| Exhibit R-2, RDT&E Budget Item Justification: PB 2020 Navy | | | | | | | | | | | Date: March 2019 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Appropriation/Budget Activity<br>1319: *Research, Development, Test & Evaluation, Navy I* BA 7: *Operational Systems Development* | | | | | R-1 Program Element (Number/Name)<br>PE 1203109N *I (U)Satellite Communications (SPACE)* | | | | | | | |
| **COST ($ in Millions)** | **Prior Years** | **FY 2018** | **FY 2019** | **FY 2020 Base** | **FY 2020 OCO** | **FY 2020 Total** | **FY 2021** | **FY 2022** | **FY 2023** | **FY 2024** | **Cost To Complete** | **Total Cost** |
| Total Program Element | 0.000 | 40.330 | 34.174 | 15.868 | - | 15.868 | 23.086 | 22.088 | 17.376 | 16.454 | 35.416 | 204.792 |
| 0728: *EHF SATCOM Terminals* | 0.000 | 21.830 | 17.729 | 0.000 | - | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 39.559 |
| 2472: *Mobile User Objective Sys (MUOS)* | 0.000 | 13.556 | 15.530 | 15.868 | - | 15.868 | 23.086 | 22.088 | 17.376 | 16.454 | 35.416 | 159.374 |
| 3398: *Enterprise SATCOM Gateway Modems (ESGMs)* | 0.000 | 0.116 | 0.915 | 0.000 | - | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 1.031 |
| 9999: *Congressional Adds* | 0.000 | 4.828 | 0.000 | 0.000 | - | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 4.828 |
| **Program MDAP/MAIS Code:**<br>**Project MDAP/MAIS Code(s):** 290, 345 | | | | | | | | | | | | |

**Note**

Navy Multiband Terminal (NMT) Program has been realigned from PE 1203109N to PE 0303109N (U)SATELLITE COMMUNICATIONS (SPACE) starting in FY20.

**A. Mission Description and Budget Item Justification**

The Navy Multiband Terminal (NMT) Program is the required Navy component to the Advanced Extremely High Frequency (AEHF) program for enhancing protected and survivable satellite communications to Naval forces. The NMT system provides an increase in single service capability from 1.5 Megabits per second (Mbps) to 8 Mbps, increases the number of coverage areas and retains Anti-Jam/Low Probability of Intercept (AJ/LPI) protection characteristics. It is compatible with legacy Navy Low Data Rate/Medium Data Rate (LDR/MDR) terminals and will sustain the Military Satellite Communications (MILSATCOM) architecture by providing connectivity across the spectrum of mission areas, to include land, air and naval warfare, special operations, strategic nuclear operations, strategic defense, theater missile defense, and space operations and intelligence in support of Resilient Command and Control (RC2) initiatives. The NMT system replenishes and improves on Navy terminal capabilities of the Military Strategic, Tactical & Relay System (MILSTAR), Defense Satellite Communications System (DSCS), Wideband Global Satellite (WGS) and Global Broadcast Service (GBS). The new system equips the warfighters with the assured, jam resistant, secure communications as described in the joint AEHF satellite communications system and WGS Operational Requirements Documents (ORD).

The Navy GBS Program is the Navy component of the Joint Military Satellite Communications (MILSATCOM) ACAT IC program that delivers the continuous flow of high-speed, high-volume communication and information flow for deploying, deployed, on the move, and garrisoned forces. The Joint GBS system supports the Navy Strategic Plan and equips warfighters with Resilient Command and Control (RC2) communications. The Enterprise SATCOM Gateway Modem (ESGM) is the Department of Defense (DoD) Chief Information Officer directed solution to satisfy the Transmission Security (TRANSEC) requirement in place of the Joint Internet. Testing and fielding of the ESGM is a joint venture, operationally directed by the Defense Information Systems Agency (DISA) and the United States Air Force (USAF) as the lead service. GBS augments and interfaces with other communications systems, provides relief to overburdened communications systems already in place, and provides information to previously unsupported users. GBS provides bandwidth five times any other system, up to 45 Mbps of forward link data (shore to ship) per WGS satellite transponder.

| Exhibit R-2, RDT&E Budget Item Justification: PB 2020 Navy | Date: March 2019 |
|---|---|
| **Appropriation/Budget Activity**<br>1319: *Research, Development, Test & Evaluation, Navy I* BA 7: *Operational Systems Development* | **R-1 Program Element (Number/Name)**<br>PE 1203109N *I (U)Satellite Communications (SPACE)* |

The Mobile User Objective System (MUOS) program provides for the development of the next generation Department of Defense (DoD) advanced narrowband communications satellite constellation. MUOS is the only Ultra High Frequency (UHF) satellite system replacing the aging UHF Follow-on (UFO) system, which is currently beyond its design life. MUOS provides legacy UHF satellite communications as well as a Wideband Code Division Multiple Access (WCDMA) capability which significantly increases performance and capacity critical to support Combatant Command priorities.

| B. Program Change Summary ($ in Millions) | FY 2018 | FY 2019 | FY 2020 Base | FY 2020 OCO | FY 2020 Total |
|---|---|---|---|---|---|
| Previous President's Budget | 37.836 | 39.174 | 47.333 | - | 47.333 |
| Current President's Budget | 40.330 | 34.174 | 15.868 | - | 15.868 |
| Total Adjustments | 2.494 | -5.000 | -31.465 | - | -31.465 |
| • Congressional General Reductions | - | - | | | |
| • Congressional Directed Reductions | - | -5.000 | | | |
| • Congressional Rescissions | - | - | | | |
| • Congressional Adds | - | - | | | |
| • Congressional Directed Transfers | - | - | | | |
| • Reprogrammings | - | - | | | |
| • SBIR/STTR Transfer | -1.111 | 0.000 | | | |
| • Program Adjustments | -0.001 | 0.000 | -31.288 | - | -31.288 |
| • Rate/Misc Adjustments | 0.000 | 0.000 | -0.177 | - | -0.177 |
| • Congressional Directed Reductions Adjustments | -1.394 | - | - | - | - |
| • Congressional Add Adjustments | 5.000 | - | - | - | - |

| Congressional Add Details ($ in Millions, and Includes General Reductions) | FY 2018 | FY 2019 |
|---|---|---|
| **Project:** 9999: *Congressional Adds* | | |
| Congressional Add: *NMT Development* | 4.828 | 0.000 |
| Congressional Add Subtotals for Project: 9999 | 4.828 | 0.000 |
| Congressional Add Totals for all Projects | 4.828 | 0.000 |

**Change Summary Explanation**

Navy Multiband Terminal (NMT) Program (Project 0728) has been realigned from PE 1203109N to PE 0303109N (U)SATELLITE COMMUNICATIONS (SPACE) starting in FY20.

| Exhibit R-2, RDT&E Budget Item Justification: PB 2020 Navy | Date: March 2019 |
|---|---|
| **Appropriation/Budget Activity**<br>1319: *Research, Development, Test & Evaluation, Navy I* BA 7: *Operational Systems Development* | **R-1 Program Element (Number/Name)**<br>PE 1203109N *I (U)Satellite Communications (SPACE)* |

The MUOS (Project 2472) increase in FY20 funds End to End (E2E) MUOS usability enhancements. This is offset by reduction of $1.691M to account for the availability of prior year balances.

The Congressional Add in FY18 provides $5M (Project 0728) for the development, test and evaluation of enhanced capabilities for the Navy Multiband Terminal (NMT) by furthering Science & Technology (S&T) research and transition activities associated with resilient communications capabilities.

Schedule:
EHF SATCOM Terminals (Project 0728) - No change
MUOS (Project 2472) Enterprise Agile Deployment (EAD) 8 slipped one quarter due to technical issues identified and corrected.

Technical:
EHF SATCOM Terminals (Project 0728): No change

| Exhibit R-2A, RDT&E Project Justification: PB 2020 Navy | | | | | | | | | | | Date: March 2019 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Appropriation/Budget Activity<br>1319 / 7 | | | | | R-1 Program Element (Number/Name)<br>PE 1203109N / *(U)Satellite Communications (SPACE)* | | | | Project (Number/Name)<br>0728 / *EHF SATCOM Terminals* | | | |
| **COST ($ in Millions)** | **Prior Years** | **FY 2018** | **FY 2019** | **FY 2020 Base** | **FY 2020 OCO** | **FY 2020 Total** | **FY 2021** | **FY 2022** | **FY 2023** | **FY 2024** | **Cost To Complete** | **Total Cost** |
| 0728: *EHF SATCOM Terminals* | 0.000 | 21.830 | 17.729 | 0.000 | - | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 39.559 |
| Quantity of RDT&E Articles | | - | - | - | - | - | - | - | - | - | | |
| **Project MDAP/MAIS Code:** 290 | | | | | | | | | | | | |

**Note**

Navy Multiband Terminal (NMT) Program has been realigned from PE 1203109N to PE 0303109N starting in FY20.

**A. Mission Description and Budget Item Justification**

The Navy Multiband Terminal (NMT) Program is the required Navy component to the Advanced Extremely High Frequency (AEHF) Program for enhancing protected and survivable satellite communications to Naval forces. Although development of the NMT terminal is complete, software and hardware upgrade development is ongoing to provide enhanced capabilities to the fleet. The NMT system provides an increase in single service capability from 1.5 Megabits per second (Mbps) to 8 Mbps, increases the number of coverage areas, and retains Anti-Jam/Low Probability of Intercept (AJ/LPI) protection characteristics. It is compatible with legacy Navy Low Data Rate/Medium Data Rate (LDR/MDR) terminals and will sustain the Military Satellite Communications (MILSATCOM) architecture by providing connectivity across the spectrum of mission areas, to include land, air and naval warfare, special operations, strategic defense, theater missile defense, and space operations and intelligence. The NMT system replenishes and improves on Navy Military Strategic, Tactical & Relay System (MILSTAR), Defense Satellite Communications System (DSCS), Wideband Global Satellite (WGS), and Global Broadcast Service (GBS) terminal capabilities. The new system equips the warfighters with assured, jam resistant, secure communications as described in both the joint AEHF Satellite Communications System and the WGS Operational Requirement Documents (ORD). Mission requirements specific to Navy operations, including threat levels and scenarios, are contained in the ORD. The NMT provides multiband Satellite Communications (SATCOM) capability for ship, submarine, and protected MILSATCOM for shore sites.

The Wideband Anti-Jam Modem System (WAMS) is a Navy technology upgrade that enhances communication capability of shipboard and submarine NMTs by providing wideband Anti-Jam (AJ) Satellite Communication throughput over Wideband Global SATCOM (WGS). WAMS is a major contributor in supporting the National Defense Strategy by investing in resilience to provide assured communications capabilities. WAMS enables space segment Anti Jam (AJ) diversity (EHF/AEHF and WGS), thus enabling NMT ships and submarines equipped with the modem to operate in wideband links closer to threat jammers. The United States USAF (USAF) Protected Tactical Enterprise Service (PTES) program will provide the ground hub component of the WAMS communication system. This PTES joint hub will serve as a DoD enterprise service ground solution for the use of the Protected Tactical Waveform (PTW) of SATCOM communications and introduces a Network Operations Without Shore (NOWS) capability. The NOWS capability will use the Direct Sequence Spread Spectrum (DSSS) waveform that provides uninterrupted communication in case of loss of shore hub connectivity. PTW is a Frequency Hopped Spread Spectrum (FHSS) waveform that provides high data rates in a benign environment and anti-jam protection to meet contested data rate requirements. High data rate anti-jam capability is enabled via the Protected Tactical Waveform (PTW) and low data rate anti-jam capability is provided via the Direct Sequence Spread Spectrum (DSSS) waveform. These two waveforms are designed to operate over the Wideband Global SATCOM system as well as other transponded satellites, and are also forward compatible with the on-board processing capabilities of the future Protected Tactical Satellites (PTS). WAMS enables the use of WGS X and Ka-band resources to assure access to mission critical communications to provide Resilient Command and

| Exhibit R-2A, RDT&E Project Justification: PB 2020 Navy | | Date: March 2019 |
|---|---|---|
| **Appropriation/Budget Activity**<br>1319 / 7 | **R-1 Program Element (Number/Name)**<br>PE 1203109N / *(U)Satellite Communications (SPACE)* | **Project (Number/Name)**<br>0728 / *EHF SATCOM Terminals* |

Control (RC2) capabilities in contested/degraded environments, formerly known as Anti-Access/Area Denial (A2AD). The use of WAMS PTW on WGS will augment AEHF Extended Data Rate (XDR) services to provide the information throughput capacity necessary to support critical Command and Control capability.

Joint Aerial Layer Network-Maritime (JALN-M) is the Navy implementation of the JALN architecture which provides assured communications in any environment, especially in a satellite denied environment. With disruption or loss of Space tier communications, JALN-M establishes and/or restores connectivity. A critical component of RC2 capabilities is Adaptive Coding (AC) software development incorporation into the baseline NMT terminal including the Advanced Time Division Multiple Access (TDMA) Interface Processor (ATIP) in addition to supporting the JALN-M demonstration. This capability autonomously enhances maximum throughput and supports degraded conditions by adjusting End-to-End code rate to provide continuous, mission critical, and protected communications. The JALN-M Demo completed in FY18.

Development efforts, including Adaptive Coding, Time of Day, and the Wideband Anti-Jam Modem System (WAMS) augment the baseline NMT system to pace the evolving threats to the warfighter. The Time of Day (TOD) capability promotes communications reliability and resiliency; when the channel is degraded due to inclement weather or adversarial action. TOD enables the system to automatically transition to a more robust, lower code rate resulting in ability to maintain satellite link thereby allowing the fleet to preserve communications.

Technology Insertion, studies and implementation is necessary for military satellite communications systems development to support emerging technologies for Commercial Broadband Satellite Program (CBSP) and Global Broadcast Service (GBS) Terminals in the out years.

| B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each) | FY 2018 | FY 2019 | FY 2020 Base | FY 2020 OCO | FY 2020 Total |
|---|---|---|---|---|---|
| ***Title:*** NMT Resilient C2 Development | 19.671 | 17.729 | 0.000 | 0.000 | 0.000 |
| ***Articles:*** | - | - | - | - | - |
| ***Description:*** Software and hardware upgrade development is ongoing to provide Resilient Command and Control (RC2) capabilities to pace the evolving threats to the warfighter in contested/degraded environments. The Wideband Anti-Jam Modem System (WAMS) will provide an anti-jamming capability that will counter various adversary threats. Adaptive Coding (AC) will autonomously maximize throughput in degraded or benign conditions over the Advanced Extremely High Frequency (AEHF) satellites, providing significantly more throughput than is available today in the baseline NMT. The Time of Day (TOD) capability promotes communications reliability and resiliency; when the channel is degraded due to inclimate weather or adversarial action. TOD enables the system to automatically transition to a more robust, lower code rate resulting in ability to maintain satellite link thereby allowing the fleet to preserve communications. | | | | | |
| ***FY 2019 Plans:***<br>Complete major Time of Day (TOD) software design development efforts on the affected systems, NMT and ATIP, to implement the more robust AC capability. The NMT and ATIP vendors will develop parallel Engineering Change Proposals (ECPs) to design and ensure the interoperability of AC software and TOD encryption that | | | | | |

| Exhibit R-2A, RDT&E Project Justification: PB 2020 Navy | | Date: March 2019 |
|---|---|---|
| **Appropriation/Budget Activity**<br>1319 / 7 | **R-1 Program Element (Number/Name)**<br>PE 1203109N / *(U)Satellite Communications (SPACE)* | **Project (Number/Name)**<br>0728 / *EHF SATCOM Terminals* |

| B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each) | FY 2018 | FY 2019 | FY 2020 Base | FY 2020 OCO | FY 2020 Total |
|---|---|---|---|---|---|
| will enable a more robust, lower code rate when the link margin is degraded. The program will undertake NSA certification of AC TOD encryption solution and author a Key Management Plan (KMP) to support key generation, distribution and operation of the AC TOD encryption. The ToD encryption functionality will be hosted in the ATIP and allow for continued operations during degraded link environments using lower code rate / data rate without dropping the communications link. The program will develop test plans and execute test events to verify system of systems capability. This includes the development of the network interface of Automated Digital Network System (ADNS) to support a dynamic bandwidth capability that enables data rate to change based on modem link condition on the radio to router interface. This will complete the integration and testing of NMT and ATIP design development as well as development plans for TOD encryption solution and associated technical and system risk reduction.<br><br>NMT will continue to support the Air Force Lead Developmental Test Organization (LDTO) EPS events and EPS Multi-Service Operational Test and Evaluation (MOT&E) to include completion of test reports and documenting configuration setting on the Navy Last Mile.<br><br>Define the Navy's WAMS technical baseline for integration into NMT. Continue to develop and design the Modem Mission Management System interim (MMSi) and Key Management System interim (KMSi) interfaces, including integration strategies for MMS/KMS operational compatibility with the DoD Protected Tactical Enterprise Service (PTES) ground solution architecture. This will also include Navy specification development and review of the Air Force Technical Requirements Documents (TRD). Obtain and certify space assets and ground facilities to support testing and assessment of Engineering Design Model (EDM) modems. Develop test plans and procedures to commence Navy testing of USAF EDM modems after delivery. Testing will include analysis of three separate vendor EDM designs procured from the USAF Protected Tactical Field Service Demonstration (PTSFD) effort. The testing process verifies and validates the vendor designs to ensure that Navy unique performance (antenna handover) and environmental (shock, vibration, temperature, and humidity) requirements are addressed in the design. Navy testing of both surface and submarine terminal variant EDM WAMS modems in Navy Labs. Testing will verify and validate waveform and system specification compliance and help refine the Navy test plan and schedule which will allow for the coordination of joint Initial Operational Capability (IOC) test events with the Air Force.<br><br>***FY 2020 Base Plans:***<br>N/A<br><br>***FY 2020 OCO Plans:*** | | | | | |

| Exhibit R-2A, RDT&E Project Justification: PB 2020 Navy | | Date: March 2019 |
|---|---|---|
| **Appropriation/Budget Activity**<br>1319 / 7 | **R-1 Program Element (Number/Name)**<br>PE 1203109N / *(U)Satellite Communications (SPACE)* | **Project (Number/Name)**<br>0728 / *EHF SATCOM Terminals* |

| B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each) | FY 2018 | FY 2019 | FY 2020 Base | FY 2020 OCO | FY 2020 Total |
|---|---|---|---|---|---|
| N/A<br>***FY 2019 to FY 2020 Increase/Decrease Statement:***<br>The decrease from FY19 to FY20 is due to the realignment of Project Unit 0728 from PE 1203109N to PE 0303109N beginning in FY20. | | | | | |
| ***Title:*** Joint Aerial Layer Network Maritime (JALN-M)<br>***Articles:***<br>***FY 2019 Plans:***<br>N/A<br>***FY 2020 Base Plans:***<br>N/A<br>***FY 2020 OCO Plans:***<br>N/A | 2.059<br>- | 0.000<br>- | 0.000<br>- | 0.000<br>- | 0.000<br>- |
| ***Title:*** Technology Insertion<br>***Articles:***<br>***Description:*** Overall program efforts include technology insertion implementation and associated testing required to support satellite communications.<br>***FY 2019 Plans:***<br>N/A<br>***FY 2020 Base Plans:***<br>N/A<br>***FY 2020 OCO Plans:***<br>N/A | 0.100<br>- | 0.000<br>- | 0.000<br>- | 0.000<br>- | 0.000<br>- |
| **Accomplishments/Planned Programs Subtotals** | 21.830 | 17.729 | 0.000 | 0.000 | 0.000 |

| Exhibit R-2A, RDT&E Project Justification: PB 2020 Navy | | Date: March 2019 |
|---|---|---|
| **Appropriation/Budget Activity**<br>1319 / 7 | **R-1 Program Element (Number/Name)**<br>PE 1203109N / *(U)Satellite Communications (SPACE)* | **Project (Number/Name)**<br>0728 / *EHF SATCOM Terminals* |

**C. Other Program Funding Summary ($ in Millions)**

| Line Item | FY 2018 | FY 2019 | FY 2020 Base | FY 2020 OCO | FY 2020 Total | FY 2021 | FY 2022 | FY 2023 | FY 2024 | Cost To Complete | Total Cost |
|---|---|---|---|---|---|---|---|---|---|---|---|
| • OPN/3216: *NAVY MULTIBAND TERMINAL (NMT)* | 62.113 | 109.385 | 88.021 | - | 88.021 | 70.187 | 24.249 | 16.585 | 20.281 | 73.062 | 1,551.433 |

**Remarks**

Funding for NMT OPN in PE 0303109N starting in FY20.

The Other Appropriation represents remaining procurement and installation of NMT production units for Afloat and Shore requirements to reach Full Operational Capability. Funding also includes the procurement and installation of Assured Command and Control (AC2) modems as well as the installation of Advanced Time Division Multiple Access (TDMA) Interface Processors (ATIPs), X/KA Back-Fits, and Ashore Antennas.

**D. Acquisition Strategy**

The Navy Multiband Terminal (NMT) Follow-On Full Deployment (FOFD) contract will continue NMT production for Afloat platforms and Shore locations, in support of the Chief of Naval Operations and the Department of the Navy (DON), and will allow the NMT Program to complete Full Operational Capability (FOC) . The competitive contract awarded to Comtech supports the development of Advanced Time Division Multiple Access (TDMA) Interface Processor (ATIP) and Assured Command and Control (AC2) modem enhancements such as Adaptive Coding. A new competitive contract will be awarded to support development and procurement of the Wideband Anti-Jam Modem System (WAMS).

**E. Performance Metrics**

The RDT&E goal for the NMT program is to create a military satellite communications system that consolidates capabilities of current and future satellite systems into a single terminal, and develops terminal communications capabilities that will counter all current and projected threats to satellite operations enabling communications in all environments.

| Exhibit R-3, RDT&E Project Cost Analysis: PB 2020 Navy | | Date: March 2019 |
|---|---|---|
| **Appropriation/Budget Activity**<br>1319 / 7 | **R-1 Program Element (Number/Name)**<br>PE 1203109N / *(U)Satellite Communications (SPACE)* | **Project (Number/Name)**<br>0728 / *EHF SATCOM Terminals* |

**Product Development ($ in Millions)**

| Cost Category Item | Contract Method & Type | Performing Activity & Location | Prior Years | FY 2018 Cost | FY 2018 Award Date | FY 2019 Cost | FY 2019 Award Date | FY 2020 Base Cost | FY 2020 Base Award Date | FY 2020 OCO Cost | FY 2020 OCO Award Date | FY 2020 Total Cost | Cost To Complete | Total Cost | Target Value of Contract |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Software Development Time of Day (TOD) | C/CPAF | RAYTHEON : Marlborough, MA | 0.000 | 3.140 | Dec 2017 | 1.886 | Dec 2018 | 0.000 | | - | | 0.000 | 0.000 | 5.026 | - |
| Software Development ATIP Adaptive Coding (AC) /Time of Day (TOD) | C/CPFF | COMTECH : Tempe, AZ | 0.000 | 3.225 | Dec 2017 | 1.716 | Dec 2018 | 0.000 | | - | | 0.000 | 0.000 | 4.941 | - |
| Software Development Engineering | C/CPFF | NUWC : Newport, RI | 0.000 | 3.062 | Jan 2018 | 3.598 | Jan 2019 | 0.000 | | - | | 0.000 | 0.000 | 6.660 | - |
| Software Development Engineering | WR | SSC PAC : San Diego, CA | 0.000 | 0.581 | Jan 2018 | 0.565 | Jan 2019 | 0.000 | | - | | 0.000 | 0.000 | 1.146 | - |
| WAMS EDM Hardware | C/CPIF | RAYTHEON : Marlborough, MA | 0.000 | 0.550 | Aug 2018 | 0.000 | Jan 2019 | 0.000 | | - | | 0.000 | 0.000 | 0.550 | - |
| WAMS EDM Hardware | C/CPIF | L3 Systems West: : Salt Lake City, UT | 0.000 | 0.485 | Aug 2018 | 0.000 | | 0.000 | | - | | 0.000 | 0.000 | 0.485 | - |
| WAMS EDM Hardware | C/CPIF | ViaSat : Carlsbad, CA | 0.000 | 0.317 | Aug 2018 | 0.000 | | 0.000 | | - | | 0.000 | 0.000 | 0.317 | - |
| | | **Subtotal** | 0.000 | 11.360 | | 7.765 | | 0.000 | | - | | 0.000 | 0.000 | 19.125 | N/A |

**Support ($ in Millions)**

| Cost Category Item | Contract Method & Type | Performing Activity & Location | Prior Years | FY 2018 Cost | FY 2018 Award Date | FY 2019 Cost | FY 2019 Award Date | FY 2020 Base Cost | FY 2020 Base Award Date | FY 2020 OCO Cost | FY 2020 OCO Award Date | FY 2020 Total Cost | Cost To Complete | Total Cost | Target Value of Contract |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Software Integration/ Government Oversight | WR | NUWC : Newport, RI | 0.000 | 1.254 | Nov 2017 | 1.123 | Nov 2018 | 0.000 | | - | | 0.000 | 0.000 | 2.377 | - |
| Software Integration Support | WR | SSC PAC : San Diego, CA | 0.000 | 0.793 | Nov 2017 | 0.725 | Nov 2018 | 0.000 | | - | | 0.000 | 0.000 | 1.518 | - |
| Software Engineering Support | C/CPFF | SYSTECH : San Diego, CA | 0.000 | 2.348 | Nov 2017 | 2.016 | Nov 2018 | 0.000 | | - | | 0.000 | 0.000 | 4.364 | - |
| WAMS Studies and Design | FFRDC | MIT/LL : Lexington, MA | 0.000 | 0.500 | Jan 2018 | 1.095 | Jan 2019 | 0.000 | | - | | 0.000 | 0.000 | 1.595 | - |
| WAMS Cybersecurity Engineering | WR | NSA : Fort Meade, MD | 0.000 | 0.000 | | 0.250 | Jan 2019 | 0.000 | | - | | 0.000 | 0.000 | 0.250 | - |
| | | **Subtotal** | 0.000 | 4.895 | | 5.209 | | 0.000 | | - | | 0.000 | 0.000 | 10.104 | N/A |

| Exhibit R-3, RDT&E Project Cost Analysis: PB 2020 Navy | | | Date: March 2019 |
|---|---|---|---|
| Appropriation/Budget Activity<br>1319 / 7 | R-1 Program Element (Number/Name)<br>PE 1203109N / *(U)Satellite Communications (SPACE)* | Project (Number/Name)<br>0728 / *EHF SATCOM Terminals* | |

**Test and Evaluation ($ in Millions)**

| Cost Category Item | Contract Method & Type | Performing Activity & Location | Prior Years | FY 2018 Cost | FY 2018 Award Date | FY 2019 Cost | FY 2019 Award Date | FY 2020 Base Cost | FY 2020 Base Award Date | FY 2020 OCO Cost | FY 2020 OCO Award Date | FY 2020 Total Cost | Cost To Complete | Total Cost | Target Value of Contract |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| EPS & JALN-M Development Test and Evaluation | WR | SSC PAC : San Diego, CA | 0.000 | 3.728 | Nov 2017 | 3.396 | Nov 2018 | 0.000 | | - | | 0.000 | 0.000 | 7.124 | - |
| Operational Test & Evaluation | WR | COMOPTEVFOR : Norfolk, VA | 0.000 | 0.009 | Nov 2017 | 0.000 | | 0.000 | | - | | 0.000 | 0.000 | 0.009 | - |
| | | **Subtotal** | 0.000 | 3.737 | | 3.396 | | 0.000 | | - | | 0.000 | 0.000 | 7.133 | N/A |

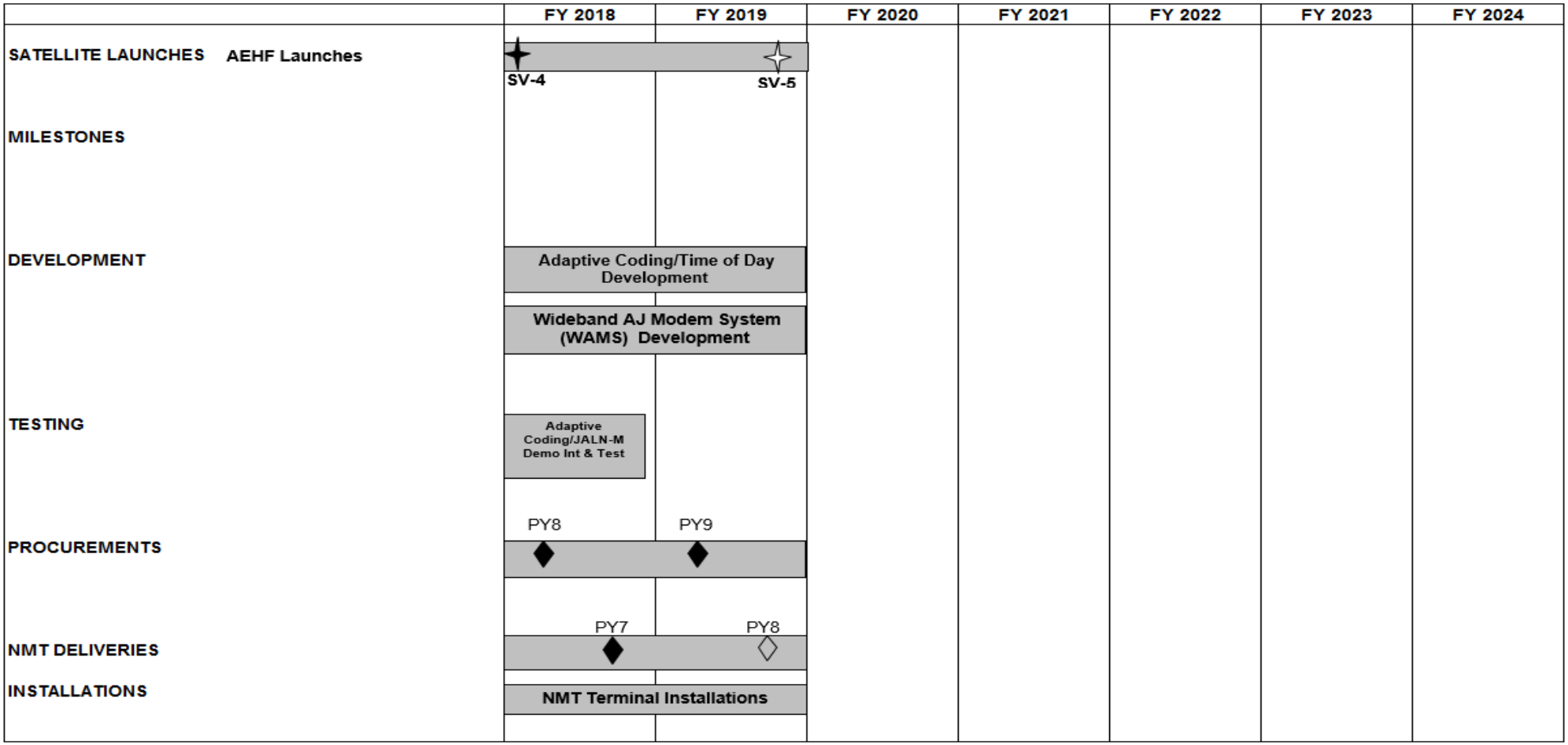
**Management Services ($ in Millions)**

| Cost Category Item | Contract Method & Type | Performing Activity & Location | Prior Years | FY 2018 Cost | FY 2018 Award Date | FY 2019 Cost | FY 2019 Award Date | FY 2020 Base Cost | FY 2020 Base Award Date | FY 2020 OCO Cost | FY 2020 OCO Award Date | FY 2020 Total Cost | Cost To Complete | Total Cost | Target Value of Contract |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Contract Management | C/CPFF | BAH : San Diego, CA | 0.000 | 0.232 | Nov 2017 | 0.170 | Nov 2018 | 0.000 | | - | | 0.000 | 0.000 | 0.402 | - |
| Program Management | C/CPFF | BAH : San Diego, CA | 0.000 | 1.556 | Nov 2017 | 1.139 | Nov 2018 | 0.000 | | - | | 0.000 | 0.000 | 2.695 | - |
| Travel | Various | SPAWAR : Various | 0.000 | 0.050 | Nov 2017 | 0.050 | Nov 2018 | 0.000 | | - | | 0.000 | 0.000 | 0.100 | - |
| | | **Subtotal** | 0.000 | 1.838 | | 1.359 | | 0.000 | | - | | 0.000 | 0.000 | 3.197 | N/A |

| | Prior Years | FY 2018 | | FY 2019 | | FY 2020 Base | | FY 2020 OCO | | FY 2020 Total | Cost To Complete | Total Cost | Target Value of Contract |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Project Cost Totals** | 0.000 | 21.830 | | 17.729 | | 0.000 | | - | | 0.000 | 0.000 | 39.559 | N/A |

**Remarks**

| Exhibit R-4, RDT&E Schedule Profile: PB 2020 Navy | | Date: March 2019 |
|---|---|---|
| **Appropriation/Budget Activity**<br>1319 / 7 | **R-1 Program Element (Number/Name)**<br>PE 1203109N / *(U)Satellite Communications (SPACE)* | **Project (Number/Name)**<br>0728 / *EHF SATCOM Terminals* |




**Notes:**
FY20-24 NMT funding is provided under PE 0303109N Project 0728.

| Exhibit R-4A, RDT&E Schedule Details: PB 2020 Navy | | Date: March 2019 |
|---|---|---|
| **Appropriation/Budget Activity**<br>1319 / 7 | **R-1 Program Element (Number/Name)**<br>PE 1203109N / *(U)Satellite Communications (SPACE)* | **Project (Number/Name)**<br>0728 / *EHF SATCOM Terminals* |

## Schedule Details

| | Start | | End | |
|---|---|---|---|---|
| **Events by Sub Project** | **Quarter** | **Year** | **Quarter** | **Year** |
| ***Proj 0728*** | | | | |
| AEHF Launch SV-4 | 1 | 2018 | 1 | 2018 |
| AEHF Launch SV-5 | 4 | 2019 | 4 | 2019 |
| Adaptive Coding & JALN-M Integration & Testing | 1 | 2018 | 4 | 2018 |
| Wideband AJ Modem Development | 1 | 2018 | 4 | 2019 |
| NMT Procurement Year (PY8) | 2 | 2018 | 2 | 2018 |
| NMTI Procurement Year (PY9) | 2 | 2019 | 2 | 2019 |
| NMT FRP PY7 Delivery | 3 | 2018 | 3 | 2018 |
| NMT FRP PY8 Delivery | 3 | 2019 | 3 | 2019 |
| A2AD Adaptive Coding/Time of Day | 1 | 2018 | 4 | 2019 |

| Exhibit R-2A, RDT&E Project Justification: PB 2020 Navy | | | | | | | | | | | Date: March 2019 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Appropriation/Budget Activity<br>1319 / 7 | | | | | R-1 Program Element (Number/Name)<br>PE 1203109N / *(U)Satellite Communications (SPACE)* | | | | Project (Number/Name)<br>2472 / *Mobile User Objective Sys (MUOS)* | | | |
| **COST ($ in Millions)** | **Prior Years** | **FY 2018** | **FY 2019** | **FY 2020 Base** | **FY 2020 OCO** | **FY 2020 Total** | **FY 2021** | **FY 2022** | **FY 2023** | **FY 2024** | **Cost To Complete** | **Total Cost** |
| 2472: *Mobile User Objective Sys (MUOS)* | 0.000 | 13.556 | 15.530 | 15.868 | - | 15.868 | 23.086 | 22.088 | 17.376 | 16.454 | 35.416 | 159.374 |
| Quantity of RDT&E Articles | | - | - | - | - | - | - | - | - | - | | |

**Project MDAP/MAIS Code:** 345

**A. Mission Description and Budget Item Justification**

Mobile User Objective System (MUOS) provides a worldwide, multi-service population of mobile and fixed-site terminal users with Ultra High Frequency (UHF) Narrowband, beyond line of sight satellite communications (SATCOM). MUOS significantly increases performance and capacity in support of critical Combatant Command SATCOM priorities. MUOS is the replacement system for the UHF Follow-on (UFO) system, which is currently beyond its design life. MUOS consists of Space, Ground, and User Entry Segments. The Space Segment consists of 5 geosynchronous satellites, one which is an on-orbit spare, and provides both a legacy UHF payload, which is backward compatible with UFO, and a Wideband Code Division Multiple Access (WCDMA) payload, which provides 3G cellular-like capability. The Ground Segment consists of four world-wide Radio Access Facilities (RAFs) and two satellite control facilities. Each RAF includes three 60 ft. antennas, and numerous racks of equipment. The RAF in Hawaii includes a Network Management Facility (NMF). The RAFs in Hawaii and Virginia each include a Switching Facility (SF). The User Entry Segment consists of the MUOS waveform that is ultimately integrated into MUOS-capable terminals. The MUOS legacy capability has been in operational use since 2012, and the WCDMA capability transitioned to Early Combatant Command Use in July 2016.
In addition to providing UHF SATCOM for the Department of Defense, the Navy has the overall responsibility to deliver the End-to-End MUOS capability to the warfighter. This responsibility involves systems engineering, integration, and test management of all MUOS system of system activities.

The FY20 program funds system optimization and modernization to address the dynamic, worldwide electromagnetic and cybersecurity environment in which MUOS operates. Efforts include technical analyses and engineering efforts for rapid technology insertion, and necessary changes requested by the warfighter and radio program offices to align end-to-end MUOS capabilities with warfighter missions. These changes include: software improvements for faster radio start-up and connection to the MUOS system; and software changes to allow end users to move radio profile information from one radio to another. Funds also support integration of the MUOS waveform into MUOS-capable terminals and the subsequent terminal certification testing. Funds are required for completion of Multi-Service Operational Test and Evaluation-2B (MOT&E-2B) activities in order to achieve Full Operational Capability (FOC) and deliver the End-to-End MUOS capability to the warfighter.

| **B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)** | **FY 2018** | **FY 2019** | **FY 2020 Base** | **FY 2020 OCO** | **FY 2020 Total** |
|---|---|---|---|---|---|
| ***Title:*** Mobile User Objective Sys (MUOS) | 13.556 | 15.530 | 15.868 | 0.000 | 15.868 |
| ***Articles:*** | - | - | - | - | - |
| ***FY 2019 Plans:***<br>FY19 funds activities to prepare for and conduct Development Test and Multi-service Operational Test and Evaluation-2B (MOT&E-2B), due to the June 2016 Director, Operational Test & Evaluation (DOT&E) assessment | | | | | |

| Exhibit R-2A, RDT&E Project Justification: PB 2020 Navy | | Date: March 2019 |
|---|---|---|
| **Appropriation/Budget Activity**<br>1319 / 7 | **R-1 Program Element (Number/Name)**<br>PE 1203109N / *(U)Satellite Communications (SPACE)* | **Project (Number/Name)**<br>2472 / *Mobile User Objective Sys (MUOS)* |

| B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each) | FY 2018 | FY 2019 | FY 2020 Base | FY 2020 OCO | FY 2020 Total |
|---|---|---|---|---|---|
| that found Mobile User Objective System (MUOS) not operationally effective or suitable. Additionally, FY19 funds support the engineering and research efforts as part of the Ultra-High Frequency (UHF) Narrowband satellite communications (SATCOM) Analysis of Alternatives (AoA). FY19 continues support of integration of the MUOS waveform into MUOS-capable terminals and execution of certification testing of MUOS-capable terminals in support of Department of Defense terminal programs. Continue to address operational test deficiencies, particularly addressing the capability to monitor system status and provide situational awareness for the system operators. Continue to address emerging cybersecurity requirements. Continue development of a modernized geolocation Ground Segment subsystem in order to meet baseline requirements. Continue to address the dynamic, worldwide electronic magnetic environment through system optimization to ensure capacity is available to the end user.<br>***FY 2020 Base Plans:***<br>FY20 funds system optimization, electro-magnetic interference mitigation efforts, continues development of a modernized geolocation Ground Segment subsystem, and continues addressing emerging cybersecurity requirements to ensure capacity is available to the end user. FY20 funds post-test activities required for completion of MOT&E-2B, to include data analysis and final test report. Additionally, FY20 funds continue support of integration of the MUOS waveform into MUOS-capable terminals and subsequent terminal certification testing. FY20 funds End to End (E2E) MUOS Usability Enhancements and improvements to over-the-air provisioning and profile portability.<br>***FY 2020 OCO Plans:***<br>N/A<br>***FY 2019 to FY 2020 Increase/Decrease Statement:***<br>Increase in funding from FY19 to FY20 is to fund E2E MUOS usability enhancements. These changes include: software improvements for faster radio start-up and connection to the MUOS system; and software changes to allow end users to move radio profile information from one radio to another. | | | | | |
| **Accomplishments/Planned Programs Subtotals** | 13.556 | 15.530 | 15.868 | 0.000 | 15.868 |

**C. Other Program Funding Summary ($ in Millions)**

| Line Item | FY 2018 | FY 2019 | FY 2020 Base | FY 2020 OCO | FY 2020 Total | FY 2021 | FY 2022 | FY 2023 | FY 2024 | Cost To Complete | Total Cost |
|---|---|---|---|---|---|---|---|---|---|---|---|
| • WPN/2433: *Fleet Satellite Comm Follow-On* | 39.532 | 60.279 | 67.380 | - | 67.380 | 53.460 | 45.985 | 46.907 | 47.846 | 243.162 | 2,705.300 |

| Exhibit R-2A, RDT&E Project Justification: PB 2020 Navy | | Date: March 2019 |
|---|---|---|
| **Appropriation/Budget Activity**<br>1319 / 7 | **R-1 Program Element (Number/Name)**<br>PE 1203109N / *(U)Satellite Communications (SPACE)* | **Project (Number/Name)**<br>2472 / *Mobile User Objective Sys (MUOS)* |

**C. Other Program Funding Summary ($ in Millions)**

| Line Item | FY 2018 | FY 2019 | FY 2020 Base | FY 2020 OCO | FY 2020 Total | FY 2021 | FY 2022 | FY 2023 | FY 2024 | Cost To Complete | Total Cost |
|---|---|---|---|---|---|---|---|---|---|---|---|

**Remarks**

**D. Acquisition Strategy**

Currently interim contractor support and engineering activities are procured via the baseline Mobile User Objective System (MUOS) Risk Reduction and Design Development contract. The program is working to transition these Space, Ground and User Entry Segments activities to dedicated sustainment contracts. Integration of the MUOS waveform into MUOS-capable terminals and execution of certification testing of MUOS-capable terminals are executed primarily by the Navy Working Capital Funded Space and Naval Warfare Systems Command (SPAWAR) Systems Center Pacific.

**E. Performance Metrics**

MUOS Goal: Achieve Full Operational Capability in FY 2020.

Metric: Successful completion of Multi-Service Operational Test and Evaluation-2B (MOT&E-2B) FY19.

| Exhibit R-3, RDT&E Project Cost Analysis: PB 2020 Navy | | | Date: March 2019 |
|---|---|---|---|
| Appropriation/Budget Activity<br>1319 / 7 | R-1 Program Element (Number/Name)<br>PE 1203109N / *(U)Satellite Communications (SPACE)* | Project (Number/Name)<br>2472 / *Mobile User Objective Sys (MUOS)* | |

**Product Development ($ in Millions)**

| Cost Category Item | Contract Method & Type | Performing Activity & Location | Prior Years | FY 2018 Cost | FY 2018 Award Date | FY 2019 Cost | FY 2019 Award Date | FY 2020 Base Cost | FY 2020 Base Award Date | FY 2020 OCO Cost | FY 2020 OCO Award Date | FY 2020 Total Cost | Cost To Complete | Total Cost | Target Value of Contract |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Engineering Contract | C/CPAF | Lockheed Martin : Sunnyvale, CA | 0.000 | 7.700 | Oct 2017 | 7.850 | Oct 2018 | 0.000 | | - | | 0.000 | 0.000 | 15.550 | - |
| Follow On Contract | SS/IDIQ | TBD : TBD | 0.000 | 0.000 | | 0.000 | | 11.377 | Oct 2019 | - | | 11.377 | 0.000 | 11.377 | - |
| | | **Subtotal** | 0.000 | 7.700 | | 7.850 | | 11.377 | | - | | 11.377 | 0.000 | 26.927 | N/A |

**Remarks**

The MUOS (Project 2472) increase in FY20 funds End to End (E2E) MUOS usability enhancements.

**Test and Evaluation ($ in Millions)**

| Cost Category Item | Contract Method & Type | Performing Activity & Location | Prior Years | FY 2018 Cost | FY 2018 Award Date | FY 2019 Cost | FY 2019 Award Date | FY 2020 Base Cost | FY 2020 Base Award Date | FY 2020 OCO Cost | FY 2020 OCO Award Date | FY 2020 Total Cost | Cost To Complete | Total Cost | Target Value of Contract |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Developmental Test & Evaluation | WR | SSC PAC : San Diego, CA | 0.000 | 1.515 | Oct 2017 | 1.104 | Oct 2018 | 0.000 | | - | | 0.000 | 0.000 | 2.619 | - |
| Operational Test & Evaluation | WR | COTF : Norfolk, VA | 0.000 | 0.250 | Oct 2017 | 2.048 | Oct 2018 | 0.450 | Oct 2019 | - | | 0.450 | 0.000 | 2.748 | - |
| | | **Subtotal** | 0.000 | 1.765 | | 3.152 | | 0.450 | | - | | 0.450 | 0.000 | 5.367 | N/A |

**Remarks**

FY20 funds a small amount of work required to finish Multi-service Operational Test and Evaluation-2B (MOT&E-2B) activities.

**Management Services ($ in Millions)**

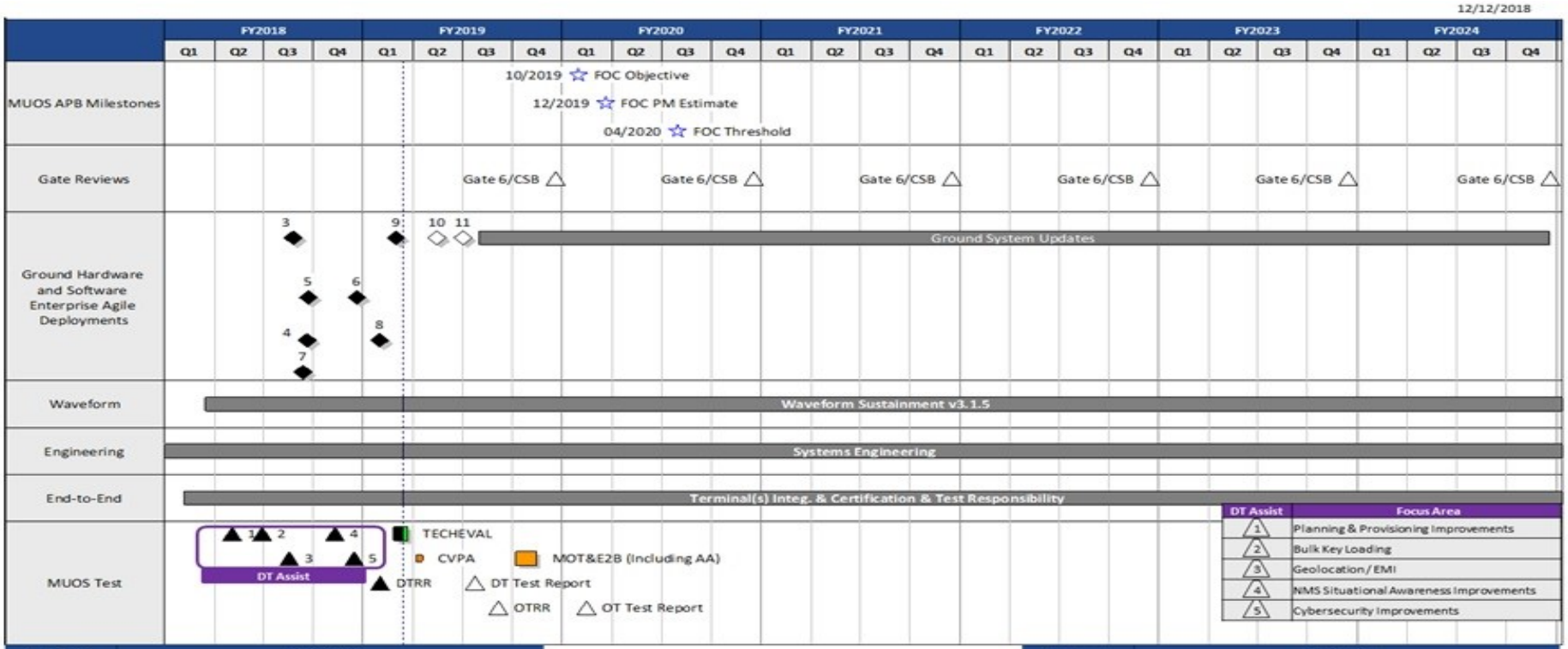
| Cost Category Item | Contract Method & Type | Performing Activity & Location | Prior Years | FY 2018 Cost | FY 2018 Award Date | FY 2019 Cost | FY 2019 Award Date | FY 2020 Base Cost | FY 2020 Base Award Date | FY 2020 OCO Cost | FY 2020 OCO Award Date | FY 2020 Total Cost | Cost To Complete | Total Cost | Target Value of Contract |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Contract Engineering Support | C/CPFF | SBG : Alexandria, VA | 0.000 | 2.795 | Oct 2017 | 3.100 | Oct 2018 | 2.000 | Oct 2019 | - | | 2.000 | 0.000 | 7.895 | - |
| Government Engineering | WR | SSC PAC : San Diego, CA | 0.000 | 1.296 | Oct 2017 | 1.428 | Oct 2018 | 2.041 | Oct 2019 | - | | 2.041 | 0.000 | 4.765 | - |
| | | **Subtotal** | 0.000 | 4.091 | | 4.528 | | 4.041 | | - | | 4.041 | 0.000 | 12.660 | N/A |

| Exhibit R-3, RDT&E Project Cost Analysis: PB 2020 Navy | | | Date: March 2019 |
|---|---|---|---|
| Appropriation/Budget Activity<br>1319 / 7 | R-1 Program Element (Number/Name)<br>PE 1203109N / *(U)Satellite Communications (SPACE)* | Project (Number/Name)<br>2472 / *Mobile User Objective Sys (MUOS)* | |

| | Prior Years | FY 2018 | | FY 2019 | | FY 2020 Base | | FY 2020 OCO | | FY 2020 Total | Cost To Complete | Total Cost | Target Value of Contract |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Project Cost Totals** | 0.000 | 13.556 | | 15.530 | | 15.868 | | - | | 15.868 | 0.000 | 44.954 | N/A |

**Remarks**

| Exhibit R-4, RDT&E Schedule Profile: PB 2020 Navy | | Date: March 2019 |
|---|---|---|
| **Appropriation/Budget Activity**<br>1319 / 7 | **R-1 Program Element (Number/Name)**<br>PE 1203109N / *(U)Satellite Communications (SPACE)* | **Project (Number/Name)**<br>2472 / *Mobile User Objective Sys (MUOS)* |




| Acronym | Definition |
|---|---|
| AA | Adversarial Assessment |
| APB | Acquisition Program Baseline |
| ATO | Authority to Operate |
| CSB | Configuration Steering Board |
| CVPA | Cooperative Vulnerability Penetration Assessment |
| DT | Development Test |
| DTRR | Development Test Readiness Review |

| Acronym | Definition |
|---|---|
| EMI | Electro Magnetic Interference |
| FOC | Full Operational Capability |
| NMS | Network Management Segment |
| OT | Operational Test |
| OTRR | Operational Test Readiness Review |
| TECHEVAL | Techincal Evaluation |

| Exhibit R-4A, RDT&E Schedule Details: PB 2020 Navy | | Date: March 2019 |
|---|---|---|
| **Appropriation/Budget Activity**<br>1319 / 7 | **R-1 Program Element (Number/Name)**<br>PE 1203109N / *(U)Satellite Communications (SPACE)* | **Project (Number/Name)**<br>2472 / *Mobile User Objective Sys (MUOS)* |

## Schedule Details

| | Start | | End | |
|---|---|---|---|---|
| **Events by Sub Project** | **Quarter** | **Year** | **Quarter** | **Year** |
| ***Proj 2472*** | | | | |
| Systems Engineering | 1 | 2018 | 4 | 2024 |
| Terminal Integration, Certification, and Test | 1 | 2018 | 4 | 2024 |
| Waveform Sustainment | 1 | 2018 | 4 | 2024 |
| Developmental Test Assist Event 1 | 2 | 2018 | 2 | 2018 |
| Developmental Test Assist Event 2 | 2 | 2018 | 2 | 2018 |
| Developmental Test Assist Event 3 | 3 | 2018 | 3 | 2018 |
| Agile Deployments 3-5 | 3 | 2018 | 3 | 2018 |
| Agile Deployment 7 | 3 | 2018 | 3 | 2018 |
| Agile Deployment 6 | 4 | 2018 | 4 | 2018 |
| Agile Deployment 8 | 1 | 2019 | 1 | 2019 |
| Developmental Test Assist Event 4 | 4 | 2018 | 4 | 2018 |
| Developmental Test Assist Event 5 | 4 | 2018 | 4 | 2018 |
| Agile Deployment 9 | 1 | 2019 | 1 | 2019 |
| Developmental Test Readiness Review | 1 | 2019 | 1 | 2019 |
| Tech Eval | 1 | 2019 | 1 | 2019 |
| Cooperative Vulnerability Penetration Assessment | 2 | 2019 | 2 | 2019 |
| Agile Deployment 10 | 2 | 2019 | 2 | 2019 |
| Agile Deployment 11 | 3 | 2019 | 3 | 2019 |
| Ground System Updates | 3 | 2019 | 4 | 2024 |
| DT Test Report | 3 | 2019 | 3 | 2019 |
| Operational Test Readiness Review | 3 | 2019 | 3 | 2019 |

| Exhibit R-4A, RDT&E Schedule Details: PB 2020 Navy | | Date: March 2019 |
|---|---|---|
| **Appropriation/Budget Activity**<br>1319 / 7 | **R-1 Program Element (Number/Name)**<br>PE 1203109N / *(U)Satellite Communications (SPACE)* | **Project (Number/Name)**<br>2472 / *Mobile User Objective Sys (MUOS)* |

| | Start | | End | |
|---|---|---|---|---|
| **Events by Sub Project** | **Quarter** | **Year** | **Quarter** | **Year** |
| MOT&E2B / Adversarial Assessment | 4 | 2019 | 4 | 2019 |
| Gate 6/CSB FY19 | 4 | 2019 | 4 | 2019 |
| Full Operational Capability (FOC) Objective | 1 | 2020 | 1 | 2020 |
| Full Operational Capability (FOC) Program Manager Estimate | 1 | 2020 | 1 | 2020 |
| OT Test Report | 1 | 2020 | 1 | 2020 |
| Full Operational Capability (FOC) Threshold | 3 | 2020 | 3 | 2020 |
| Gate 6/CSB FY20 | 4 | 2020 | 4 | 2020 |
| Gate 6/CSB FY21 | 4 | 2021 | 4 | 2021 |
| Gate 6/CSB FY22 | 4 | 2022 | 4 | 2022 |
| Gate 6/CSB FY23 | 4 | 2023 | 4 | 2023 |
| Gate 6/CSB FY24 | 4 | 2024 | 4 | 2024 |

| Exhibit R-2A, RDT&E Project Justification: PB 2020 Navy | | | Date: March 2019 |
|---|---|---|---|
| Appropriation/Budget Activity<br>1319 / 7 | R-1 Program Element (Number/Name)<br>PE 1203109N / *(U)Satellite Communications (SPACE)* | Project (Number/Name)<br>3398 / *Enterprise SATCOM Gateway Modems (ESGMs)* | |

| COST ($ in Millions) | Prior Years | FY 2018 | FY 2019 | FY 2020 Base | FY 2020 OCO | FY 2020 Total | FY 2021 | FY 2022 | FY 2023 | FY 2024 | Cost To Complete | Total Cost |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 3398: *Enterprise SATCOM Gateway Modems (ESGMs)* | 0.000 | 0.116 | 0.915 | 0.000 | - | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 1.031 |
| Quantity of RDT&E Articles | | - | - | - | - | - | - | - | - | - | | |

**A. Mission Description and Budget Item Justification**

The Navy Global Broadcast Service (GBS) Program is the Navy component of the Joint Military Satellite Communications (MILSATCOM) program that delivers the continuous flow of high-speed, high-volume communication and information flow for deploying, deployed, on the move, and garrisoned forces. The GBS system supports the Navy Strategic Plan and equips warfighters with a proven Resilient Command and Control (RC2) capability. GBS provides Satellite Communications (SATCOM) capability for forces afloat, ashore, and Naval Special Warfare Command.

The Enterprise SATCOM Gateway Modem (ESGM) is the Department of Defense (DoD) Chief Information Officer directed solution to satisfy the Transmission Security (TRANSEC) requirement. This modem will replace the existing modem in the GBS System. Testing and fielding of the Enterprise SATCOM Gateway Modems (ESGMs) is a joint venture, operationally directed by the Defense Information Systems Agency (DISA) and the United States Air Force (USAF) as the lead service. Additionally, the ESGM will continue to enable GBS reception of the Digital Video Broadcast - Satellite 2nd Generation (DVB-S2).

FY19 GBS activities will complete Joint GBS integration and support the Joint GBS DT/OT event.

| B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each) | FY 2018 | FY 2019 | FY 2020 Base | FY 2020 OCO | FY 2020 Total |
|---|---|---|---|---|---|
| ***Title:*** Enterprise SATCOM Gateway Modems (ESGMs) | 0.116 | 0.915 | 0.000 | 0.000 | 0.000 |
| ***Articles:*** | - | - | - | - | - |
| ***FY 2019 Plans:***<br>United States Air Force (USAF) will follow up with a Joint Services DT/OT. Complete environmental quality tests to support the Joint led GBS-ESGM technical baseline. Participate in DISA test planning for Joint-specific GBS and Navy-specific requirements during GBS Joint ESGM DT and OT activities. | | | | | |
| ***FY 2020 Base Plans:***<br>N/A | | | | | |
| ***FY 2020 OCO Plans:***<br>N/A | | | | | |
| ***FY 2019 to FY 2020 Increase/Decrease Statement:*** | | | | | |

| Exhibit R-2A, RDT&E Project Justification: PB 2020 Navy | | Date: March 2019 |
|---|---|---|
| **Appropriation/Budget Activity**<br>1319 / 7 | **R-1 Program Element (Number/Name)**<br>PE 1203109N / *(U)Satellite Communications (SPACE)* | **Project (Number/Name)**<br>3398 / *Enterprise SATCOM Gateway Modems (ESGMs)* |

| B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each) | FY 2018 | FY 2019 | FY 2020 Base | FY 2020 OCO | FY 2020 Total |
|---|---|---|---|---|---|
| Decrease of $0.915M from FY19 to FY20 is due to completion of testing efforts finalizing the Joint led GBS-ESGM technical baseline. | | | | | |
| **Accomplishments/Planned Programs Subtotals** | 0.116 | 0.915 | 0.000 | 0.000 | 0.000 |

**C. Other Program Funding Summary ($ in Millions)**

N/A

**Remarks**

**D. Acquisition Strategy**

The GBS program reached a Full Rate Production Decision on 24 Oct 2008 and is in sustainment. The Enterprise Satellite Communications (SATCOM) Gateway Modem (ESGM), the Commercial Off-The-Shelf (COTS) Internet Protocol (IP) modem, provides Transmission Security functionality in support of DoD CIO direction to implement Information Assurance for all transmission media.

**E. Performance Metrics**

The RDT&E goal for the GBS program is to create a military satellite communications system that supports current and future requirements for Resilient Command and Control (RC2) and Information Assurance.

| Exhibit R-3, RDT&E Project Cost Analysis: PB 2020 Navy | | | Date: March 2019 |
|---|---|---|---|
| **Appropriation/Budget Activity**<br>1319 / 7 | **R-1 Program Element (Number/Name)**<br>PE 1203109N / *(U)Satellite Communications (SPACE)* | **Project (Number/Name)**<br>3398 / *Enterprise SATCOM Gateway Modems (ESGMs)* | |

**Support ($ in Millions)**

| Cost Category Item | Contract Method & Type | Performing Activity & Location | Prior Years | FY 2018 Cost | FY 2018 Award Date | FY 2019 Cost | FY 2019 Award Date | FY 2020 Base Cost | FY 2020 Base Award Date | FY 2020 OCO Cost | FY 2020 OCO Award Date | FY 2020 Total Cost | Cost To Complete | Total Cost | Target Value of Contract |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Systems Engineering | WR | SSC PAC : San Diego, CA | 0.000 | 0.000 | | 0.188 | Nov 2018 | 0.000 | | - | | 0.000 | 0.000 | 0.188 | - |
| Systems Engineering | WR | NUWC : Newport, RI | 0.000 | 0.116 | Nov 2017 | 0.165 | Nov 2018 | 0.000 | | - | | 0.000 | 0.000 | 0.281 | - |
| Systems Engineering | WR | SSC LANT : Charleston, SC | 0.000 | 0.000 | | 0.200 | Nov 2018 | 0.000 | | - | | 0.000 | 0.000 | 0.200 | - |
| | | **Subtotal** | 0.000 | 0.116 | | 0.553 | | 0.000 | | - | | 0.000 | 0.000 | 0.669 | N/A |

**Test and Evaluation ($ in Millions)**

| Cost Category Item | Contract Method & Type | Performing Activity & Location | Prior Years | FY 2018 Cost | FY 2018 Award Date | FY 2019 Cost | FY 2019 Award Date | FY 2020 Base Cost | FY 2020 Base Award Date | FY 2020 OCO Cost | FY 2020 OCO Award Date | FY 2020 Total Cost | Cost To Complete | Total Cost | Target Value of Contract |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Developmental Test & Evaluation | C/CPFF | SYSTECH : San Diego, CA | 0.000 | 0.000 | | 0.163 | Nov 2018 | 0.000 | | - | | 0.000 | 0.000 | 0.163 | - |
| Operational Test & Evaluation | WR | COMOPTEVFOR : Norfolk, VA | 0.000 | 0.000 | | 0.133 | Nov 2018 | 0.000 | | - | | 0.000 | 0.000 | 0.133 | - |
| Developmental Test & Evaluation | WR | SSC PAC : San Diego, CA | 0.000 | 0.000 | | 0.000 | | 0.000 | | - | | 0.000 | 0.000 | 0.000 | - |
| | | **Subtotal** | 0.000 | 0.000 | | 0.296 | | 0.000 | | - | | 0.000 | 0.000 | 0.296 | N/A |

**Management Services ($ in Millions)**

| Cost Category Item | Contract Method & Type | Performing Activity & Location | Prior Years | FY 2018 Cost | FY 2018 Award Date | FY 2019 Cost | FY 2019 Award Date | FY 2020 Base Cost | FY 2020 Base Award Date | FY 2020 OCO Cost | FY 2020 OCO Award Date | FY 2020 Total Cost | Cost To Complete | Total Cost | Target Value of Contract |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Program Management | C/CPFF | BAH : San Diego | 0.000 | 0.000 | | 0.061 | Nov 2018 | 0.000 | | - | | 0.000 | 0.000 | 0.061 | - |
| Travel | Reqn | SPAWAR : Various | 0.000 | 0.000 | | 0.005 | Nov 2018 | 0.000 | | - | | 0.000 | 0.000 | 0.005 | - |
| | | **Subtotal** | 0.000 | 0.000 | | 0.066 | | 0.000 | | - | | 0.000 | 0.000 | 0.066 | N/A |

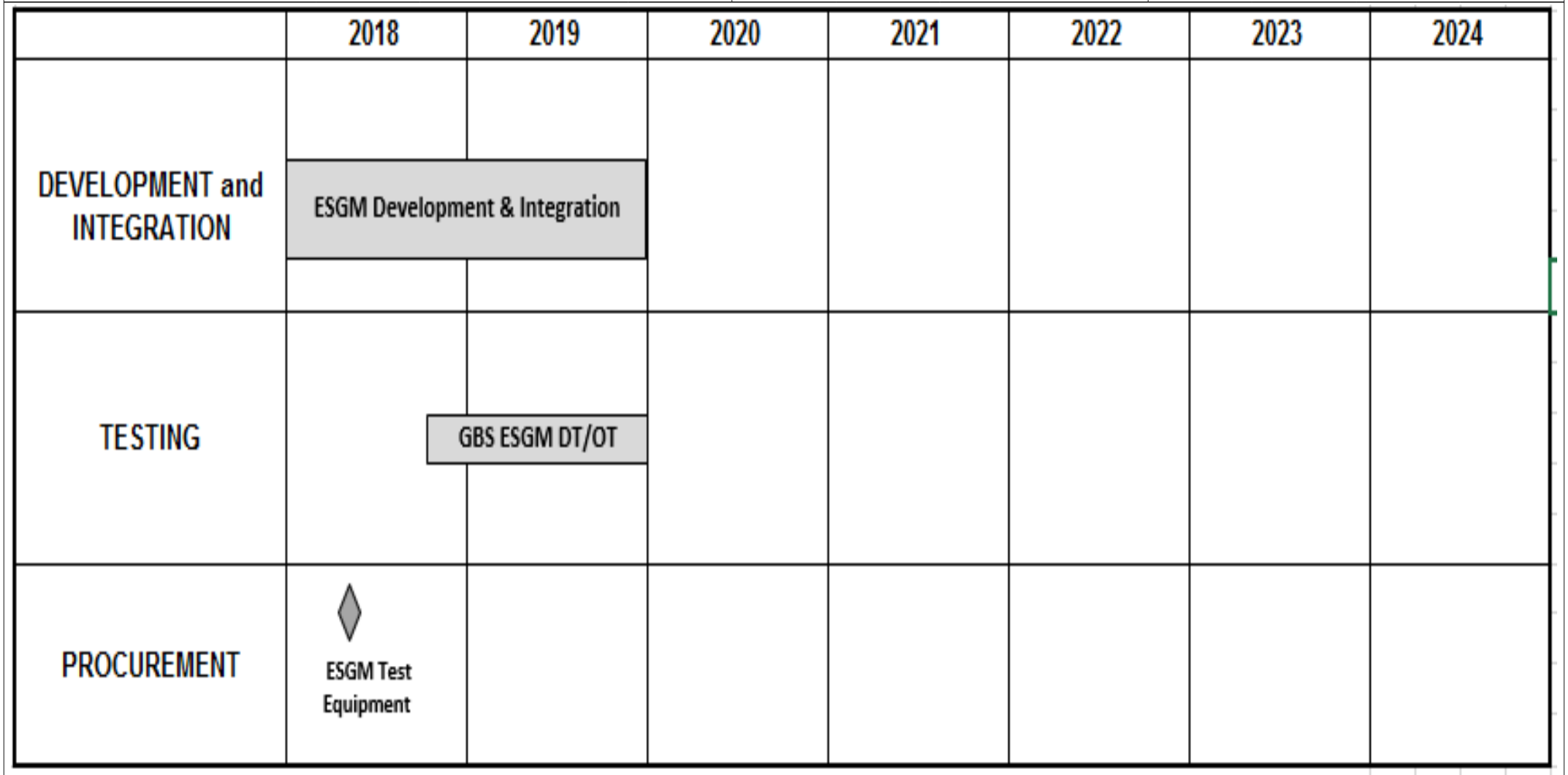
| | Prior Years | FY 2018 | | FY 2019 | | FY 2020 Base | | FY 2020 OCO | | FY 2020 Total | Cost To Complete | Total Cost | Target Value of Contract |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Project Cost Totals** | 0.000 | 0.116 | | 0.915 | | 0.000 | | - | | 0.000 | 0.000 | 1.031 | N/A |

| Exhibit R-3, RDT&E Project Cost Analysis: PB 2020 Navy | | | Date: March 2019 |
|---|---|---|---|
| Appropriation/Budget Activity<br>1319 / 7 | R-1 Program Element (Number/Name)<br>PE 1203109N / *(U)Satellite Communications (SPACE)* | Project (Number/Name)<br>3398 / *Enterprise SATCOM Gateway Modems (ESGMs)* | |

| | Prior Years | FY 2018 | FY 2019 | FY 2020 Base | FY 2020 OCO | FY 2020 Total | Cost To Complete | Total Cost | Target Value of Contract |
|---|---|---|---|---|---|---|---|---|---|

**Remarks**

| Exhibit R-4, RDT&E Schedule Profile: PB 2020 Navy | | Date: March 2019 |
|---|---|---|
| **Appropriation/Budget Activity**<br>1319 / 7 | **R-1 Program Element (Number/Name)**<br>PE 1203109N / *(U)Satellite Communications (SPACE)* | **Project (Number/Name)**<br>3398 / *Enterprise SATCOM Gateway Modems (ESGMs)* |



| Exhibit R-4A, RDT&E Schedule Details: PB 2020 Navy | | Date: March 2019 |
|---|---|---|
| **Appropriation/Budget Activity**<br>1319 / 7 | **R-1 Program Element (Number/Name)**<br>PE 1203109N / *(U)Satellite Communications (SPACE)* | **Project (Number/Name)**<br>3398 / *Enterprise SATCOM Gateway Modems (ESGMs)* |

## Schedule Details

| | Start | | End | |
|---|---|---|---|---|
| **Events by Sub Project** | **Quarter** | **Year** | **Quarter** | **Year** |
| ***Proj 3398*** | | | | |
| ESGM Environmental Quality Testing | 1 | 2018 | 4 | 2019 |
| GBS ESGM DT/OT | 3 | 2018 | 4 | 2019 |
| ESGM Test Equipment Buy | 2 | 2018 | 2 | 2018 |

| Exhibit R-2A, RDT&E Project Justification: PB 2020 Navy | | | Date: March 2019 |
|---|---|---|---|
| Appropriation/Budget Activity<br>1319 / 7 | R-1 Program Element (Number/Name)<br>PE 1203109N / *(U)Satellite Communications (SPACE)* | Project (Number/Name)<br>9999 / *Congressional Adds* | |

| COST ($ in Millions) | Prior Years | FY 2018 | FY 2019 | FY 2020 Base | FY 2020 OCO | FY 2020 Total | FY 2021 | FY 2022 | FY 2023 | FY 2024 | Cost To Complete | Total Cost |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 9999: *Congressional Adds* | 0.000 | 4.828 | 0.000 | 0.000 | - | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 4.828 |
| Quantity of RDT&E Articles | | - | - | - | - | - | - | - | - | - | | |

**A. Mission Description and Budget Item Justification**

This Congressional Add provides for the development, test and evaluation of enhanced capabilities for the Navy Multiband Terminal (NMT) by furthering Science & Technology (S&T) research and transition activities associated with resilient communications capabilities. Specifically, this funding will provide for technology testing, evaluation, demonstration and validation for an analog canceller for Wideband Satellite Communications (SATCOM) interface mitigation, modular hardware open platform for wideband SATCOM interface mitigation, and an all-digital modem.

| B. Accomplishments/Planned Programs ($ in Millions) | FY 2018 | FY 2019 |
|---|---|---|
| ***Congressional Add:*** NMT Development | 4.828 | 0.000 |
| ***FY 2018 Accomplishments:*** Developed, tested and evaluated an analog canceller for Wideband Satellite Communications (SATCOM) interface mitigation by building an integrated photonic based analog canceller prototype and integrating it into the overall SATCOM system. Developed, tested and evaluated modular hardware open platform for wideband SATCOM interface mitigation, establish a test platform and sub-system lab testing. Developed, tested and evaluated an all-digital modem prototype. | | |
| ***FY 2019 Plans:*** N/A | | |
| **Congressional Adds Subtotals** | 4.828 | 0.000 |

**C. Other Program Funding Summary ($ in Millions)**

N/A

**Remarks**

**D. Acquisition Strategy**

N/A

**E. Performance Metrics**

The performance goal is met if successful development test and evaluation is achieved.

| Exhibit R-3, RDT&E Project Cost Analysis: PB 2020 Navy | | Date: March 2019 |
|---|---|---|
| **Appropriation/Budget Activity**<br>1319 / 7 | **R-1 Program Element (Number/Name)**<br>PE 1203109N / *(U)Satellite Communications (SPACE)* | **Project (Number/Name)**<br>9999 / *Congressional Adds* |

**Product Development ($ in Millions)**

| Cost Category Item | Contract Method & Type | Performing Activity & Location | Prior Years | FY 2018 Cost | FY 2018 Award Date | FY 2019 Cost | FY 2019 Award Date | FY 2020 Base Cost | FY 2020 Base Award Date | FY 2020 OCO Cost | FY 2020 OCO Award Date | FY 2020 Total Cost | Cost To Complete | Total Cost | Target Value of Contract |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Analog Canceller | C/CPFF | TBD : TBD | 0.000 | 1.500 | Feb 2019 | 0.000 | | 0.000 | | - | | 0.000 | 0.000 | 1.500 | - |
| Modular Hardware Open Platform | C/CPFF | TBD : TBD | 0.000 | 1.300 | Feb 2019 | 0.000 | | 0.000 | | - | | 0.000 | 0.000 | 1.300 | - |
| All Digital Modem | C/CPFF | TBD : TBD | 0.000 | 1.478 | Feb 2019 | 0.000 | | 0.000 | | - | | 0.000 | 0.000 | 1.478 | - |
| | | **Subtotal** | 0.000 | 4.278 | | 0.000 | | 0.000 | | - | | 0.000 | 0.000 | 4.278 | N/A |

**Support ($ in Millions)**

| Cost Category Item | Contract Method & Type | Performing Activity & Location | Prior Years | FY 2018 Cost | FY 2018 Award Date | FY 2019 Cost | FY 2019 Award Date | FY 2020 Base Cost | FY 2020 Base Award Date | FY 2020 OCO Cost | FY 2020 OCO Award Date | FY 2020 Total Cost | Cost To Complete | Total Cost | Target Value of Contract |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Engineering Services Support | WR | SPAWAR System Center : San Diego, CA | 0.000 | 0.230 | Sep 2018 | 0.000 | | 0.000 | | - | | 0.000 | 0.000 | 0.230 | - |
| | | **Subtotal** | 0.000 | 0.230 | | 0.000 | | 0.000 | | - | | 0.000 | 0.000 | 0.230 | N/A |

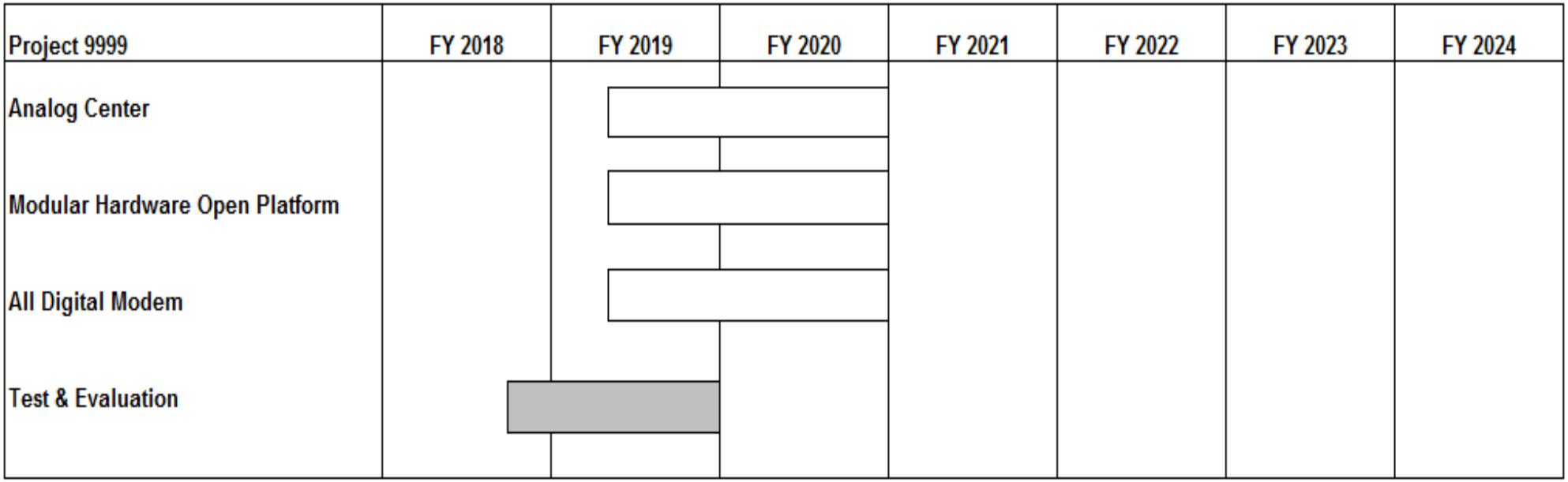
**Test and Evaluation ($ in Millions)**

| Cost Category Item | Contract Method & Type | Performing Activity & Location | Prior Years | FY 2018 Cost | FY 2018 Award Date | FY 2019 Cost | FY 2019 Award Date | FY 2020 Base Cost | FY 2020 Base Award Date | FY 2020 OCO Cost | FY 2020 OCO Award Date | FY 2020 Total Cost | Cost To Complete | Total Cost | Target Value of Contract |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Test & Evaluation | WR | SPAWAR System Center : San Diego, CA | 0.000 | 0.320 | Sep 2018 | 0.000 | | 0.000 | | - | | 0.000 | 0.000 | 0.320 | - |
| | | **Subtotal** | 0.000 | 0.320 | | 0.000 | | 0.000 | | - | | 0.000 | 0.000 | 0.320 | N/A |

| | Prior Years | FY 2018 | | FY 2019 | | FY 2020 Base | | FY 2020 OCO | | FY 2020 Total | Cost To Complete | Total Cost | Target Value of Contract |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Project Cost Totals** | 0.000 | 4.828 | | 0.000 | | 0.000 | | - | | 0.000 | 0.000 | 4.828 | N/A |

**Remarks**

| Exhibit R-4, RDT&E Schedule Profile: PB 2020 Navy | | Date: March 2019 |
|---|---|---|
| **Appropriation/Budget Activity**<br>1319 / 7 | **R-1 Program Element (Number/Name)**<br>PE 1203109N / *(U)Satellite Communications (SPACE)* | **Project (Number/Name)**<br>9999 / *Congressional Adds* |



| Exhibit R-4A, RDT&E Schedule Details: PB 2020 Navy | | Date: March 2019 |
|---|---|---|
| **Appropriation/Budget Activity**<br>1319 / 7 | **R-1 Program Element (Number/Name)**<br>PE 1203109N / *(U)Satellite Communications (SPACE)* | **Project (Number/Name)**<br>9999 / *Congressional Adds* |

## Schedule Details

| | Start | | End | |
|---|---|---|---|---|
| **Events by Sub Project** | **Quarter** | **Year** | **Quarter** | **Year** |
| ***Proj 9999*** | | | | |
| Analog Canceller: Schedule Detail | 2 | 2019 | 4 | 2020 |
| Modular Hardware Open Platform: Schedule Detail | 2 | 2019 | 4 | 2020 |
| All Digital Modem: Schedule Detail | 2 | 2019 | 4 | 2020 |
| Test & Evaluation: Schedule Detail | 4 | 2018 | 4 | 2019 |