SAFETYGRAM

July 2015

As much as I prefer the generally favorable flying weather of summer, I've never been a fan of the heat. Living in Texas forced me to adapt, but let's just say I prefer area maneuvers and cross country flying up high during the summer over sweaty pattern time down low. However, just like cleaning up messes goes with raising kids (totally worth it), dealing with heat is part of summertime flying (also worth it). As the temperatures peak this month, let's review the impact on performance – for both human and aircraft performance.

I think it's pretty intuitive to most of us that aircraft performance decreases with hot summer weather conditions; you can usually see it, feel it, and measure it pretty easily. Let's take a quick look at why that occurs. First, some geeky background info: a standard atmospheric day is a day where the temperature is 59F (15C) at sea level, the atmospheric pressure is 29.92 inches (1013 millibars) of mercury, and the air is perfectly dry. So, accounting for standard atmospheric lapse rate on a standard day, if you were on an airfield with a 1000' field elevation your altimeter would be 28.86" and it would be 55.4F (and density altitude = 1000' – more on that later). I don't know why ICAO picked that as a standard day…I've never actually seen a "standard" day, especially not in the summer. Instead, I've seen that 1000' field have a density altitude of over 6000' when the humidity and temps climb into the "really sweaty" range (even when the altimeter is in the high pressure range like 30.20"). Summer temps and humidity tend to be a lot higher than standard day, and we need to account for it in our performance computations.

Because of that, we have to correct for conditions to figure out how the aircraft will actually perform. Density altitude is the altitude that an aircraft will perform as if it were actually at versus the altitude it's physically at (pressure altitude corrected for temperature and humidity). Not to be too basic, but we all know the amount of air (it's density and velocity) moving over an airfoil determines how effective that airfoil is. Wings and propellers are both airfoils; the denser the air they move through, the more lift and thrust produced. Conversely, the less dense the air, the less lift and thrust produced. What does that mean to me as a pilot? Take the same aircraft, taking off from the same airport, attempting to clear the same obstacle, and you might make it one day but not another day if the density altitude has increased significantly. Performance can be cut roughly in half during the summer vs. winter conditions. That's the key reason AFI 34-117 requires us to "compute takeoff and landing performance for each airport of intended use based on actual or forecast conditions," for all flights.

What's less intuitive to most of us and harder to measure is the decrease in human performance as we get hot and sweaty. Most people seem to take this into account during strenuous physical exercise, but for some reason we don't seem to think about it as much in a flight environment. My gut feel is that most pilots are more worried about having to use the bathroom in the middle

of a flight than the physiological effects of dehydration. When we sweat we lose water, salts, and minerals – all things our brain and muscles need for optimum performance. When it's really hot, we can lose 1-2 quarts of fluid per hour. That can have a serious effect on mental faculties and our muscles (don't forget the heart is a muscle!). I've watched students mentally shut down in a hot environment when they don't properly replace what they've sweated out. Don't let that happen to you! Get enough fluids and get the right kind of them.

As much as I enjoy a good coffee, I have to admit that coffee, soda, and energy drinks aren't good for my pilot performance in a summer environment. So instead of two cups of coffee in the morning, I'll have one small cup if I'm going to fly that day. I've also found that in addition to reducing caffeine intake, water and drinks that replenish sodium, potassium, and magnesium seem to help me out quite a bit. In short, I make a concerted effort to take care of my body in hot conditions so it'll take care of me in flight. Sometimes, that may even mean allowing for an extra bathroom stop on long cross country flights…

Finally, since we've been talking about performance I thought I'd end on a fun fact about the term "V Speeds" from the May/June FAA Safety Briefing: do you know what "V" in V Speeds stands for? Answer: "Most native speakers of English assume that V is for velocity, and that mostly works. To be precise, though, the word velocity means "speed in a particular direction." Technically, V stands for "vitesse," another aviation term borrowed from the French; "vitesse" being the French word for "speed" or "rate."

FAA Safety Briefing (Magazine):
http://www.faa.gov/news/safety_briefing/

Pilot's Handbook of Aeronautical Knowledge (Density Altitude):
http://www.faa.gov/regulations_policies/handbooks_manuals/aviation/pilot_handbook/media/PHAK%20-%20Chapter%2003.pdf

Rehydration:
http://www.nata.org/sites/default/files/FluidReplacementsForAthletes.pdf

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