

Weight and Balance

- The a/c must be flown within legal weight restrictions at all times
- The a/c must be loaded within C of G restrictions at all times
- Operation outside of parameters established by a/c design ~~engineers~~ is unsafe and invalidates the C of A.

Balance refers to the location of the center of gravity along the longitudinal axis of the airplane

Effects of C of G on longitudinal Stability:

Forward C of G

- Nose heavy-nose wants to go down
- To counteract, up elevator is used which creates extra drag (lower cruise speed)
- Longer ground run at faster than normal speed
- May run out of "up elevator" required to maintain cruise flight, and to hold a/c in nose up attitude during landing
- Reduced range
- Increased stall speeds
- Increased approach speed
- Increased landing distance

Rearward C of G

- A/c is unstable and difficult to control
- Airborne earlier
- Tendency to pitch up and stall
- Greater tendency to flip a/c in gusty conditions
- Spin recoveries difficult/impossible

How to shift weight in the a/c to stay within C of G limits:

Example:

A C152 is fully loaded to 1670 lbs and 1/2 inch aft the C of G limits.

In order to be safe and legal for flight, it is decided than some of the 120lbs in the baggage compartment will have to be moved forward in the cabin to the front seat.

To determine how much weight must be moved use the following formula:

$$\frac{w \text{ (weight to be shifted)}}{W \text{ (Gross weight of a/c)}} = \frac{d \text{ (distance beyond aft CofG)}}{D \text{ (distance between stations)}}$$

$$\frac{w}{1670\text{lbs}} = \frac{1/2 \text{ inch}}{45 \text{ inches}}$$

$$1670 \div 45 = 37.1$$

$$37.1 \times 1/2 = 18.55$$

Answer: 18.55 lbs must be moved ahead to the front seat.