Exhibit R-2, RDT&E Budget Item Justification: PB 2025 Air Force	Date: March 2024
Appropriation/Budget Activity 3600: *Research, Development, Test & Evaluation, Air Force* / BA 5: *System Development & Demonstration (SDD)*	**R-1 Program Element (Number/Name)** PE 0604201F / *PNT Resiliency, Mods, and Improvements*

COST ($ in Millions)	Prior Years	FY 2023	FY 2024	FY 2025 Base	FY 2025 OCO	FY 2025 Total	FY 2026	FY 2027	FY 2028	FY 2029	Cost To Complete	Total Cost
Total Program Element	-	170.057	163.156	217.662	0.000	217.662	126.611	85.681	88.783	90.536	0.000	942.486
651030: *GPS Receiver Development*	-	170.057	163.156	217.662	0.000	217.662	126.611	85.681	88.783	90.536	0.000	942.486
Quantity of RDT&E Articles	-	-	-	-	-	-	-	-	-	-		

A. Mission Description and Budget Item Justification

Positioning, Navigation, and Timing (PNT) solutions are critical to offensive and defense operations, enabling delivery of precision fires, safe aerial navigation, and time coordination across multiple platforms and subsystems. PNT must be maintained in the face of emerging and continuously evolving adversarial electronic and cyber threats, requiring increased system resiliency and rapid adaptability. Evolving threats will drive upgrades such as Global Positioning System (GPS) receiver modernization, development of standard navigational system formats/interfaces, increased use of open system architecture design principles, incorporation of alternative navigation sources into navigational solutions, advanced anti-jam antennas, antenna electronics, radio frequency monitoring/locating/reporting capabilities, and precision clock improvements to maintain current and future force capabilities.

Project 651030 includes Embedded GPS/Inertial Navigation System (INS) Modernized (EGI-M), Miniaturized Airborne GPS Receiver 2000 Modernization (MAGR-2K-M), Resilient GPS (R-EGI) development, Software Defined User Equipment (SDUE), anti-jam antenna/antenna electronics development, situational awareness devices, and other advanced/non-GPS PNT solutions. Activities also include, but are not limited to, current program planning, rapid prototyping/advanced technology and concept development, execution, and future program planning and support to other GPS enabled systems as required, covered within Budget Activities 6.3, 6.4, and 6.5. The PNT Resiliency, Mods, and Improvements (RMI) effort provides rapidly re-programmable application space for Alternate Satellite Navigation Systems User Equipment (UE), enabling agile and resilient response to GPS threat environments. Funds may be used to address emerging and short-notice Diminishing Manufacturing and Material Shortage (DMSMS) issues.

This program element may include necessary civilian pay expenses required to manage, execute, and deliver weapon system capability. The use of such program's funds would be in addition to the civilian pay expenses budgeted in program element 0605827F, 0605828F, 0605829F, 0605831F, 0605832F, 0605833F, 0605898F, 0606398F. In FY2023 2.747M was expended for civilian pay expenses in this program element, and in FY2024 9.500M is forecasted for civilian pay expenses in this program element.

The total cost of the R-EGI Middle Tier of Acquisition effort is 249.570M, including RDT&E and procurement of prototype units. The R-EGI program is fully funded across the Future Years Defense Program.

This requirement supports performance of a full financial audit as required by title 10 U.S.C. Chapter 9A, Sec 240-D.

Exhibit R-2, RDT&E Budget Item Justification: PB 2025 Air Force	Date: March 2024
Appropriation/Budget Activity 3600: *Research, Development, Test & Evaluation, Air Force* / BA 5: *System Development & Demonstration (SDD)*	**R-1 Program Element (Number/Name)** PE 0604201F / *PNT Resiliency, Mods, and Improvements*

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 2023	FY 2024	FY 2025 Base	FY 2025 OCO	FY 2025 Total
Previous President's Budget	176.335	163.156	217.277	0.000	217.277
Current President's Budget	170.057	163.156	217.662	0.000	217.662
Total Adjustments	-6.278	0.000	0.385	0.000	0.385
• 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	-6.278	0.000			
• Other Adjustments	0.000	0.000	0.385	0.000	0.385

Change Summary Explanation

FY23 reduced -$6.278M for Small Business Innovative Research (SBIR)

C. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025
Title: Embedded GPS/INS - Modernized (EGI-M)	59.324	17.947	17.100
Description: EGI-M is a combined INS/GPS aircraft position, navigation, and timing system. The program upgrades the legacy EGI design to enhance resiliency against existing and emerging adversarial navigational warfare threats. Design features, such as interface standardization and software modularity to incorporate alternative navigation and timing sources, aim to reduce DoD cost and timelines to respond to newly identified threats and enhance current force capabilities. EGI-M incorporates M-Code and Automatic Dependent Surveillance-Broadcast (ADS-B) Out compliance capability into EGI receivers while addressing parts obsolescence, reducing configuration count from 260+ to a desired end-state of 16, and decreasing production and sustainment costs. EGI-M has two prime contractors: Northrop Grumman and Honeywell. Both contractors required re-baselining given delays to Military Global Positioning Equipment (MGUE). Northrop Grumman has completed re-baselining and is executing accordingly while Honeywell has not. ***FY 2024 Plans:***			

Exhibit R-2, RDT&E Budget Item Justification: PB 2025 Air Force	Date: March 2024
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C. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025
Continue development and testing of Engineering Development Models (EDMs). Contractors will also begin building Production Representative Units (PRUs) for delivery to lead aircraft platforms in support of aircraft operational test. ***FY 2025 Plans:*** Complete delivery of EDMs, begin delivery of PRUs. Finalize hardware verification testing as software integration and validation analysis continues. ***FY 2024 to FY 2025 Increase/Decrease Statement:*** Funding decreased due to planned completion of EDM development; program re-baselined in FY23 due to technical complexities			
Title: Miniaturized Airborne GPS Receiver 2000 - Modernization (MAGR-2K-M) ***Description:*** MAGR-2K-M is an aircraft GPS receiver. The program increases MAGR-2K-Legacy resiliency against existing and emerging adversarial navigational warfare threats while reducing cost and timelines to incorporate future capabilities in response to newly identified threats. MAGR-2K-M incorporates M-Code capability into MAGR-2K-Legacy receivers while addressing parts obsolescence and providing a pathway to ADS-B Out implementation. The receiver performs appropriate trade studies and incorporates additional resiliency features, such as alternate navigation inputs. ***FY 2024 Plans:*** Continue testing and problem resolution of any issues that may arise from Lead Platform and box level qualification testing such as performance, cyber, and military standard order and development test. Prepare artifacts to acquire Program Executive Office (PEO) certification (Milestone C), which enables platforms to procure MAGR 2K-M units for fielding. Anomalies found in the Global Reference Atmospheric Model (GRAM) Software Version 6.3.1 during Ground Testing, final report expected March 2024, could result in GRAM Software rework, leading to schedule slips and increased funding required for integration of the new SW into the MAGR-2K-M box. ***FY 2025 Plans:*** Continue to prepare for Program Executive Office (PEO) certification (Milestone C), which enables platforms to procure MAGR 2K-M units for fielding. ***FY 2024 to FY 2025 Increase/Decrease Statement:*** Funding decreased due to planned baseline development effort completion. If GRAM Software rework is required, FY2024 to FY2025 funding requirement will increase to integrate new software into the MAGR-2K-M box.	15.500	7.000	5.000
Title: PNT Resiliency, Mods, and Improvements (RMI) ***Description:*** Conduct studies and analysis of PNT systems and requirements, develop and evaluate alternative courses of action, identify, plan and conduct PNT technology transition projects, conduct prototype and acquisition program planning, and provide recommended solutions to DoD and Air Force decision makers relative to navigation warfare threat evolution and technology	2.000	2.000	2.000

C. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025
emergence. This includes work for more flexible Secure Software Defined Receiver User Equipment to include, but not limited to, developing an associated antenna electronics capability to capture other than GPS signals like Multi-Global Navigation Satellite Systems to include Navigation Technology Satellite-III and other commercial solutions. ***FY 2024 Plans:*** Continue conducting studies and analysis of PNT systems and requirements. Supports risk reduction efforts to transition Alternative PNT (Alt-PNT) technologies into DoD PNT systems. Accommodates evaluation of existing systems. Development and documentation of external and internal interface design requirements. ***FY 2025 Plans:*** Studies and advanced analysis of PNT systems and requirements will move toward completion. Testing will support efforts to minimize level of risk as transition continues toward Alt-PNT technologies into DoD PNT systems. Team will develop and document internal interface design requirements, accommodating evaluation of existing systems. ***FY 2024 to FY 2025 Increase/Decrease Statement:*** N/A			
Title: Resilient EGI (R-EGI) ***Description:*** Establishes a Government Reference Architecture (GRA) embodying modular open systems architecture (MOSA), enabling and accelerating the transition and operational insertion of future resilient PNT DoD capabilities. R-EGI delivers improved PNT resiliency through the rapid design, development, test, and transition of science and technology efforts to operational PNT systems. R-EGI enables the design and development of various aircraft PNT Line Replaceable Units (LRUs) that are rapidly upgradeable to counter evolving adversarial threats; the program demonstrates the GRA through prototyping of an open R-EGI LRU. The program matures, prototypes, and tests PNT technologies/systems and enables transition paths to flow new technologies into the R-EGI LRU and iterate as required to support the warfighter. ***FY 2024 Plans:*** Complete deliveries of the Production Representative Prototypes (PRP), Test Readiness Review, Cyber Testing, Developmental Testing, and PRP integration into lead platform. The FY24 milestones and efforts will serve as verification of the R-EGI LRU in preparation of Qualification Testing on Lead Platform test assets, which is planned to finalize in FY25. Development and integration of R-EGI into Medium Form Factor engineering design to include the development of a Government Owned Level 3 Technical Data Package (TDP) and delivery of R-EGI Medium Form Factor PRPs to the Government and the aircraft prime vendor for testing and integration. ***FY 2025 Plans:***	50.511	84.209	117.562

Exhibit R-2, RDT&E Budget Item Justification: PB 2025 Air Force	Date: March 2024
Appropriation/Budget Activity 3600: *Research, Development, Test & Evaluation, Air Force* / BA 5: *System Development & Demonstration (SDD)*	**R-1 Program Element (Number/Name)** PE 0604201F / *PNT Resiliency, Mods, and Improvements*

C. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025
Complete Technical Readiness Review (TRR) and Level 3 Technical Data Package (TDP) in preparation for delivery of Production Representative Prototypes (PRP) and integration and test activities on lead platforms. The FY25 milestones and efforts will serve as verification of the R-EGI LRU to prepare for qualification test and integration activities. ***FY 2024 to FY 2025 Increase/Decrease Statement:*** Funding increased due to development work and final design projects in preparation for aircraft integration test events.			
Title: Positioning Navigation Timing Software Defined User Equipment (PNT SDUE) ***Description:*** PNT SDUE will develop a Satellite Navigation (SATNAV) Software Defined Receiver (SSDR) hosted on a Commercial Off-the-Shelf (COTS) Field Programmable Gate Array (FPGA) delivering an M-Code receiver with agile reprogramming capability to provide robust, resilient PNT against navigational warfare (NAVWAR) and cyber threats utilizing a government owned technical baseline. The program will also develop Software Defined Antenna Electronics (SDAE) utilizing COTS FPGA equipment to support the ingest of new satellite signals/capabilities, signal processing, and the incorporation of a Global Navigation Satellite System (GNSS) capability in a software reprogrammable environment. The GNSS receiver and antenna electronics will interface directly with R-EGI via modular open standard architecture. This program will transition and field advanced User Equipment capabilities from the Navigation Technology Satellite (NTS)-3 Air Force Vanguard effort. ***FY 2024 Plans:*** Hold the Initial Design Review (IDR) and validate Design Agent initial direction. Begin preparation for the Detailed Design Review (DDR) 18-months after contract award (mid FY2025) using requisite design products. DDR will review all developed Digital Engineering (DE) artifacts and have the ability to meet system size, weight, and power (SWaP) requirements based on DE modeling, system architecture documentation (focused on an open system approach with government owned baseline), and initial design specifications. PNT SDUE will also initiate multiple pre-planned product improvements to expand the future program capability set from initial capability to a more robust one to better meet future Operational Mission needs. ***FY 2025 Plans:*** Preliminary Design Review (PDR) will support closing out on-going efforts and entering a Milestone-B decision point. Focus of this year will be the completion of the antenna electronics for meeting emergent needs and expediting production. ***FY 2024 to FY 2025 Increase/Decrease Statement:*** Funding increased due to ramp up of PNT SDUE developmental efforts.	42.722	52.000	76.000
Accomplishments/Planned Programs Subtotals	170.057	163.156	217.662

D. Other Program Funding Summary ($ in Millions)

N/A

Exhibit R-2, RDT&E Budget Item Justification: PB 2025 Air Force	Date: March 2024
Appropriation/Budget Activity 3600: *Research, Development, Test & Evaluation, Air Force* / BA 5: *System Development & Demonstration (SDD)*	**R-1 Program Element (Number/Name)** PE 0604201F / *PNT Resiliency, Mods, and Improvements*

D. Other Program Funding Summary ($ in Millions)

Remarks

Navigation, Timing, Satellite 3 (NTS-3) Software Defined User Equipment (SDUE)/Soteria has been renamed to Positioning Navigation Timing Software Defined User Equipment (PNT SDUE) beginning FY23 per signed Acquisition Decision Memorandum.

E. Acquisition Strategy

Modify and modernize existing legacy PNT systems to incorporate major enhancements such as Global Positioning System (GPS) M-Code, ADS-B Out, and alternative PNT solutions to GPS while reducing lifecycle costs through common sustainment practices and economies of scale. Design, development, and testing efforts, to include the development of government owned reference architectures for rapid capability insertion, share a common PE to allow flexibility in funding and planning. Integration and operational testing of completed PNT solutions are accomplished by individual platforms and weapons systems. This approach uses cost plus fixed fee (CPFF) contract types based on acquisition phase and risk with a mix between competition and sole-source strategies. Modifications to legacy receivers are acquired via Engineering Change Proposals (ECP)/Task Orders on existing contracts. Other Transaction Authorities (OTA) and industry consortiums are used to support prototyping and open standards development for new PNT solutions.

Exhibit R-3, RDT&E Project Cost Analysis: PB 2025 Air Force		Date: March 2024
Appropriation/Budget Activity 3600 / 5	**R-1 Program Element (Number/Name)** PE 0604201F / *PNT Resiliency, Mods, and Improvements*	**Project (Number/Name)** 651030 / *GPS Receiver Development*

Product Development ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2023 Cost	FY 2023 Award Date	FY 2024 Cost	FY 2024 Award Date	FY 2025 Base Cost	FY 2025 Base Award Date	FY 2025 OCO Cost	FY 2025 OCO Award Date	FY 2025 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
EGI-M #1 EMD	C/CPFF	Honeywell : Clearwater, FL	-	18.938	Nov 2022	3.390	Nov 2023	5.055	Oct 2024	-		5.055	Continuing	Continuing	-
EGI-M #2 EMD	SS/CPFF	Northrop Grumman : Woodland Hills, CA	-	32.719	Nov 2022	4.898	Nov 2023	6.535	Oct 2024	-		6.535	Continuing	Continuing	-
MAGR-2K-M	SS/CPFF	Raytheon : El Segundo, CA	-	12.600	Oct 2022	7.000	Dec 2023	5.000	Oct 2024	-		5.000	Continuing	Continuing	-
PNT RMI	SS/CPFF	Collins Aerospace : Des Moines, IA	-	4.800	Mar 2023	2.000	Mar 2024	2.000	Mar 2025	-		2.000	Continuing	Continuing	-
R-EGI	C/CPFF	IS4S : Huntsville, AL	-	3.750	Jan 2023	-		-		-		-	Continuing	Continuing	-
R-EGI Modernization & Additional Platforms	C/CPFF	TBD : TBD	-	37.900	Mar 2023	70.997	Mar 2024	108.732	Jan 2025	-		108.732	Continuing	Continuing	-
PNT SDUE	TBD	Not specified. : TBD	-	29.612	May 2023	50.000	Mar 2024	49.293	Jan 2025	-		49.293	Continuing	Continuing	-
		Subtotal	-	140.319		138.285		176.615		-		176.615	Continuing	Continuing	N/A

Support ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2023 Cost	FY 2023 Award Date	FY 2024 Cost	FY 2024 Award Date	FY 2025 Base Cost	FY 2025 Base Award Date	FY 2025 OCO Cost	FY 2025 OCO Award Date	FY 2025 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
EGI-M FFRDC	Various	MITRE Corp. : Bedford, MA	-	0.263	Nov 2022	0.263	Dec 2023	0.100	Feb 2025	-		0.100	Continuing	Continuing	-
R-EGI FFRDC	Various	MITRE Corp. : Bedford, MA	-	1.261	Nov 2022	4.000	Dec 2023	4.000	Feb 2025	-		4.000	Continuing	Continuing	-
PNT SDUE FFRDC	Various	MITRE Corp : Bedford, MA	-	6.150	May 2023	2.000	Dec 2023	7.524	Feb 2025	-		7.524	Continuing	Continuing	-
DCA Civ Pay	Allot	Allotment : Wright Patterson AFB, OH	-	2.747	Jan 2023	9.500	Jan 2024	9.870	Oct 2024	-		9.870	Continuing	Continuing	-
		Subtotal	-	10.421		15.763		21.494		-		21.494	Continuing	Continuing	N/A

Exhibit R-3, RDT&E Project Cost Analysis: PB 2025 Air Force		Date: March 2024
Appropriation/Budget Activity 3600 / 5	**R-1 Program Element (Number/Name)** PE 0604201F / *PNT Resiliency, Mods, and Improvements*	**Project (Number/Name)** 651030 / *GPS Receiver Development*

Test and Evaluation ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2023 Cost	FY 2023 Award Date	FY 2024 Cost	FY 2024 Award Date	FY 2025 Base Cost	FY 2025 Base Award Date	FY 2025 OCO Cost	FY 2025 OCO Award Date	FY 2025 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
EGI-M	PO	Various : TBD	-	0.500	Nov 2022	0.300	Nov 2023	1.500	Feb 2025	-		1.500	Continuing	Continuing	-
MAGR-2K-M	PO	Various : TBD	-	0.900	Jun 2023	-		-		-		-	Continuing	Continuing	-
R-EGI	PO	Various : TBD	-	1.000	Dec 2022	0.750	Dec 2023	-		-		-	Continuing	Continuing	-
R-EGI Modernization & Additional Platforms	Various	Various : TBD	-	1.000	Mar 2023	-		1.050	Dec 2024	-		1.050	Continuing	Continuing	-
PNT SDUE	Various	Various : TBD	-	-		-		8.649	Mar 2025	-		8.649	Continuing	Continuing	-
		Subtotal	-	3.400		1.050		11.199		-		11.199	Continuing	Continuing	N/A

Management Services ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2023 Cost	FY 2023 Award Date	FY 2024 Cost	FY 2024 Award Date	FY 2025 Base Cost	FY 2025 Base Award Date	FY 2025 OCO Cost	FY 2025 OCO Award Date	FY 2025 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Strategic Planning/PMA	C/Various	SERCO : Robins AFB, GA	-	15.917	Oct 2022	8.058	Oct 2023	8.354	Mar 2025	-		8.354	Continuing	Continuing	-
		Subtotal	-	15.917		8.058		8.354		-		8.354	Continuing	Continuing	N/A

	Prior Years	FY 2023		FY 2024		FY 2025 Base		FY 2025 OCO		FY 2025 Total	Cost To Complete	Total Cost	Target Value of Contract
Project Cost Totals	-	170.057		163.156		217.662		-		217.662	Continuing	Continuing	N/A

Remarks

EGI-M funding for EMD #1 and EMD #2 decreased significantly from FY 23 to FY 24 due to expected EMD completion/Engineering Development Model (EDM) delivery in 2nd Quarter (#2) and 3rd Quarter (#1) FY 24. Follow-on efforts will be accomplished on the production & sustainment IDIQ contract.

R-EGI Modernization & Additional Platforms increase is due to the approval of development of additional R-EGI Form Factor 3.

Exhibit R-4, RDT&E Schedule Profile: PB 2025 Air Force		Date: March 2024
Appropriation/Budget Activity 3600 / 5	**R-1 Program Element (Number/Name)** PE 0604201F / *PNT Resiliency, Mods, and Improvements*	**Project (Number/Name)** 651030 / *GPS Receiver Development*

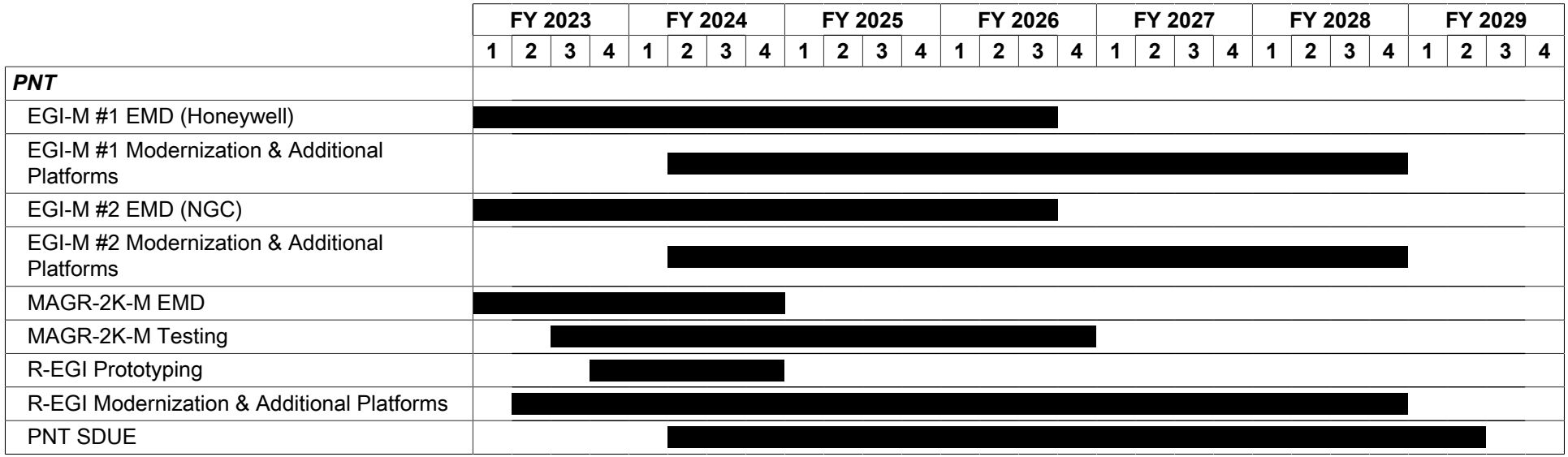

Exhibit R-4A, RDT&E Schedule Details: PB 2025 Air Force		Date: March 2024
Appropriation/Budget Activity 3600 / 5	**R-1 Program Element (Number/Name)** PE 0604201F / *PNT Resiliency, Mods, and Improvements*	**Project (Number/Name)** 651030 / *GPS Receiver Development*

Schedule Details

	Start		End	
Events by Sub Project	**Quarter**	**Year**	**Quarter**	**Year**
PNT				
EGI-M #1 EMD (Honeywell)	1	2023	3	2026
EGI-M #1 Modernization & Additional Platforms	2	2024	4	2028
EGI-M #2 EMD (NGC)	1	2023	3	2026
EGI-M #2 Modernization & Additional Platforms	2	2024	4	2028
MAGR-2K-M EMD	1	2023	4	2024
MAGR-2K-M Testing	3	2023	4	2026
R-EGI Prototyping	4	2023	4	2024
R-EGI Modernization & Additional Platforms	2	2023	4	2028
PNT SDUE	2	2024	2	2029

Note

Position Navigation and Timing (PNT) schedules updated to reflect current developmental timelines and reflect development for additional aircraft which will be utilizing modernized PNT receiver technology.