THE SECOND CIVIL GPS FREQUENCY --

CLARIFYING THE ASSUMPTIONS

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I. RECENT HISTORY

The 2000 DOT budget included $17 million for a second civil frequency for GPS, as previously announced by Vice President Al Gore.

The Congress eliminated the funding from FAA's budget. A Congressional footnote explained that the second frequency benefited users other than aviation, and there would be no objection to funds being reprogrammed from other agencies' budget for the project.

This demonstration of Congressional independence surprised FAA and, presumably, the White House as well. Hands were wrung in the Executive Branch.

Was this really a loss? And if so, to whom?

II. WHAT THE SECOND FREQUENCY DOES

The proposed second civil GPS frequency primarily provides a duplicate signal to the existing one. Currently, if the GPS frequency is lost the positioning and timing service is lost. This is a fairly frequent occurrence in the US, and is a more or less permanent situation in Italy where a harmonic of the TV signals block GPS. So if one of the two proposed frequencies is blocked, the other would continue to provide service. This is a useful, and relatively low cost, improvement for some users. But not necessarily for all.

III. UNINTENTIONAL INTERFERENCE

The second frequency is a definite protection against unintentional interference such as a stray radio or TV signal. The likelihood that the stray signal would block two frequencies is very small. For users of GPS who rely solely on GPS for positioning and timing, such as

motor vehicles, emergency services, police, railways, surveyors, agriculturists, backpackers, etc., this is a definite improvement. These users are not in the "safety of life" category and do not need a dissimilar, redundant, signal. For these users the second frequency will improve the continuity of GPS. Ninety-five per cent of the users of GPS are not in the safety of life category. Make no mistake—the second GPS frequency is a good idea.

IV. INTENTIONAL INTERFERENCE

Intentional interference is another matter. The GPS satellite is at a medium orbit of 11,000 miles and transmits with a power of just one watt. The received power on the ground is 1^{-16} watt—one ten quadrillionth of a watt. A simple 5 watt noise jammer on the GPS frequency can kill the GPS signal to a range of 200 kilometers. A jammer borne by a small weather balloon can kill GPS in an area 800 miles wide.

And here's the rub: it's as easy to jam two GPS frequencies as it is to jam one. Therefore, the second civil frequency provides no protection against intentional interference.

Here's a recent insight. Several weeks ago, at an RTCA hearing on GPS in London, an FAA official stated that the second frequency would provide a "back-up for GPS." A man in the audience rose, stated that his job at the UK Ministry of Defense was to jam GPS, and said, "I can jam two frequencies as easily as one." Of course.

V. AVIATION AND MARINE NAVIGATION

Navigation by GPS for airplanes and vessels is a classic safety of life application. Loss of radionavigation for aircraft in bad weather could easily cause multiple crashes—if the aircraft are only equipped with GPS. The civil aviation world is now fully aware of this risk and consequently GPS "sole means" navigation is a dead issue. A full array of ILS's will be retained and some type of en route radionavigation system – probably both LORAN C and DME—will be teamed with GPS to provide a truly redundant, failsafe mixture.

With this blended array on board, loss of GPS will not cause a loss of navigation. LORAN C and DME/DME navigation is virtually as accurate as GPS, so there will not even be an erosion of performance. The pilots may not even notice that GPS is gone. ILS or MLS will provide precision approach.

VI. IS THE SECOND FREQUENCY NEEDED?

The requirement that aircraft carry a back-up navigation system in addition to GPS means that loss of GPS will have a limited impact on aviation safety and utility.

The top 640 airports in the US are equipped with one or more ILS's, and for aircraft destined for these airports, the effect of loss of GPS will be virtually nil. For aircraft destined for a non-ILS airport and intending to make a WAAS/GPS precision approach, there will be a loss. In that case, a non-precision approach must be made or the aircraft must divert to an ILS equipped airport. GPS precision approaches primarily benefit small airports and general aviation, and for these beneficiaries the second civil frequency will be useful to protect against unintentional interference. But no aviation (or other) user will be protected from intentional interference by the second frequency.

VII. GPS AS A SUPPLEMENTAL NAVIGATION SYSTEM

The death of GPS sole means navigation can be summarized as follows:

- GPS can only be used when teamed with a dissimilar system for all phases of flight—en route, terminal maneuvering, and precision approach. GPS, therefore, is a supplemental navigation system.
- VOR/DME, DME/DME, ILS, MLS and TLS can be used as stand alone systems and can be used without GPS. They are primary systems.

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