



Training: Bob Juncosa

“What Makes Planes Go Up”

I was recently part of a generally friendly exchange on Facebook. Someone rather cheekily asked, “What makes a plane go up?” The answer he was hoping for was, “the elevator” because he was ready to pounce back with an emphatic, “No, the throttle!” He was not happy with my answer which was neither of those.

His answer, like most of others posted, depends on the context and perspective of the poster. This fellow was answering from the perspective of a civil aviation pilot in a properly trimmed plane in level flight. In that circumstance, advancing the throttle does indeed make the plane go up.

He bristled a bit when I asked about when a plane is inverted, or knife edge, going vertical, or in a steep dive? Advancing the throttle in these circumstances can sometimes be a very bad thing and does not necessarily make the plane go up. Since none of these flight orientations are desirable in a Cessna 172, he considered them outside of the scope of his question but is it?

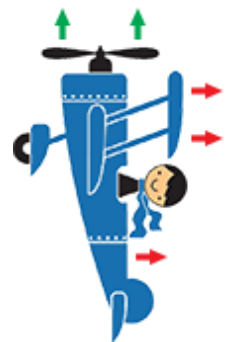
For what it’s worth, here is a much more long winded version of the answer I gave him.

A plane “goes up” in relation to the ground from just one thing, *lift*. There are two main contributors to lift. They are aerodynamic lift and the vertical component of the thrust vector and neither is always present.



Aerodynamic lift is generated by the geometry of the aircraft. This can be a combination of things like airfoil, fuselage shape, wing angle of incidence, etc. Consider the case when an airplane is in level flight. As the plane moves through the air, the majority of the lift is generated by the shape of the airfoil and the other surfaces of the plane. In this case, increasing thrust, increases the airspeed, thus increasing the aerodynamic lift. The faster you go, the higher the rate of climb with virtually no change in the attitude of the plane.

Lift from the thrust vector is the portion of the thrust that is in the vertical direction. Consider the case when the plane is pointed straight up. In this case, none of the aerodynamic lift is in the vertical direction so it doesn’t contribute anything to making the plane go up. In the example on the right, the aerodynamic forces created by the wings and other surfaces would actually make the plane go to the right! Because the plane is pointed straight up, all of the thrust is in the vertical direction and so that is what makes the plane go up. If you have enough thrust in that direction to overcome the weight and drag of the plane, you have “unlimited vertical.”



What about the in-between case when the plane isn’t flying level or completely vertical? This is where the elevator (finally) comes into play. The elevator is not responsible for lift. It is responsible for *pitch*, i.e. the angle of the thrust line relative to the light of flight. When there is a positive pitch angle, a portion of the forces from the airflow hitting the plane are now in the vertical direction. This contributes an increase in aerodynamic lift. Also when pitched up, there is now a portion of the thrust that is in the vertical direction so it too contributes to making the plane go up.

OK, all well and good. You may or may not have known all this yet are perfectly capable of making your plane go up and down at will. Sure, but knowing this as an RC pilot gives you more options on *how* to make your plane go up

and the very first opportunity we have to make your plane go up take-off. That will be the subject of next month's training article.

“A successful day at the field is one when you don't need any glue or a trash bag.”

- Kathleen Juncosa

Bob Juncosa

bob.juncosa@gmail.com