Exhibit R-2, RDT&E Budget Item Justification: PB 2021 Air Force											Date: February 2020	
Appropriation/Budget Activity 3620F: *Research, Development, Test & Evaluation, Space Force I* BA 5: *System Development & Demonstration (SDD)*					R-1 Program Element (Number/Name) PE 1206431SF *I Advanced EHF MILSATCOM (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	0.000	0.000	0.000	138.257	-	138.257	95.856	15.010	15.280	0.000	0.000	264.403
657104: *MILSATCOM Space Modernization Initiative (SMI)*	0.000	0.000	0.000	138.257	-	138.257	95.856	15.010	15.280	0.000	0.000	264.403
Quantity of RDT&E Articles	-	-	-	-	-	-	-	-	-	-		
Program MDAP/MAIS Code: 261												

A. Mission Description and Budget Item Justification

In FY 2021, PE 1206431F, Advanced EHF MILSATCOM (SPACE) efforts were transferred to Appropriation 3620, Research, Development, Test & Evaluation, Space Force, PE 1206431SF, Advanced EHF MILSATCOM (SPACE) from Appropriation 3600, Budget Activity 05 due to the creation of a new Appropriation for Space Force.

The Space Force ability to deliver global satellite communications (SATCOM) is unprecedented, and the joint warfighter relies on this capability at all levels and across the range of military operations. SATCOM provides survivable communications for Presidential support and nuclear command and control, and affords national and military leaders a means to maintain strategic situational awareness and convey their intent to the Joint Force Commander (JFC). In order for the United States to maintain its asymmetric advantage of global space-based communications, the SATCOM enterprise must be prepared to "fight SATCOM" as a single enterprise through a Contested, Degraded and Operationally-limited (CDO) environment, prevent or withstand loss, and continue to deliver effects to warfighters.

The Space Modernization Initiative (SMI) strategy is to evolve current and future SATCOM systems to meet the needs of an integrated "Fighting SATCOM" Enterprise, sustain the existing AEHF system capability, develop a more affordable and resilient SATCOM enterprise capable of meeting near term and emerging requirements, demonstrate technologies and Concepts of Operations (CONOPS) that lead to a future Protected Anti-Jam Tactical SATCOM (PATS) capability that provides tactical level Military SATCOM (MILSATCOM) users protected, anti-jam satellite communications while operating in a contested environment, and develop an integrated (Commercial SATCOM (COMSATCOM and MILSATCOM) "Fighting SATCOM" Enterprise. PATS will provide tactical users significantly higher data rates than AEHF and a security architecture that enables forward deployed users to have protected satellite communications in scenarios where AEHF terminals cannot be deployed.

Under this construct the SMI will: 1) Continue the Capabilities Insertion Program (CIP) to enhance the current AEHF constellation and Protected Communications performance, and improve system operational resiliency, 2) Invest in technologies and demonstrations (e.g. Protected Tactical Service Field Demonstration (PTSFD)) that enable the future Protected Tactical Enterprise Service (PTES) and SATCOM programs by continued development of the Protected Tactical Testbed, and demonstrating resilient and affordable wideband protected technologies and CONOPS, 3) Demonstrate and develop a roadmap to evolve the current stove piped MILSATCOM Command and Control (C2) management system into an integrated "Fighting SATCOM" Enterprise, 4) Develop and demonstrate flexible terminal interface technologies with Services and SATCOM Terminal providers, and 5) Develop and demonstrate an improved integration of ground gateways and data networking with the space segment with the goal of providing seamless end to end SATCOM service for the warfighters in a CDO environment.

The FY 2021 funding request was reduced by $7.224 million to account for the availability of prior year execution balances.

Exhibit R-2, RDT&E Budget Item Justification: PB 2021 Air Force	Date: February 2020
Appropriation/Budget Activity 3620F: *Research, Development, Test & Evaluation, Space Force I* BA 5: *System Development & Demonstration (SDD)*	**R-1 Program Element (Number/Name)** PE 1206431SF *I Advanced EHF MILSATCOM (SPACE)*

Space acquisition must respond with speed and agility to emerging adversary threats. Space & Missile Systems Center (SMC) is transforming the organization and implementation of space acquisition to an enterprise approach, maximizing innovation and resiliency, leveraging international, commercial, and mission partnerships, and managing program/project priorities according to an integrated unclassified/classified enterprise space architecture. Expanding the appropriate acquisition authorities and contract mechanisms to deliver capability sooner, SMC will strategically execute experimentation, prototyping, risk reduction, and other efforts to develop new or repurpose capabilities.

This program element may include necessary civilian pay expenses required to manage, execute, and deliver AEHF weapon system capability. The use of such program funds would be in addition to the civilian pay expenses budgeted in program elements 1206392SF and 1206398SF.

This program is in Budget Activity 5, System Development and Demonstration (SDD) because it has passed Milestone B approval and is conducting engineering and manufacturing development tasks aimed at meeting validated requirements prior to full rate production.

B. Program Change Summary ($ in Millions)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
Previous President's Budget	0.000	0.000	0.000	-	0.000
Current President's Budget	0.000	0.000	138.257	-	138.257
Total Adjustments	0.000	0.000	138.257	-	138.257
• Congressional General Reductions	0.000	0.000			
• Congressional Directed Reductions	0.000	0.000			
• Congressional Rescissions	0.000	0.000			
• Congressional Adds	0.000	0.000			
• Congressional Directed Transfers	0.000	0.000			
• Reprogrammings	0.000	0.000			
• SBIR/STTR Transfer	0.000	0.000			
• Other Adjustments	0.000	0.000	138.257	-	138.257

Change Summary Explanation

FY 2021: +$138.257M; funds starting in FY 2021 were transferred from RDT&E, Air Force to RDT&E, Space Force.

C. Accomplishments/Planned Programs ($ in Millions)	FY 2019	FY 2020	FY 2021
Title: Capabilities Insertion Program (CIP)	0.000	0.000	69.614
Description: Develop software that will increase the current AEHF constellation and Protected Communications capabilities, broaden overall user base, and accommodate a larger user population through improved resource utilization efficiencies. Develop modifications that will improve the Protected mission operational resiliency. Develop software to increase current AEHF terminal data rates with adaptive coding algorithms. Invest in technology demonstrations that improve the operational mission resiliency			

Exhibit R-2, RDT&E Budget Item Justification: PB 2021 Air Force	Date: February 2020
Appropriation/Budget Activity 3620F: *Research, Development, Test & Evaluation, Space Force I* BA 5: *System Development & Demonstration (SDD)*	**R-1 Program Element (Number/Name)** PE 1206431SF *I Advanced EHF MILSATCOM (SPACE)*

C. Accomplishments/Planned Programs ($ in Millions)	FY 2019	FY 2020	FY 2021
and effectiveness for all protected capabilities, which include, but are not limited to; Rapid Adaptive Planning and Situational Awareness for the Warfighter (RAPSAW), Mission Planning Element (MPE) 8.4, Cyber Defense-in-depth, etc. ***FY 2020 Plans:*** N/A ***FY 2021 Plans:*** Continue OR2/2B Phase 2, which adds capability to constellation and ground software updates. Other continuing projects include the RAPSAW resiliency effort that decreases the mission planning timelines, de-conflicts communication planning for the operators, and provides enhanced situational awareness of payload and terminal resources; MPE 8.4 - a capability improvement to the AEHF system that improves the Wideband EHF Beyond-Line-of-Sight Terminal (WEB-T) functionality and crypto redesign; and Cyber Defense-in-depth - that will deliver new system enhancements and upgrades to fortify AEHF against cyber security threats. This will provide new capabilities and functionality for defensive cyber operation and hardening against cyber-attacks on-orbit and on the ground. Invest in technology demonstrations that improve operational mission resiliency and effectiveness for all protected capabilities. These activities include, but are not limited to W/V Frequency utility, etc. Rapidly respond to implement system resiliency and situational awareness necessary to operate in the contested space domain. Activities may include, but are not limited to program office support, studies, technical analysis, experimentation, prototyping, etc. ***FY 2020 to FY 2021 Increase/Decrease Statement:*** N/A			
Title: Protected Tactical Testbed ***Description:*** Protected Tactical Testbed provides a government gold standard of reference for risk reduction and experimentation on critical technology elements for the space payload, terminals and networking segments of the PATS system. Supports the hardware development of the hub component for the PTES ground system and any necessary test capabilities to support either the over-the-air (OTA) or laboratory demonstrations for the PTSFD. It enables system integration capabilities with industry and FFRDC partners for interoperability testing and conducting experiments to mature the PATS operations, with a focus on the Protected Tactical Waveform (PTW). This effort is planned to move to PE 1206761SF, Protected Tactical Service (PTS) in FY 2022. ***FY 2020 Plans:*** N/A ***FY 2021 Plans:*** During PTES Phase I, testbed assets will continue to be developed and procured to support the PATS mission. Continue Testbed support to PTES Operational Demonstration and PTES extensibility to PTS. PTES, PTS and Army-Air Force Anti-Jam Modem	0.000	0.000	6.952

Exhibit R-2, RDT&E Budget Item Justification: PB 2021 Air Force	Date: February 2020
Appropriation/Budget Activity 3620F: *Research, Development, Test & Evaluation, Space Force I* BA 5: *System Development & Demonstration (SDD)*	**R-1 Program Element (Number/Name)** PE 1206431SF *I Advanced EHF MILSATCOM (SPACE)*

C. Accomplishments/Planned Programs ($ in Millions)	FY 2019	FY 2020	FY 2021
(A3M) will utilize the test assets to develop Key Management Systems (KMS), Mission Management Systems (MMS), Joint Hub, Space Hub, and Terminal Modem Line Replacement Unit (TM LRU), and Terminal / Hub capability in support of risk reduction events and testing of numerous over-the-air, interoperability demonstrations, is planned to include: a) demonstration of PTW of Kirameki Satellites (in cooperation with Japan) which will mature International Partner user CONOPS within PATS; b) maturation and demonstration of Enterprise Management and Control functions while roaming between MILSATCOM and COMSATCOM systems; and c) participation in Navy Trident Warrior exercise which helps mature PTW COCOM CONOPS. Protected Tactical Testbed is planned to move to PE 1206761SF, PTS in FY 2022. ***FY 2020 to FY 2021 Increase/Decrease Statement:*** N/A			
Title: Army-Air Force Anti-Jam Modem (A3M) ***Description:*** The A3M will develop PTW modems that meet all environmental, integration, and mission requirements for Satellite Transportable Terminal (STT) and Ground Multi-band Terminal (GMT) tactical users. A3M development includes fabrication of pre-production modems, development of operator training materials, fielding, and sustainment planning. ***FY 2020 Plans:*** N/A ***FY 2021 Plans:*** Continue modem development, conduct Critical Design Reviews (CDR), fabrication of pre-production modems and developmental testing including National Cyber Range (NCR), blue and red team testing. Continue GMT modification preparation, cable design and non-recurring engineering. ***FY 2020 to FY 2021 Increase/Decrease Statement:*** N/A	0.000	0.000	18.479
Title: Fighting SATCOM Enterprise ***Description:*** Warfighters require SATCOM capabilities that can effectively operate in a CDO environment. Some key areas that are the focus of this effort: 1) Provide situational awareness and synchronization of operations across the SATCOM enterprise; 2) Provide Full-spectrum Defensive Space Control (DSC) allowing warfighters to communicate through any operational environment; 3) Manage and direct COMSATCOM resources employed by DoD users; 4) Develop flexible terminal interface standards for adoption by Service terminal program offices to operate on a variety of waveforms over varying frequencies and providers with quick transition or, when possible, simultaneously; 5) Enable users to maintain their networks when transitioning to different beams, antennas, satellite, or systems; 6) Improve the cyber resiliency for warfighters, protecting their operational information as	0.000	0.000	43.212

Exhibit R-2, RDT&E Budget Item Justification: PB 2021 Air Force	Date: February 2020
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C. Accomplishments/Planned Programs ($ in Millions)	FY 2019	FY 2020	FY 2021
well as their communications data and control systems in the face of a determined and sophisticated attacker; and 7) Enable data interoperability with joint command and control systems. ***FY 2020 Plans:*** N/A. ***FY 2021 Plans:*** This is not a New Start, as it transitions the effort started under Program Element 1206445F, COMSATCOM Integration. This effort will focus on a Fighting SATCOM Enterprise and the award of Block 0 effort necessary to: 1) integrate the tools to provide SATCOM capability to global warfighters and restore services in tactically-relevant timelines, and 2) improve resilience and operational agility in CDO environments, by leveraging DoD and commercial systems, capabilities, and products to deliver connectivity to users in all operational conditions. Achieve Block 0 Initial Operational Capability (IOC). Begin Block I, utilizing a development operations approach. ***FY 2020 to FY 2021 Increase/Decrease Statement:*** N/A.			
Accomplishments/Planned Programs Subtotals	0.000	0.000	138.257

D. 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
• SPAF 01 ADV555:: *Advanced EHF*	28.329	21.894	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	50.223
• SPSF 01 ADV555:: *Advanced EHF*	0.000	0.000	14.823	-	14.823	0.000	0.000	0.000	0.000	0.000	14.823
• SPSF 01 MILSAT: *MILSATCOM*	0.000	0.000	4.518	-	4.518	17.001	8.993	0.000	0.000	0.000	30.512

Remarks

The FY21-23 MILSAT SPSF above funds the production of the A3M. A3M is a joint effort between the MILSATCOM Directorate (SMC) and the Program Manager (PM) Tactical Networks (TM), Aberdeen Proving Ground (APG) to develop a common modem for the AF GMT and Army STT. Leveraging similar mission and environmental requirements enables selection of the high water mark requirements to meet both mission parameters with greater efficiency while reducing risk and lifecycle cost.

E. Acquisition Strategy

A3M is an ACAT III program. A3M leverages the PTSFD technology maturation resulting in a low risk development effort delivering pre-production modems with 100% production ready components. This will include certified End Cryptographic Units (ECUs) for full scope operational and cyber testing, operator and maintainer training materials, and all required intellectual property rights, provisioning documentation, and training materials to enable swift terminal modification for operational use and sustainment. The development phase will deliver pre-production PTW capable modems ready for "build to print" production. Blended developmental and operational testing is expected to include full environmental, blue, and red team testing prior to the production decision.

Exhibit R-2, RDT&E Budget Item Justification: PB 2021 Air Force	Date: February 2020
Appropriation/Budget Activity 3620F: *Research, Development, Test & Evaluation, Space Force I* BA 5: *System Development & Demonstration (SDD)*	**R-1 Program Element (Number/Name)** PE 1206431SF *I Advanced EHF MILSATCOM (SPACE)*

"Fighting SATCOM" Enterprise intends to utilize the Middle Tier Acquisition Section 804 authorities to develop rapid operational prototype capabilities in blocks starting in FY 2021. This work leverages the Wideband Communication Analysis (WCS) Analysis of Alternatives (AoA) Final Report (2019) and the Protected Satellite Communication Services (PSCS) AoA Final Report (2016). Findings in both AoA reports identified the need for an enterprise approach to managing SATCOM in an aggregated architecture for both cost savings and the necessary responsiveness to counter evolving threats. Market research has identified high Technology Readiness Level products; and prototyping demonstrated mature interfaces and architectures to enable rapid capabilities that are "Fighting SATCOM" Enterprise-aligned.

Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Air Force		Date: February 2020
Appropriation/Budget Activity 3620F / 5	**R-1 Program Element (Number/Name)** PE 1206431SF / *Advanced EHF MILSATCOM (SPACE)*	**Project (Number/Name)** 657104 / *MILSATCOM Space Modernization Initiative (SMI)*

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
Capabilities Insertion Program (CIP)	SS/CPIF	Lockheed Martin : Sunnyvale, CA	-	-		-		61.185	Oct 2020	-		61.185	Continuing	Continuing	-
W/V Frequency utilization demonstration	MIPR	AFRL : Various	-	-		-		8.554	Nov 2020	-		8.554	Continuing	Continuing	-
Protected Tactical Testbed	Various	Various : Various	-	-		-		6.123	Dec 2020	-		6.123	Continuing	Continuing	-
A3M PTW Modem Development	C/TBD	TBD : TBD	-	-		-		16.100	Nov 2020	-		16.100	Continuing	Continuing	-
Fighting SATCOM Enterprise	TBD	Not specified. : TBD	-	-		-		35.063	Jan 2021	-		35.063	Continuing	Continuing	-
Technical Mission Analysis	MIPR	Aerospace : El Segundo, CA	-	-		-		2.300	Oct 2020	-		2.300	Continuing	Continuing	-
Enterprise SE&I	C/CPAF	Linquest : Los Angeles, CA	-	-		-		3.497	Oct 2020	-		3.497	Continuing	Continuing	-
		Subtotal	-	-		-		132.822		-		132.822	Continuing	Continuing	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
FFRDC	MIPR	Aerospace : El Segundo, CA	-	-		-		2.000	Oct 2020	-		2.000	Continuing	Continuing	-
Other Support	Various	Various : Various	-	-		-		0.300	Nov 2020	-		0.300	Continuing	Continuing	-
A&AS	Various	Various : Various	-	-		-		3.135	Oct 2020	-		3.135	Continuing	Continuing	-
		Subtotal	-	-		-		5.435		-		5.435	Continuing	Continuing	N/A

	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	-	-		0.000		138.257		-		138.257	Continuing	Continuing	N/A

Remarks

Exhibit R-4, RDT&E Schedule Profile: PB 2021 Air Force		Date: February 2020
Appropriation/Budget Activity 3620F / 5	**R-1 Program Element (Number/Name)** PE 1206431SF / *Advanced EHF MILSATCOM (SPACE)*	**Project (Number/Name)** 657104 / *MILSATCOM Space Modernization Initiative (SMI)*

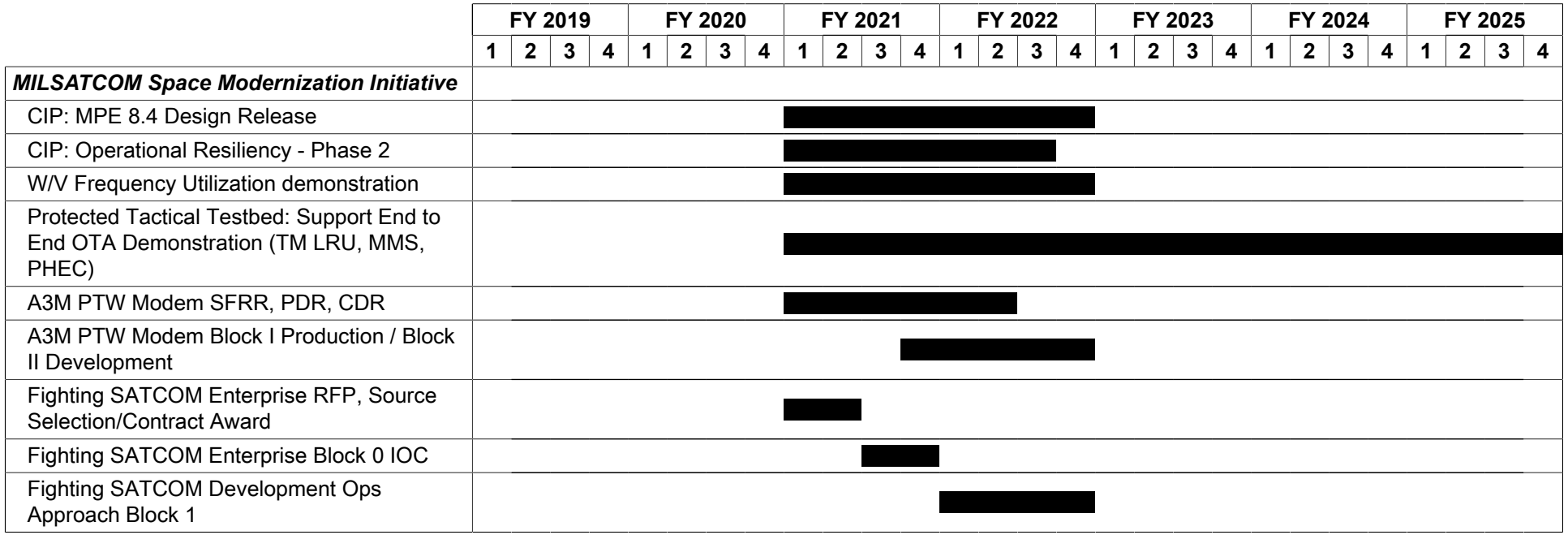

Exhibit R-4A, RDT&E Schedule Details: PB 2021 Air Force		Date: February 2020
Appropriation/Budget Activity 3620F / 5	**R-1 Program Element (Number/Name)** PE 1206431SF / *Advanced EHF MILSATCOM (SPACE)*	**Project (Number/Name)** 657104 / *MILSATCOM Space Modernization Initiative (SMI)*

Schedule Details

	Start		End	
Events by Sub Project	**Quarter**	**Year**	**Quarter**	**Year**
MILSATCOM Space Modernization Initiative				
CIP: MPE 8.4 Design Release	1	2021	4	2022
CIP: Operational Resiliency - Phase 2	1	2021	3	2022
W/V Frequency Utilization demonstration	1	2021	4	2022
Protected Tactical Testbed: Support End to End OTA Demonstration (TM LRU, MMS, PHEC)	1	2021	4	2025
A3M PTW Modem SFRR, PDR, CDR	1	2021	2	2022
A3M PTW Modem Block I Production / Block II Development	4	2021	4	2022
Fighting SATCOM Enterprise RFP, Source Selection/Contract Award	1	2021	2	2021
Fighting SATCOM Enterprise Block 0 IOC	3	2021	4	2021
Fighting SATCOM Development Ops Approach Block 1	1	2022	4	2022