

Center of Gravity (C.G.) Considerations and Neutral Pitch Stability

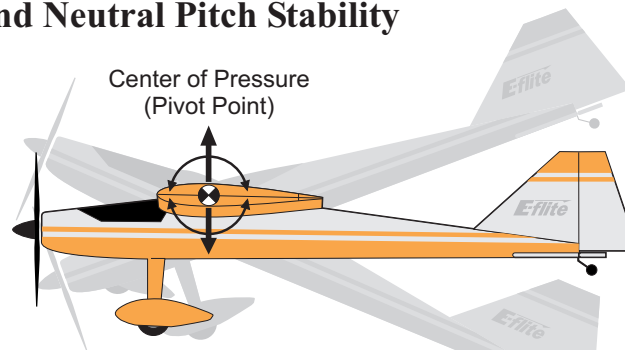
Center of Gravity (C.G.) location can have the single greatest influence on how an airplane handles in the air. Changing the C.G. can make a previously poor handling plane fly great, or turn an otherwise great airplane into a chore to fly. The C.G. location favorable to precision aerobatics is a compromise between “flying on rails” handling and unrestricted maneuverability, that is, neither tail heavy nor nose heavy, a.k.a., “neutral”.

Explained: As the air flows around a symmetrical airfoil wing, the areas of greatest low pressure are located near the wing’s thickest point. Between the top and bottom centers of pressure is the wing’s aerodynamic pivot point (pitch axis). With very few exceptions, when the C.G. is in-line with the wing’s thickest point (pivot point) the airplane will be balanced neutral.

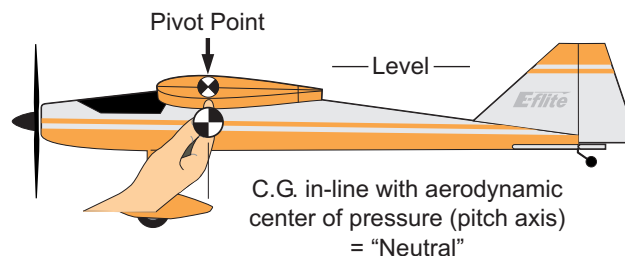
On 99% of models the wing’s thickest point and neutral C.G. location is between 30-33% of the wing chord. When the C.G. is neither forward nor aft of the wing’s thickest point, an airplane neither resists nor exaggerates what it is told to do, has almost no tendency to change its state, and behaves basically the same at nearly any speed.

On the other hand, when the center of gravity is aft of the wing’s center of pressure, an airplane becomes unstable and would be inclined to swap ends in flight (similar to shooting an arrow backwards) if it were not for the tail and corrective inputs. While sometimes manageable at higher speeds, a plane with an aft C.G. becomes especially unpredictable and hard to control when the tail becomes less effective at lower airspeeds (e.g., landing)!

While a significantly nose heavy airplane won’t attempt to swap ends, it will tend to behave differently at different speeds, e.g., becoming a lawn dart when slowed and/or rolled upside down. Since the airspeed is constantly changing during aerobatics, it’s well worth the effort to relocate the batteries and/or add weight to achieve a C.G. that is neither forward nor aft in order to achieve the “neutral” flying qualities and predictable handling that enable pilots to practice more effectively and ultimately remain ahead of the airplane.



Whenever a symmetrical wing airplane is pitched up or down, it’s aerodynamically inclined to pivot around the wing’s thickest point (center of pressure). When the C.G. is neither forward nor aft of the wing’s thickest point (pivot point) the airplane tends to be the most neutral/predictable.



When the C.G. is aft of the wing’s thickest point (pivot point), the airplane becomes unstable – similar to shooting an arrow backwards – and would be inclined to swap ends in flight if not for the tail and corrective inputs!

