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**Exhibit R-2, RDT&E Budget Item Justification:** PB 2022 Air Force **Date:** May 2021

<b>Appropriation/Budget Activity</b> 3600: <i>Research, Development, Test &amp; Evaluation, Air Force I BA 4: Advanced Component Development &amp; Prototypes (ACD&amp;P)</i>	<b>R-1 Program Element (Number/Name)</b> PE 1203164F / <i>NAVSTAR Global Positioning System (User Equipment) (SPACE)</i>
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COST (\$ in Millions)	Prior Years	FY 2020	FY 2021	FY 2022 Base	FY 2022 OCO	FY 2022 Total	FY 2023	FY 2024	FY 2025	FY 2026	Cost To Complete	Total Cost
Total Program Element	1,292.024	308.215	0.000	0.000	0.000	0.000	-	-	-	-	-	-
643833: <i>MILITARY GLOBAL POSITIONING SYSTEM USER EQUIP</i>	1,292.024	308.215	0.000	0.000	0.000	0.000	-	-	-	-	-	-
Quantity of RDT&E Articles	-	-	-	-	-	-	-	-	-	-	-	-

**Program MDAP/MAIS Code:** 447

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

Note: "NAVSTAR" will be removed from the program title in this Budget Line Item in the next budget submission.

In FY2021, PE 1203164F, NAVSTAR Global Positioning System (User Equipment) efforts were transferred to Appropriation 3620, Research, Development, Test & Evaluation (RDT&E), Space Force, PE 1203164SF NAVSTAR Global Positioning System (User Equipment) from Appropriation 3600, Budget Activity 04, due to the creation of a new Appropriation for Space Force.

The Global Positioning System (GPS) is a space-based radio Positioning, Navigation, and Timing (PNT) distribution system. GPS User Equipment (UE) consists of standardized receivers, antennas, antenna electronics, and other related equipment, grouped together in sets to derive navigation and time information transmitted from GPS satellites. These receiver sets are used by the Department of Defense (DoD). RDT&E funds UE development, integration, test, and analysis for new PNT receiver capabilities in Navigation Warfare (NAVWAR) across all military platforms using GPS services.

The Military Global Positioning System User Equipment (MGUE) Increment (Inc) 1 program is responsible for the development of standard modernized receiver form factors for the Service-nominated lead platforms. The MGUE Inc 1 Capability Development Document (CDD) was approved by the Joint Requirements Oversight Council (JROC) on 24 July 2014. MGUE Inc 1 is initiating a new family of modernized GPS receivers that will deliver significantly improved capability to counter current and emerging PNT threats and enable military operations in a NAVWAR environment where current legacy receiver performance would be compromised. MGUE Inc 1 received a Milestone A decision in April 2012. The program received direction in February 2014, from the Under Secretary of Defense for Acquisition, Technology, and Logistics (USD(AT&L)) to execute a new acquisition strategy, accelerating the program to provide test units faster to facilitate military end users. The MGUE program received a Milestone B decision in January 2017.

The MGUE Inc 2 effort will continue to expand Military-Code (M-Code) receiver technology into additional applications (space receivers and precision guided munitions), and develop a modernized Handheld device to meet Service requirements. This effort leverages the MGUE Inc 1 technology to the maximum extent while addressing the production of M-Code integrated circuits far into the future. The MGUE Inc 2 program is being executed in three parts: 1) Risk Reduction Activities, 2) Miniature Serial Interface (MSI) Receiver Card Middle Tier Acquisition rapid prototyping, and 3) Joint Modernized GPS Handheld Receiver Middle Tier Acquisition rapid prototyping effort. The JROC approved the MGUE Inc 2 CDD on 6 April 2018. The Air Force Service Acquisition Executive approved the MGUE Inc 2 Acquisition

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Strategy to include designation of two Middle Tier Acquisition Rapid Prototype efforts: 1) Miniature Serial Interface (MSI) Receiver Cards to include next-generation Application Specific Integrated Circuit (ASIC) and 2) Joint, Modernized Handheld Receiver.

Space acquisition must respond with speed and agility to emerging adversary threats. Space & Missile Systems Center (SMC) has transformed 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 (PE) may include necessary civilian pay expenses required to manage, execute, and deliver MGUE weapon system capability. The use of such program funds would be in addition to the civilian pay expenses budgeted in PEs 1206392F and 1206398F.

This effort is in Budget Activity 4, Advanced Component Development and Prototypes (ACD&P), because efforts are necessary to evaluate integrated technologies, representative modes or prototype systems in a high fidelity and realistic operating environment.

<b>B. Program Change Summary (\$ in Millions)</b>	<b>FY 2020</b>	<b>FY 2021</b>	<b>FY 2022 Base</b>	<b>FY 2022 OCO</b>	<b>FY 2022 Total</b>
Previous President's Budget	320.598	0.000	0.000	0.000	0.000
Current President's Budget	308.215	0.000	0.000	0.000	0.000
Total Adjustments	-12.383	0.000	0.000	0.000	0.000
• 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	-1.705	0.000			
• SBIR/STTR Transfer	-10.678	0.000			
• Other Adjustments	0.000	0.000	0.000	0.000	0.000

**Change Summary Explanation**

FY 2020: -1.750M Decrease for higher Air Force Space priorities

<b>C. Accomplishments/Planned Programs (\$ in Millions)</b>	<b>FY 2020</b>	<b>FY 2021</b>	<b>FY 2022</b>
<b>Title:</b> MGUE Inc 1	77.845	-	-
<b>Description:</b> The MGUE Inc 1 program develops standard modernized receiver form factors for the Service-nominated lead platforms in accordance with the MGUE Inc 1 CDD.			

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<b>Appropriation/Budget Activity</b> 3600: Research, Development, Test & Evaluation, Air Force I BA 4: Advanced Component Development & Prototypes (ACD&P)	<b>R-1 Program Element (Number/Name)</b> PE 1203164F I NAVSTAR Global Positioning System (User Equipment) (SPACE)
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<b>C. Accomplishments/Planned Programs (\$ in Millions)</b>	FY 2020	FY 2021	FY 2022
<p><b>Title:</b> Advanced Technology</p> <p><b>Description:</b> Advanced Technology includes efforts to mature technology for future GPS receivers called out in the MGUE CDDs. These efforts aim to find innovative solutions to increase resiliency in GPS performance and improve on size, weight, power, and cost (SWAP/C) of military receivers.</p>	8.000	-	-
<p><b>Title:</b> System/Platform Integration and Performance Certification</p> <p><b>Description:</b> Integration of MGUE Inc 1 receiver form factors into the Service-nominated lead platforms in support of developmental and operational test events. Conduct technical and operational modernization impact analysis for MGUE Service lead platform integration.</p>	47.258	-	-
<p><b>Title:</b> Information Assurance, Security/Compatibility Certification, and Test/Evaluation</p> <p><b>Description:</b> Develop, implement, and maintain GPS security certification programs. Development of DoD Policy, strategy and resource requirements for MGUE security certification and compatibility certification. Security certification, compatibility certification, and security approval ensures future military GPS receivers protect critical program information and continue working in all environments and concepts of operations called for by U.S. Strategic Command.</p>	3.302	-	-
<p><b>Title:</b> MGUE Inc 2 Risk Reduction</p> <p><b>Description:</b> The MGUE Inc 2 program will develop M-Code receiver technology for additional applications (space receivers, precision guided munitions, and handheld receivers) to meet Service requirements. MGUE Inc 2 Risk Reduction activities include, but are not limited to, acquisition strategy development, early design efforts through Preliminary Design Review (PDR) for the next generation ASIC using 14nm ASIC technology node, handheld design activities and early user demonstrations, advanced concept studies, receiver component prototyping to include MGUE Inc 2 requirements.</p>	171.810	-	-
<b>Accomplishments/Planned Programs Subtotals</b>	308.215	-	-

<b>D. Other Program Funding Summary (\$ in Millions)</b>											
<u>Line Item</u>	<u>FY 2020</u>	<u>FY 2021</u>	<u>FY 2022</u>	<u>FY 2022</u>	<u>FY 2022</u>						
			<u>Base</u>	<u>OCO</u>	<u>Total</u>	<u>FY 2023</u>	<u>FY 2024</u>	<u>FY 2025</u>	<u>FY 2026</u>	<u>Cost To Complete</u>	<u>Total Cost</u>
• SPAF 01 GPSSPC: Navstar GPS Space	0.000	-	-	-	-	-	-	-	-	-	-

**Remarks**  
Space Procurement, Air Force (SPAF) funding in this PE supports legacy SAASM efforts. Similar work for the MGUE is in the planning phase.

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**E. Acquisition Strategy**

The MGUE program has developed a comprehensive acquisition strategy to provide modernized GPS capabilities to U.S. and Allied Forces by developing a competitive market driven approach. This strategy establishes the signal compatibility and security criteria along with a process for evaluating components to enable rapid movement from development to fielding. The pillars of this effort are: (a) establishing time certain and low risk development; (b) bounding requirements to leverage mature technology to the maximum extent possible; (c) focusing on the development of form factors based on well-defined standards to support lead platform integration; and (d) implementing a proactive, collaborative MGUE platform integration activity to mitigate risk and reduce cost for DoD force structure modernization.

The MGUE program awarded three sole source contracts for the Inc 1 Technology Development Phase effort in September 2012, as follow-on efforts to the competitively awarded Modernized User Equipment (MUE) contracts awarded in June 2006. The effort spans the Technology Maturation and Risk Reduction Phase through design and includes integration and test of M-Code receivers into Service-nominated lead platforms. This effort also includes the security and compatibility certification of GPS receiver cards as a part of the integration effort. The Service lead platforms will select from the available vendors to integrate and perform operational testing with funding from the MGUE program. This supports compliance with PL 111-383, section 913.

The MGUE Inc 2 program developed an Acquisition Strategy to continue MGUE development by: addressing long term producibility of MGUE ASICs, identifying a U.S. owned trusted foundry for ASIC development, delivering GPS receiver cards to meet stringent Inc 2 requirements, and developing a modernized GPS handheld receiver to meet the needs of the Services. The MGUE Inc 2 program is being executed in three parts: 1) Risk Reduction Activities, 2) MSI Middle Tier Acquisition rapid prototyping, and 3) Joint Modernized GPS Handheld Receiver Middle Tier Acquisition rapid prototyping effort. The Air Force Service Acquisition Executive approved the MGUE Inc 2 Acquisition Strategy to include designation of two Middle Tier Acquisition Rapid Prototype efforts: 1) Miniature Serial Interface Receiver Card (includes next-generation ASIC) and 2) Joint, Modernized Handheld Receiver.

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**Exhibit R-3, RDT&E Project Cost Analysis: PB 2022 Air Force** **Date:** May 2021

<b>Appropriation/Budget Activity</b> 3600 / 4	<b>R-1 Program Element (Number/Name)</b> PE 1203164F / NAVSTAR Global Positioning System (User Equipment) (SPACE)	<b>Project (Number/Name)</b> 643833 / MILITARY GLOBAL POSITIONING SYSTEM USER EQUIP
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<b>Product Development (\$ in Millions)</b>				<b>FY 2020</b>		<b>FY 2021</b>		<b>FY 2022 Base</b>		<b>FY 2022 OCO</b>		<b>FY 2022 Total</b>	<b>Cost To Complete</b>	<b>Total Cost</b>	<b>Target Value of Contract</b>
<b>Cost Category Item</b>	<b>Contract Method &amp; Type</b>	<b>Performing Activity &amp; Location</b>	<b>Prior Years</b>	<b>Cost</b>	<b>Award Date</b>	<b>Cost</b>	<b>Award Date</b>	<b>Cost</b>	<b>Award Date</b>	<b>Cost</b>	<b>Award Date</b>	<b>Cost</b>			
MGUE Inc 1 Technology Development (1)	C/CPIF	Collins Aerospace : Cedar Rapids, IA	146.703	18.610	Nov 2019	-		-		-		-	-	-	167.971
MGUE Inc 1 Technology Development (2)	C/CPIF	Raytheon : El Segundo, CA	194.016	27.539	Nov 2019	-		-		-		-	-	-	211.320
MGUE Inc 1 Technology Development (3)	C/CPIF	L3Harris Tech : Anaheim, CA	107.300	5.000	Nov 2019	-		-		-		-	-	-	120.189
MGUE Inc 1 Pre-Tech Development	Various	Various : Various	59.880	8.000	Jan 2020	-		-		-		-	-	-	-
MGUE Inc 1 Demos	Various	Various : TBD	0.000	-		-		-		-		-	-	-	-
MGUE Inc 1 Platform Integration	Various	Various : Various	211.671	30.560	Nov 2019	-		-		-		-	-	-	-
MGUE Inc 1 Compatibility Certification	Various	Various : Various	11.158	-		-		-		-		-	-	-	-
MGUE Inc 1 Information Assurance	Various	Various : Various	23.217	2.678	Jan 2020	-		-		-		-	-	-	-
MGUE Inc 1 Security Certification	Various	Various : Various	32.913	0.000	Jan 2020	-		-		-		-	-	-	-
MGUE Inc 1 Technical Mission Analysis	MIPR	Various : El Segundo, CA	60.248	11.539	Oct 2019	-		-		-		-	-	-	-
MGUE Inc 1 Enterprise SE&I	Various	SAIC : El Segundo, CA	102.734	18.392	Nov 2019	-		-		-		-	-	-	132.525
MGUE Inc 2 Risk Reduction	Various	Various : Various	195.630	156.974	Jan 2020	-		-		-		-	-	-	1,013.400
MGUE Inc 2 Technical Mission Analysis	MIPR	Various : El Segundo, CA	2.466	5.500	Oct 2019	-		-		-		-	-	-	-
MGUE Inc 2 Enterprise SE&I	Various	SAIC : El Segundo, CA	2.000	5.215	Nov 2019	-		-		-		-	-	-	97.300
<b>Subtotal</b>			1,149.936	290.007		-		-		-		-	-	-	N/A

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<b>Test and Evaluation (\$ in Millions)</b>				<b>FY 2020</b>		<b>FY 2021</b>		<b>FY 2022 Base</b>		<b>FY 2022 OCO</b>		<b>FY 2022 Total</b>	<b>Cost To Complete</b>	<b>Total Cost</b>	<b>Target Value of Contract</b>
<b>Cost Category Item</b>	<b>Contract Method &amp; Type</b>	<b>Performing Activity &amp; Location</b>	<b>Prior Years</b>	<b>Cost</b>	<b>Award Date</b>	<b>Cost</b>	<b>Award Date</b>	<b>Cost</b>	<b>Award Date</b>	<b>Cost</b>	<b>Award Date</b>	<b>Cost</b>			
MGUE Inc 1 Test and Evaluation	Various	Various : San Diego, CA	19.591	3.733	Jan 2020	-		-		-		-	-	-	-
<b>Subtotal</b>			19.591	3.733		-		-		-		-	-	-	N/A

<b>Management Services (\$ in Millions)</b>				<b>FY 2020</b>		<b>FY 2021</b>		<b>FY 2022 Base</b>		<b>FY 2022 OCO</b>		<b>FY 2022 Total</b>	<b>Cost To Complete</b>	<b>Total Cost</b>	<b>Target Value of Contract</b>
<b>Cost Category Item</b>	<b>Contract Method &amp; Type</b>	<b>Performing Activity &amp; Location</b>	<b>Prior Years</b>	<b>Cost</b>	<b>Award Date</b>	<b>Cost</b>	<b>Award Date</b>	<b>Cost</b>	<b>Award Date</b>	<b>Cost</b>	<b>Award Date</b>	<b>Cost</b>			
MGUE Inc 1 FFRDC	Various	Aerospace/MITRE : Various	57.502	6.735	Dec 2019	-		-		-		-	-	-	-
MGUE Inc 2 FFRDC	Various	Aerospace/MITRE : Various	0.000	1.639	Jan 2020	-		-		-		-	-	-	-
MGUE Inc 1 A&AS	Various	Various : Various	54.014	3.469	Dec 2019	-		-		-		-	-	-	-
MGUE Inc 2 A&AS	Various	Various : Various	8.850	2.332	Jan 2020	-		-		-		-	-	-	-
MGUE Inc 1 and Inc 2 Other Support	Various	Various : Various	2.131	0.300	Oct 2019	-		-		-		-	-	-	-
<b>Subtotal</b>			122.497	14.475		-		-		-		-	-	-	N/A

	<b>Prior Years</b>	<b>FY 2020</b>	<b>FY 2021</b>	<b>FY 2022 Base</b>	<b>FY 2022 OCO</b>	<b>FY 2022 Total</b>	<b>Cost To Complete</b>	<b>Total Cost</b>	<b>Target Value of Contract</b>
<b>Project Cost Totals</b>	1,292.024	308.215	0.000	-	-	-	-	-	N/A

**Remarks**

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<b>Exhibit R-4, RDT&amp;E Schedule Profile:</b> PB 2022 Air Force		<b>Date:</b> May 2021
<b>Appropriation/Budget Activity</b> 3600 / 4	<b>R-1 Program Element (Number/Name)</b> PE 1203164F / NAVSTAR Global Positioning System (User Equipment) (SPACE)	<b>Project (Number/Name)</b> 643833 / MILITARY GLOBAL POSITIONING SYSTEM USER EQUIP

FY 2020				FY 2021				FY 2022				FY 2023				FY 2024				FY 2025				FY 2026			
1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4

<b>MGUE Increment 1</b>	
MGUE Inc 1 Developmental Test*	
<b>MGUE Increment 2</b>	
MGUE Inc 2 Next-Gen ASIC Studies up to PDR	
MGUE Inc 2 Handheld Risk Reduction Activities/Prototypes	

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<b>Exhibit R-4A, RDT&amp;E Schedule Details:</b> PB 2022 Air Force		<b>Date:</b> May 2021
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Schedule Details

Events by Sub Project	Start		End	
	Quarter	Year	Quarter	Year
<b>MGUE Increment 1</b>				
MGUE Inc 1 Developmental Test*	1	2020	4	2020
<b>MGUE Increment 2</b>				
MGUE Inc 2 Next-Gen ASIC Studies up to PDR	1	2020	4	2020
MGUE Inc 2 Handheld Risk Reduction Activities/Prototypes	1	2020	4	2020

**Note**

All 5 form factors will go through some form of Developmental Test. Per the MGUE Inc 1 Acq Strategy however, only the first card of each variant (GB-GRAM-M/GRAM-S/M) will go through formal Operational Test. OT could/would complete on the "first card" while other form factors continue to go through DT.