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Vulnerability Issue Delays GPS-Based Aircraft Navigation

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A recent report on Global Positioning System (GPS) vulnerability was a significant factor in the U.S. government's decision to delay by two years its planned transition to the satellite-based system for civilian aircraft navigation.

The transition from land-based radionavigation systems to primary reliance on the GPS satellite constellation, previously targeted for 2008, is now envisioned in 2010. The revised schedule is outlined in the 2001 Federal Radionavigation plan, which was released March 26 by the U.S. departments of Transportation and Defense.

The Federal Radionavigation Plan is a policy planning document for federally operated radionavigation systems that is updated every two years.

Mike Shaw, director of radionavigation in the Department of Transportation, said the revised timetable in the latest plan is based in part on the findings of a federally sponsored study that concluded that signals from the GPS system are vulnerable to both incidental and deliberate interference.

That study, dubbed "Vulnerability Assessment of the Transportation Infrastructure Relying on the Global Positioning System," was prepared by the Volpe National Transportation System Center of Cambridge, Mass. It was released Sept. 10.

"Clearly when the [Volpe] report first surfaced, people took it seriously," said Howard Aylesworth, director of airspace systems at the Aerospace Industries Association here. This radionavigation plan "is a serious attempt to try and assess the risks and look at any remedial measures that might be necessary," he said.

The GPS system consists of roughly 24 satellites that provide position-location, time and speed information to receivers anywhere on the globe. It was developed by the U.S. Air Force primarily for military navigation, but also transmits signals for civilian use.

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Mike Shaw

"We are seeking a sensible transition to satellite-based navigation services as our primary means of navigation, while recognizing the need to maintain backup navigation aids where required," Norman Mineta, the U.S. Secretary of Transportation, said in a statement.

Shaw said additional time is needed to integrate two new civilian signals slated for introduction into the GPS satellites, as well as to bring ground-based GPS augmentation systems on line.

The new civilian signals, L2 and L5, are slated for introduction in 2003 and 2005, respectively. The initial operating capability for the L2 signal is slated for 2008; for L5 it is 2012.

The new civilian signals will be more accurate than those now available, and also will be less vulnerable to physical obstruction or unintentional interference from electronic devices that operate in the same frequencies, Shaw said.

But the new signals still might be vulnerable to intentional jamming, Shaw said.

"Unintentional interference hits one frequency so it can be mitigated with multiple frequencies, but there are still those out there who would wish to engage in intentional interference," Shaw said.

The Department of Transportation is working with the Pentagon to reduce that vulnerability, Shaw said.

A Pentagon official said a variety of options for protecting the civilian signal are available, depending on what the Transportation Department wants.

"We told the Department of Transportation they need to determine their requirements for interference rejection," the Pentagon official said. "They need to go to their user community and look at what their planning will be for GPS-based services and determine how much interference rejection they need."

Once civilian GPS users determine their requirements for signal protection, the Pentagon can determine which technologies can be made available, the official said. "There are plenty of anti-jam technologies, and the levels of sophistication and cost are very much dependent on how much rejection you want," the official said.

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The U.S. government's plan for modernizing the GPS constellation and delaying the transition from primary reliance on ground-based navigation services could mean a multibillion-dollar opportunity for the GPS industry, Shaw said. "We think there will be a capability for more applications that we don't even know of today," he said.

Ron Stearns, a consulting analyst with the aerospace and defense group at Frost & Sullivan, Mountain View, Calif., is not so sure.

"At first glance, it's difficult to quantify," Stearns said. "If [GPS receiver] manufacturers were to come out with a system that could accept both GPS and ground-based radionavigation signals, they could have a very viable and popular product."

But most of the companies will wait for the government to more clearly define the GPS operational standards before they commit money to product development, Stearns said.

"For a manufacturer to move forward aggressively and design new products, they have to know what aspects and capabilities everyone has," Stearns said. "There is still some ambiguity in what they need to do to meet the customers' needs."

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