



**Stan/Eval Newsletter
CIVIL AIR PATROL
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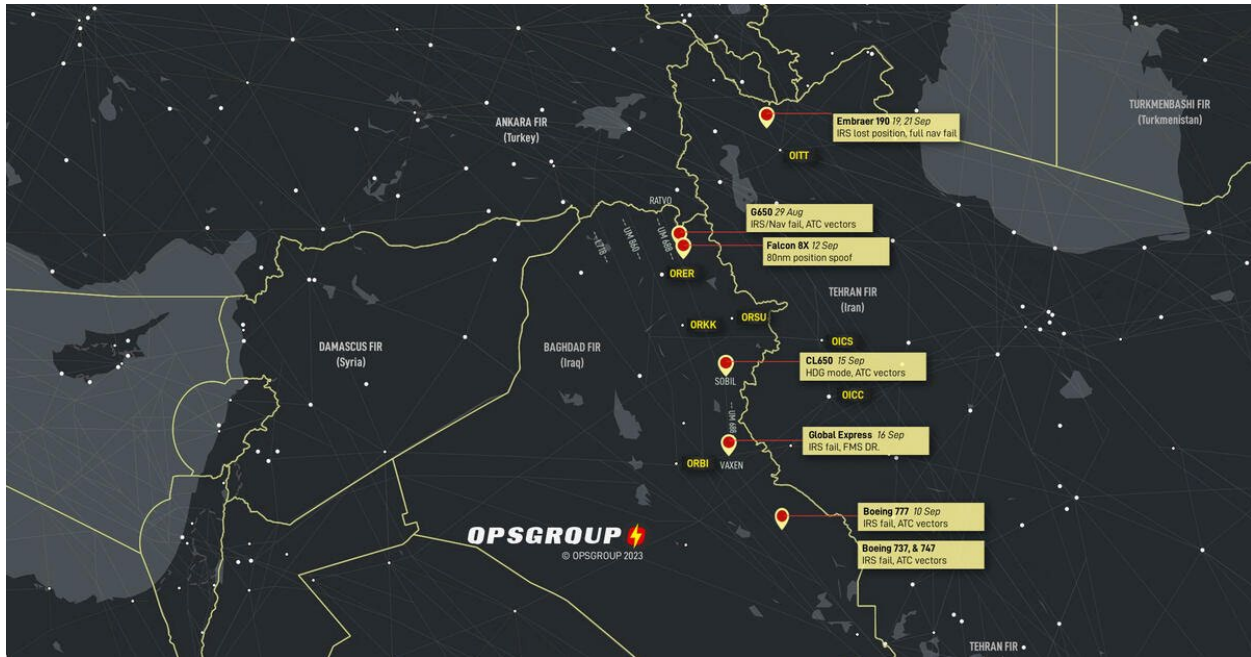
Table of Contents

<i>Spoofing GPS (AVWeb)</i>	2
<i>Fuelish Mistakes (AINAlerts)</i>	3
<i>Back to Basics - Navigation:</i>	3
<i>Doing Nothing (Capt Gianna, NYWG)</i>	5

Spoofting GPS (AVWeb)

Some people may wonder why we still require pilots, especially Mission Pilots, to be able to navigate by other than GPS. After all, GPS is accurate, easy to use, and is omnipresent in the CAP fleet. There are several reasons for this. One reason is that in a national emergency, just when the nation needs us the most, the Air Force (who controls GPS) may opt to turn GPS off. This would be done to deny terrorists or invaders navigational information. But by its nature, GPS is a very weak signal as GPS satellites don't have much transmit power to spare which in turn makes it vulnerable to jamming or worse. Worse means spoofing. AVWeb explains in an article that came out 27 September as follows:

“Someone in the Middle East has figured out how to spoof GPS data and it's playing havoc with aircraft navigation. [OPSGROUP](#) (a site used by airline, business, and cargo pilots) is reporting that aircraft using Airway UMB688 in northern Iraq are experiencing complete navigation system failures because the hacker replaces the position data beamed by the GPS signals with false coordinates. “[Twelve] separate reports have been now received by OPSGROUP, and in most cases the [Inertial Reference System] becomes unusable, VOR/DME sensor inputs fail, the aircraft UTC clock fails, and the crew have been forced to request vectors from ATC to navigate,” the site reported.



OPSGROUP says all the aircraft involved have state-of-the-art navigation systems and include a range of Boeing, Gulfstream, Dassault and Bombardier aircraft. The publication stressed that this is not ordinary GPS jamming, which is a common occurrence in the area. The attacks have all been the same so far. The specific GPS receiver on a single aircraft is sent a signal that shifts the displayed position by 60 nautical miles. The aircraft's nav systems freak out at the sudden change in data and in almost all cases the screens become useless. Crews then must call ATC for vectors

to stay on course. The publication says the loss of precise navigation data is especially dangerous in that area because of military action and the proximity of Iranian airspace, entry to which will likely prompt a military intercept.”

So, it is serious business to be able to navigate using VORs, pilotage, and/or dead reckoning. It also raises the question of whether you would notice that your GPS is giving you erroneous information. Having your position jump 60 miles would be a good indicator but it might be a lot more subtle and not easily detected. Good discipline is to occasionally verify in flight that what your VOR navigation is telling you and what GPS is telling you are consistent. Doing so will improve your VOR skills while at the same time increasing your appreciation for how easy GPS has made navigation!

Fuelish Mistakes (AINAlerts)

Fueling aircraft with the wrong type of fuel can lead to a complete loss of engine power causing serious injury or death. This is most critical when an aircraft powered by a reciprocating engine is fueled with kerosene-based jet-A fuel rather than aviation gasoline (avgas). According to the FAA, a reciprocating engine burning jet-A fuel at high power settings suffers detonations, rapid loss of power, and high cylinder head temperatures, quickly followed by a complete engine failure.

For a variety of reasons, according to investigators, reciprocating engine-powered aircraft continue to crash with the wrong type of fuel in their tanks. These crashes are often deadly since there is just enough avgas in the aircraft’s fuel system to take off and begin its initial climb—to a low altitude—where the mixture of jet-A becomes great enough to cause an engine failure.

On Oct. 5, 2019, a Piper Aerostar 602P crashed less than four miles south of the Kokomo Municipal Airport (KOKK) in Kokomo, Indiana. The sole ATP-rated pilot was fatally injured in the crash. The NTSB cited in the probable cause “a dual engine power loss caused by the line service technician fueling the airplane with the wrong fuel, which resulted in an aerodynamic stall and subsequent loss of control.” The report continued, saying, “Contributing...was the pilot’s inadequate supervision of the fuel servicing.”

Back to Basics - Navigation:

To pass our private pilot check ride, we had to demonstrate basic navigation skills in addition to following the magenta line on a GPS. GPS has revolutionized navigation for GA and a lost pilot is almost unheard of nowadays. Even yet, basic navigation skills are ever more important for CAP Mission Pilot. In time of crisis, our nation will rely on us to carry out our missions even when GPS is disabled which is a high probability event for certain national emergencies. Even the venerable VOR may not be available. So, time to brush up on basic navigation. Without a GPS, ADF, LORAN, VORs, or inertial Nav, what’s a pilot to do?

Two basic navigational techniques are dead reckoning and pilotage. Pilotage is navigating by reference to the ground such as following a river or a road. Or flying from a visible waypoint (mountain top, airport, tower, and so forth) to another visible waypoint. This is a very effective way to get from point A to point B and up until electronic navigation came on the scene it was the way most pilots navigated. Plus, it’s fun to do. Get out that sectional, do a little planning, and you can navigate to anywhere in America if the visibility is good and the TFRs low. Pilotage is what we

use in the pattern or close to an airport. Of course, pilotage doesn't work so well when the visibility is poor. Getting lost is possible even with CAVU conditions if waypoints are hard to recognize or you inadvertently follow the wrong road. Pilotage is a good way to discover that sectionals have their limitations as there are many roads and rivers down there not depicted on the chart and waypoints visible on the chart

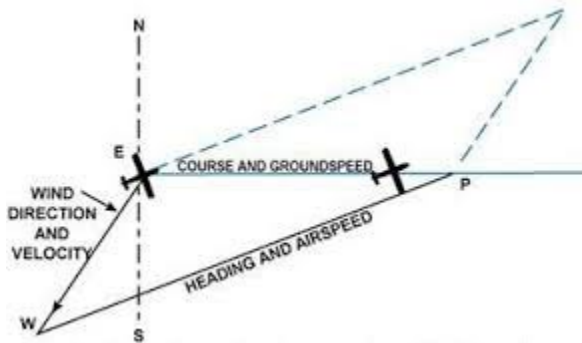


may not be obvious from the air and vice versa. So, although pilotage is straightforward and can be easy, it can be confusing and requires some skill in the planning so that easy to spot waypoints are chosen. As in anything having to do with aviation, you always need a plan B. What will you do if things don't seem to be working out? Have an alternate or an easy to find waypoint you can return to for re orientation. As with any other aviation skill, pilotage requires practice to stay proficient. So, take your GPS in case you get lost, but try and navigate by pilotage on your next flight (VFR please!) and see how you do. It's a lot more interesting and fun than following the magenta line.

The other basic navigational technique is dead reckoning. This involves flying a heading for a given amount of time. Whereas pilotage depends on looking outside, dead reckoning depends on a compass and a stopwatch. To get from point A to point B, you figure out the heading to fly and the time it will take. This can be extremely accurate if you know winds. To get the heading to fly you can use a wind triangle or an E6B (remember those?). Even if you are a bit off, you will be amazed at how accurately you can navigate.



Most of the time, we use a combination of pilotage and dead reckoning. We start at point A, dead reckon to point B, and then look out the window to see if we can see B. If you are good, you can use the difference between your position and the position of point B (the "error") to modify your next dead reckoned leg. How accurate is this? That depends on the skill of the pilot/navigator. This is precisely the technique that Lindbergh used to go from New York to Paris. When over the ocean where there were no landmarks (and he was essentially IFR), he relied solely on dead reckoning to approximate a great circle course. He had some notion of the winds and would adjust his heading every hour to correspond to the great circle course. He crossed the coast of Ireland within 3 miles of his plan after flying something on the order of 3,000 miles. Not bad.



One of the rules of thumb for pilotage and dead reckoning is to keep your legs short. That way if you make a mistake, you haven't strayed too far off course. Plus, short legs allow you to check your progress (assuming you aren't over the Atlantic) fairly often.

For CAP Mission Pilots, basic navigation is mandatory, not optional. There will come a time when that will be the only way we will be able to fly a mission. Be ready for that. Keep your GPS but navigate using the basics as often as you can.

Doing Nothing (Capt. Gianna, NYWG)

Our CAP 182T was ready to take off at the busy airport. The crew had completed the startup checklist and received taxi instructions from Ground control and had made it to the run-up area. We were completing the before takeoff checklist and going through the run-up process as two private jets lined up for the runway before the run-up pad.

Think of it this way: there was a "little jet" followed by a "big jet." Seeing this and envisioning us stuck behind an ever-growing line of jets, we asked to takeoff "in sequence" with the other traffic. Our CAP 182 was "number three for takeoff."

At this time, there was a series of busy inspections from the tower and complex interactions between tower and aircraft. Planes were cleared to land in sequence, planes were cleared to takeoff from other runways, orders to "lineup and wait" and turnoff instructions.

Little Jet began to inch forward toward the hold line. It moved a couple of feet, then stopped. Then it moved a couple of feet again, then stopped. It hesitantly began to move forward again, this time crossing the hold line and then coming to a stop. Half of Little Jet was over the line, half was behind the line. Meanwhile Big Jet slowly inched up behind Little Jet.

The crew of Little Jet called the tower to confirm their takeoff instructions. Tower reminded them to "hold." A brief conversation followed. The crew of Little Jet was confused. They thought they had been cleared to takeoff. They were not.

"Where are you now?" asked the tower.
"We are over the hold line."

On the radio, a landing corporate jet announced, "we are going around."

Tower then cleared up the mess, sent the two jets on their way, re-sequenced the landing traffic, and put our 182 into the takeoff lineup and sent us on our way.

What happened here was a runway incursion caused by an apparently inexperienced or overworked crew. Perhaps they were task saturated. Or simply confused by the complex radio communication.

As a rule, as a PIC if you aren't sure, DO NOT MOVE. Certainly, do not cross a hold line if you aren't sure you are cleared to cross. There may be some exceptions at times when it would be dangerous to sit where you are and need to move ASAP. But in general, the safest option is to stop and hold where you are and get clarification. If the radio traffic is busy, you may need to wait to get bandwidth. And while this is happening, you need to ignore the "pressure" to do something. Sometimes the best thing to do is nothing.

Articles for the National Stan Eval Newsletter:

These articles have been written to present ideas, techniques, and concepts of interest to CAP aircrews rather than provide any direction. The articles in this newsletter should in no way be considered CAP policy. We are always looking for brief articles of interest to CAP aircrews to include in this newsletter. CAP has many very experienced pilots and aircrew who have useful techniques, experiences, and tips to share. Please send your contribution to stephen.hertz@vawg.cap.gov. You can view past issues [here](#).