

Apr 08, 2022

Department of Defense  
OFFICE OF PREPUBLICATION AND SECURITY REVIEW

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# MILITARY GLOBAL POSITIONING SYSTEM (GPS) USER EQUIPMENT INCREMENT 1 (MGUE INC 1)

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Selected Acquisition Report (SAR)



AS OF THE FY 2021 PRESIDENT'S BUDGET  
U.S. AIR FORCE

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## Program Manager

**Name:** Col. Clifford Sulham

**Date Assigned:** August 16, 2019

**Address:** 483 N. Aviation Blvd

El Segundo, CA 90245

**Phone:** 310-653-3930

## Mission and Description

The objective of the Military Global Positioning System (GPS) User Equipment (MGUE) program is to deliver affordable advanced GPS capabilities to military users as rapidly as possible and to meet the needs of a broad user base. The MGUE program has developed a comprehensive acquisition strategy to provide modernized GPS capabilities to US and Allied forces by establishing time certain and low risk development, bounding requirements to leverage mature technology to the maximum extent possible, implementing cost and schedule controls during Engineering & Manufacturing Development (EMD) and Low Rate Initial Production (LRIP). There will be a focus on implementing a proactive, collaborative MGUE Platform integration activity to mitigate risk and reduce cost for DoD modernization. MGUE will develop form factors based on well-defined standards to support lead platform integration and will introduce the Common GPS Module (CGM) to support long term vision and modernized capabilities for non-lead platform and unique applications.

## Executive Summary

### *Program Highlights Since Last Report*

MGUE Increment 1 delivers two circuit card receiver form factors, ground & aviation/maritime, to be demonstrated in four Service-nominated lead platforms: The Air Force B-2 bomber, the Navy Arleigh Burke Guided Missile Destroyer (DDG), the United States Marine Corps Joint Light Tactical Vehicle, and the Army Stryker Combat Vehicle. The Space and Missile Systems Center contracted with three vendors to develop MGUE technologies: L3Harris (L3H), Raytheon Technologies Corp (RTX) (formerly Raytheon Company), and BAE Systems (formerly Collins Aerospace). L3H and RTX are developing the primary ground and aviation/maritime cards, respectively that are integrating into the lead platforms. To assist the Services, the MGUE Increment 1 program will provide MGUE card-level Integration Guides for the integration of the MGUE GPS Receiver Application Module (GRAM) Standard Electronic Module (GRAM-S/M) and Ground Based GRAM Modernized (GB-GRAM-M) receiver cards in host systems. After lead platform Field Testing, the Services will procure and sustain MGUE Increment 1 receivers in their weapon systems identified for GPS modernization.

In 2019 the MGUE Increment 1 Program Office reported on the pending loss of Trusted Foundries for MGUE digital Application Specific Integrated Circuits (ASIC). Defense Logistics Agency awarded the ASIC bulk contracts in May of 2021 and this risk is considered closed.

In the previous SAR, the program reported a schedule baseline deviation due to technical issues associated with RTX GRAM-S/M receiver card development. This resulted in not meeting three of the six schedule baseline activities: 1st GRAM-S/M Technical Requirements Verification, DDG Program Executive Office (PEO) Certification, and B-2 PEO Certification. Over the last two years, the program has aggressively worked to overcome technical requirement challenges and establish a new cost and schedule baseline for the remaining work. The Program Office conducted and completed an Independent Schedule Risk Assessment on December 3, 2019 and an Independent Program Assessment in February 2020. However, in March 2020, re-baseline and requirement verification activities were impacted by COVID-19 restrictions. On June 9, 2020, the Service Acquisition Executive directed the program to convert remaining Raytheon development from a Cost Plus effort to a Firm Fixed Price (FFP) effort and change program exit criteria in order to bound future cost and schedule risk and focus remaining resources on completing the card development. The Program Office released the FFP modification Request for Proposals on July 31, 2020 and the Government and Raytheon concluded negotiations in November 2020. The contract was awarded in December 2020, enabling the Service Cost Position to be completed on January 13, 2021. As a result, the program was able to complete its re-baseline. SAF/AQ signed a new Acquisition Program Baseline (APB) on January 27, 2021, with revised program cost and schedule milestones. Raytheon delivered software Build 6.2 on November 23, 2021; this software contains the full technical baseline content and will enter Formal Qualification Testing in 2022.

Since the last SAR, the program office completed two of the six total APB milestones: (1) Joint Light Tactical Vehicle (JLTV) PEO certification of readiness for Field Test and (June 2020) and (2) Army Stryker PEO certification of readiness for Field Test (March 2021). The PEO for Space Production and his Army SES counterparts collaborated on an innovative approach to consolidate ground card lead platform Field Testing in 2021 into one event, JLTV Field Utility Evaluation (FUE). Marine Corps Operational Test and Evaluation Activity completed JLTV FUE at White Sands Missile Range on September 14, 2021. This was

a critical program Exit Criteria event. The next APB milestone is GRAM-S/M Technical Requirements Verification, expected to complete by April 2023.

### *History of Significant Developments Since Program Initiation*

History of Significant Developments Since Program Initiation	
Date	Significant Development Description
May 2003	The GPS Directorate first issued Program Research and Development Announcement (PRDA) contracts in 2003 to achieve technology demonstration of early MGUE concepts.
May 2006	The GPS Program Office continued the work of the PRDA contracts via three competitively awarded Modernized User Equipment development contracts in 2006.
June 2006	The Secretary of the Air Force submitted an Analysis of Alternatives (AoA) providing Congress with a summary of the studies conducted to modernize GPS. The AoA found that developing new Military-Code (M-Code) signals as the most cost effective solution to mitigate growing denial of service and integrity threats to the warfighter.
April 2012	USD(AT&L) approved the Milestone A Acquisition Decision Memorandum (ADM) and 2366a certifications were made for the MGUE Inc 1 program, initiating awarding technology development contracts. Materiel Development Decision approved for Inc 2 and MGUE Inc 2 designated as a pre-Major Defense Acquisition Program (MDAP) with the Air Force as lead.
September 2012	Competitively awarded three technology development contracts to Raytheon, L-3 Interstate Electronics Corporation, and Rockwell Collins Inc.
February 2014	USD(AT&L) signed an ADM to accelerate the MGUE Inc 1 effort via a combined Milestone B/C. This ADM added software risk reduction efforts and accelerated delivery of security certification and test material into the Technology Development phase of the MGUE Inc 1 program previously planned for the EMD phase.
June 2014	In response to the February 2014 ADM, the GPS Directorate awarded Engineering Change Proposals (ECPs) on all three MGUE Inc 1 development contracts to add software development risk reductions scope.
July 2014	JROC operational requirements approved. Four KPPs identified in the CDD: (1) Positioning, Navigation, and Timing (PNT) Determination, (2) PNT Accuracy, (3) Integrity and (4) Cryptography, Security Architecture, and Key Distribution.
September 2014	MGUE Inc 1 Preliminary Design Reviews were completed by all three MGUE vendors.
November 2014	Completed a MGUE Technology Readiness Assessment indicating all critical technologies were at a Technology Readiness Level of 6 or higher.
January 2015	In response to the February 2014 ADM, the GPS Directorate awarded ECPs on all three MGUE Inc 1 development contracts for additional test hardware deliveries.
April 2015	USD(AT&L) signed an updated Acquisition Strategy capturing accelerated approach.
June 2015	Existing contracts modified again adding resiliency and increasing software assurance.
October 2016	L3 Technologies (L3T) became the first MGUE contractor to receive security and compatibility certification.
January 2017	USD(AT&L) approved the MGUE Inc 1 2366B certifications and determinations, the Milestone B APB and ADM, and established MGUE Inc 1 as an Acquisition Category (ACAT) ID MDAP. The ADM also relieved the program of Milestone C as production decisions will be made by the hosting platforms.
March 2017	PEO Ammunition conducted a Live Fire event at Yuma Proving Ground to assess the maturity of MGUE Inc 1 technology for Precision Guided Munitions (PGMs). Conducted a combination of

	5 ballistic trajectory shots and 3 First-Ever M-Code Guide-to-Hit test shots for each of the two vendors using a U.S. government-designed 81mm Mortar PGM.
July 2017	Four B-2 Developmental flight tests to confirm B-2 Operational Flight Program compatibility using an MGUE-based prototype Miniature Airborne Global Positioning System Receiver 2000 M-Code completed on July 14, 2017.
November 2017	USD(AT&L) delegated the MDA to the Secretary of the Air Force as an ACAT IC.
December 2017	All three MGUE contracts updated with ECP 4 for Roving Channel Hot Start modification.
May 2018	Completed the 1 <sup>st</sup> edition MGUE Integration Guides, fulfilling an MGUE Increment 1 APB Exit Criteria.
May 2018	US Navy Communications and Navigation GPS Program Office awarded a contract modification to support M-Code Integration efforts aligning the GPS-based PNT Service development effort with MGUE program objectives and delivery schedules with Roving Channel Hot Start capabilities.
June 2018	United States Marine Corps (USMC) JLTV Joint Program Office delivered the five JLTVs to be used for the upcoming USMC lead platform integration.
August 2018	L3T's GB-GRAM-M card successfully completed Electromagnetic Interference/Electromagnetic Compatibility, Environmental, and Reliability testing.
August 2018	L3T received GB-GRAM-M delta security certification.
September 2018	L3T received GB-GRAM-M delta security approval.
November 2018	Raytheon received GRAM-S/M initial security certification.
March 2019	In March 2019, the US Army conducted a very successful "live-fire" test of a Precision Guidance Kit with a L3H MGUE Inc 1 ASIC. The successful test gave the Army confidence to move out on a substantial Inc 1 ASIC procurement in late FY 2019.
July 2019	All three MGUE contracts were updated with ECP-6. Raytheon ECP 6 was awarded on June 24, 2019, L3H on June 28, 2019, and Collins Aerospace on July 31, 2019.
September 2019	Collins Aerospace GB-GRAM-M achieved the 10,000 hours reliability requirement at the US Army Electronic Proving Ground test facility in Fort Huachuca, AZ on September 19, 2019.
September 2019	L3H GB-GRAM-M card successfully closed all remaining Technical Requirements Verification (TRV) liens on September 30, 2019.
October 2019	L3H GB-GRAM-M was granted Delta Security Certification on September 13, 2019 and Security Approval on October 6, 2019.
October 2019	The program manager signed a program deviation report on October 31, 2019 indicating the first GRAM-S/M TRV, DDG PEO Certification, and B-2 PEO Certification events will extend beyond current APB threshold dates.
April 2020	ECP-7, which includes a new National Security Agency (NSA) crypto key structure and Pseudo Random Noise Expansion, was awarded to BAE Systems on April 21, 2020.
May 2020	Completed first Developmental Test of a MGUE Inc 1 Lead Platform on May 8, 2020.
May 2020	L3H GB-GRAM-M Build 5.4 achieved Delta Security Certification on May 12, 2020.
June 2020	ECP-7, which includes a new NSA crypto key structure and Pseudo Random Noise Expansion, was awarded to L3H on June 18, 2020.
June 2020	PEO certified the GB-GRAM-M as ready to enter field testing in the JLTV lead platform on June 26, 2020.
August 2020	Completed Developmental Testing of the Army Stryker lead platform on August 15, 2020.

December 2020	ECP-7, which includes a new NSA crypto key structure and Pseudo Random Noise Expansion, was awarded to Raytheon on December 18, 2020.
December 2020	Converted remaining Raytheon GRAM-S/M development effort to FFP on December 18, 2020.
January 2021	Updated APB approved January 27, 2021. This update to the original APB was due to schedule breach documented in the October 2019 MGUE Inc 1 Program Deviation Report.
March 2021	PEO certified the GB-GRAM-M as ready to enter field testing in the Army Stryker lead platform on March 18, 2021.
September 2021	Completed Marine Corps Operational test and Evaluation Activity began JLV Field User Evaluation on August 24, 2021 and completed September 13, 2021; this evaluation is a MGUE Inc 1 Program Exit Criteria.
November 2021	Raytheon delivered GRAM-S/M software Build 6.2 on November 23, 2021 which is the Full-Technical Baseline software and is currently on track to the two remaining lead platform PEO certifications, pending funding resolution.

## Schedule

### Schedule Events

Schedule Events					
Events	Initial Development APB Objective	Current APB Development Objective/Threshold		Current Estimate	Deviations
Award Technology Development Contract	Sep 2012	Sep 2012	Sep 2012	September 28, 2012	
System Requirements Review	Jul 2013	Jul 2013	Jul 2013	July 1, 2013	
System Design Review	Mar 2014	Mar 2014	Mar 2014	March 20, 2014	
Preliminary Design Review	Sep 2014	Sep 2014	Sep 2014	September 17, 2014	
Milestone B	Jan 2017	Jan 2017	Jan 2017	January 18, 2017	
1st GB-GRAM-M Card Technical Requirements Verification	Sep 2018	Mar 2019	Mar 2019	March 30, 2019	
Card-level PEO Certification for JLTV	Dec 2019	Jun 2020	Jun 2020	June 26, 2020	
Card-level PEO Certification for Stryker	Sep 2020	Sep 2020	Mar 2021	March 18, 2021	
1st GRAM S/M Card Technical Requirements Verification	Jul 2019	Apr 2023	Oct 2023	Apr 2023	
Card-level PEO Certification for B-2	Feb 2020	Jan 2024	Jan 2025	Jan 2024	
Card-level PEO Certification for DDG	Oct 2019	Mar 2024	Sep 2024	Mar 2024	

### Schedule Notes

The Card-level PEO Certification for JLTV current estimate changed from May 2020 to June 2020 due to COVID-related test delays. This milestone was successfully completed on June 26, 2020.

The Card-level PEO Certification for Stryker current estimate changed from December 2020 to March 2021 to allow stakeholders adequate time to reassess MGUE readiness following successful closure of critical Deficiency Reports in February 2021. The milestone was completed on March 18, 2021.

The 1st GRAM-S/M Card Technical Requirements Verification current estimate changed from TBD to April 2023, the Card-level PEO Certification for B-2 current estimate changed from TBD to January 2024, and the Card-level PEO Certification for DDG current estimate changed from TBD to March 2024 to align with the new program baseline established January 27, 2021.



*Significant Schedule Risks*

Significant Schedule Risks	
Milestone B (January 2017)	
1.	Late discovery of software deficiencies: Contractor incremental software deliveries will have new functionality that may result in deficiencies.
2.	Late discovery of hardware deficiencies: Defects in contractor hardware designs discovered in the Government reliability testing could cause delays in lead platform integration and testing.
3.	Test planning execution: Government test team may not be ready to test Final Test Articles. Test execution may be inefficient.
4.	Test coverage gaps: Due to the large number of technical requirements, a Design of Experiment (DOE) was created to ensure validation of the CDD in the lab. However, there may be some functions or interfaces not uniquely tested as part of the DOE, which could be discovered at the next higher level of assembly, particularly for non-lead platforms where box-level testing is not identified.
Current Estimate (December 2021)	
1.	Late discovery of hardware deficiencies: Defects in contractor hardware designs discovered in the Government reliability testing could cause delays in lead platform integration and testing.
2.	Aviation/Maritime card B-2 box-level functional qualification testing: any major deficiencies in the aviation/maritime software could delay functional qualification testing for the B-2 lead platform.
3.	Aviation/Maritime card DDG System Integration Testing (SIT): any major deficiencies in the aviation/maritime software could delay SIT for the DDG lead platform.
4.	Aviation/Maritime card Test Planning and Strategy: If the Test Plan and Detailed Test Procedures are not adequate to sell off the requirements through the existing requirements verification process, then unverified requirements could exist, potentially impacting the Aviation/Maritime TRV Milestone.

## Performance

Performance Characteristics					
Initial Development APB Objective	Current APB Development Objective/Threshold		Demonstrated Performance	Current Estimate	Deviation
<b>PNT Determination</b>					
MGUE shall use M-Code, P(Y)-Code, and C/ACode; MGUE shall be capable of acquiring M-Code in the presence of $J/S \leq 41$ dB; MGUE shall use GPS signals needed to determine PNT in BFEA environments.	MGUE shall use M-Code, P(Y)-Code, and C/ACode; MGUE shall be capable of acquiring M-Code in the presence of $J/S \leq 41$ dB; MGUE shall use GPS signals needed to determine PNT in BFEA environments.	(T=0) MGUE shall use M-Code, P(Y)-Code, and C/ACode; MGUE shall be capable of acquiring M-Code in the presence of $J/S \leq 41$ dB; MGUE shall use GPS signals needed to determine PNT in BFEA environments.	Ground Card: pass  Aviation/Maritime Card: TBD, will first be assessed at Technical Requirements Verification (TRV) Milestone, Estimated Completion Date (ECD): April 2023.	MGUE shall use M-Code, P(Y)-Code, and C/ACode; MGUE shall be capable of acquiring M-Code in the presence of $J/S \leq 41$ dB; MGUE shall use GPS signals needed to determine PNT in BFEA environments.	
<b>PNT Accuracy</b>					
Ground: 10.0 m H, 20.0 m V, 0.1 m/s (velocity, per axis) and 100 nsec; Aviation: 3.0 m H, 5.25 m V and 30 nsec; Maritime: 7.0 m H, 12.5 m V and 50 nsec.	Ground: 10.0 m H, 20.0 m V, 0.1 m/s (velocity, per axis) and 100 nsec; Aviation: 3.0 m H, 5.25 m V and 30 nsec; Maritime: 7.0 m H, 12.5 m V and 50 nsec.	(T=0) Ground: 10.0 m H, 20.0 m V, 0.1 m/s (velocity, per axis) and 100 nsec; Aviation: 3.0 m H, 5.25 m V and 30 nsec; Maritime: 7.0 m H, 12.5 m V and 50 nsec.	Ground Card: pass  Aviation/Maritime Card: TBD, will first be assessed at Technical Requirements Verification (TRV) Milestone, Estimated Completion Date (ECD): April 2023.	Ground: 10.0 m H, 20.0 m V, 0.1 m/s (velocity, per axis) and 100 nsec; Aviation: 3.0 m H, 5.25 m V and 30 nsec; Maritime: 7.0 m H, 12.5 m V and 50 nsec.	
<b>Integrity</b>					
Ground: MGUE shall reject invalid GPS signals 99% of the time so they are not used in the PNT solution; MGUE shall detect and reject MSI provided from GPS satellites and	Ground: MGUE shall reject invalid GPS signals 99% of the time so they are not used in the PNT solution; MGUE shall detect and reject MSI provided from GPS satellites and	(T=0) Ground: MGUE shall reject invalid GPS signals 99% of the time so they are not used in the PNT solution; MGUE shall detect and reject MSI provided from GPS	Ground Card: pass  Aviation/Maritime Card: TBD, will first be assessed at Technical Requirements Verification (TRV) Milestone, Estimated	Ground: MGUE shall reject invalid GPS signals 99% of the time so they are not used in the PNT solution; MGUE shall	

Performance Characteristics				
Initial Development APB Objective	Current APB Development Objective/Threshold	Demonstrated Performance	Current Estimate	Deviation
reject that data from the PNT solution. Aviation: MGUE shall report when GPS should not be used for PNT. Maritime: MGUE shall report when GPS should not be used for PNT.	reject that data from the PNT solution. Aviation: MGUE shall report when GPS should not be used for PNT. Maritime: MGUE shall report when GPS should not be used for PNT.	satellites and reject that data from the PNT solution. Aviation: MGUE shall report when GPS should not be used for PNT. Maritime: MGUE shall report when GPS should not be used for PNT.	Completion Date (ECD): April 2023.	detect and reject MSI provided from GPS satellites and reject that data from the PNT solution. Aviation: MGUE shall report when GPS should not be used for PNT. Maritime: MGUE shall report when GPS should not be used for PNT.

Classified Performance information is provided in the classified annex to this submission.

**Requirements Source:**

CDD dated May 9, 2014 as approved and validated by JROC memorandum 077-14 dated July 24, 2014

## Acquisition Budget Estimate

### Total Acquisition Cost

Category	Base Year	Development APB	APB Name (Current) Mm/dd/yyyy)		Budget Estimate PB 2023		Deviation
		Objective (BY\$)	Objective (BY\$)	Threshold (BY\$)	BY\$	TY\$	
RDT&E	2017	1505.7	1655.5	1821.1	1674.9	1751.1	
Procurement							
MILCON							
Acq. O&M							
<b>Total</b>	2017	1505.7	1655.5	N/A	1674.9	1751.1	
PAUC	2017	N/A	N/A	N/A	N/A		
APUC		N/A	N/A	N/A	N/A		

### Total End Item Quantity

Quantity Category	Current APB Quantity	Current Estimate Quantity
Development	0	0
Procurement	0	0
<b>Total</b>	0	0

### Budget Notes

Increase in FY 2019 RDT&E due to net of Congressional Recession and reprogramming for other Air Force priorities.

Increase in FY 2020 RDT&E due to a net of higher Air Force priorities, reprogramming for other Air Force priorities, and reallocation of funds between MGUE Inc 1 and Inc 2.

Decrease in FY 2021 RDT&E due to a reallocation of funds between MGUE Inc 1 and Inc 2.

Increase in FY 2023- 2025 RDT&E to fund to the updated service cost estimate and inflation adjustments.

**Risk and Sensitivity Analysis**

Risks and Sensitivity Analysis	
Current Baseline Estimate (January 2021)	
1.	Development APB (BY 2017): Total Acquisition Cost - \$1,505.7M (Quantity 0); PAUC - N/A (Quantity 0); APUC -N/A (Quantity 0) Risks - MGUE cost/schedule baseline established prior to completion of outstanding Over Target Schedule/Over Target Baseline negotiations and aggressive Service-provided lead platform integration and operational test schedules.
Original Baseline Estimate (January 2017)	
1.	Development APB (BY 2017): Total Acquisition Cost - \$1,505.7M (Quantity 0); PAUC - N/A (Quantity 0); APUC -N/A (Quantity 0) Risks - MGUE cost/schedule baseline established prior to completion of outstanding Over Target Schedule/Over Target Baseline negotiations and aggressive Service-provided lead platform integration and operational test schedules.
Revised Original Estimate (N/A)	
None	
Current Procurement Cost (December 2020)	
1.	Development APB (BY 2017): Total Acquisition Cost - \$1,674.9M (Quantity 0); PAUC - N/A (Quantity 0); APUC -N/A (Quantity 0) Risks - An Independent Schedule Risk Assessment was completed on December 3, 2019. The program received a new ADM signed by SAF/AQ in August 2020, converted the Raytheon contract to FFP in December 2020, and established a new APB in January 2021. As of December 2021, the program has verified 84% of Raytheon GRAM-S/M requirements and identified root cause for 100% of deficiencies that previously led to declaring breach on three APB milestones in 2019. Raytheon delivered software Build 6.2 on November 23, 2021 - which is the Full-Technical Baseline software and is currently on track to the two remaining lead platform PEO certifications.

## Unit Cost

### *Current Baseline Compared with Current Estimate*

This program has no defined quantities; therefore, Unit Cost Reporting does not apply.

### *Original Baseline Compared with Current Estimate*

This program has no defined quantities; therefore, Unit Cost Reporting does not apply.

## Contracts

### General Notes:

The following contracts are more than 90% complete and are no longer reporting in the SAR:

FA8807-12-C-0011 – L3 Technologies

FA8807-12-C-0013 – BAE Systems

Contract Data (\$TYM)		
Contract Number	FA8807-12-C-0012	
Effort Number		
Modification Number		
Contract Type	FFP	
Award Date	9/28/2012	
Definitization Date	9/28/2012	
Order Number		
CAGE Code/CAGE Legal Name	4U884/Raytheon Company	
Contract Title	Military GPS User Equipment (MGUE)	
Contract Address	2000 E. El Segundo Blvd, El Segundo, CA 90245	
Contracts/Effort Price, Quantity, and Performance (\$M)		
Initial Target Price	Current Target Price	
25.2	156.4	
Initial Ceiling Price	Current Ceiling Price	
N/A	N/A	
Contract's EAC	PM's EAC	
116.2	116.2	
Initial Quantity	Current Quantity	Delivered Quantity
0	0	0
BAC	BCWP	ACWP
N/A	N/A	N/A
BCWS	Cost Variance	Schedule Variance
N/A	N/A	N/A

### Contract Notes

Cost and Schedule Variance reporting is no longer required on this contract. The contract converted from Cost Plus to FFP contract effective January 1, 2021. The difference between the Initial Target Price and the Current Target Price is directly related to the shift from CPIF to FFP. The PM's Estimated Price at Complete aligns with Raytheon's Estimated Price; there is no earned value reporting with the FFP contract going forward.

## Technologies and Systems Engineering

### Significant Technical Risks

Significant Schedule and Technical Risks	
Milestone B (January 2017)	
1.	Late discovery of software deficiencies: Contractor incremental software deliveries will have new functionality that may result in deficiencies.
2.	Late discovery of hardware deficiencies: Defects in contractor hardware designs discovered in the Government reliability testing could cause delays in lead platform integration and testing.
3.	Test planning execution: Government test team may not be ready to test Final Test Articles. Test execution may be inefficient.
4.	Test coverage gaps: Due to the large number of technical requirements, a DOE was created to ensure validation of the CDD in the lab. However, there may be some functions or interfaces not uniquely tested as part of the DOE, which could be discovered at the next higher level of assembly, particularly for non-lead platforms where box-level testing is not identified.
Current Estimate (December 2021)	
1.	Late Discovery of Hardware Deficiencies: If MGUE receivers fail to meet Technical Requirements Document requirements by hardware qualification run-for-record testing at Electronic Proving Grounds due to hardware deficiencies, then hardware redesign and rework will be required, causing significant cost growth and schedule delays to TRV.
2.	Raytheon (RTN) GRAM-S/M 6.2 Software (SW) Readiness for MAGR-2K-M24 FQT: If RTX GRAM-S/M 6.2 SW fails short of minimum capability for integration and requires a change to the CGM-S then performing MAGR-2K-M24 Functional Qualification Testing will be dependent on release of RTX GRAM-S/M 6.3 SW. This will incur a six month slip onto the B-2 programs critical path.
3.	RTN GRAM-S/M 6.2 Readiness for DDG SIT: If RTX SW build plan baselined in FFP contract does not address deficiencies blocking SIT entrance criteria then there will be a slip in SIT for DDG, and PEO Certification for DDG Lead Platform may be affected.
4.	GRAM-S/M Test Planning and Strategy: If the RFX FFP Test Plan and DTPs are not adequate to sell off the requirements through the existing CVRB process then unverified requirements will exist, potentially impacting the GRAM-S/M TRV Milestone Date.



## Deliveries and Expenditures

### *Deliveries*

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

### *Expended and Appropriated*

Total Acquisition Cost: 1751.1

Expended to Date: 1284.3

Percent Expended: 73.34%

Total Funding Years: 14

Years Appropriated: 11

Percent Years Appropriated: 71.43%

Appropriated to Date: 1420.8

Percent Appropriated: 81.14%

### Low Rate Initial Production

There is no LRIP for this program.

### Operating and Support Costs

O&S requirements will be addressed by the DoD Services following completion of the MGUE development program.