Selected Acquisition Report (SAR)

Next Generation Operational Control System (OCX)

FY 2024 President's Budget

Defense Acquisition Visibility Environment (DAVE)

Table of Contents

Common Acronyms and Abbreviations

$B - Billions of Dollars
$K - Thousands of Dollars
$M - Millions of Dollars
ACAT - Acquisition Category
Acq O&M - Acquisition-Related Operations and Maintenance
ADM - Acquisition Decision Memorandum
APB - Acquisition Program Baseline
APPN - Appropriation
APUC - Average Procurement Unit Cost
BA - Budget Authority/Budget Activity
Blk - Block
BY - Base Year
CAPE - Cost Assessment and Program Evaluation
CARD - Cost Analysis Requirements Description
CDD - Capability Development Document
CLIN - Contract Line Item Number
CPD - Capability Production Document
CY - Calendar Year
DAB - Defense Acquisition Board
DAE - Defense Acquisition Executive
DAMIR - Defense Acquisition Management Information Retrieval
DoD - Department of Defense
DSN - Defense Switched Network
EMD - Engineering and Manufacturing Development
EVM - Earned Value Management
FMS - Foreign Military Sales
FOC - Full Operational Capability
FRP - Full Rate Production
FY - Fiscal Year
FYDP - Future Years Defense Program
ICE - Independent Cost Estimate
Inc - Increment
IOC - Initial Operational Capability
JROC - Joint Requirements Oversight Council
KPP - Key Performance Parameter
LRIP - Low Rate Initial Production
MDA - Milestone Decision Authority
MDAP - Major Defense Acquisition Program
MILCON - Military Construction
N/A - Not Applicable
O&M - Operations and Maintenance
O&S - Operating and Support
ORD - Operational Requirements Document
OSD - Office of the Secretary of Defense
PAUC - Program Acquisition Unit Cost
PB - President's Budget

PE - Program Element
PEO - Program Executive Officer
PM - Program Manager
POE - Program Office Estimate
RDT&E - Research, Development, Test, and Evaluation
SAR - Selected Acquisition Report
SCP - Service Cost Position
TBD - To Be Determined
TY - Then Year
U.S. - United States
UCR - Unit Cost Reporting
USD(A&S) - Under Secretary of Defense (Acquisition and Sustainment)
USD(AT&L) - Under Secretary of Defense (Acquisition, Technology and Logistics)

Program Information

Program Name

Next Generation Operational Control System (OCX)

DoD Component

Air Force

Responsible Office

Program Manager

Name: Barbara Baker
Date Assigned: August 1, 2019
Address: 483 N. Aviation
El Segundo, CA 90245
Phone: (310) 653-3002

Mission and Description

The Global Positioning System (GPS) is a space based positioning, navigation, and timing distribution system, which operates through weather and electromagnetic environments (jamming, spoofing, etc.). GPS supports both civil and military users in air, space, sea, and land operations. GPS is a satellite-based radio navigation system that serves military and civil users worldwide. GPS users process satellite signals to determine accurate position, velocity, and time. GPS must comply with 10 United States Code (USC) Section 2281 which requires that the Secretary of Defense ensures the continued sustainment and operation of GPS for military and civilian purposes and 51 USC Section 50112, which requires that GPS complies with certain standards and facilitates international cooperation.The GPS Next Generation Operational Control System (OCX) program develops and fields a modernized satellite command and control (C2) system which replaces the current ground control system for legacy and new GPS satellites. OCX implements a modern flexible architecture with built-in robust information assurance to address emerging cyber threats. The Air Force is taking a block approach to develop OCX with each block delivering upgrades as they become available.The OCX program of record consists of 2 block deliverables: Block 1, and Block 2. OCX Block 0, a subset of Block 1, will allow OCX to support the launch and checkout of GPS III satellites. OCX Block 1 replaces the existing legacy GPS C2 system and fields the operational capability to control legacy satellites (GPS IIR, IIR-M, and IIF) and control existing signals (L1 C/A, L1P(Y), L2P(Y)). OCX Block 1 also adds the operational capability to command and control the GPS III satellites and the modernized civil signals (L2C and L5). OCX Block 2 adds operational control of the new international open/civil L1C signal in compliance with 2004 European Union-United States agreement and adds control of the modernized Military Code signal. With the restructuring of the program as a result of the Nunn-McCurdy process, Block 1 and Block 2 capabilities will be delivered concurrently. The majority of Block 2 capabilities were merged into the Block 1 delivery during the 2014 OCX restructure. Recent analysis found it would be cheaper to merge the remaining Block 2 capabilities into Block 1 than to deliver Block 2 after Block 1. This approach delivers Block 2 capabilities sooner and eliminates the impact to GPS operations from a transition from Block 1 to Block 2.On December 20, 2019, the President of the United States established the United States Space Force which assumed the responsibility for all major space acquisition programs. This program is now a United States Space Force program.

Executive Summary

OCX

Program Highlights Since Last Report

OCX remains a large software-intensive program that is performing well using metric driven decisions and its remaining technical risks are typical of a complex software acquisition. Since the last SAR the Government continues its plan to mitigate an unacceptable cyber risk caused by the sale of an International Business Machines product line to Lenovo, a foreign owned company, in a manner which saves the government $150M in future costs. This Hewlett-Packard (HP) Replacing IBM Project (HRIP) held Raytheon to its original contract commitment to qualify the OCX Block 1 and 2 mission software on IBM while separately directing them to build up the new HP environments in parallel.After concluding a major program element referred to as Certificate of Conformance (CoC) in December 2021, Hewlett-Packard (HP) based Segment Integration efforts initiated both in the factory and at operational sites. In January 2022, the GPS System Simulator (GSYS) was used to converge a Kalman Filter solution, demonstrating a capability vital to GPS operations in the factory. This was a first on the HP baseline. Concurrently, HP equipment successfully commanded and received telemetry from all three classes of GPS satellite or "Iron Bird" simulators (one for GPS IIR/IIR-M, IIF, and III, respectively). Subsequently, OCX demonstrated the ability to initialize all three signal types (Legacy Navigation (LNAV), Military Navigation (MNAV), and Civil Navigation (CNAV)). The last of four Legacy Ground Antenna Element (LGAE) interfaces was installed at Kwajalein Island in April 2022, completing all OCX equipment installations apart from the classified portion of the Alternate Master Control Station (AMCS). AMCS is being retained to support HP Formal Qualification Testing (FQT) and will ship to Vandenberg Space Force Base (VSFB) in mid-2023. Additionally, key communication links between Schriever Space Force Base (SSFB) and VSFB were finished in May 2022. In June 2022, OCX also received Space Authorizing Official and National Industrial Security Program Authorizing Official permission to connect all remaining links between the Software Integration and Test Lab at Raytheon's factory in Aurora CO; the Transition Support Facility (TSF) at SSFB; and test equipment at the Consolidated Test Environment in Colorado Springs, CO and the Telecommunications Simulator Test Station at Cape Canaveral Space Force Station, FL. This allowed several segment integration efforts to finish.In the factory, HP Formal Qualification Test (FQT) Golden Dry Run (GDR) began in August 2022. Initial pass rates were lower than anticipated, in the 50% range. Primary issues included challenges with integrating the Navigation (NAV) configuration item with other subsystems, and challenges related to end-to-end alerting and overall system stability. To address these issues, Raytheon engaged with a key subcontractor, L3Harris, who sent additional Subject Matter Experts to address navigation-related Discrepancy Reports (DR). Raytheon has also brought back OCX veterans and other senior engineers to work through the higher-than-expected DR count. Since HP FQT will formally verify 65% of the program's remaining segment requirements, it remains the program's primary focus and gauge of system maturity.In the field, OCX continues to focus on preparing deployed components for operations, including connecting OCX to other agencies' systems. In this period, connections were made with the existing Ground Support Facility, which supports transition; the Integrated Correlation and Detection System, which supports the U.S. Nuclear Detonation Detection System; the 18th and 19th Space Defense Squadrons (18/19 SDS), in support of USSF space domain awareness and collision avoidance operations; the National Geospatial-Intelligence Agency (NGA), a key partner in navigation operations; the Operational Support System, in support of the GPS IIR/IIR-M and GPS III Space Vehicles; and the Eastern Vehicle Checkout Facility which demonstrates whether OCX is able to conduct tracking, telemetry & commanding operations on the network.Furthermore, the analysis of Live Sky data collected using OCX's 17 global monitor stations completed in September 2022. The analysis concluded OCX would meet over 90 navigation-centric requirements.The Launch and Checkout System (LCS), or OCX Block 0, is operating nominally. To date, LCS has supported the launch and checkout of GPS III Space Vehicles (SV)s 1 through 5 and is on track to support the SV06 launch on January 18, 2023. The FY 2023 Omnibus Funding Bill reduced the OCX budget by $74.3M, citing unjustified growth for Block 1 and 2 Interim Contractor Support. The mark will hamper the contractor's ability to integrate OCX with the GPS Space and User segments and support Government-led Developmental Testing (DT) slated for early FY 2024. The Program Manager signed a Program Deviation Report (PDR) on October 26, 2022 and submitted it to the Defense Acquisition Executive (DAE). The PDR reported a schedule deviation for the final APB milestone, Ready to Transition to Operations (RTO), from its APB threshold date of April 2023. The OCX team briefed program status to the DAE on November 2, 2022 and plans to provide a follow-up briefing in April 2023.This is a software-intensive program actively using Development Security Operations (DevSecOps), with routine, low-level development and program execution issues worked day-to-day.

History of Significant Developments Since Program Initiation	
History of Significant Developments Since Program Initiation	
Date	**Significant Development Description**
Sep - 2022	OCX finished Live Sky analysis.
Aug - 2022	HP FQT GDR began August 15, 2022.
Jul - 2022	TSF installation completed July 27, 2022.
Jun - 2022	MCS installation completed June 15, 2022.
Jun - 2022	OCX finished a campaign to initialize all three signal types (LNAV, CNAV, and MNAV) on all three vehicle class simulators (GPS IIR/IIR-M, IIF and III).
Mar - 2022	The last of four LGAE site installations was completed in the Marshall Islands (Kwajalein).
Dec - 2021	On December 17, 2021 Government accepted Raytheon's IBM based CoC.
Dec - 2021	The MCS Element FQT ended on December 16, 2021.
Nov - 2021	The Transition Support Facility installation began at SSFB on November 9, 2021.
Oct - 2021	Global LGAE interface deployment began with Cape Canaveral Space Force Station, which was installed on October 26, 2021.
Oct - 2021	MCS installation began at SSFB on October 5, 2021.
Oct - 2021	The AMCS installation began at Vandenberg Space Force Base on October 12, 2021.
Jul - 2021	All 17 MS installations completed; the last site, Ecuador, finished installation on July 23, 2021.
Jun - 2021	GPS III SV05 satellite control authority transferred to 2 SOPS on June 28, 2021 following LCS support of the launch on June 17, 2021.
Nov - 2020	GPS III SV04 satellite control authority transferred to 2 SOPS on November 16, 2020 following LCS support of the launch on November 5, 2020.
Nov - 2020	The primary GGA (Rack 2) was integrated onto SIPRNet at SAFB on November 23, 2020.
Sep - 2020	GPS System Simulator Element FQT completed on September 8, 2020.
Sep - 2020	The Global MS deployment campaign began with the completion of the Schriever Air Force Base (SAFB) installation on September 4, 2020.
Sep - 2020	The Product Test campaign completed on September 25, 2020, having assessed over 10,000 configuration item-level requirements.
Jul - 2020	GPS III SV 03 satellite control authority transferred to 2 SOPS on July 23, 2020 following LCS support of the launch on June 30, 2020.
Mar - 2020	Hewlett Packard Enterprise Replacing International Business Machines Project contract modification definitized.
Mar - 2020	SV02 satellite control authority transferred to 2 SOPS.
Dec - 2019	SV01 satellite control authority transferred to Second Space Operations Squadron (2 SOPS).
Aug - 2019	LCS supported launch of the second GPS III SV02 on August 22, 2019.
Aug - 2019	OCX Block 1 and 2 completed software development.
Mar - 2019	Completed production of all 34 OCX Monitoring Station Receivers and received security accreditation for both the unclassified and classified variants.
Jan - 2019	Completed the pilot phase for monitoring station obsolescence.
Dec - 2018	LCS supported launch of first GPS III SV01 on December 23, 2018.
Oct - 2018	LCS received Authority to Operate on October 2, 2018, which is valid for two years

Sep - 2018	USD(A&S) recertified Milestone B on September 27, 2018. The recertification established a new APB and revalidated the program funding to the SCP. The MDA remains with USD(A&S) and Milestone C was waived.
Oct - 2017	The program office accepted Block 0 LCS delivery to support the first GPS III launch, which successfully occurred on December 23, 2018.
Jun - 2017	GPS OCX Capability Development Document (CDD) approved.
Jun - 2017	The DAB occurred on June 20, 2017, and USD(AT&L) agreed to approve OCX's new Milestone B certification and new APB objective dates of April 2021 for Milestone C and April 2022 for Block 1 and 2.
Mar - 2017	Program Office and Raytheon completed OTB/OTS process on March 28, 2017. Execution against the new baseline began on April 1, 2017.
Oct - 2016	OCX was recertified on October 12, 2016 and the Milestone B, original and current APBs were rescinded. The contract was restructured to reflect a 24-month plus six-month risk schedule extension. All Block 2 content was re-phased to deliver concurrently with Block 1.
Sep - 2016	Quarterly review conducted with USD(AT&L). Raytheon reported they met Block 0 LCS FQT Test Readiness Review key milestones. Raytheon also reported on improvements on implementing Development Operations processes, including increased automation in software development, platform deployment, and test as well as an updated configuration management and software development approach.
Jul - 2016	Raytheon completed Block 0 FQT Golden Dry Run, demonstrating the maturity of Block 0 requirements to support LCS.
Jun - 2016	The Secretary of the Air Force declared a critical Nunn-McCurdy breach on June 30, 2016.
Feb - 2016	Due to reported schedule delays, the Air Force awarded GPS III Contingency Operations to bridge capability between Block 0 and Block 1.
Dec - 2015	Second Deep Dive with USD(AT&L) was conducted resulting in OSD and the Air Force jointly agreeing to a 24-month replan to the schedule objectives for Milestone C, Block 1 RTO and Block 2 RTO in the APB.
Dec - 2015	Program Office reported a schedule breach against current baseline on December 23, 2015.
Oct - 2015	A revised APB was signed on October 19, 2015.
Feb - 2015	Program Office and Raytheon held a Deep Dive with USD(AT&L) which directed the development of a new APB and established new milestones to measure schedule and cost performance.
Jun - 2014	Government completed Over Target Baseline (OTB) / Over Target Schedule (OTS). The result of the OTB/OTS resulted in revised milestone dates which required the program to submit a Program Deviation Report to USD (AT&L). As part of the OTB/OTS initiatives, Raytheon paused software development activities and focused its effort on completing the balance of Block 1 & Block 2 systems engineering.
Jun - 2013	Raytheon conducted a Critical Design Review for the GPS III LCS (Block 0). The design artifacts assessed by the Government team demonstrated that Raytheon's design and software architecture were adequate to meet requirements.
Mar - 2012	OCX Program received Milestone B approval and was authorized to begin Engineering and Manufacturing Development. An updated APB was signed by the Milestone Decision Authority (MDA), USD(AT&L).
Feb - 2010	OCX development contract awarded to Raytheon for $886M, with an option to begin preliminary work on Blocks 3 & 4 which are to provide additional capabilities to support follow-on, upgraded versions of GPS III satellites.
Feb - 2007	The United States Air Force began the OCX program with a technology development phase (Phase A). Awarded Phase A contracts for $160M each to Northrop Grumman and Raytheon to produce competitive prototypes.

Schedule

OCX

Events	Milestone Baseline Objective	Current Baseline Objective/Threshold		Current Estimate/Actual	Deviation
Development Contract Award	Feb 2010	Feb 2010	Feb 2010	Feb 2010	
Block 1 and 2 PDR	Aug 2011	Aug 2011	Aug 2011	Aug 2011	
Milestone B	Nov 2012	Nov 2012	Nov 2012	Nov 2012	
Block 0 (LCS Delivery)	Oct 2017	Oct 2017	Oct 2017	Sep 2017	
Revised Milestone B	Sep 2018	Sep 2018	Sep 2018	Sep 2018	
Block 1 RTO	Apr 2022	Apr 2022	Apr 2023	May 2024	
Block 2 RTO	Apr 2022	Apr 2022	Apr 2023	May 2024	

Note:

The Block 1 and 2 RTO current estimate changed from December 2023 to May 2024. This shift accounts for technical issues, contractor staffing challenges that might emerge in early FY 2024, and the risk that operational assets (crews and satellites) might not be available to fully support Government-led Developmental Testing. Therefore, the government estimates DD250 submission to occur in the October 2023 timeframe. The government estimates seven months of transition/activities are required between the Raytheon contract delivery submission date and the APB RTO milestone, putting RTO estimate at mid-2024.

Performance

OCX

Performance Characteristics					
Milestone Baseline	Current Baseline Objective/Threshold		Demonstrated Performance	Current Estimate/Actual	Deviation
(KPP) - Availability of Position Accuracy a. b. Horizontal c.d. Vertical					
UEE = 0.8 m rms HORIZONTAL Note 1) a. 4.5 m (95%) @ 90% availability (any lat/long) b. 4.0 m (95%) @ 99.9% availability (global Average) VERTICAL (see Note 1) c. 7.0 m (95%) @ 90% availability (any lat/long) d. 7.0 m (95%) @ 99.9% availability (global average) UEE = 2.6 m rms (See Note 1) HORIZONTAL (see Note 1) a. 11.5 m (95%) @ 90% availability (any lat/long) b. 11.5 m (95%) @ 99.9% availability (global average) VERTICAL (see Note 1) c. 17.7 m (95%) @ 90% availability (any lat/long)d. 17.7 m global average. (95%) @ 99.9% availability *Note 1: Availability of position accuracy is dependent on the GPS receiver's UEE.	UEE = 0.8 m rms HORIZONTAL Note 1) a. 4.5 m (95%) @ 90% availability (any lat/long) b. 4.0 m (95%) @ 99.9% availability (global Average) VERTICAL (see Note 1) c. 7.0 m (95%) @ 90% availability (any lat/long) d. 7.0 m (95%) @ 99.9% availability (global average) UEE = 2.6 m rms (See Note 1) HORIZONTAL (see Note 1) a. 11.5 m (95%) @ 90% availability (any lat/long) b. 11.5 m (95%) @ 99.9% availability (global average) VERTICAL (see Note 1) c. 17.7 m (95%) @ 90% availability (any lat/long)d. 17.7 m global average. (95%) @ 99.9% availability *Note 1: Availability of position accuracy is dependent on the GPS receiver's UEE.	UEE = 0.8 m rms HORIZONTAL Note 1) a. 4.5 m (95%) @ 90% availability (any lat/long) b. 4.0 m (95%) @ 99.9% availability (global Average) VERTICAL (see Note 1) c. 7.0 m (95%) @ 90% availability (any lat/long) d. 7.0 m (95%) @ 99.9% availability (global average) UEE = 2.6 m rms (See Note 1) HORIZONTAL (see Note 1) a. 11.5 m (95%) @ 90% availability (any lat/long) b. 11.5 m (95%) @ 99.9% availability (global average) VERTICAL (see Note 1) c. 17.7 m (95%) @ 90% availability (any lat/long)d. 17.7 m global average. (95%) @ 99.9% availability *Note 1: Availability of position accuracy is dependent on the GPS receiver's UEE.	TBD	UEE = 0.8 m rms HORIZONTAL Note 1) a. 4.5 m (95%) @ 90% availability (any lat/long) b. 4.0 m (95%) @ 99.9% availability (global Average) VERTICAL (see Note 1) c. 7.0 m (95%) @ 90% availability (any lat/long) d. 7.0 m (95%) @ 99.9% availability (global average) UEE = 2.6 m rms (See Note 1) HORIZONTAL (see Note 1) a. 11.5 m (95%) @ 90% availability (any lat/long) b. 11.5 m (95%) @ 99.9% availability (global average) VERTICAL (see Note 1) c. 17.7 m (95%) @ 90% availability (any lat/long)d. 17.7 m global average. (95%) @ 99.9% availability *Note 1: Availability of position accuracy is dependent on the GPS receiver's UEE.	

(KPP) - Availability of Time Transfer Accuracy					
UEE = 0.8 m rms (See Note 1) 15 nanoseconds (ns) (95%) @ 90% availability (any lat/long) 15 ns (95%) @ 99.9% availability (global average) UEE = 2.6 m rms (See Note 1) 40 ns (95%) @ 90% availability (any lat/long) 50 ns (95%) @ 99.9% availability (global average) Static Time Transfer 3.0 ns (95%) @ >99.9% availability Note 1: Availability of time transfer accuracy (dynamic) is dependent on the GPS receiver's UEE.	UEE = 0.8 m rms (See Note 1) 15 nanoseconds (ns) (95%) @ 90% availability (any lat/long) 15 ns (95%) @ 99.9% availability (global average) UEE = 2.6 m rms (See Note 1) 40 ns (95%) @ 90% availability (any lat/long) 50 ns (95%) @ 99.9% availability (global average) Static Time Transfer 3.0 ns (95%) @ >99.9% availability Note 1: Availability of time transfer accuracy (dynamic) is dependent on the GPS receiver's UEE.	UEE = 0.8 m rms (See Note 1) 15 nanoseconds (ns) (95%) @ 90% availability (any lat/long) 15 ns (95%) @ 99.9% availability (global average) UEE = 2.6 m rms (See Note 1) 40 ns (95%) @ 90% availability (any lat/long) 50 ns (95%) @ 99.9% availability (global average) Static Time Transfer 3.0 ns (95%) @ >99.9% availability Note 1: Availability of time transfer accuracy (dynamic) is dependent on the GPS receiver's UEE.	TBD	UEE = 0.8 m rms (See Note 1) 15 nanoseconds (ns) (95%) @ 90% availability (any lat/long) 15 ns (95%) @ 99.9% availability (global average) UEE = 2.6 m rms (See Note 1) 40 ns (95%) @ 90% availability (any lat/long) 50 ns (95%) @ 99.9% availability (global average) Static Time Transfer 3.0 ns (95%) @ >99.9% availability Note 1: Availability of time transfer accuracy (dynamic) is dependent on the GPS receiver's UEE.	

(KPP) - Backward Compatibility					
All modifications made to the existing GPS Space Segment and Control Segment shall allow the continued operation of existing IS-GPS-200, ISGPS-700, IS-GPS-705 and SS-GPS-001 compliant UE and continued operation of legacy receivers (to include Federal augmentation system receivers) IAW performance meeting the APB, Precise Positioning Service Performance Standard and GPS Positioning Service Performance Standard, and Federal augmentation system specifications for the Local Area Augmentation System, Wide Area Augmentation System, Nationwide Differential GPS, and Maritime Differential GPS.	All modifications made to the existing GPS Space Segment and Control Segment shall allow the continued operation of existing IS-GPS-200, ISGPS-700, IS-GPS-705 and SS-GPS-001 compliant UE and continued operation of legacy receivers (to include Federal augmentation system receivers) IAW performance meeting the APB, Precise Positioning Service Performance Standard and GPS Positioning Service Performance Standard, and Federal augmentation system specifications for the Local Area Augmentation System, Wide Area Augmentation System, Nationwide Differential GPS, and Maritime Differential GPS.	All modifications made to the existing GPS Space Segment and Control Segment shall allow the continued operation of existing IS-GPS-200, ISGPS-700, IS-GPS-705 and SS-GPS-001 compliant UE and continued operation of legacy receivers (to include Federal augmentation system receivers) IAW performance meeting the APB, Precise Positioning Service Performance Standard and GPS Positioning Service Performance Standard, and Federal augmentation system specifications for the Local Area Augmentation System, Wide Area Augmentation System, Nationwide Differential GPS, and Maritime Differential GPS.	TBD	At contract delivery (DD250), OCX may not meet Positioning Signal Integrity and Continuity Assurance (PSICA) that relate to the GPS Positioning Service Performance Standard. The specified approach is new for OCX (the prior system did not have these requirements). It is technologically possible to modify the integrity monitor but there would be programmatic impacts.	
(KPP) - Net-Ready KPP					
Availability of Accuracy in the terrestrial Transfer Determination Capability; service volume with UE UEE = 0.8 m rms HORIZONTAL 4.5 m (95%)@ 90% availability (any lat/long) 4.0 m (95%) @ 99.9% availability (global VERTICAL 7.0 m (95%)@ 90% availability (any lat/long) 7.0 m (95%) @ 99.9% availability (global average) UEE = 2.6m rms	Availability of Accuracy in the terrestrial Transfer Determination Capability; service volume with UE UEE = 0.8 m rms HORIZONTAL 4.5 m (95%)@ 90% availability (any lat/long) 4.0 m (95%) @ 99.9% availability (global VERTICAL 7.0 m (95%)@ 90% availability (any lat/long) 7.0 m (95%) @ 99.9% availability (global average) UEE = 2.6m rms	Availability of Accuracy in the terrestrial Transfer Determination Capability; service volume with UE UEE = 0.8 m rms HORIZONTAL 4.5 m (95%)@ 90% availability (any lat/long) 4.0 m (95%) @ 99.9% availability (global VERTICAL 7.0 m (95%)@ 90% availability (any lat/long) 7.0 m (95%) @ 99.9% availability (global average) UEE = 2.6m rms	TBD	Availability of Accuracy in the terrestrial Transfer Determination Capability; service volume with UE UEE = 0.8 m rms HORIZONTAL 4.5 m (95%)@ 90% availability (any lat/long) 4.0 m (95%) @ 99.9% availability (global VERTICAL 7.0 m (95%)@ 90% availability (any lat/long) 7.0 m (95%) @ 99.9% availability (global average) UEE = 2.6m rms	

HORIZONTAL 11.5 m (95%)@ 90% availability (any lat/long) 11.5 m (95%)@ 99.9% availability (global average) VERTICAL 17.7 m (95%)@ 90% availability (any lat/long) 17.7 m (95%) @ 99.9% availability (global average) Availability of Dynamic and Static Time Transfer Accuracy with UE. UEE = 0.8 m rms 15 ns (95%)@90% availability (any lat/long) 15 ns (95%)@ 99.9% availability (global coverage) UEE = 2.6 m rms 40 ns (95%)@ 90% availability (any lat/long) 50 ns (95%)@ 99.9% availability (global coverage) Static Time Transfer Threshold=Objective 30ns (95%) @> 99.9% availability Note: This represents the cumulative threshold/objective achieved by the collective contributions of the space, control, and/or user segments. Availability of position accuracy is dependent on the GPS	HORIZONTAL 11.5 m (95%)@ 90% availability (any lat/long) 11.5 m (95%)@ 99.9% availability (global average) VERTICAL 17.7 m (95%)@ 90% availability (any lat/long) 17.7 m (95%) @ 99.9% availability (global average) Availability of Dynamic and Static Time Transfer Accuracy with UE. UEE = 0.8 m rms 15 ns (95%)@90% availability (any lat/long) 15 ns (95%)@ 99.9% availability (global coverage) UEE = 2.6 m rms 40 ns (95%)@ 90% availability (any lat/long) 50 ns (95%)@ 99.9% availability (global coverage) Static Time Transfer Threshold=Objective 30ns (95%) @> 99.9% availability Note: This represents the cumulative threshold/objective achieved by the collective contributions of the space, control, and/or user segments. Availability of position accuracy is dependent on the GPS	HORIZONTAL 11.5 m (95%)@ 90% availability (any lat/long) 11.5 m (95%)@ 99.9% availability (global average) VERTICAL 17.7 m (95%)@ 90% availability (any lat/long) 17.7 m (95%) @ 99.9% availability (global average) Availability of Dynamic and Static Time Transfer Accuracy with UE. UEE = 0.8 m rms 15 ns (95%)@90% availability (any lat/long) 15 ns (95%)@ 99.9% availability (global coverage) UEE = 2.6 m rms 40 ns (95%)@ 90% availability (any lat/long) 50 ns (95%)@ 99.9% availability (global coverage) Static Time Transfer Threshold=Objective 30ns (95%) @> 99.9% availability Note: This represents the cumulative threshold/objective achieved by the collective contributions of the space, control, and/or user segments. Availability of position accuracy is dependent on the GPS		HORIZONTAL 11.5 m (95%)@ 90% availability (any lat/long) 11.5 m (95%)@ 99.9% availability (global average) VERTICAL 17.7 m (95%)@ 90% availability (any lat/long) 17.7 m (95%) @ 99.9% availability (global average) Availability of Dynamic and Static Time Transfer Accuracy with UE. UEE = 0.8 m rms 15 ns (95%)@90% availability (any lat/long) 15 ns (95%)@ 99.9% availability (global coverage) UEE = 2.6 m rms 40 ns (95%)@ 90% availability (any lat/long) 50 ns (95%)@ 99.9% availability (global coverage) Static Time Transfer Threshold=Objective 30ns (95%) @> 99.9% availability Note: This represents the cumulative threshold/objective achieved by the collective contributions of the space, control, and/or user segments. Availability of position accuracy is dependent on the GPS	

receiver's UEE. Note: Mission: Provide: Positioning, Navigation, and Time Transfer Determination Capability; Military Protection and Operations Capability; and Constellation Management.	receiver's UEE. Note: Mission: Provide: Positioning, Navigation, and Time Transfer Determination Capability; Military Protection and Operations Capability; and Constellation Management.	receiver's UEE. Note: Mission: Provide: Positioning, Navigation, and Time Transfer Determination Capability; Military Protection and Operations Capability; and Constellation Management.		receiver's UEE. Note: Mission: Provide: Positioning, Navigation, and Time Transfer Determination Capability; Military Protection and Operations Capability; and Constellation Management.	
(KPP) - Position and Time Transfer Integrity					
The GPS III Enterprise shall not transmit Misleading SIS Information (MSI) to the user with a probability greater than 0.0001 per hour.	The GPS III Enterprise shall not transmit Misleading SIS Information (MSI) to the user with a probability greater than 0.0001 per hour.	The GPS III Enterprise shall not transmit Misleading SIS Information (MSI) to the user with a probability greater than 0.0001 per hour.	TBD	At contract delivery (DD250), OCX may not meet Positioning Signal Integrity and Continuity Assurance that relate to MSI. The specified approach is new for OCX (the prior system did not have these requirements). It is technologically possible to modify the integrity monitor but there would be programmatic impacts.	
(KPP) - Sustainment					
The achievement of the Availability of Position Accuracy KPP and Time Transfer Accuracy KPP thresholds satisfies this KPP.	The achievement of the Availability of Position Accuracy KPP and Time Transfer Accuracy KPP thresholds satisfies this KPP.	The achievement of the Availability of Position Accuracy KPP and Time Transfer Accuracy KPP thresholds satisfies this KPP.	TBD	The achievement of the Availability of Position Accuracy KPP and Time Transfer Accuracy KPP thresholds satisfies this KPP.	

(KPP) - System Survivability					
The System Survivability KPP is satisfied by meeting the thresholds of the Availability of Position Accuracy KPP (SS and CS); Position and Time Transfer Integrity KPP (SS and CS); Availability of Time Transfer Accuracy KPP (SS and CS); PNT Determination KPP (User Segment); Accuracy KPP (User Segment); System Survivability - Cybersecurity KPP (CS); Integrity KPP (User Segment); Cryptography, Security Architecture, and Key Distribution KPP (User Segment); and External Augmentation KPP (User Segment).* See Table 5-1 OCX System Survivability - Cybersecurity (KPP) in approved CDD for GPS OCX.	The System Survivability KPP is satisfied by meeting the thresholds of the Availability of Position Accuracy KPP (SS and CS); Position and Time Transfer Integrity KPP (SS and CS); Availability of Time Transfer Accuracy KPP (SS and CS); PNT Determination KPP (User Segment); Accuracy KPP (User Segment); System Survivability - Cybersecurity KPP (CS); Integrity KPP (User Segment); Cryptography, Security Architecture, and Key Distribution KPP (User Segment); and External Augmentation KPP (User Segment).* See Table 5-1 OCX System Survivability - Cybersecurity (KPP) in approved CDD for GPS OCX.	The System Survivability KPP is satisfied by meeting the thresholds of the Availability of Position Accuracy KPP (SS and CS); Position and Time Transfer Integrity KPP (SS and CS); Availability of Time Transfer Accuracy KPP (SS and CS); PNT Determination KPP (User Segment); Accuracy KPP (User Segment); System Survivability - Cybersecurity KPP (CS); Integrity KPP (User Segment); Cryptography, Security Architecture, and Key Distribution KPP (User Segment); and External Augmentation KPP (User Segment).* See Table 5-1 OCX System Survivability - Cybersecurity (KPP) in approved CDD for GPS OCX.	TBD	The System Survivability KPP is satisfied by meeting the thresholds of the Availability of Position Accuracy KPP (SS and CS); Position and Time Transfer Integrity KPP (SS and CS); Availability of Time Transfer Accuracy KPP (SS and CS); PNT Determination KPP (User Segment); Accuracy KPP (User Segment); System Survivability - Cybersecurity KPP (CS); Integrity KPP (User Segment); Cryptography, Security Architecture, and Key Distribution KPP (User Segment); and External Augmentation KPP (User Segment).* See Table 5-1 OCX System Survivability - Cybersecurity (KPP) in approved CDD for GPS OCX.	

Requirement Reference

GPS OCX CDD dated June 29, 2017.

Note:

This performance baseline is for OCX and was derived from the system-level CDD requirements. The GPS III program will track cost, schedule, and performance separately in its own APB.Performance characteristics System Survivability, Sustainment, and Availability of Time Transfer Accuracy were added in the approved September 27, 2018 APB. The "Performance Demonstrated" entries are dependent on IST 3-1 test results, which are projected to be available post-DD250.

Acquisition Budget Estimate
OCX

Total Acquisition Cost

		Milestone APB	Current Baseline		Budget Estimate PB 2024		
Category	**Base Year**	**Objective (BY$M)**	**Objective (BY$M)**	**Threshold (BY$M)**	**BY$M**	**TY$M**	**Deviation**
RDT&E	2017	6,030.4	6,030.4	6,633.4	5,993.3	6,069.2	
Procurement	2017	0	0	0			
MILCON	2017	0	0	0	0		
Acq. O&M	2017	0	0	0	0		
Total		6,030.4	6,030.4		5,993.3	6,069.2	
PAUC	2017	6,030.400	6,030.400	6,633.440	5,993.300	6,069.200	
APUC	2017						

Budget Note:

Decrease in FY 2014 RDT&E due to Below Threshold Reprogramming of $0.8M to pay Cancel Year bill via an approved Upward Obligation Adjustment in May 2017.

Decrease in FY 2021 RDT&E of $1.6M due to higher Space Force priorities.

Net decrease in FY 2022 RDT&E of $9.8M due to an increase of a realignment of funds to OCX ($3.7M) and a decrease due to Small Business Innovative Research ($13.5M).

Decrease in FY 2023 RDT&E due to Congressional mark of $74.3M.

Net increase in FY 2024 RDT&E of $23.6M due to increase of $24M to fund OCX Baseline disconnect and inflation adjustment ($0.7M) and a decrease due to higher Space Force priorities ($1.1M).

Total End Item Quantity

Quantity Category	Current APB Quantity	Current Estimate Quantity
Development	1	1
Procurement	0	0
Acq. O&M	--	--

Unit Cost
OCX

Current UCR Baseline and Current Estimate (Base-Year Dollars)			
Category ($M) Base Year:2017	**Current UCR Baseline**	**Current Estimate**	**% Change**
Program Acquisition Unit Cost			
Cost	6,030.4	5,993.3	
Quantity	1	1	
Unit Cost	6,030.400	5,993.300	-0.62%
Average Procurement Unit Cost			
Cost			
Quantity			
Unit Cost			

Original UCR Baseline and Current Estimate (Base-Year Dollars)			
Category ($M) Base Year:2017	**Original UCR Baseline**	**Current Estimate**	**% Change**
Program Acquisition Unit Cost			
Cost	6,030.4	5,993.3	
Quantity	1	1	
Unit Cost	6,030.400	5,993.300	-0.62%
Average Procurement Unit Cost			
Cost			
Quantity			
Unit Cost			

Risks

OCX

Risk and Sensitivity Analysis

Risk and Sensitivity Analysis
Current Procurement Cost (December - 2022)
1. Although technical issues moved the schedule, the program continues to execute within Total Acquisition/PAUC values. No cost risks as this time.
Revised Original Estimate (September - 2018)
1. Total Acquisition Cost - $6030.4M (BY 2017); PAUC - $6030.4M; Risks - Minimal efficiency gains in the final testing phase from the implementation of Development Operations (DevOps) and hardware/software obsolescence.
Current Baseline Estimate (September - 2018)
1. Total Acquisition Cost - $6030.4M (BY 2017); PAUC - $6030.4M; Risks - Minimal efficiency gains in the final testing phase from the implementation of Development Operations (DevOps) and hardware/software obsolescence.

Significant Schedule Risks

Significant Schedule Risks
Current Estimate (December - 2022)
1. Operational assets may not be fully available for the Government's Developmental Test (DT) campaign and resolving issues during DT and may add increased schedule risk. Near term challenges include meeting Integrated System Test (IST) 3-1 Phase 1 needs for ready environments, relevant TOs and test procedures, and available test and operational staff to conduct dry runs and test events. In addition, technical issues and schedule concurrency continue to place pressure on the DD250 delivery date. The government projects DD250 acceptance date of December 2023.
Revised Milestone B (September - 2018)
1. Development Operations (DevOps) Adoption. 2. Simulation Accreditation. 3. Integration/Product test.
Milestone B (November - 2012)
1. Information Assurance Requirement. 2. Software Development Plan. 3. Software Defects. 4. Systems Engineering process discipline.

Technologies and Systems Engineering

Significant Technical Riskss
Current Estimate (December - 2022)

1. Software Qualification.
2. Site Acceptance Testing.
3. Development Testing.

Revised Milestone B (September - 2018)

1. Development Operations (DevOps) Adoption.
2. Simulation Accreditation.
3. Integration/Product test.

Milestone B (November - 2012)

1. Information Assurance Requirement.
2. Software Development Plan.
3. Software Defects.
4. Systems Engineering process discipline.

Low Rate Initial Production

OCX

There is no LRIP for this program.

Contracts

OCX

This program has no Major Contracts as defined by 10 USC4351(e)(2)(A). The following contract is more than 90% complete and is no longer reporting in the SAR: FA8807-10-C-0001 – Raytheon.

Deliveries and Expenditures

OCX

Deliveries				
Delivered to Date	Planned to Date	Actual to Date	Total Quantity	Percent Delivered
Development	0	0	1	0.00%
Production	0	0	0	0.00%
Total Program Quantity Delivered	0	0	1	0.00%

Expended and Appropriated (TY $M)

Years Appropriated to date: 17

Total Years Appropriated Funding (Current Baseline): 19

Percent Years Appropriated: 89.47%

Then-Year Funding Appropriated as Percentage of Total Acquisition Estimate: 96.38%

Then-Year Funding Expended as Percentage of Total Acquisition Estimate: 91.93%

Total Acquisition Cost: $6,069.2

Operating and Support Costs

OCX

O&S Cost Breakdown:

Category (BY2017$ Million)	GPS OCX
Unit-Level Manpower	$232.4
Unit Operations	$81.0
Maintenance	$870.8
Sustaining Support	$219.7
Continued System Improvements	$926.6
Other	$5.3
Total	$2,335.8

Cost Estimate Source: Single Best Estimate dated February 24, 2023

Total Program O&S Cost Compared with Baseline					
	Current Baseline				
Base Year: 2017	Objective (BY$M)	Threshold (BY$M)	Current Estimate (BY$M)	Current Estimate (TY$M)	Deviation
Total O&S	$2,303.2	$2,533.5	$2,335.8	$3,300.6	
Total Disposal	0	0	5.3	8.5	

O&S Cost Note: The 2022 OCX O&S SBE approved on February 24, 2023 continues to experience fact-of-life changes. This has made some of the February 2022 SBE assumptions overcome by events and will be updated accordingly in future estimates.

O&S costs includes operating, maintaining, and supporting the dedicated Master Control Station (MCS) located at Schriever Space Force Base Colorado and the Alternate MCS (AMCS) located at Vandenberg SFB, California, both of which include connections to the ground antenna and monitoring stations which support the GPS III, GPS III Follow-On (GPS IIIF), and GPS II legacy spacecraft. Also included are the costs of operating, maintaining, and supporting 17 monitoring stations, six controlled by the 50th Space Wing and 11 co-located at National Geo-spatial Intelligence Agency sites. Satellite operations at the MCS include mission planning, mission payload operations, and monitoring of satellite state of health. Monitor stations receive mission payload data and transfer this data to the MCS to ensure spacecraft are operating as desired.

The system to be supported will consist of the MCS, AMCS, Launch and Checkout System, Transition Support Facility, Data Storage and Archive System, GPS System Simulator, Standard Space Trainer software, four ground antennae elements, and 17 remote sites.

The program plans for a 10-year operational period. Manpower assumes a mixture of Space Force personnel performing organic work with assistance from contractor engineers.

Hardware depot maintenance will be 100% supported by Tobyhanna Army Depot while the Organizational Level maintenance will be Contractor Logistics Support (in alignment with operational unit's maintenance structure). The estimate assumes 30% organic sotware maintenance and 70% contractor software maintenance.

Operating and Support Costs - Disposal and Unitized Costs

OCX

Annual Unitized O&S Cost Definition and Calculation Relative to Total O&S Cost:

The annual O&S Cost was calculated based on the total BY 2017 cost of $2,335.8 and divided by the expected service life of 10 years, resulting in an annual O&S Cost of $233.6 based of this February 2023 Single Best Estimate.

Sustainment Factors	System Name: OCX	Antecedent System Name:
Quantity to Sustain	1	
Unit of Measure	System	
Unit Expected Service Life	10	

Base Year: 2017

Annual Unitized O&S Cost by Category Base Year $ Unit:($M)	System Name: OCX	Antecedent System Name:
Unit-Level Manpower	$23.2	
Unit Operations	$8.1	
Maintenance	$87.1	
Sustaining Support	$22.0	
Continued System Improvements	$92.7	
Other	$0.5	
Total O&S	$233.6	$0.0

Disposal/Demilitarization Cost Estimate

(BY2017$M)	System Name: OCX	Antecedent System Name:
Total Disposal	$5.3	

Cost Estimate Source - Disposal	
Type:	Other
Approval Authority and Date:	PEO 02/24/2023
Note:	
None	
Disposal Cost Note:	
None	
Antecedent Estimate Assumptions:	
Not Applicable	