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USAF Renews GPS III Focus

By Robert Wall, Washington

The U.S. Air Force is about to make key decisions on the future GPS III program and is reinvigorating the development that had slowed while the Pentagon addressed more near-term concerns with the GPS constellation.

The wide-reaching GPS III program is to redefine the architecture for the space-based navigation and timing system and ensure its viability for another 30 years. It is to address a multitude of issues, including the design of the spacecraft, spares requirements, signal strength and protection of the constellation against attack.

But the Pentagon has been distracted during the last few months, trying to determine how to upgrade the signal on the GPS IIR and GPS IIF satellites. That effort has kept USAF managers from aggressively working on GPS III. Now the Pentagon has given the green light to the GPS II upgrade, which will allow operators to boost by a factor of 10 the power of the signal from the satellites and overcome jamming. The power increase is made possible by adding solar panels to the spacecraft before launch and through a mechanism to divert power from either the precision P-Code or the newer military M-Code to boost power for the other. First launch of a satellite with that feature is slated for October or November 2003.

But that improvement won't be enough for the long term, military planners believe, since jamming techniques are expected to become more sophisticated, and U.S. users will want more capability. Moreover, the ability to transfer power between the two signals won't be an option in the future when both are used heavily by warfighters.

For the GPS III phase, Air Force officials plan to invite industry bids in August. Contract award is planned for early next year, says Col. Douglas Loverro, the GPS program director. Teams led by Boeing, Lockheed Martin and Spectrum Astro have been involved in architecture studies. The Pentagon's space czar, Peter B. Teets, in the coming weeks is to decide what the acquisition plan will look like. The Air Force projects a first launch in 2010, although the timetable could be adjusted depending on the in-orbit life of existing satellites.

The next-generation satellite is supposed to provide 100 times more power than the current ones, with a signal increase of at least 20 dB. Contractor studies have shown an increase of 25 dB. would represent the right mix of capability and cost. That will be achieved, in part, by giving the spacecraft a single spot-beam capability to focus power and signal strength on a given area. The goal is "to fix the jamming threat once and for all," Loverro said.

Another area the Air Force has identified for further improvement is accuracy. The service already is gradually enhancing accuracy from 2 meters (7 ft.) to less than 1 meter. However, that doesn't mean a GPS signal can guide a bomb to within 1 meter of its target. Due largely to the constellation's

geometry, bomb accuracy of only 3-5 meters can be achieved. The goal for GPS III is to refine the signal to 20-50-cm. (8-20-in.) precision to allow a bomb to be delivered within 1-meter accuracy, Loverro said. That level of precision is needed to minimize unintended consequences. And, as the military fields smaller bombs, it will need greater accuracy to ensure the weapons can still destroy a target.

Another major change for the constellation is expected to be a move from six orbital planes to three. Also, spacecraft will be placed in nonrepeating orbits, unlike today. Loverro said that shift should deliver better signal availability at marginal cost. A three-plane architecture would require two additional satellites over its 30-year life. However, Loverro said that would be offset by a reduction in the number of spares needed. The effect of the change should be to increase the availability of highly accurate GPS signals. Currently, accuracy fluctuates over a location during the course of a day.

Attention also will be placed on reducing the vulnerability of the GPS system in terms of physical security for ground stations and cryptographic security for the signals that communicate with the spacecraft. The Pentagon also wants higher signal integrity to allow the signals to be used for critical activities such as landing commercial aircraft. The goal is to make the system's availability and accuracy more reliable and also to let users know the "health" of the signal by monitoring it in real time. That would allow operators relying on the signal to switch to manual operations when the signal is degraded.

USAF officials are confident they can execute the program at a reasonable cost. Boeing, Lockheed Martin and Spectrum Astro have "engineered systems that met the [GPS III] goal with very affordable approaches," Loverro said. However, detailed cost estimates won't be developed until the next phase when architecture designs would be refined.