Four H Weather

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The hot, hazy, humid weather we've had so far during Soarfest can easily lead to hyperthermia. Heat and dehydration are special dangers to soaring pilots, and no doubt contribute to accidents in the desert southwest, as suggested by Tom Knauff in this month's Soaring. The essence of a previous discussion, mistakenly erased from this site, is presented here, with some enhancement.

For the same ambient temperature (say 96F), hot and humid is even worse than hot and dry, so a pilot could potentially be at greater risk in Dansville or Julian than in Arizona (the problem in the desert is that it gets a lot hotter than 96F). The life-saving mechanism of evaporative cooling is roughly proportional to the dew point depression (difference between temp and dew point): In an environment of saturated air above 100F, you would eventually die regardless of how wet you stayed. The body strives for life, in hot weather by sweating, and shunting blood to the skin by peripheral vasodilation (where it is cooled by the evaporating sweat), especially the head and scalp, since a disproportionately large amount of blood flows through them. But sweating is a double-edged sword: as sweat evaporates, the body loses water which came from the blood plasma, with three main negative physiologic effects: The blood volume decreases, and because red blood cells (RBCs) do not evaporate, the fraction of RBCs in the blood (the hematocrit) increases; this causes the viscosity of the blood to increase. Both of these factors make it harder for the heart to pump blood to the periphery. Furthermore, electrolytes in sweat, particularly sodium chloride, which again initially came from the blood plasma, are lost: hyponatremia is the principal electrolyte imbalance. These factors result in a vicious cycle (positive feedback loop), which can lead to a medical flight emergency (e.g. a seizure, or fainting from hypovolemia) before the affected individual realizes it.

How to cope? Obviously one needs to drink copious fluids containing appropriate electrolytes (e.g. Gatorade). Drinking just water will wash out sodium chloride, which can ultimately be fatal (as it was for a college student pledging for a frat in upstate NY not long ago): hyponatremia. Now if you drink all that water, your body will have to pass the excess; and if you have not developed the equipment and psyche for on-board relief, you won't drink enough. One can help matters greatly just by augmenting sweating! Keep yourself damp or wet. Carry a little spritzer up with you and spray yourself. Keep your hat, head, and scalp damp and cool. Carry a little towel if necessary to wipe your glasses. This way you avoid the electrolyte and blood plasma loss (it should be obvious the water in your spritzer can be pure). You also minimize the need to drink so much, and consequently the need for "plumbing". I've found that cotton is the best fabric for keeping you damp and cool; polyesters are designed to wick moisture away from the skin...you want the skin to lose heat by conduction (contact) with the water. For precisely the same reason, cotton is the worst fabric to wear in winter, if you're concerned about hypothermia.

Thermoregulation of the human body is primarily controlled by adjusting the diameter of blood vessels, principally arteries. The blood flow, when laminar as is usually but not always the case, is proportional to the fourth power of the diameter, so only slight changes have a big effect. To counteract hyperthermia, pheripheral vessels dilate, shunting blood to the surface for cooling, as

mentioned. Similarly to counteract hypothermia, they constrict and shunt blood to the vital body core (the body rates the heart and lungs as more vital than the brain). Key for our 4H note is the effect of age, which advances with concomitantly decreasing ability to change diameter (atherosclerosis, which actually begins much earlier in life than commonly appreciated). Thus the risk of heat exhaustion or stroke is significantly greater for older pilots like myself. Sometimes very high time pilots, who tend to be older, crash for no obvious reason which is food for thought.

Safe and cool flying.

Ray