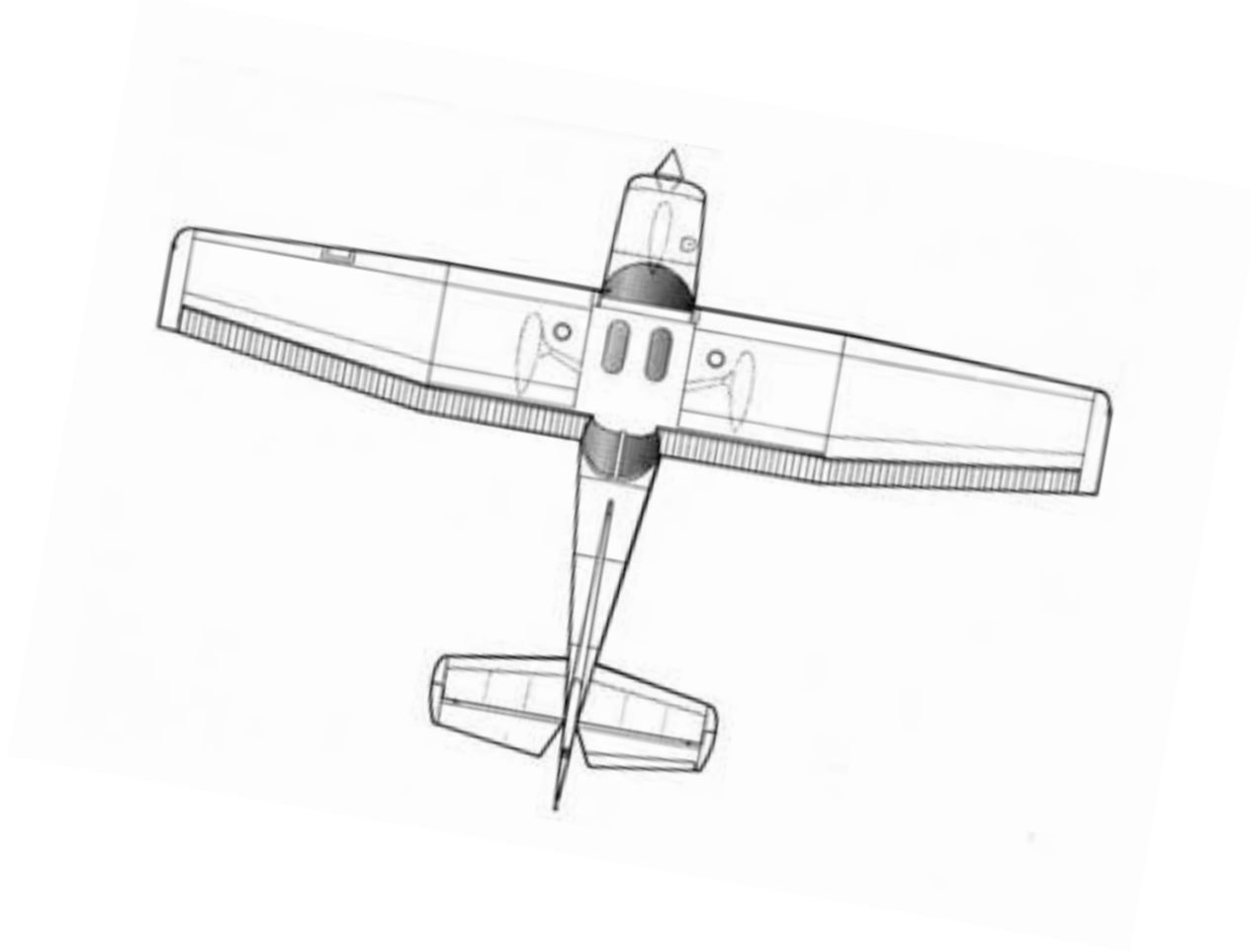


Rudder with roll rate

Turns - Slip: Not enough rudder



Turns - Slip: Too much rudder



Summary

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