

Aerodynamics – Part 1

Air Speeds, Climbs and Turns

Daniel Sullivan September 25, 2019

1. Best angle of climb:
 - a. How is this determined?
 - b. What is the V-speed designation for best angle of climb?
 - c. Does it vary with weight of the aircraft? If so (in general, no sophisticated math) how?
 - d. Does it vary with altitude? If so (in general, no sophisticated math) how?
 - e. What marking on the airspeed indicator identifies best angle of climb speed?
2. Best rate of climb:
 - a. How is this determined?
 - b. What is the V-speed designation for best rate of climb?
 - c. Does it vary with weight of the aircraft? If so (in general, no sophisticated math) how?
 - d. Does it vary with altitude? If so (in general, no sophisticated math) how?
 - e. What marking on the airspeed indicator identifies best rate of climb speed?
3. Altitude comes in five flavors (there are five types of altitudes). There are only four flavors (types) of airspeed.
 - a. What are the four types of airspeed?
 - b. What distinguishes each (that is, what is their purpose or how are they used)?
4. Not exactly Baskin Robins and their 51 flavors, but lift enhancing devices may be as close as you can get. Depending on how many variations of each basic type you include there can be more than a dozen.
 - a. Lift enhancing devices fall into two broad categories – what are they?
 - b. Identify the basic types in each category
5. Ceiling – as high as you can go (or, at least as high as you can go until you reach the basis of their definition)
 - a. There are two types that you generally see used (but bonus points for identifying a third) – what are the two (or three, if you know) types of aircraft ceilings?
 - b. How is each defined?
 - c. Twin engine aircraft have the same ceilings as a single engine aircraft. But, for a twin engine aircraft with only one engine running one of the ceilings (sticking to the two basic ones) is defined differently than its single-engine counterpart. What is it and how is it defined?
 - d. Best angle of climb and best rate of climb are also related to one of the two basic types of ceiling. Which one, and how do best rate of climb and best angle of climb relate to this ceiling?

6. Maneuvering speed (maximum structural maneuvering speed):
 - a. How is this determined?
 - b. What is it used for / what is its significance?
 - c. What is the V-speed designation for maneuvering speed?
 - d. Does it vary with weight of the aircraft? If so (in general, no sophisticated math) how?
 - e. Does it vary with altitude? If so (in general, no sophisticated math) how?
 - f. What marking on the airspeed indicator identifies maneuvering speed?
7. Turning
 - a. What is the primary force that makes an aircraft turn?
 - b. How is this force brought into effect (that is – how do you maneuver the aircraft to create this force) and around what axis does this force work?
 - c. What is happening aerodynamically (what are the aerodynamic forces on the wings) that causes the aircraft to maneuver into the attitude needed for turning?
 - d. A force around what other axis is needed to make a proper turn.
 - i. What is this axis, how is it created?
 - ii. Why is it necessary (or, putting this another way – what happens if you don't bring this force into play when you turn)?
 - e. What is a standard rate turn (AKA 'standard turn')?
 - f. An important skill required for instrument flying is a timed turn. To do this properly it is necessary to roll out of the turn at the same (constant) rate of roll you used to roll into the turn. One commonly used guidance is that you should roll out of a turn starting at a point (heading) equal to one-half your bank angle prior to the heading you intend to be at when straight and level. If your standard turn requires a bank angle of 18° how many seconds (at a constant roll rate) should it take for you to roll from level to an 18° bank – and subsequently that would be the number of seconds required to roll out of the turn back to straight and level?
 - g. Does lift change in a turn? If so, why?