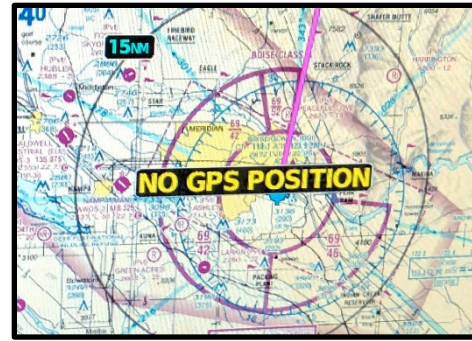


FLIGHT ADVISORY GPS INTERFERENCE TESTING

GPS Jamming in General Aviation

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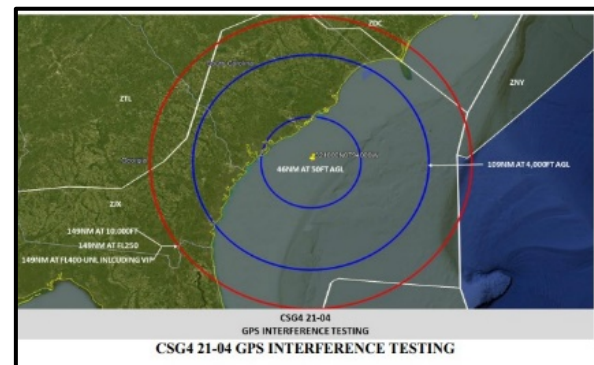
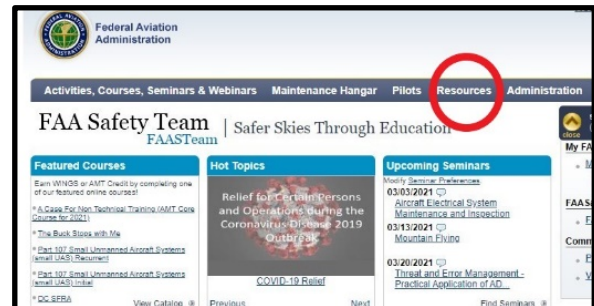
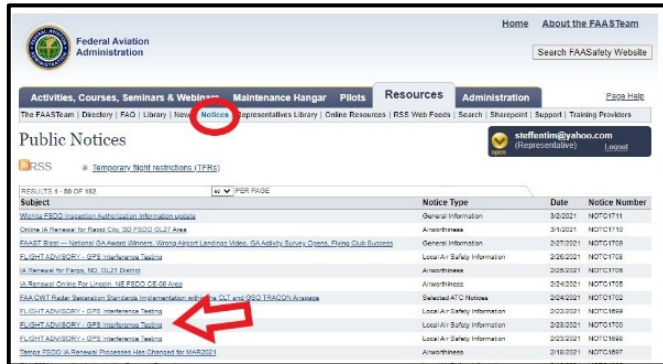
It is a cold morning in February. As you climb on departure you hear Big Sky announce “GPS Jamming will commence in 5 minutes”. IFR conditions prevail throughout southern Idaho. What do you do next?

Our modern world increasingly relies on GPS. GPS is the primary navigation system for most of the population, whether on the ground, in the air or on the water. The GPS signal, however, is vulnerable to interference from a variety of sources. This vulnerability has led the military to increasingly practice with GPS jammed. The many vulnerabilities are detailed in two documents cited at the end of this article. This article will focus on the nuts-and-bolts of coping with GPS jamming in General Aviation (GA) aircraft.

Preflight Planning

Your earliest notice of upcoming GPS jamming is available in “Flight Advisories for GPS Interference”. Go to <https://www.faa.gov> then go to FAASafety – Resources – Notices. Here you can find the bulletin for your area, which includes a map of the area of GPS interference. You can also have notices sent directly to you via email.

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Planned times for GPS jamming in those exercises can change. Your most up-to-date information will be in the GPS NOTAMS. These NOTAMS are on the FAA site, but you find them under “Predefined Query”.

“A Quick Way to Search for GPS NOTAMS” from BruceAir shows you how to navigate the FAA NOTAM page to the section with GPS NOTAMS. See the citations section of this article for the link or search for the title online with your favorite search engine.



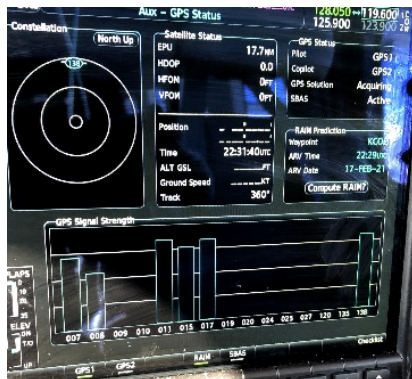
Armed with knowledge of the upcoming jamming, your preflight planning can include appropriate backups. What airways can I transition to in the area of the jamming? What radial/DME can define my courses or fixes in the jamming volume? If my destination is near jamming, do I have an approach and transition that I can fly without GPS? How about my alternate? Alternate considerations are just like the pre-WAAS days – I need a way to land without GPS.

GPS Interference Indications

The GPS Status page of your navigation system will show you losing satellites as the jamming signal overwhelms your receiver. You will start with a full set of satellites locked, then watch those drop off line. These pictures show that happening to a Garmin G-1000. As you get below 4 or 5 satellites you will first lose precision approach capability (no LPV) and get a “Loss of Integrity (LOI)” caution, followed at some point by “Dead Reckoning (DR)”.

One of the more disorienting aspects of GPS loss is most moving maps act erratically with signal loss. The moving map starts to twist or rotate erratically as it tries to figure out the aircraft track.

ADS-B positions and alerts are now unreliable, and if your plane calculates a wind arrow you can expect that be gone. Also remember if the GPS gets lost it can no longer compute your time or fuel correctly.



Some of you may know that iPads and some other portables use GPS as well as GLONASS (Russian GPS). So will they still work? It may be worth trying. GPS and GLONASS are very close together in the radio spectrum though, so I have yet to see a portable device stay locked when a navigation system quit. GPS interference can come from a variety of sources though, as detailed in the two articles cited at the end.

TAWS warns you of proximity to terrain based on your GPS position. When that position is lost, expect spurious terrain warnings along with the previously mentioned moving map rotation. This picture shows a TAWS warning while flying at FL 200 over Cascade during GPS Jamming.



Reaction to Jamming

Fortunately the Laws of Physics still apply, even without GPS. Dead Reckoning, Pilotage and VOR enroute navigation should get you to most locations. Remember if you aren't receiving the NAVAID ahead of you, a radial from the one behind you might work just fine.

Our techniques for approaching GPS jamming include:

1-Aviate – Set your heading bug to the wind-corrected heading that is holding you on course. If the autopilot is flying, we select heading mode so the plane doesn't try to chase bad course information. Check the GPS status page.

2-Navigate – Select the appropriate NAVAIDs and ensure reception. Switch to "Green Needles"/VLOC etc. with the appropriate course selected.

3-Communicate – Notify ATC of degraded navigation capability. "We are GPS out, request direct Donnelly then..." In extreme circumstances, when safety of flight is uncertain the correct callout to stop jamming is "CEASE BUZZER" to ATC or on the Emergency Frequency if jamming is causing or complicating a hazardous situation.

Additional Notes

DME Issue – many GA aircraft are certified to use the GPS in lieu of DME. Some still have DME. In many aircraft it is not very clear which system is being used to generate DME. If your aircraft uses GPS for DME, then you cannot fly approaches requiring DME while suffering GPS interference.

GPS Deception – This article describes dealing with GPS "Denial" where the signal is lost to interference or jamming. The New Yorker article in the citations includes several examples of GPS "Deception". With deception, your aircraft will seem fine (no cautions or flags), but you will not be where the GPS indicates. In this case, checking your position against legacy nav aids can be critical even when everything "looks fine".

It is a cold morning in February. As you climb on departure you hear Big Sky announce “GPS Jamming will commence in 5 minutes”. IFR conditions prevail throughout southern Idaho. What do you do next?

Having reviewed the NOTAMs and planned for this outage, you select heading mode and check the GPS status page. Before GPS is lost, you note the winds and your wind correction. Your NAVAIDs were set up prior to takeoff, so the transition to VORs will be simple. As satellites disappear from your screen you are mentally prepared for the cautions, warnings and TAWS alerts plus the loss of wind and traffic information. You notify ATC once GPS is lost and request an amended clearance if needed.



Citations

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