



United States Air Force

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Report to Congressional Committees

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Global Positioning System  
III Space Segment  
Suitability for Multi-Year  
Procurement

April 2014

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## 1. Introduction

This report was prepared as directed on page 162 of Senate Report 113-44 to accompany S. 1197, the National Defense Authorization Act for Fiscal Year 2014 (FY14 NDAA). The report language states:

*In an effort to reduce acquisition costs, the committee directs the Secretary of the Air Force to assess the feasibility and advisability of multi-year procurement of the GPS III satellite system under existing authorities. The assessment shall be due by February 28, 2014.*

This report responds to the committee's direction by describing the overall feasibility and advisability of multi-year procurement of the GPS III satellite system. This report does not constitute an Air Force position, but rather one option the Air Force is evaluating for procuring future GPS III satellites at a reduced unit price.

## 2. Executive Summary

Title 10 United States Code (USC) Section 2281 directs the Secretary of Defense to provide for the sustainment of the global positioning system (GPS) services to benefit both national security and civil interests. The current GPS constellation consists of a mix of 31 GPS IIA, IIR, IIR-M, and IIF satellites, with additional GPS IIF satellites being added. GPS III satellites fulfill two roles: sustaining the constellation; and providing enhanced capabilities to the warfighter. The GPS Program Office continually assesses methods to reduce GPS satellite procurement cost to the government and the United States taxpayer. Multi-year procurement (MYP) is one option that has the potential to reduce GPS III satellite unit cost.

A primary feature of MYP contracting is a mutual long-term, large quantity commitment by the government and prime contractor to enable savings. MYP contracting also encourages industry investment in product, factory processes, and key personnel that would not be practical without government commitment for a larger quantity buy. The resulting stability, often a benchmark of profitable commercial programs, becomes a characteristic of the government program.

A GPS III MYP contract order for multiple satellites would enable the prime contractor to establish long-term commitments to a supply chain for large lot buys of components, parts, materials, and associated effort. Currently, the GPS program procures an average of two satellites per year under an annual buy structure. While this allows the government the flexibility to adapt to a changing budget profile and constellation needs, it prevents the program from realizing savings that MYP could provide.

The GPS III Program Office conducted an MYP analysis comparing the current status of GPS III against the MYP criteria contained in 10 USC 2306b. Conditions that are required for MYP contracting include: 1) substantial savings; 2) a stable need for the items; 3) an expectation that sufficient funding will be requested to avoid contract cancellation; 4) stable design for the items and low technical risks; 5) realistic cost estimates; and 6) the promotion of national security.

The GPS III program expects to meet all MYP conditions no earlier than FY16. Substantial savings (MYP criterion #1) can be achieved by providing a stable, long-term commitment and a stable production environment for the prime contractor and its supply chain. A stable need for GPS satellites (MYP criterion #2) derives from the Department of Defense's (DoD) mandate to comply with 10 USC 2281 for constellation sustainment. A stable GPS III design (MYP criterion #4) will be validated following completion of development for the first satellite, and technical risk will not be excessive following delivery and test of the first navigation payload. Realistic cost estimates (MYP criterion #5) will be based on actual costs from two development satellites and from completed elements of four production satellites. Sustaining the GPS constellation is a national security requirement (MYP criterion #6).

While all of the above are true, other considerations have to be fully analyzed before making a commitment through an MYP contract (MYP criterion #3). One of the primary

## *Global Positioning System III Space Segment Suitability for Multi-Year Procurement*

requirements for GPS III is to replenish the constellation. Based on that requirement, a healthy constellation reduces the need for larger annual buys of GPS III satellites in the near term. In addition, early-to-need procurement would require unnecessary funding for satellite storage. In a budget-constrained environment, the Air Force would not procure more GPS III satellites than are needed to maintain the constellation.

At this time the Air Force is conducting trade-off analyses associated with future GPS space vehicle acquisition strategies including, but not limited to, evolution of future GPS III requirements, GPS constellation sustainment need dates, and GPS program affordability within the defense budget. If affordable, the Air Force plans to present a GPS III acquisition approach to DoD that balances cost, performance and flexibility. At this time, analysis indicates that MYP contracting for GPS III is not feasible until at least FY16.

### 3. Report

#### 3.1 GPS III Program Description

Title 10 United States Code (USC) Section 2281 directs the Secretary of Defense to provide for the sustainment of the global positioning system (GPS) services to benefit both national security and civil interests. The current GPS constellation consists of a mix of 31 GPS IIA, IIR, IIR-M, and IIF satellites, with additional GPS IIF satellites being added. The Space and Missile Systems Center's GPS Directorate (SMC/GP) is in the process of an enterprise modernization effort of space, ground, and user segments. The space segment modernization began with GPS IIR-M and IIF satellites, which added flexible power and modernized signal capabilities. GPS III is the third generation of satellites that sustain current positioning, navigation, and timing (PNT) and United States nuclear detonation detection system (USNDS) services while incrementally fielding new capabilities in a risk-managed approach to achieve the full capabilities defined in the GPS III capability development document (CDD). GPS III satellites fulfill two roles: constellation sustainment; and providing enhanced capabilities to the warfighter.

GPS III's acquisition strategy has two key elements: (1) establishing low-risk/high confidence development; and (2) maturing technology and reducing risk to enable follow-on capabilities. In September 2010, the GPS Program Office completed Milestone C (MS-C) for GPS III satellites one through eight. These satellites will add: eight times more M-code power, enabling greater military anti-jam protection; a new internationally interoperable civil signal L1C; increased availability of position accuracy; and a 25 percent greater design life than the GPS IIF satellite, which will reduce constellation replenishment rates.

In addition, GPS III is built with a scalable satellite bus that enables a growth path to greater warfighter capabilities. The flexibility of the GPS III bus also allows Air Force Space Command (AFSPC) to develop plans to accommodate new hosted payloads provided by other federal agencies and international partners at a significantly reduced on-orbit cost to the United States government. In April 2013, the Air Force completed a preliminary design review (PDR) that incorporated a search and rescue (SAR/GPS) payload provided by Canada, a laser retro-reflector array (LRA) payload provided by the National Air and Space Administration (NASA), and a redesigned nuclear detonation detection system (NDS) payload provided by the Department of Energy (DOE).

The Air Force is in the process of developing an acquisition strategy for future GPS satellites beyond GPS III satellite eight with increased emphasis on affordability.

## 3.2 GPS III Multi-Year Procurement Elements

The Air Force has evaluated an alternative procurement approach for GPS III satellites using Multi-year Procurement (MYP), which is a special contracting method to acquire known requirements in quantities and total costs planned for up to five years. Initial analysis indicates that an MYP contract for GPS III has the potential to provide the following benefits:

- (1) generate substantial savings compared to the traditional annual procurement due to a stable and predictable minimum annual need for satellites;
- (2) improve procurement stability by establishing a long-term commitment that stabilizes workforce and the industrial base;
- (3) optimize production flow by reducing disruptions in vendor delivery schedules, reducing administrative burden, and capturing steeper learning curve savings to reduce build times; and
- (4) mitigate diminishing manufacturing sources and material shortages.

The GPS III Program Office conducted an MYP analysis comparing the current status of GPS III against the MYP criteria contained in Title 10 USC 2306b. Conditions that are required for MYP contracting include: 1) substantial savings; 2) a stable need for the items; 3) an expectation that sufficient funding will be requested to avoid contract cancellation; 4) stable design for the items and low technical risks; 5) realistic cost estimates; and 6) the contract will promote national security. The GPS III program is anticipated to meet all MYP conditions no earlier than FY16.

MYP will achieve substantial savings versus an annual procurement approach (MYP criterion #1) by providing a stable, long-term commitment and a stable production environment for the prime contractor and its supply chain. Typically, significant funding is required in the first one to three years of an MYP contract to procure the economic order quantities (EOQ) parts and materials. Savings from the EOQ buy are realized in later purchase years. A stable need for GPS satellites (MYP criterion #2) stems from DoD's requirement to comply with Title 10 USC 2281 for constellation sustainment. If DoD decides to pursue an MYP for GPS III, the associated FY16 President's Budget request will reflect a funding profile to support this (MYP criterion #3). A stable GPS III design (MYP criterion #4) will be validated following completion of development for the first satellite, and technical risk will not be excessive following delivery and test of the first navigation payload. Realistic cost estimates (MYP criterion #5) will be based on actual costs from two development satellites and from completed elements of four production satellites. An MYP contract (MYP criterion #6) for GPS III would promote national security by ensuring the sustainment of the GPS constellation.

## 3.3 GPS III MYP Potential Savings

### 3.3.1 Economic Order Quantities

The single biggest driver to GPS III unit cost is how parts and materials are purchased and tested. EOQs enable lower costs by funding bulk buys of components, parts, materials,

and effort in advance to maintain a planned production schedule. EOQ will include large-lot procurement of satellite material improving production stability. Each material lot buy has a set amount of fixed procurement costs that can only be reduced through amortization across a larger quantity of units. An EOQ buy includes traditional long lead parts, critical parts with projected end of supply or production concerns, components on the critical path, and vendor procurements required to maintain the industrial base.

In addition, the larger buys ensure a common configuration, mitigate schedule risk, and mitigate diminishing manufacturing sources and material shortages. This also helps to eliminate the potential risk for part redesign and delta qualification tests.

When parts and materials are procured for an end unit, a sufficient amount of testing is required to qualify the specific lot of parts. This testing and the sample parts required to support it add cost each time a lot is purchased. GPS III utilizes more than 13,500 electrical, electro-magnetic, electro-mechanical and electro-optical (EEEE) parts. These fixed costs for parts and material can be reduced through larger quantity procurements which necessitate fewer lot buys.

Additionally, EOQ enables shared labor and reduced costs to perform the parts screening and the GPS III specific radiation testing across the supply chain necessary for each procurement.

### 3.3.2 Risk Reduction Savings

Long-term agreements lower risk associated with the manufacturing and production of parts, supplier fragility, supply chain management, and the need for spare components. Supplier fragility can be mitigated by ensuring that the vendor has a steady production line to meet GPS III needs. Protecting against supplier fragility can minimize the amount of risk included in pricing associated with re-design and requalification of components. Supply chain management costs can be minimized with an MYP approach because in many cases rework can take place in parallel to production of the next unit. The same concept applies to the need for spare parts, boards, or components. Also, labor at the factory can be stabilized and optimized for assembly, integration and testing. This allows the contractor to balance the ebbs and flows of required personnel, reduce training costs, and maximize learning curve efficiencies.

Risk reduction can reduce the total price of an end item depending on the contract terms and conditions in place. The cancellation ceiling included in an MYP is a great example of a contract term that significantly reduces risk and therefore price throughout the supply chain. The government benefits from the savings of an EOQ buy, while the cancellation ceiling mitigates the contractor financed risk if the government buys less than the full order. A cancellation charge is the amount of unrecovered costs which would have been recouped through amortization over the full term of the contract, including the term cancelled, and may include remaining EOQ charges, reasonable preproduction or startup, labor learning, and other nonrecurring costs.

#### 4. GPS III MYP Way Forward

The GPS Program Office continually assesses methods to reduce cost to the government in procurement of GPS satellites. MYP is one option that has the potential to create savings for GPS and the United States taxpayer. There is a clear long term need to procure satellites to maintain the levels of service required by public law. Purchases of EOQ could result in significant reductions in the cost of lot testing, facilitate more economic purchasing approaches, allow optimized and balanced workflows, and diminish the need for obsolescence mitigation by placing the responsibility to ensure continuity of production on the contractor.

While all of the above are true, other considerations have to be fully analyzed before making a commitment through a MYP contract. One of the primary requirements for GPS III is to replenish the constellation. Based on that requirement, a healthy constellation reduces the need for larger annual buys of GPS III satellites in the near term. In addition, early-to-need procurement would require funding for satellite storage. In a budget-constrained environment, the Air Force would not procure more GPS III satellites than are needed to maintain the constellation.

At this time the Air Force is conducting trade-off analyses associated with future GPS space vehicle acquisition strategies including, but not limited to, evolution of future GPS III requirements, GPS constellation sustainment need dates, and GPS program affordability within the defense budget. If affordable, the Air Force plans to present a GPS III acquisition approach to DoD that balances cost, performance and flexibility. At this time, analysis indicates that MYP contracting for GPS III is not feasible until at least FY16.

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