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Altimetry SOP

Most pressure altimeters are subject to mechanical, elastic, temperature, and installation errors. Although manufacturing and installation specifications, as well as the periodic test and inspections required by regulations (14 CFR Part 43, Appendix E), act to reduce these errors, any scale error may be observed in the following manner:

1. Set the current reported altimeter setting on the altimeter setting scale.
2. Altimeter should now read field elevation if you are located on the same reference level used to establish the altimeter setting.
3. Note the variation between the known field elevation and the altimeter indication. If this variation is in the order of plus or minus 75 feet, the accuracy of the altimeter is questionable and the problem should be referred to an appropriately rated repair station for evaluation and possible correction.

Once in flight, it is very important to obtain frequently current altimeter settings en route.

Maneuvering Speed (V_A) and Aircraft Weight

By: Al Secen

What do you know about design maneuvering speed V_A and the protection that it provides to you and the airplane? How does V_A differ from V_O, operating maneuvering speed?

V_A is a speed that is missing from the airspeed indicator, but there should be a placard somewhere that says what the speed is at max weight. Of course, V_A (and other speeds) change with the weight of the airplane. And, counter-intuitively, it DECREASES as the weight decreases. Why comes from the lift equation.

$$L = C_L \frac{\rho v^2}{2} S$$

Lift is equal to the coefficient of lift (C_L) times one half the product of air density (ρ) and the airplane's velocity squared (V^2) and the surface area of the wing (S). There is no "weight" term in that equation. What's up?

In level un-accelerated flight, weight equals lift and so L becomes W in the equation above.

$$W = C_L \frac{\rho v^2}{2} S$$

You can determine speeds that vary with weight (like stall speed or landing speed) by dividing the equation for one weight by the second to get

$$\frac{W_1}{W_2} = \frac{v_1^2}{v_2^2}$$

Then, solving for the new speed V_2 gets us

$$v_2 = v_1 \sqrt{\frac{W_2}{W_1}}$$

From here, math tells us that going from max weight to a lighter weight (W_1 down to W_2) will be a fraction (i.e., less than 1) times the original velocity (V_1), or a lower speed.

OK…that's hard to understand.

V_A versus V_O

Vo is a selected (not necessarily computed) speed that must not exceed a value related to stalling speed. According to 23.1507, Vo is a speed where the airplane will stall in a nose-up pitching maneuver before exceeding the airplane structural limits. This is actually closer to the definition of “maneuvering speed” than the common usage of V_A, but is distinguished from “turbulent air penetration speed” by being related to a control force, not a force imparted by outside forces, i.e., wind shear.

Estimating V_A

If you are flying an airplane below the maximum gross takeoff weight (the weight the manufacturer computes for V_A), you can compute a rule-of-thumb speed by reducing V_A by 1% for every 2% reduction in weight.

So, if V_A is computed to be 90Kts at 3000 lbs, and you are only at 2400 lbs, then reduce V_A to 81 Kts.

How about this? An airplane is rated to certain G-loading: $G = \frac{Lift}{Weight}$. Normal straight and level flight is 1G. Maximum G loading in normal category is +3.8 G’s.

In straight and level flight at a given speed (remember the lift equation), the airplane is at a given angle of attack (AOA) producing lift equal to its weight (say 4° AOA). Let’s say the airplane at gross weighs 3000 lbs., so it’s generating 3000 lbs of lift in straight and level flight.

If a gust comes along and raises the AOA to its maximum (C_{LMax}), the MOST lift the airplane will generate is 3.8 x 3000, or 11,400 lbs., or

$$3.8G = \frac{11{,}400}{3000}$$

Now, let’s say the airplane only weighs 2000 lbs. If we are at the same speed (and AOA) the airplane wing will still produce the same lift at CL_{Max}, but the G-loading will be

$$5.7G = \frac{11400}{2000}$$

That’s bad. The only way to reduce the amount of lift generated at C_{LMAX} is to reduce the speed, hence V_A for lighter weights is at a lower speed.

Importantly, V_A actually stands for *design maneuvering speed,* which is structural design airspeed used in determining the strength requirements for the airplane and its control surfaces.

The structural design requirements do not cover multiple control inputs in one axis or control inputs in more than one axis at a time at any speed, even below V_A

To make matters more confusing, there is also *operating maneuvering speed* (V_O) that is a maneuvering speed limitation that must not exceed the design maneuvering speed, V_A. This is actually closer to what we understand V_A to be (see sidebar).

CFR 14 Part 23 introduced (V_O) in 2007 for pilots to differentiate the maneuvering speed used operationally from the design maneuvering speed used to show compliance with the structural type certification requirements (V_A). CFR 14 Part 25 (transport category design) does not contain V_O. Nonetheless, CFR 25 .1583(a)(3) was amended in 2010 as a result of American Airlines flight 587 that crashed in New York in November 2001.

The NTSB's investigation of the accident revealed that many pilots have a general misunderstanding of what the design maneuvering speed (V_A) is and the extent of structural protection that exists when an airplane is operated at speeds below its V_A. They found that many pilots mistakenly believe that, as long as the airplane's speed is below V_A, they can make any control input they desire without risking structural damage to the airplane. Unfortunately, this is not so.

When you find yourself in turbulent air, or are practicing high performance maneuvers, do you think about the speed that you should remain below to prevent damage to the airplane? A little review of V_A (and V_O) might be in order before your next bumpy flight.

Aviation Safety: Flying the ADIZ

ASRS's award winning publication CALLBACK is a monthly safety newsletter, which includes de-identified ASRS report excerpts with supporting commentary in a popular "lessons learned" format. In addition, CALLBACK may contain features on ASRS research studies and related aviation safety information. Editorial use and reproduction of CALLBACK articles is encouraged.

The excerpt in italics to the right is reprinted from NASA's ARSR database

I departed this morning on a Special Flight Rules Area (SFRA) flight plan, and my intention was to maintain 1,400 feet until [laterally] clear of [Class] B airspace, which would keep me clear of the Flight Restricted Zone and all [Class] B airspace. At approximately 1,200 feet in my climb, my dog, which had been harnessed in the back seat, leapt into the front passenger seat. In doing so, he hit the dash, somehow managing to clear my flight plan out of my Garmin 430. He pulled my GDL 39 out of the cigarette lighter (my backup navigation), he knocked my tablet (also my backup navigation) onto the passenger side floor, and he ripped the microphone port of my headset out at the connector. I inadvertently made a climbing turn to 2,200 feet and may have broken into Class B airspace. A few minutes later as I was still trying to re-trim the airplane, Potomac was trying to reach me, and it was clear to me they couldn't hear me. I finally freed the cord [from under the dog] and made contact with Potomac. In doing so, my concentration was broken, and when I looked at my position, I was either in or very close to violating the FRZ. I immediately turned around and again made contact with Potomac. At this point forward I stayed clear of Bravo and the FRZ.

Flying in the Washington Area brings challenges to the pilot that few other areas in the US bring. Immediately after 9/11, the FAA and the security community established a zone around Washington that was and is an ADIZ – an Air Defense Identification Zone.

Established in the mid 20th century, the ADIZ is normally an area that can be found offshore of the United States and is used to identify and protect the country from aerial invasion (or incoming bombers). The establishment of such an area around Washington was unprecedented within the continental airspace.

That's not to say that pilots don't enter an ADIZ every day. If you have ever flown into the United States VFR in a GA aircraft from the Caribbean, you have used the ADIZ procedures as they were intended. To complete an operation like this (VFR into the United States across the ADIZ) you must file a Defense VFR flight plan.

Most pilots know that VFR flight plans do not enter the ATC system the same way an IFR flight plan does. That's because IFR flight plans are a pilot's way of asking ATC to provide separation services to their flight, whether they are in or out of the clouds. VFR flights (and their flight plans) do not engage ATC services that way – controllers do not have to separate VFR flights if they don't have the time or ability. But, there are times ATC wants to know about your VFR flight, like when you're entering the United States from offshore.

More importantly, your defense VFR flight plan is passed to NORAD and the Air Defense Sector (North East, South East, or West). They watch the radar for your flight. If they see an intruder without an assigned beacon code or at the wrong time and place (i.e., not matching a DVFR FP), they dispatch fighters to investigate. Sound familiar?

The pilot in this month's ASRS report, in any other part of the country, might chalk the episode up as a comedy of errors brought on by a friendly puppy in the airplane.

The stickler pilot might find evidence of carelessness taking a dog into an airplane that could've caused an accident.

This pilot, however, feared for his certificate – his flying privilege easily could be taken away by crossing the invisible boundary between SFRA and FRZ airspace.

Next time you are flying the corridor between GAI and ANP, know that you are being watched the same way as for Russian bombers.

Editor's Note

If there are activities you would like to have added to the Upcoming Events Page, please let Al Secen know before the 25th of the month (publication date of the newsletter).

Upcoming Events

Sat Mar 14, 2020
7am - 1pm Club fly-in: Sky Bryce Winterfest Fly-in
Where: Bryce Resort, 1982 Fairway Dr, Basye, VA 22810, USA

Sat Mar 28, 2020
8am - 10:30am PANCAKE BREAKFAST FLY-IN
Where: KPVG - Hampton Roads Executive Airport, 5172 US-460, Chesapeake, VA23321, USA

Tue Mar 31, 2020 -Sun Apr 5, 2020
All day Sun N Fun
Where: Lakeland, FL, USA

Fri Apr 24, 2020 - Sun Apr 26, 2020
All day Beer and Guns weekend in WV
Where: Boggs Field-KUSW, 217 Airfield road, Spencer, WV 25276, USA

Sun May 10, 2020
9am - 3pm Club fly-in: DeNunzio's
Where: KLBE (Arnold Palmer Regional Airport, 148 Aviation Ln # 103, Latrobe,PA 15650, USA

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