Exhibit R-2, RDT&E Budget Item Justification: PB 2021 Navy											Date: February 2020	
Appropriation/Budget Activity 1319: *Research, Development, Test & Evaluation, Navy I* BA 7: *Operational Systems Development*					R-1 Program Element (Number/Name) PE 1203109N *I Satellite Communications (SPACE)*							
COST ($ in Millions)	**Prior Years**	**FY 2019**	**FY 2020**	**FY 2021 Base**	**FY 2021 OCO**	**FY 2021 Total**	**FY 2022**	**FY 2023**	**FY 2024**	**FY 2025**	**Cost To Complete**	**Total Cost**
Total Program Element	21.946	32.059	15.868	70.056	-	70.056	0.000	0.000	0.000	0.000	21.714	161.643
0728: *Navy Multiband Terminal (NMT)*	21.830	16.307	0.000	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	38.137
2472: *Mobile User Objective Sys (MUOS)*	0.000	14.845	15.868	70.056	-	70.056	0.000	0.000	0.000	0.000	21.714	122.483
3398: *Enterprise SATCOM Gateway Modems (ESGMs)*	0.116	0.907	0.000	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	1.023
Program MDAP/MAIS Code: **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

(0728) 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 warfighters with the assured, jam resistant, secure communications as described in the joint AEHF satellite communications system and WGS Operational Requirements Documents (ORD).

(3398) 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 2021 Navy	Date: February 2020
Appropriation/Budget Activity 1319: *Research, Development, Test & Evaluation, Navy I* BA 7: *Operational Systems Development*	**R-1 Program Element (Number/Name)** PE 1203109N *I Satellite Communications (SPACE)*

(3398) 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 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
Previous President's Budget	34.174	15.868	23.086	-	23.086
Current President's Budget	32.059	15.868	70.056	-	70.056
Total Adjustments	-2.115	0.000	46.970	-	46.970
• Congressional General Reductions	-	-			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	-	-			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-1.300	0.000			
• SBIR/STTR Transfer	-0.815	0.000			
• Program Adjustments	0.000	0.000	46.987	-	46.987
• Rate/Misc Adjustments	0.000	0.000	-0.017	-	-0.017

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.

The MUOS (Project 2472) increase in FY21 funds End-to-End (E2E) MUOS usability enhancements, pre-acquisition activities for MUOS 6 and 7 satellites, migration of MUOS ground infrastructure to Advanced Cryptographic Capability (ACC), and accelerate integration of ACC on DMR to support integration and test of MUOS ACC implementation.
The FY2021 funding request was reduced by $3.091 million to account for the availability of prior year execution balances.

Schedule:
EHF SATCOM Terminals (Project 0728) - No change
MUOS (Project 2472) - Contract and acquisition planning for MUOS 6 and 7

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

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy			Date: February 2020
Appropriation/Budget Activity 1319 / 7	R-1 Program Element (Number/Name) PE 1203109N / *Satellite Communications (SPACE)*	Project (Number/Name) 0728 / *Navy Multiband Terminal (NMT)*	

COST ($ in Millions)	Prior Years	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total	FY 2022	FY 2023	FY 2024	FY 2025	Cost To Complete	Total Cost
0728: *Navy Multiband Terminal (NMT)*	21.830	16.307	0.000	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	38.137
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 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 7	**R-1 Program Element (Number/Name)** PE 1203109N / *Satellite Communications (SPACE)*	**Project (Number/Name)** 0728 / *Navy Multiband Terminal (NMT)*

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 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
Title: NMT Resilient C2 Development	16.307	0.000	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 2020 Plans: FY20 Plans for NMT funded under PE 0303109N, Project 0728.					
FY 2021 Base Plans:					

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 7	**R-1 Program Element (Number/Name)** PE 1203109N / *Satellite Communications (SPACE)*	**Project (Number/Name)** 0728 / *Navy Multiband Terminal (NMT)*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
FY21 Plans for NMT funded under PE 0303109N, Project 0728. ***FY 2021 OCO Plans:*** N/A					
Accomplishments/Planned Programs Subtotals	16.307	0.000	0.000	0.000	0.000

C. Other Program Funding Summary ($ in Millions)

Line Item	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total	FY 2022	FY 2023	FY 2024	FY 2025	Cost To Complete	Total Cost
• OPN/3216: *NAVY MULTIBAND TERMINAL (NMT)*	108.985	76.715	64.552	-	64.552	30.522	17.413	21.033	21.444	73.062	1,563.389

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).

Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 7	**R-1 Program Element (Number/Name)** PE 1203109N / *Satellite Communications (SPACE)*	**Project (Number/Name)** 0728 / *Navy Multiband Terminal (NMT)*

Product Development ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Software Development Time of Day (TOD)	C/CPAF	RAYTHEON : Marlborough, MA	3.140	1.886	Dec 2018	0.000		0.000		-		0.000	0.000	5.026	-
Software Development ATIP Adaptive Coding (AC) /Time of Day (TOD)	C/CPFF	COMTECH : Tempe, AZ	3.225	1.716	Dec 2018	0.000		0.000		-		0.000	0.000	4.941	-
Software Development Engineering	C/CPFF	NUWC : Newport, RI	3.062	3.598	Jan 2019	0.000		0.000		-		0.000	0.000	6.660	-
Software Development Engineering	WR	NIWC PAC : San Diego, CA	0.581	0.565	Jan 2019	0.000		0.000		-		0.000	0.000	1.146	-
WAMS EDM Hardware	C/CPIF	RAYTHEON : Marlborough, MA	0.550	0.000	Jan 2019	0.000		0.000		-		0.000	0.000	0.550	-
WAMS EDM Hardware	C/CPIF	L3 Systems West: : Salt Lake City, UT	0.485	0.000		0.000		0.000		-		0.000	0.000	0.485	-
WAMS EDM Hardware	C/CPIF	ViaSat : Carlsbad, CA	0.317	0.000		0.000		0.000		-		0.000	0.000	0.317	-
		Subtotal	11.360	7.765		0.000		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 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Software Integration/ Government Oversight	WR	NUWC : Newport, RI	1.254	1.123	Nov 2018	0.000		0.000		-		0.000	0.000	2.377	-
Software Integration Support	WR	NIWC PAC : San Diego, CA	0.793	0.725	Nov 2018	0.000		0.000		-		0.000	0.000	1.518	-
Software Engineering Support	C/CPFF	SYSTECH : San Diego, CA	2.348	2.016	Nov 2018	0.000		0.000		-		0.000	0.000	4.364	-
WAMS Studies and Design	FFRDC	MIT/LL : Lexington, MA	0.500	0.750	Jan 2019	0.000		0.000		-		0.000	0.000	1.250	-
WAMS Cybersecurity Engineering	WR	NSA : Fort Meade, MD	0.000	0.250	Jan 2019	0.000		0.000		-		0.000	0.000	0.250	-
		Subtotal	4.895	4.864		0.000		0.000		-		0.000	0.000	9.759	N/A

Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 7	**R-1 Program Element (Number/Name)** PE 1203109N / *Satellite Communications (SPACE)*	**Project (Number/Name)** 0728 / *Navy Multiband Terminal (NMT)*

Test and Evaluation ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
EPS & JALN-M Development Test and Evaluation	WR	NIWC PAC : San Diego, CA	3.728	2.319	Nov 2018	0.000		0.000		-		0.000	0.000	6.047	-
Operational Test & Evaluation	WR	COMOPTEVFOR : Norfolk, VA	0.009	0.000		0.000		0.000		-		0.000	0.000	0.009	-
		Subtotal	3.737	2.319		0.000		0.000		-		0.000	0.000	6.056	N/A

Management Services ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Contract Management	C/CPFF	BAH : San Diego, CA	0.232	0.170	Nov 2018	0.000		0.000		-		0.000	0.000	0.402	-
Program Management	C/CPFF	BAH : San Diego, CA	1.556	1.139	Nov 2018	0.000		0.000		-		0.000	0.000	2.695	-
Travel	Various	NAVWAR : Various	0.050	0.050	Nov 2018	0.000		0.000		-		0.000	0.000	0.100	-
		Subtotal	1.838	1.359		0.000		0.000		-		0.000	0.000	3.197	N/A

Remarks

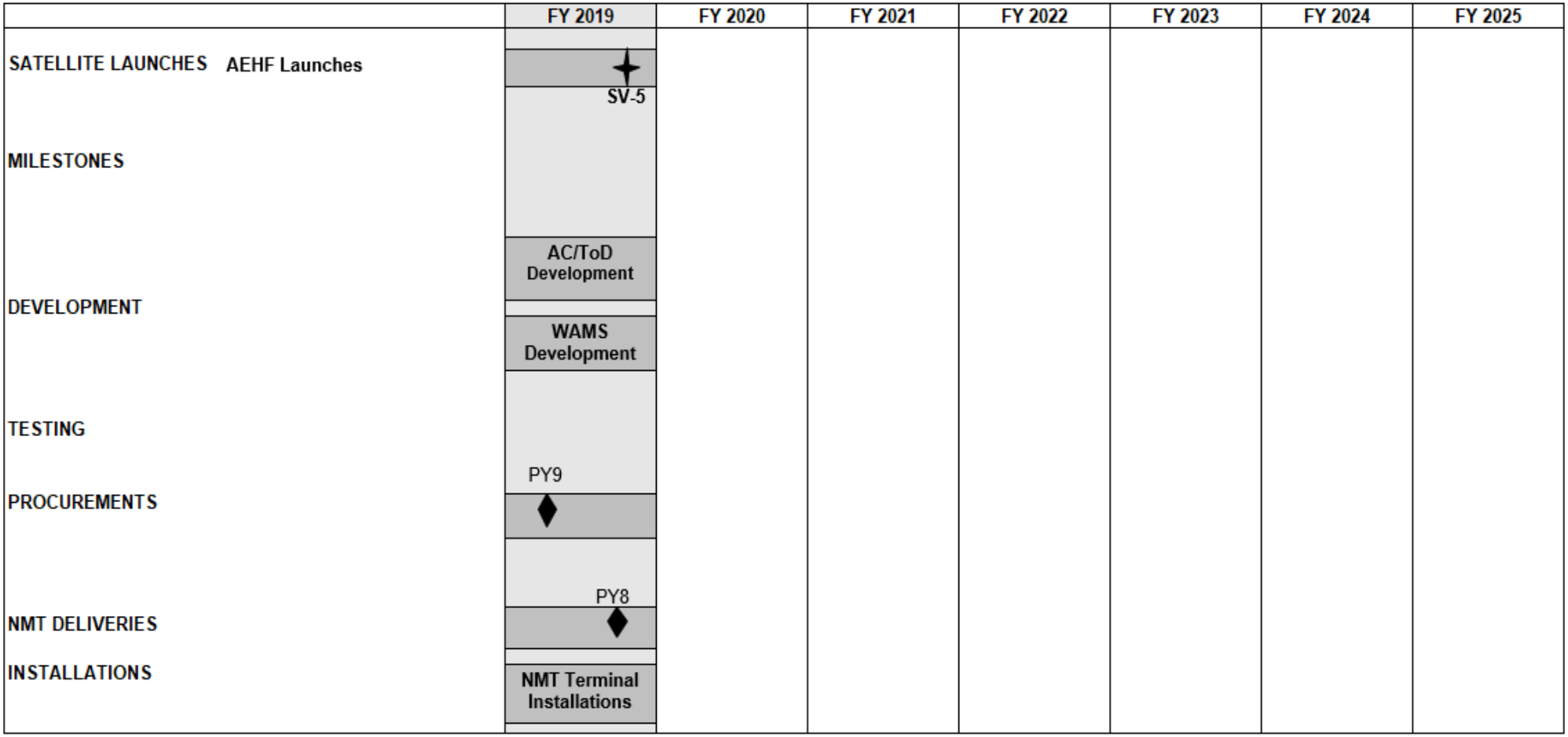
Naval Information Warfare Systems Command (NAVWAR) formerly known as Space and Naval Warfare Systems Command (SPAWAR)

	Prior Years	FY 2019		FY 2020		FY 2021 Base		FY 2021 OCO		FY 2021 Total	Cost To Complete	Total Cost	Target Value of Contract
Project Cost Totals	21.830	16.307		0.000		0.000		-		0.000	0.000	38.137	N/A

Remarks

FY20 and out NMT cost data is provided under PE 0303109N, Project 0728.

Exhibit R-4, RDT&E Schedule Profile: PB 2021 Navy			Date: February 2020
Appropriation/Budget Activity 1319 / 7	**R-1 Program Element (Number/Name)** PE 1203109N / *Satellite Communications (SPACE)*	**Project (Number/Name)** 0728 / *Navy Multiband Terminal (NMT)*	



Notes:
FY20 and out NMT funding is provided under PE 0303109N Project 0728.

Exhibit R-4A, RDT&E Schedule Details: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 7	**R-1 Program Element (Number/Name)** PE 1203109N / *Satellite Communications (SPACE)*	**Project (Number/Name)** 0728 / *Navy Multiband Terminal (NMT)*

Schedule Details

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

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy			Date: February 2020
Appropriation/Budget Activity 1319 / 7	R-1 Program Element (Number/Name) PE 1203109N / *Satellite Communications (SPACE)*	Project (Number/Name) 2472 / *Mobile User Objective Sys (MUOS)*	

COST ($ in Millions)	Prior Years	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total	FY 2022	FY 2023	FY 2024	FY 2025	Cost To Complete	Total Cost
2472: *Mobile User Objective Sys (MUOS)*	0.000	14.845	15.868	70.056	-	70.056	0.000	0.000	0.000	0.000	21.714	122.483
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 (E2E) MUOS capability to the warfighter. This responsibility involves systems engineering, integration, and test management of all MUOS system of system activities.

The FY21 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 E2E 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. Funding is also for pre-acquisition activities for MUOS 6 and 7 satellites, migration of MUOS ground infrastructure to Advanced Cryptographic Capability (ACC), and to accelerate integration of ACC on DMR to support integration and test of MUOS ACC implementation.

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
Title: Mobile User Objective Sys (MUOS)	14.845	15.868	70.056	0.000	70.056
Articles:	-	-	-	-	-
FY 2020 Plans: FY20 funds system optimization, electro-magnetic interference mitigation efforts, continues development of a modernized geolocation Ground Segment subsystem, and continues addressing emerging cybersecurity					

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 7	**R-1 Program Element (Number/Name)** PE 1203109N / *Satellite Communications (SPACE)*	**Project (Number/Name)** 2472 / *Mobile User Objective Sys (MUOS)*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
requirements to ensure capacity is available to the end user. FY20 funds post-test activities required for completion of Multi-service Operational Test and Evaluation-2B (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) Mobile User Objective System (MUOS) Usability Enhancements and improvements to over-the-air provisioning and profile portability. ***FY 2021 Base Plans:*** FY21 funds the continuation of system optimization and electro-magnetic interference mitigation efforts, continues the development of a modernized geolocation Ground Segment subsystem, and continues to address emerging cybersecurity requirements to ensure capacity is available to the end user. Additionally, FY21 funds E2E MUOS Usability Enhancements and improvements to over-the-air provisioning and profile portability. FY21 also funds the initiation of pre-acquisition activities for MUOS 6 and 7 satellites, migration of MUOS ground infrastructure to Advanced Cryptographic Capability (ACC) from Enhanced FireFly Communications Security (COMSEC) which includes changes to MUOS waveform software and artifacts, software updates to existing KG-175 devices, accelerated integration of ACC on DMR to support integration and test of MUOS ACC implementation, and updates to MIL-STD-188-187A and associated terminal certification program. ***FY 2021 OCO Plans:*** N/A ***FY 2020 to FY 2021 Increase/Decrease Statement:*** Increase in funding from FY20 to FY21 is to fund E2E MUOS usability enhancements, pre-acquisition activities for MUOS 6 and 7 satellites, migration to Advanced Cryptographic Capability (ACC), and accelerated integration of ACC on DMR.					
Accomplishments/Planned Programs Subtotals	14.845	15.868	70.056	0.000	70.056

C. Other Program Funding Summary ($ in Millions)

Line Item	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total	FY 2022	FY 2023	FY 2024	FY 2025	Cost To Complete	Total Cost
• WPN/2433: *Fleet Satellite Comm Follow-On*	60.279	67.380	53.460	-	53.460	45.985	45.789	46.346	48.518	186.272	2,694.310

Remarks

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 7	**R-1 Program Element (Number/Name)** PE 1203109N / *Satellite Communications (SPACE)*	**Project (Number/Name)** 2472 / *Mobile User Objective Sys (MUOS)*

D. Acquisition Strategy

The program has awarded the Ground and User Entry Segment sustainment contracts. Contractor support for MUOS 6 and 7 pre-acquisition activities will be procured via system engineering support contract. MUOS 6 and 7 pre-acquisition planning will also be accomplished via reimbursable work order

Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 7	**R-1 Program Element (Number/Name)** PE 1203109N / *Satellite Communications (SPACE)*	**Project (Number/Name)** 2472 / *Mobile User Objective Sys (MUOS)*

Product Development ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Engineering Contract	C/CPAF	Lockheed Martin : Sunnyvale, CA	0.000	7.165	Oct 2018	0.000		0.000		-		0.000	0.000	7.165	-
Follow On Contract	SS/IDIQ	General Dynamics : Falls Church, VA	0.000	0.000		11.377	Nov 2019	25.829	Nov 2020	-		25.829	0.000	37.206	-
Engineering Contract	C/CPFF	SBG : Alexandria, VA	0.000	0.000		0.000		14.248	Jan 2021	-		14.248	0.000	14.248	-
Government Engineering	WR	NIWC PAC : San Diego, CA	0.000	0.000		0.000		3.962	Oct 2020	-		3.962	0.000	3.962	-
DMR ACC Engineering Contract	TBD	TBD : Not Specified	0.000	0.000		0.000		21.890	Nov 2020	-		21.890	0.000	21.890	-
		Subtotal	0.000	7.165		11.377		65.929		-		65.929	0.000	84.471	N/A

Remarks

The MUOS (Project 2472) increase in FY21 funds End to End (E2E) MUOS usability enhancements, pre-acquisition activities for MUOS 6 and 7 satellites, migration of MUOS ground infrastructure to Advanced Cryptographic Capability (ACC), and accelerated integration of ACC on DMR to support integration and test of MUOS ACC implementation.

Test and Evaluation ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Developmental Test & Evaluation	WR	NIWC PAC : San Diego, CA	0.000	1.104	Oct 2018	0.000		0.000		-		0.000	0.000	1.104	-
Operational Test & Evaluation	WR	COTF : Norfolk, VA	0.000	2.048	Oct 2018	0.450	Oct 2019	0.000		-		0.000	0.000	2.498	-
		Subtotal	0.000	3.152		0.450		0.000		-		0.000	0.000	3.602	N/A

Management Services ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Contract Engineering Support	C/CPFF	SBG : Alexandria, VA	0.000	3.100	Jan 2019	2.000	Jan 2020	2.042	Jan 2021	-		2.042	0.000	7.142	-

Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Navy			Date: February 2020
Appropriation/Budget Activity 1319 / 7	R-1 Program Element (Number/Name) PE 1203109N / *Satellite Communications (SPACE)*	Project (Number/Name) 2472 / *Mobile User Objective Sys (MUOS)*	

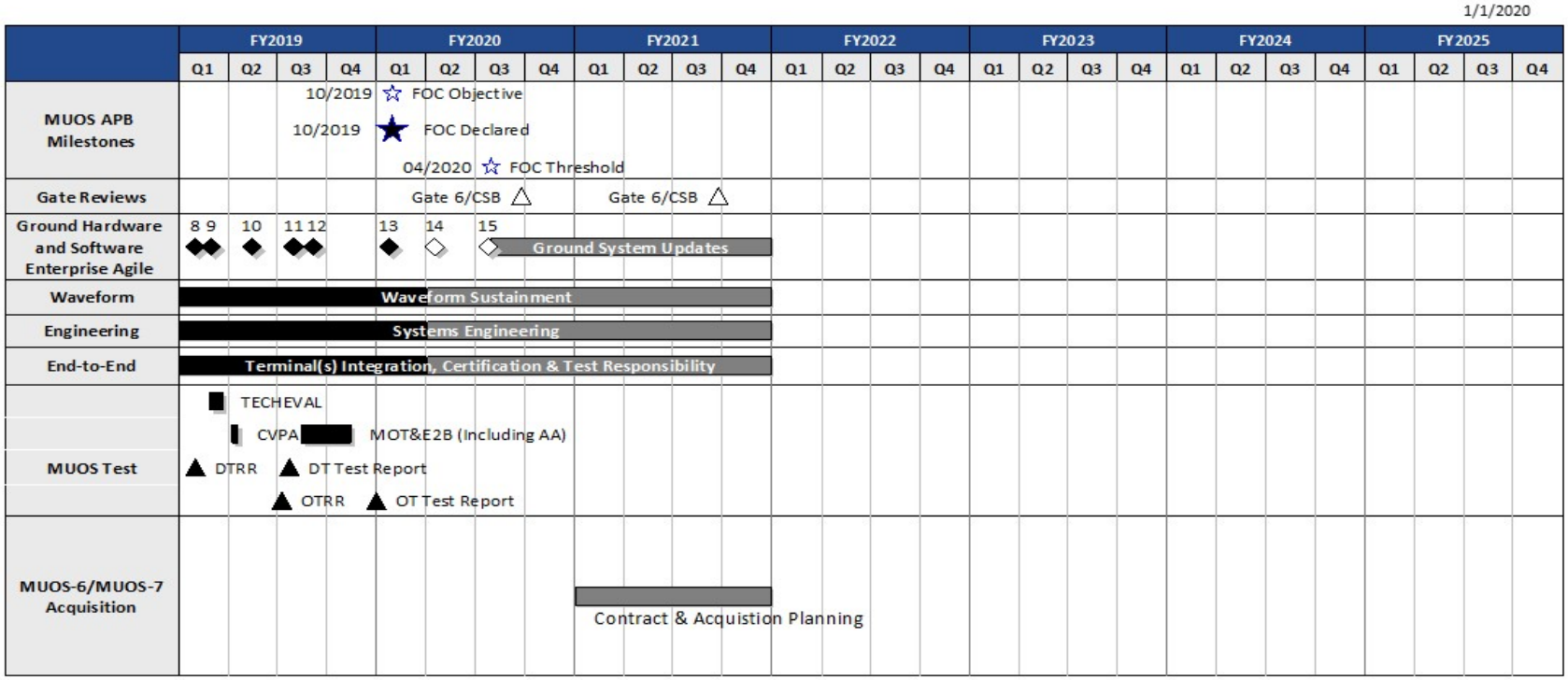
Management Services ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Government Engineering	WR	NIWC PAC : San Diego, CA	0.000	1.428	Oct 2018	2.041	Oct 2019	2.085	Oct 2020	-		2.085	0.000	5.554	-
		Subtotal	0.000	4.528		4.041		4.127		-		4.127	0.000	12.696	N/A

	Prior Years	FY 2019		FY 2020		FY 2021 Base		FY 2021 OCO		FY 2021 Total	Cost To Complete	Total Cost	Target Value of Contract
Project Cost Totals	0.000	14.845		15.868		70.056		-		70.056	0.000	100.769	N/A

Remarks

Exhibit R-4, RDT&E Schedule Profile: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 7	**R-1 Program Element (Number/Name)** PE 1203109N / *Satellite Communications (SPACE)*	**Project (Number/Name)** 2472 / *Mobile User Objective Sys (MUOS)*



IOC: 07/2018 **FOC:** 10/2019

Acronym	Definition
AA	Adversarial Assessment
APB	Acquisition Program Baseline
CDR	Critical Design Review
CSB	Configuration Steering Board
CVPA	Cooperative Vulnerability Penetration Assessment

Acronym	Definition
DT	Development Test
DTRR	Development Test Readiness Review
FOC	Full Operational Capability
IOC	Initial Operational Capability
M	MUOS Space Vehicle

Acronym	Definition
MOT&E-2B	Multi-Service Operational Test and Evaluation
MS	Milestone
OT	Operational Test
OTRR	Operational Test Readiness Review
TECHEVAL	Technical Evaluation

Exhibit R-4A, RDT&E Schedule Details: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 7	**R-1 Program Element (Number/Name)** PE 1203109N / *Satellite Communications (SPACE)*	**Project (Number/Name)** 2472 / *Mobile User Objective Sys (MUOS)*

Schedule Details

	Start		End	
Events by Sub Project	**Quarter**	**Year**	**Quarter**	**Year**
Proj 2472				
Systems Engineering	1	2019	4	2021
Terminal Integration, Certification, and Test	1	2019	4	2021
Waveform Sustainment	1	2019	4	2021
Agile Deployment 8	1	2019	1	2019
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
Agile Deployment 12	3	2019	3	2019
Ground System Updates	3	2020	4	2021
DT Test Report	3	2019	3	2019
Operational Test Readiness Review	3	2019	3	2019
MOT&E2B / Adversarial Assessment	3	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
Agile Deployment 13	1	2020	1	2020
Gate 6/CSB FY20	1	2020	1	2020
Agile Deployment 14	2	2020	2	2020

Exhibit R-4A, RDT&E Schedule Details: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 7	**R-1 Program Element (Number/Name)** PE 1203109N / *Satellite Communications (SPACE)*	**Project (Number/Name)** 2472 / *Mobile User Objective Sys (MUOS)*

	Start		End	
Events by Sub Project	**Quarter**	**Year**	**Quarter**	**Year**
Agile Deployment 15	3	2020	3	2020
Full Operational Capability (FOC) Threshold	3	2020	3	2020
Gate 6/CSB FY21	1	2021	1	2021
Contract & Acquisition Planning	1	2021	4	2021

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy			Date: February 2020
Appropriation/Budget Activity 1319 / 7	R-1 Program Element (Number/Name) PE 1203109N / *Satellite Communications (SPACE)*	Project (Number/Name) 3398 / *Enterprise SATCOM Gateway Modems (ESGMs)*	

COST ($ in Millions)	Prior Years	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total	FY 2022	FY 2023	FY 2024	FY 2025	Cost To Complete	Total Cost
3398: *Enterprise SATCOM Gateway Modems (ESGMs)*	0.116	0.907	0.000	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	1.023
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 completed Joint GBS integration and supported the Joint GBS DT/OT event.

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
Title: Enterprise SATCOM Gateway Modems (ESGMs)	0.907	0.000	0.000	0.000	0.000
Articles:	-	-	-	-	-
FY 2020 Plans: N/A					
FY 2021 Base Plans: N/A					
FY 2021 OCO Plans: N/A					
Accomplishments/Planned Programs Subtotals	0.907	0.000	0.000	0.000	0.000

C. Other Program Funding Summary ($ in Millions)

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 7	**R-1 Program Element (Number/Name)** PE 1203109N / *Satellite Communications (SPACE)*	**Project (Number/Name)** 3398 / *Enterprise SATCOM Gateway Modems (ESGMs)*

C. Other Program Funding Summary ($ in Millions)

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.

Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Navy			Date: February 2020
Appropriation/Budget Activity 1319 / 7	R-1 Program Element (Number/Name) PE 1203109N / *Satellite Communications (SPACE)*	Project (Number/Name) 3398 / *Enterprise SATCOM Gateway Modems (ESGMs)*	

Support ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Systems Engineering	WR	NUWC : Newport, RI	0.116	0.253	Nov 2018	0.000		0.000		-		0.000	0.000	0.369	-
Systems Engineering	WR	NIWC LANT : Charleston, SC	0.000	0.381	Nov 2018	0.000		0.000		-		0.000	0.000	0.381	-
		Subtotal	0.116	0.634		0.000		0.000		-		0.000	0.000	0.750	N/A

Test and Evaluation ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Developmental Test & Evaluation	C/CPFF	SYSTECH : San Diego, CA	0.000	0.163	Nov 2018	0.000		0.000		-		0.000	0.000	0.163	-
Operational Test & Evaluation	WR	COMOPTEVFOR : Norfolk, VA	0.000	0.044	Nov 2018	0.000		0.000		-		0.000	0.000	0.044	-
		Subtotal	0.000	0.207		0.000		0.000		-		0.000	0.000	0.207	N/A

Management Services ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Program Management	C/CPFF	BAH : San Diego	0.000	0.061	Nov 2018	0.000		0.000		-		0.000	0.000	0.061	-
Travel	Reqn	NAVWAR : Various	0.000	0.005	Nov 2018	0.000		0.000		-		0.000	0.000	0.005	-
		Subtotal	0.000	0.066		0.000		0.000		-		0.000	0.000	0.066	N/A

Remarks

Naval Information Warfare Systems Command (NAVWAR) formerly known as Space and Naval Warfare Systems Command (SPAWAR)

	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Project Cost Totals	0.116	0.907		0.000		0.000		-		0.000	0.000	1.023	N/A

Remarks

Exhibit R-4, RDT&E Schedule Profile: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 7	**R-1 Program Element (Number/Name)** PE 1203109N / *Satellite Communications (SPACE)*	**Project (Number/Name)** 3398 / *Enterprise SATCOM Gateway Modems (ESGMs)*

	2019	2020	2021	2022	2023	2024	2025
DEVELOPMENT and INTEGRATION	ESGM Environmental Quality Testing						
TESTING	GBS ESGM DT/OT						
PROCUREMENT							

Exhibit R-4A, RDT&E Schedule Details: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 7	**R-1 Program Element (Number/Name)** PE 1203109N / *Satellite Communications (SPACE)*	**Project (Number/Name)** 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	2019	4	2019
GBS ESGM DT/OT	1	2019	4	2019