Exhibit R-2, RDT&E Budget Item Justification: PB 2022 Office of the Secretary Of Defense											Date: May 2021	
Appropriation/Budget Activity 0400: *Research, Development, Test & Evaluation, Defense-Wide* / BA 4: *Advanced Component Development & Prototypes (ACD&P)*					R-1 Program Element (Number/Name) PE 0604294D8Z / *Trusted and Assured Microelectronics*							
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	664.837	534.340	503.750	509.195	-	509.195	-	-	-	-	-	-
291: *Joint Federated Assurance Center*	12.000	5.887	0.000	0.000	-	0.000	-	-	-	-	-	-
645: *Verification & Validation (V&V) Capabilities and Standards for Trust*	188.836	39.117	0.000	0.000	-	0.000	-	-	-	-	-	-
646: *New Trust Approach Development*	40.023	38.247	0.000	0.000	-	0.000	-	-	-	-	-	-
647: *Microelectronics Innovation for National Security and Economic Competitiveness (MINSEC) Innovation and Development*	423.978	451.089	0.000	0.000	-	0.000	-	-	-	-	-	-
907: *Access to State-of-the-Art (SOTA) Microelectronics - Development*	0.000	0.000	281.594	297.195	-	297.195	-	-	-	-	-	-
908: *Access to Advanced Packaging and Testing - Development*	0.000	0.000	81.438	112.600	-	112.600	-	-	-	-	-	-
911: *Address DoD Unique Needs - Radiation Hardening and non-CMOS*	0.000	0.000	50.500	82.700	-	82.700	-	-	-	-	-	-
912: *Create a Quantifiably Assured-Microelectronics Pipeline*	0.000	0.000	90.218	16.700	-	16.700	-	-	-	-	-	-

Note

In FY 2021 Program Element (PE) funding for Project 291 – “Joint Federated Assurance Center”, Project 645 – “Verification and Validation Capabilities and Standards for Trust”, Project 646 – “New Trust Approach Development”, and Project 647 -“Microelectronics Innovation for National Security and Economic Competitiveness (MINSEC)” were realigned under four new project codes to correctly align PE funding in support of the Quantifiable Assurance method and reflective of current priorities. The new project codes are: (1) P907 Access to State-of-the-Art (SOTA) Microelectronics - Development; (2) P908 Access to Advanced Packaging and Testing -

Exhibit R-2, RDT&E Budget Item Justification: PB 2022 Office of the Secretary Of Defense	Date: May 2021
Appropriation/Budget Activity 0400: *Research, Development, Test & Evaluation, Defense-Wide I* BA 4: *Advanced Component Development & Prototypes (ACD&P)*	**R-1 Program Element (Number/Name)** PE 0604294D8Z *I Trusted and Assured Microelectronics*

Development; (3) P911 Address DoD Unique Needs Especially Radiation Hardening - Development; and (4) P912 Create a Resilient and Robust Microelectronics Pipeline - Development.

Project codes P291, P645, P646, and P647 were realigned in FY 2021 to the four new project codes to refocus the PE and provide traceability to the current enhancement priorities of SOTA access, heterogeneous packaging, quantifiable assurance, DoD unique needs, and enhanced U.S. microelectronics dominance.

A. Mission Description and Budget Item Justification

This Program Element (PE) supports microelectronics modernization activities that enable defense systems to keep pace with commercial microelectronics technological advances, reduce reliance on obsolete microelectronics, and mitigate the Department's reliance on sole source foundries for assured state-of-the-art (SOTA) microelectronics. It addresses the challenges of 1) having enduring access to a multiplicity of modern manufacturing processes that require commercial volumes to maintain long term viability and 2) protecting the intellectual property (IP) of the microelectronic parts that are manufactured.

This PE supports the 2018 National Defense Strategy's (NDS) line of effort to build a more lethal force through modernization of key capabilities, the NDS defense objective of establishing an unmatched twenty-first century National Security Innovation Base that effectively supports Department operations and sustains security and solvency, and the NDS strategic approach of reforming the Department's business practices by simultaneously increasing performance and affordability while still minimizing risk.

This PE supports the OUSD(R&E) Microelectronics Modernization Roadmap. The primary areas of focus of this roadmap include the following: access to state-of-the-art microelectronics technology, access to advanced packaging and test; access to the best commercial design technology; quantifiable assurance and secure design; foundry access; policies, standards, and Joint Federated Assurance Center (JFAC) governing body; access to radiation hardened microelectronics; access to non-complementary metal oxide semiconductor (CMOS) state-of-the-art (SOTA) microelectronics; education and workforce development; and supply chain awareness and security.

Recognizing that an assured supply of microelectronics is a U.S. Government (USG)-wide concern, this activity will interface with interagency partners to take into account interagency requirements, opportunities for collaboration, and strategic decisions that can be made to limit the overall cost of these requirements to the USG.

This activity is being led by the Under Secretary of Defense for Research and Engineering.

Exhibit R-2, RDT&E Budget Item Justification: PB 2022 Office of the Secretary Of Defense	Date: May 2021
Appropriation/Budget Activity 0400: *Research, Development, Test & Evaluation, Defense-Wide* / BA 4: *Advanced Component Development & Prototypes (ACD&P)*	**R-1 Program Element (Number/Name)** PE 0604294D8Z / *Trusted and Assured Microelectronics*

B. Program Change Summary ($ in Millions)	FY 2020	FY 2021	FY 2022 Base	FY 2022 OCO	FY 2022 Total
Previous President's Budget	547.421	489.076	519.140	-	519.140
Current President's Budget	534.340	503.750	509.195	-	509.195
Total Adjustments	-13.081	14.674	-9.945	-	-9.945
• Congressional General Reductions	-	-0.326			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	-	15.000			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-	-			
• SBIR/STTR Transfer	-12.987	-			
• Program Adjustment	-	-	-9.945	-	-9.945
• Cancelled Account Reduction	-0.094	-	-	-	-

Congressional Add Details ($ in Millions, and Includes General Reductions)	FY 2020	FY 2021
Project: 645: *Verification & Validation (V&V) Capabilities and Standards for Trust*		
Congressional Add: *Supply Chain Risk Management*	5.000	-
Congressional Add Subtotals for Project: 645	5.000	-
Project: 912: *Create a Quantifiably Assured-Microelectronics Pipeline*		
Congressional Add: *Trusted Artificial Intelligence*	-	5.000
Congressional Add Subtotals for Project: 912	-	5.000
Congressional Add Totals for all Projects	5.000	5.000

Change Summary Explanation

In FY 2021 Program Element (PE) funding for Project 645 – "Verification and Validation Capabilities and Standards for Trust", Project 646 – "New Trust Approach Development", and Project 647 -"Microelectronics Innovation for National Security and Economic Competitiveness (MINSEC)" were realigned under four new project codes to correctly align PE funding in support of the Quantifiable Assurance method and reflective of current priorities. The new project codes are: (1) P907 Access to State-of-the-Art (SOTA) Microelectronics - Development; (2) P908 Access to Advanced Packaging and Testing - Development; (3) P911 Address DoD Unique Needs Especially Radiation Hardening - Development; and (4) P912 Create a Resilient and Robust Microelectronics Pipeline - Development.

Project codes P645, P646, and P647 are being realigned in FY 2021 to the four new project codes to refocus the PE and provide traceability to the current enhancement priorities of SOTA access, heterogeneous packaging, quantifiable assurance, DoD unique needs, and enhanced U.S. microelectronics dominance.

Exhibit R-2A, RDT&E Project Justification: PB 2022 Office of the Secretary Of Defense			Date: May 2021
Appropriation/Budget Activity 0400 / 4	R-1 Program Element (Number/Name) PE 0604294D8Z / *Trusted and Assured Microelectronics*	Project (Number/Name) 291 / *Joint Federated Assurance Center*	

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
291: *Joint Federated Assurance Center*	12.000	5.887	0.000	0.000	-	0.000	-	-	-	-	-	-
Quantity of RDT&E Articles	-	-	-	-	-	-	-	-	-	-		

Note

In FY 2021 Program Element (PE) funding for Project 291 – “Joint Federated Assurance Center”, was realigned under new project code, P907 - "Access to State-of-the-Art (SOTA) Microelectronics - Development", to correctly align PE funding in support of a zero-trust philosophy and reflective of current priorities.

A. Mission Description and Budget Item Justification

This project funds the operation software and hardware assurance(SwA and HwA) support to DoD programs and organizations of the Joint Federated Assurance Center (JFAC), established in National Defense Authorization Act (NDAA) Sec 937, to increase DoD’s SwA and HwA by providing engineering tools, technical services, best-practices, innovative technologies and other assistance to programs to detect, assess, prioritize, and mitigate vulnerabilities from malicious software and hardware attacks and assurance against supply chain exploitation vulnerabilities. The JFAC will provide capabilities for programs to keep assessment findings throughout the life cycle of their systems for data mining (e.g., documentation on rationale for previous mitigation decisions). The collaboration between the JFAC and program offices will help mitigate existing and emerging critical threats and vulnerabilities in software and hardware available to all DoD programs.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2020	FY 2021	FY 2022
Title: Joint Federated Assurance Center (JFAC) ***Description:*** This project’s activities will enhance the use of software, hardware, and firmware assurance tools, techniques, and procedures directly with programs and organizations, throughout the life cycle. JFAC provides a common forum in DoD for assurance best practices, community dialog on assurance, access to new technology and tools usable by programs throughout their life cycle for maintaining quantifiable assurance data.	5.887	-	-
Accomplishments/Planned Programs Subtotals	5.887	-	-

C. Other Program Funding Summary ($ in Millions)

Line Item	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
• O&M (CIVPAY): *0303140D8Z*	1.113	-	-	-	-	-	-	-	-	-	-

Remarks

D. Acquisition Strategy

N/A

Exhibit R-3, RDT&E Project Cost Analysis: PB 2022 Office of the Secretary Of Defense			Date: May 2021
Appropriation/Budget Activity 0400 / 4	R-1 Program Element (Number/Name) PE 0604294D8Z / *Trusted and Assured Microelectronics*	Project (Number/Name) 291 / *Joint Federated Assurance Center*	

Product Development ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2020 Cost	FY 2020 Award Date	FY 2021 Cost	FY 2021 Award Date	FY 2022 Base Cost	FY 2022 Base Award Date	FY 2022 OCO Cost	FY 2022 OCO Award Date	FY 2022 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Joint Federated Assurance Center	MIPR	Army, Navy, Air Force : Various	12.000	5.887	Jan 2020	-		-		-		-	Continuing	Continuing	2.000
		Subtotal	12.000	5.887		-		-		-		-	Continuing	Continuing	N/A

	Prior Years	FY 2020		FY 2021		FY 2022 Base		FY 2022 OCO		FY 2022 Total	Cost To Complete	Total Cost	Target Value of Contract
Project Cost Totals	12.000	5.887		0.000		-		-		-	Continuing	Continuing	N/A

Remarks

Exhibit R-4, RDT&E Schedule Profile: PB 2022 Office of the Secretary Of Defense		Date: May 2021
Appropriation/Budget Activity 0400 / 4	**R-1 Program Element (Number/Name)** PE 0604294D8Z / *Trusted and Assured Microelectronics*	**Project (Number/Name)** 291 / *Joint Federated Assurance Center*

	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
Joint Federated Assurance Center																												
Mature JFAC tools, technology and talent capabilities and capacity	[redacted]																											
Maintain infrastructure services and staff	[redacted]																											
Incorporate science and technology, advanced technology solutions into the JFAC website	[redacted]																											
Develop best practices, and relationships with industry	[redacted]																											

Exhibit R-4A, RDT&E Schedule Details: PB 2022 Office of the Secretary Of Defense		Date: May 2021
Appropriation/Budget Activity 0400 / 4	**R-1 Program Element (Number/Name)** PE 0604294D8Z / *Trusted and Assured Microelectronics*	**Project (Number/Name)** 291 / *Joint Federated Assurance Center*

Schedule Details

	Start		End	
Events by Sub Project	**Quarter**	**Year**	**Quarter**	**Year**
Joint Federated Assurance Center				
Mature JFAC tools, technology and talent capabilities and capacity	2	2020	4	2021
Maintain infrastructure services and staff	2	2020	3	2021
Incorporate science and technology, advanced technology solutions into the JFAC website	2	2020	3	2021
Develop best practices, and relationships with industry	2	2020	3	2021

Exhibit R-2A, RDT&E Project Justification: PB 2022 Office of the Secretary Of Defense											Date: May 2021	
Appropriation/Budget Activity 0400 / 4					R-1 Program Element (Number/Name) PE 0604294D8Z / *Trusted and Assured Microelectronics*				Project (Number/Name) 645 / *Verification & Validation (V&V) Capabilities and Standards for Trust*			
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**
645: *Verification & Validation (V&V) Capabilities and Standards for Trust*	188.836	39.117	0.000	0.000	-	0.000	-	-	-	-	-	-
Quantity of RDT&E Articles	-	-	-	-	-	-	-	-	-	-		

Note

In FY 2021, Project Code (Pcode) 645 funds transferred from this Pcode to two new Pcodes for “P907 - Access to SOTA Microelectronics” and “P912 - Create a Resilient and Robust Microelectronics Pipeline” to properly align PE funding in support of the zero-trust philosophy and reflect current priorities. Total funding between the two years will decrease from $44.117 million to $33.686 million with $31.686 million transferring to Access to SOTA and $2.000 million transferring to Create a Resilient and Robust Microelectronics Pipeline.

A. Mission Description and Budget Item Justification

This project improves microelectronics test and verification methodologies in support of quantifying and verifying the trust and assurance of parts and develops standards and practices to foster commercial development of secure, trusted and assured parts. Verification and test technologies are required to provide direct program support for microelectronics assurance verification. Out-year demands will require an increase in capacity, which will take the form of additional personnel and/or equipment to permit scaling of microelectronics assessment capabilities. Challenges have been identified, to include the ability to analyze leading-edge technology nodes (<32 nanometers (nm)), throughput/time required for analysis, ability to analyze third-party intellectual property (IP) contained in microelectronic components, and analysis of non-application specific integrated circuit (ASIC) components that are increasingly being used for agility, e.g., Field-Programmable Gate Arrays (FPGAs). This project addresses these gaps in current technical capabilities as required to meet the realized and projected out-year demand for core Trusted & Assured Microelectronics laboratory services. Three capability areas core to microelectronics analysis and verification will be improved:

- Physical verification, i.e., destructive analysis of integrated circuits and printed circuit boards.
- Functional analysis, i.e., non-destructive screening/verification of select, critical parts.
- Design verification, i.e., verification/assurance of designs, IP, netlists, bitstreams, firmware, etc.

These improvements address two primary attributes: (1) technical capability including laboratory equipment, IP, analysis tools, such as imaging software, and highly skilled tradecraft, and (2) the capacity to perform microelectronics assessments and quantify assurance.

This project develops and matures assurance mitigations, quantitatively evaluates the effectiveness of protections of IP in support of confidentiality and integrity, and develops and validates obfuscation and disaggregation technologies. The project will address physical validation tool and capability development, design software validation tool development, counterfeit detection and imaging techniques, system vulnerability assessments, testbeds, and distributed data source availability to demonstrate and operationalize full lifecycle data driven quantifiable assurance.

Exhibit R-2A, RDT&E Project Justification: PB 2022 Office of the Secretary Of Defense		Date: May 2021
Appropriation/Budget Activity 0400 / 4	**R-1 Program Element (Number/Name)** PE 0604294D8Z / *Trusted and Assured Microelectronics*	**Project (Number/Name)** 645 / *Verification & Validation (V&V) Capabilities and Standards for Trust*

This project also develops standards and practices in support of assured designs, supply chains and formal relationships with industry.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2020	FY 2021	FY 2022
Title: Verification & Validation (V&V) Capabilities and Standards for Trust	34.117	-	-
Description: The JFAC DoD core Trusted and Assured Microelectronics (T&AM) laboratories and industry partners will (1) improve microelectronics test and verification methodologies in support of data driven verification of confidentiality, integrity, and authenticity of parts and (2) develop standards/practices to foster commercial development of quantifiably assured parts.			
Accomplishments/Planned Programs Subtotals	34.117	-	-

	FY 2020	FY 2021
Congressional Add: Supply Chain Risk Management	5.000	-
FY 2020 Accomplishments: • Aligned DoD Instruction 5200.44 (Protection of Mission Critical Functions to Achieve Trusted Systems and Networks (TSN)), and other related policies and guidance, with other USG, e.g., National Institute of Standards and Technology (NIST) 800-161 (Supply Chain Risk Management Practices for Federal Information Systems and Organizations). • Established and conducted pilot activities with programs for supply chain risk assessment on components and boards utilizing advanced analytics and public and private financial data.		
Congressional Adds Subtotals	5.000	-

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

N/A

D. Acquisition Strategy

NA

Exhibit R-3, RDT&E Project Cost Analysis: PB 2022 Office of the Secretary Of Defense			Date: May 2021
Appropriation/Budget Activity 0400 / 4	**R-1 Program Element (Number/Name)** PE 0604294D8Z / *Trusted and Assured Microelectronics*	**Project (Number/Name)** 645 / *Verification & Validation (V&V) Capabilities and Standards for Trust*	

Product Development ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2020 Cost	FY 2020 Award Date	FY 2021 Cost	FY 2021 Award Date	FY 2022 Base Cost	FY 2022 Base Award Date	FY 2022 OCO Cost	FY 2022 OCO Award Date	FY 2022 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
V&V Capabilities and Standards for Trust	MIPR	Various (Air Force, Army, Navy, National Security Agency) : Various	188.836	39.117	Mar 2020	-		-		-		-	Continuing	Continuing	-
		Subtotal	188.836	39.117		-		-		-		-	Continuing	Continuing	N/A

Remarks

N/A

	Prior Years	FY 2020 Cost	FY 2020 Award Date	FY 2021 Cost	FY 2021 Award Date	FY 2022 Base Cost	FY 2022 Base Award Date	FY 2022 OCO Cost	FY 2022 OCO Award Date	FY 2022 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Project Cost Totals	188.836	39.117		0.000		-		-		-	Continuing	Continuing	N/A

Remarks

NA

Exhibit R-4, RDT&E Schedule Profile: PB 2022 Office of the Secretary Of Defense		Date: May 2021
Appropriation/Budget Activity 0400 / 4	**R-1 Program Element (Number/Name)** PE 0604294D8Z / *Trusted and Assured Microelectronics*	**Project (Number/Name)** 645 / *Verification & Validation (V&V) Capabilities and Standards for Trust*

	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
V&V Capabilities and Standards for Trust																												
Joint Federated Assurance Center (JFAC) Hardware Assurance (HwA) Technical Working Group Support	■	■	■	■	■																							
JFAC Capability Enhancement (equipment and intellectual property procurement)	■	■	■	■	■																							
JFAC Subject Matter Expert (SME) Training and Development	■	■	■	■	■																							
JFAC Direct Program Support	■	■	■	■	■																							
Radiation Training in Support of Radiation Hardened by Design and Radiation Hardened by Process Initiatives	■	■	■	■	■																							
Strategic Radiation Hardened Electronics council (SRHEC) Coordination	■	■	■	■	■																							
Strategic Radiation Support of Rapid Fielding Optoelectronic Devices	■	■	■	■	■																							
Microelectronics Assurance and Supply Chain Standards and Best Practices Development	■	■	■	■	■																							
U.S. Government and Industry Engagement for demonstration of data driven quantifiable assurance tools, techniques, and risk based metrics	■	■	■	■	■																							
Microelectronics Assurance and Supply Chain Training for U.S. Government and Industry	■	■	■	■	■																							

Exhibit R-4, RDT&E Schedule Profile: PB 2022 Office of the Secretary Of Defense		Date: May 2021
Appropriation/Budget Activity 0400 / 4	**R-1 Program Element (Number/Name)** PE 0604294D8Z / *Trusted and Assured Microelectronics*	**Project (Number/Name)** 645 / *Verification & Validation (V&V) Capabilities and Standards for Trust*

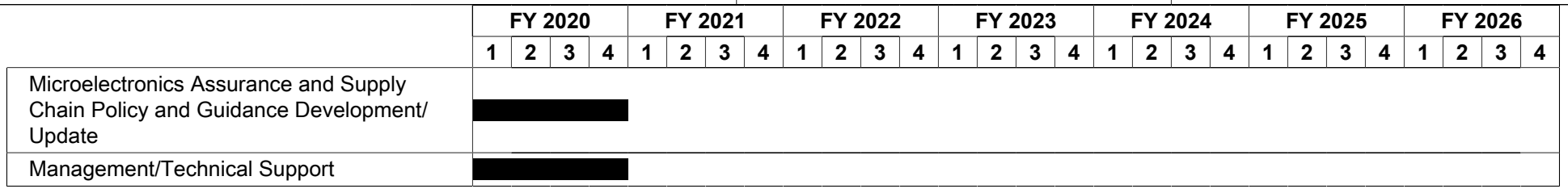

Exhibit R-4A, RDT&E Schedule Details: PB 2022 Office of the Secretary Of Defense		Date: May 2021
Appropriation/Budget Activity 0400 / 4	**R-1 Program Element (Number/Name)** PE 0604294D8Z / *Trusted and Assured Microelectronics*	**Project (Number/Name)** 645 / *Verification & Validation (V&V) Capabilities and Standards for Trust*

Schedule Details

	Start		End	
Events by Sub Project	**Quarter**	**Year**	**Quarter**	**Year**
V&V Capabilities and Standards for Trust				
Joint Federated Assurance Center (JFAC) Hardware Assurance (HwA) Technical Working Group Support	1	2020	4	2020
JFAC Capability Enhancement (equipment and intellectual property procurement)	1	2020	4	2020
JFAC Subject Matter Expert (SME) Training and Development	1	2020	4	2020
JFAC Direct Program Support	1	2020	4	2020
Radiation Training in Support of Radiation Hardened by Design and Radiation Hardened by Process Initiatives	1	2020	4	2020
Strategic Radiation Hardened Electronics council (SRHEC) Coordination	1	2020	4	2020
Strategic Radiation Support of Rapid Fielding Optoelectronic Devices	1	2020	4	2020
Microelectronics Assurance and Supply Chain Standards and Best Practices Development	1	2020	4	2020
U.S. Government and Industry Engagement for demonstration of data driven quantifiable assurance tools, techniques, and risk based metrics	1	2020	4	2020
Microelectronics Assurance and Supply Chain Training for U.S. Government and Industry	1	2020	4	2020
Microelectronics Assurance and Supply Chain Policy and Guidance Development/ Update	1	2020	4	2020
Management/Technical Support	1	2020	4	2020

Exhibit R-2A, RDT&E Project Justification: PB 2022 Office of the Secretary Of Defense											Date: May 2021	
Appropriation/Budget Activity 0400 / 4					R-1 Program Element (Number/Name) PE 0604294D8Z / *Trusted and Assured Microelectronics*				Project (Number/Name) 646 / *New Trust Approach Development*			
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**
646: *New Trust Approach Development*	40.023	38.247	0.000	0.000	-	0.000	-	-	-	-	-	-
Quantity of RDT&E Articles	-	-	-	-	-	-	-	-	-	-		

Note

In FY 2021, Project Code (Pcode) 646 funds transferred from this Pcode to the new Pcodes for "P907 - Access to State-of-the-Art (SOTA) Microelectronics - Development" to properly align funding in support of the zero-trust philosophy and reflect current enhancement priorities. Total funding between the two years will decrease from $38.247 million to $32.870 million with $32.870million transferring to Access to SOTA.

A. Mission Description and Budget Item Justification

This project funds a program of research to develop the next generation, technology data-driven approach to microelectronics assurance, to include state-of-the-art (SOTA) microelectronics, to ensure continued access to SOTA microelectronic technologies while maintaining the required level of assurance in all environments. DoD's ability to access commercial technology for its custom, secure, and assured needs is diminishing as SOTA suppliers become fewer and more focused on serving the global commercial market. DoD's technology needs are broad, and relying on a single source supplier is not feasible. Alternative, advanced manufacturing methods, technologies, and design tools are needed to produce secure and assured SOTA parts from commercial sources and to preserve access to these advanced nodes while protecting DoD and Defense Industrial Base intellectual property (IP) from exploitation. It is also intended to dramatically improve the capabilities of core Trusted & Assured Microelectronics laboratories with regard to verification and validation of SOTA microelectronics assurance.

This program of research will develop, demonstrate, and implement quantitative and innovative design, manufacturing, imaging, tagging, and control and assessment approaches for protecting DoD's microelectronics supply chain and IP, including alternatives for trusted and assured strategic radiation-hardened electronics in advanced technology nodes for next-generation strategic systems, obfuscation and disaggregation technology development, and other assurance mitigations. It will develop, demonstrate, and implement advanced imaging technologies and forensics, Design for Assurance techniques, active hardware assurance controls, electronic component markers, and a data and analysis capability to enable auditing, provenance and traceability, and independent verification and validation of commercial and specialized DoD designs. It will also develop, demonstrate, and implement concepts for the cost-effective production of custom microelectronics in low volumes and protection of sensitive IP from exploitation.

Assurance technologies that can be applied in a broad range of trusted and commercial environments can mitigate the risk associated with sole-source suppliers and increase the Government's ability to leverage commercial capabilities. The suite of developed technologies, e.g., alternative manufacturing methods and design tools, will enable DoD to obfuscate the purpose of sensitive devices, verify their origin and function, and protect sensitive IP from exploitation even while using the global supply chain for most hardware. In cases in which the risk involved precludes that level of commercial collaboration, low-volume manufacturing technologies developed under this project would permit DoD to more cheaply produce low volumes of sensitive microelectronics in secure environments. The project would also support using a repository of vetted third-party IP and electronic data automation (EDA) tools to expedite circuit design and transition promising technologies to use.

Exhibit R-2A, RDT&E Project Justification: PB 2022 Office of the Secretary Of Defense		Date: May 2021
Appropriation/Budget Activity 0400 / 4	**R-1 Program Element (Number/Name)** PE 0604294D8Z / *Trusted and Assured Microelectronics*	**Project (Number/Name)** 646 / *New Trust Approach Development*

This project initially received additional funding in FY 2019 to support Microelectronics Innovation for National Security and Economic Competitiveness (MINSEC) efforts in the following focus areas: capture and secure microelectronics R&D; new microelectronics development; radiation hardening by process (RHBP) and radiation hardening by design (RHBD); and radio frequency (RF) and optoelectronics. In FY 2019, funding for those MINSEC activities was reallocated from projects P-646 to P-647.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2020	FY 2021	FY 2022
Title: New Trust Approach Development	38.247	-	-
Description: This project's activities will mature and evaluate quantifiable assurance technologies and techniques through efforts that may include the conduct of studies and Broad Agency Announcements (BAAs) and other efforts to coordinate research programs across USG R&D organizations, academia, and industry. In addition, the core Trusted & Assured Microelectronics laboratories will initiate the conduct of identified acquisition program pilots and technology development in coordination with research programs across government R&D organizations, academia and industry.			
Accomplishments/Planned Programs Subtotals	38.247	-	-

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

N/A

D. Acquisition Strategy

N/A

Exhibit R-3, RDT&E Project Cost Analysis: PB 2022 Office of the Secretary Of Defense			Date: May 2021
Appropriation/Budget Activity 0400 / 4	R-1 Program Element (Number/Name) PE 0604294D8Z / *Trusted and Assured Microelectronics*	Project (Number/Name) 646 / *New Trust Approach Development*	

Product Development ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2020 Cost	FY 2020 Award Date	FY 2021 Cost	FY 2021 Award Date	FY 2022 Base Cost	FY 2022 Base Award Date	FY 2022 OCO Cost	FY 2022 OCO Award Date	FY 2022 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
New Trust Approach Development	MIPR	Various (Defense Advanced Research Projects Agency, Air Force, Army, Navy, National Security Agency) : Various	40.023	38.247	Mar 2020	-		-		-		-	Continuing	Continuing	-
		Subtotal	40.023	38.247		-		-		-		-	Continuing	Continuing	N/A

	Prior Years	FY 2020		FY 2021		FY 2022 Base		FY 2022 OCO		FY 2022 Total	Cost To Complete	Total Cost	Target Value of Contract
Project Cost Totals	40.023	38.247		0.000		-		-		-	Continuing	Continuing	N/A

Remarks

NA

Exhibit R-4, RDT&E Schedule Profile: PB 2022 Office of the Secretary Of Defense		Date: May 2021
Appropriation/Budget Activity 0400 / 4	**R-1 Program Element (Number/Name)** PE 0604294D8Z / *Trusted and Assured Microelectronics*	**Project (Number/Name)** 646 / *New Trust Approach Development*

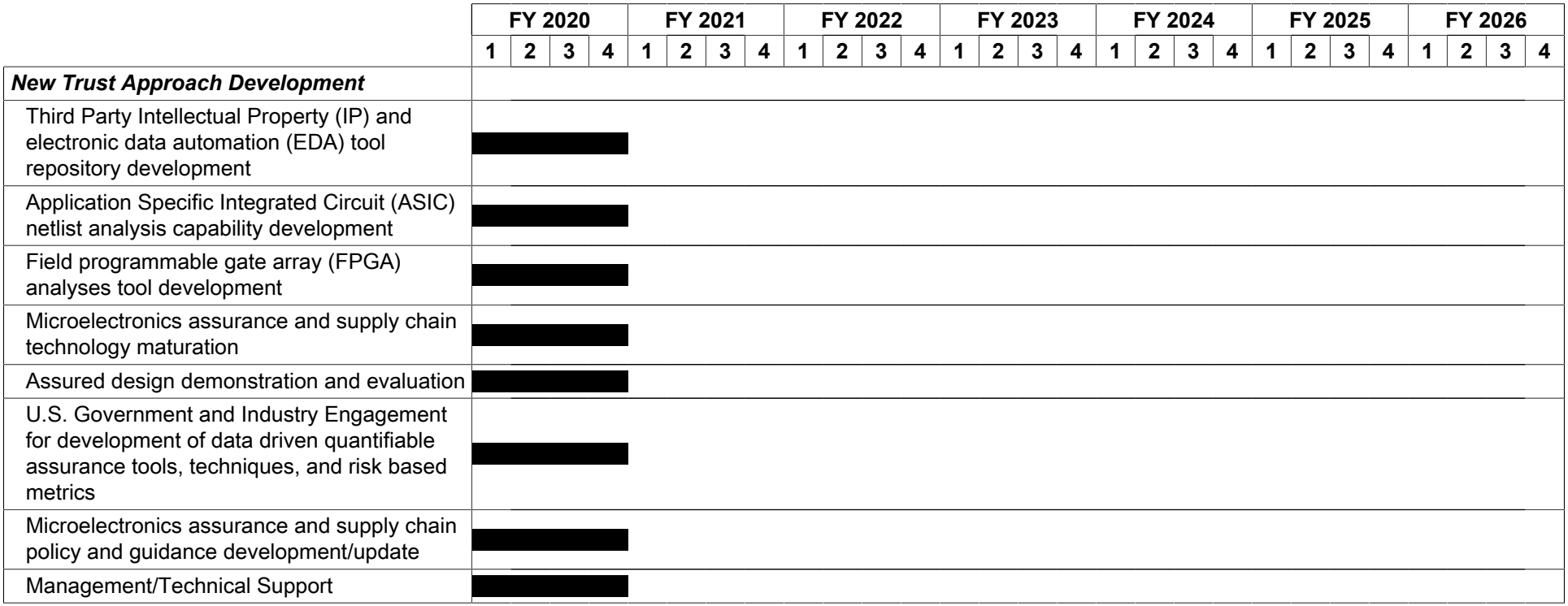

Exhibit R-4A, RDT&E Schedule Details: PB 2022 Office of the Secretary Of Defense		Date: May 2021
Appropriation/Budget Activity 0400 / 4	**R-1 Program Element (Number/Name)** PE 0604294D8Z / *Trusted and Assured Microelectronics*	**Project (Number/Name)** 646 / *New Trust Approach Development*

Schedule Details

	Start		End	
Events by Sub Project	**Quarter**	**Year**	**Quarter**	**Year**
New Trust Approach Development				
Third Party Intellectual Property (IP) and electronic data automation (EDA) tool repository development	1	2020	4	2020
Application Specific Integrated Circuit (ASIC) netlist analysis capability development	1	2020	4	2020
Field programmable gate array (FPGA) analyses tool development	1	2020	4	2020
Microelectronics assurance and supply chain technology maturation	1	2020	4	2020
Assured design demonstration and evaluation	1	2020	4	2020
U.S. Government and Industry Engagement for development of data driven quantifiable assurance tools, techniques, and risk based metrics	1	2020	4	2020
Microelectronics assurance and supply chain policy and guidance development/update	1	2020	4	2020
Management/Technical Support	1	2020	4	2020

Exhibit R-2A, RDT&E Project Justification: PB 2022 Office of the Secretary Of Defense			Date: May 2021
Appropriation/Budget Activity 0400 / 4	R-1 Program Element (Number/Name) PE 0604294D8Z / *Trusted and Assured Microelectronics*	Project (Number/Name) 647 / *Microelectronics Innovation for National Security and Economic Competitiveness (MINSEC) Innovation and Development*	

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
647: *Microelectronics Innovation for National Security and Economic Competitiveness (MINSEC) Innovation and Development*	423.978	451.089	0.000	0.000	-	0.000	-	-	-	-	-	-
Quantity of RDT&E Articles	-	-	-	-	-	-	-	-	-	-		

Note

Funds transferred from this Project code (Pcode) Pcode to new Pcodes for “P907 - Access to State-of-the-Art (SOTA) Microelectronics Development”, “P908 - Access to Advanced Packaging and Test Development”, “P911 - Address DoD Unique Needs Especially Radiation Hardening”, and “P912 - Create a Resilient and Robust Microelectronics Pipeline” to properly align funding in support of the zero-trust philosophy and reflect current priorities. Total funding will decrease between the two years from $459.170 million to $415.932 million with $281.594 million transferring to SOTA Access, $81.438 million transferring to Advanced Packaging Access,$50.500 transferring to Unique Needs, and $73.766 million transferring to Create a Resilient and Robust Microelectronics Pipeline.

A. Mission Description and Budget Item Justification

This project supports the DoD microelectronics strategy by ensuring the availability of and access to advanced, assured microelectronics that are critical for DoD and national security systems. It will support the development and delivery of tools to protect the intellectual property (IP) confidentiality and integrity across the full microelectronics life cycle for a broad range of systems and missions and will provide a path for the production of these articles.

It will allow DoD to:
1) provide multiple options for programs and the defense industrial base to rapidly modernize state-of-the-art (SOTA) microelectronic components;
2) promote access to all needed current and future semiconductor technologies, including design, fabrication, packaging, and testing, from a robust base of commercially sustainable suppliers;
3) maintain technological leadership and a secure domestic microelectronics ecosystem to create a competitive industrial base of microelectronics suppliers that can rapidly adjust to the dynamics of the industry including the initiation of modernization pilots with DoD programs and industry to prototype and demonstrate new capabilities; and
4) provide DoD’s captive specialty needs suppliers and dedicated facilities with cost-effective upgrade capabilities and resources so they can deliver advanced technologies.

This project supports a broader national strategy to focus resources, policies, and incentives to enhance current and next generation defense capability by:
1) maintaining access to U.S. domestic production of SOTA technology;

Exhibit R-2A, RDT&E Project Justification: PB 2022 Office of the Secretary Of Defense		Date: May 2021
Appropriation/Budget Activity 0400 / 4	**R-1 Program Element (Number/Name)** PE 0604294D8Z / *Trusted and Assured Microelectronics*	**Project (Number/Name)** 647 / *Microelectronics Innovation for National Security and Economic Competitiveness (MINSEC) Innovation and Development*

2) enhancing state-of-the-practice (SOTP) foundries in the U.S. to produce more advanced technologies to better serve low-volume customers in the aerospace and defense community;
3) investing in research and development (R&D) for the next generation of microelectronics for new materials, devices, architectures, and designs in coordination with the Defense Advanced Research Projects Agency (DARPA) Electronics Resurgence Initiative (ERI);
4) promoting threat awareness, proactive protection, and supply chain security to ensure these investments continue to benefit the U.S.;
5) exploring incentives for market growth through dual-use technologies, piloting acquisition reforms, partnering with industry, and providing incentives for cooperative R&D and trade; and
6) establishing innovation hub pilots with industry.

MINSEC activities are categorized into the following focus areas: access to specialized SOTA and dual use microelectronics technology, collection and analysis of data for metrics driven quantifiable assurance, maintaining and enhancing U.S capability though development, capture and secure, and transition of next generation microelectronics technology insertion; microelectronics-focused workforce development; radiation hardening by process (RHBP) and radiation hardening by design (RHBD); and radio frequency (RF) and optoelectronic (OE) microelectronics.

This project in FY 2020 funds the following focus areas: SOTA access through secure design, packaging, and enhanced foundry access; development and maturation of commercially viable quantifiable assurance technologies; capture and secure microelectronics R&D; new microelectronics development and capability insertion; RHBP and RHBD; and RF and OE microelectronics.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2020	FY 2021	FY 2022
Title: Microelectronics Innovation for National Security and Economic Competitiveness (MINSEC) ***Description:*** This project's activities will mature and evaluate microelectronics access and assurance technologies and techniques through efforts that may include the conduct of studies and Broad Agency Announcements (BAAs) and other efforts to coordinate research programs across USG R&D organizations, academia, and industry.	451.089	-	-
Accomplishments/Planned Programs Subtotals	451.089	-	-

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

Exhibit R-3, RDT&E Project Cost Analysis: PB 2022 Office of the Secretary Of Defense		Date: May 2021
Appropriation/Budget Activity 0400 / 4	**R-1 Program Element (Number/Name)** PE 0604294D8Z / *Trusted and Assured Microelectronics*	**Project (Number/Name)** 647 / *Microelectronics Innovation for National Security and Economic Competitiveness (MINSEC) Innovation and Development*

Product Development ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2020 Cost	FY 2020 Award Date	FY 2021 Cost	FY 2021 Award Date	FY 2022 Base Cost	FY 2022 Base Award Date	FY 2022 OCO Cost	FY 2022 OCO Award Date	FY 2022 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Microelectronics Innovation for National Security and Economic Competitiveness (MINSEC) Innovation and Development	MIPR	Defense Advanced Research Projects Agency, Air Force, Army, Navy, National Security Agency : Various	423.978	451.089	Mar 2020	-		-		-		-	Continuing	Continuing	-
		Subtotal	423.978	451.089		-		-		-		-	Continuing	Continuing	N/A

	Prior Years	FY 2020		FY 2021		FY 2022 Base		FY 2022 OCO		FY 2022 Total	Cost To Complete	Total Cost	Target Value of Contract
Project Cost Totals	423.978	451.089		0.000		-		-		-	Continuing	Continuing	N/A

Remarks

Exhibit R-4, RDT&E Schedule Profile: PB 2022 Office of the Secretary Of Defense		Date: May 2021
Appropriation/Budget Activity 0400 / 4	**R-1 Program Element (Number/Name)** PE 0604294D8Z / *Trusted and Assured Microelectronics*	**Project (Number/Name)** 647 / *Microelectronics Innovation for National Security and Economic Competitiveness (MINSEC) Innovation and Development*

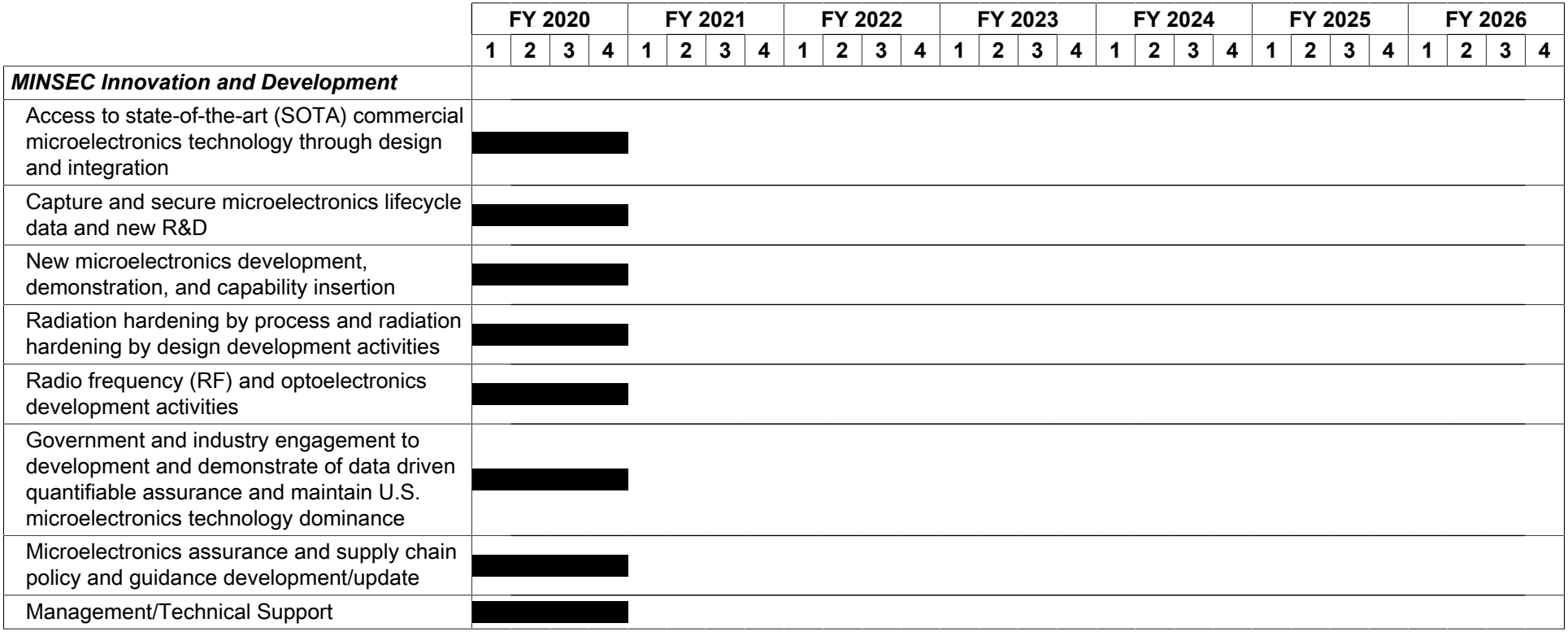

Exhibit R-4A, RDT&E Schedule Details: PB 2022 Office of the Secretary Of Defense		Date: May 2021
Appropriation/Budget Activity 0400 / 4	**R-1 Program Element (Number/Name)** PE 0604294D8Z / *Trusted and Assured Microelectronics*	**Project (Number/Name)** 647 / *Microelectronics Innovation for National Security and Economic Competitiveness (MINSEC) Innovation and Development*

Schedule Details

	Start		End	
Events by Sub Project	**Quarter**	**Year**	**Quarter**	**Year**
MINSEC Innovation and Development				
Access to state-of-the-art (SOTA) commercial microelectronics technology through design and integration	1	2020	4	2020
Capture and secure microelectronics lifecycle data and new R&D	1	2020	4	2020
New microelectronics development, demonstration, and capability insertion	1	2020	4	2020
Radiation hardening by process and radiation hardening by design development activities	1	2020	4	2020
Radio frequency (RF) and optoelectronics development activities	1	2020	4	2020
Government and industry engagement to development and demonstrate of data driven quantifiable assurance and maintain U.S. microelectronics technology dominance	1	2020	4	2020
Microelectronics assurance and supply chain policy and guidance development/update	1	2020	4	2020
Management/Technical Support	1	2020	4	2020

Exhibit R-2A, RDT&E Project Justification: PB 2022 Office of the Secretary Of Defense			Date: May 2021
Appropriation/Budget Activity 0400 / 4	R-1 Program Element (Number/Name) PE 0604294D8Z / *Trusted and Assured Microelectronics*	Project (Number/Name) 907 / *Access to State-of-the-Art (SOTA) Microelectronics - Development*	

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
907: *Access to State-of-the-Art (SOTA) Microelectronics - Development*	0.000	0.000	281.594	297.195	-	297.195	-	-	-	-	-	-
Quantity of RDT&E Articles	-	-	-	-	-	-	-	-	-	-		

A. Mission Description and Budget Item Justification

In 2021, this project incorporated portions of projects P291, P645 and P646. It will continue Joint Federated Assurance Center (JFAC) strategic partnerships and establish new strategic partnerships with existing commercial state-of-the-art (SOTA) domestic foundries to develop a data-driven, risk-based approach to supply chain protection and develop the assured access, secure design, and manufacture of advanced microelectronics technology and electronic components.

This project will develop a new data driven quantifiable assurance paradigm for supply chain protection. It will strengthen security while improving access, exposing no sensitive intellectual property (IP) to the foundry and requiring post-manufacture validation of foundry products. The enhancement will develop quantifiably assured design concepts in manufactured systems, enabling a formal risk-based approach to protection techniques. Manufactured microelectronics will be tested to ensure that IP protections meet or exceed current National Security Agency standards for IP protection, and to develop DoD's ability to detect certain malicious supply chain attacks on DoD microelectronics.

Successful implementation will transition these technologies to use in DoD programs, obtain access to multiple commercial microelectronics facilities, establish secure design capabilities, and solidify a data-driven approach to supply chain protection. It also includes keeping pace with the rapid advancements in microelectronics technology and the globalization of this industry sector. It will provide the basics for updating and strengthening DoD assurance policy and includes collaborating with industry to develop data driven quantifiable standards.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2020	FY 2021	FY 2022
Title: Joint Federated Assurance Center (JFAC)	-	8.810	9.000
Description: This project's activities will enhance the use of hardware and software tools, techniques, and assurance methodology directly with programs and organizations, throughout DoD and the life cycle. JFAC provides a common forum in DoD for assurance best practices, training, community dialog on assurance, access to new technology, collaboration with other components of USG, and tools usable by programs for maintaining quantifiable assurance data.			
FY 2021 Plans: • Procure select quantities of high-priority software and hardware assurance(SwA and HwA) tools; evaluate high payoff commercial off the shelf (COTS) components to determine exploitable vulnerabilities; map vulnerabilities and threats to SwA and HwA tool capabilities to assess how well SwA and HwA tools and techniques function.			

Exhibit R-2A, RDT&E Project Justification: PB 2022 Office of the Secretary Of Defense		Date: May 2021
Appropriation/Budget Activity 0400 / 4	**R-1 Program Element (Number/Name)** PE 0604294D8Z / *Trusted and Assured Microelectronics*	**Project (Number/Name)** 907 / *Access to State-of-the-Art (SOTA) Microelectronics - Development*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2020	FY 2021	FY 2022
• Conduct rapid acquisition pilots for enterprise procurement SwA and HwA tool enterprise license procurement models. • Expand JFAC infrastructure to deploy tools & capabilities. • Develop and distribute high priority acquisition workforce program and technical implementation guidance and training packages. ***FY 2022 Plans:*** • Select and procure quantities of state-of-the-art software assurance (SwA) tools; innovate and advance technology for vulnerability and subverted code detection of binary code in DoD embedded systems; evaluate high payoff open source components required to move DoD systems to the cloud using containers; technology and infrastructure support to programs to determine and mitigate exploitable vulnerabilities; map vulnerabilities and threats to SwA tool capabilities and provide assessments of how well SwA tools and techniques function directly to programs. • Execute enterprise license program procurement of SwA tools. • Continue expanding JFAC infrastructure to support hardware assurance, deploy SwA tools, training, shared experiences, and best tool-use practice directly to programs and organizations via the JFAC website (https://jfac.navy.mil). • Develop and make directly available to programs and organizations beyond leading edge acquisition workforce program and technical implementation guidance, training packages, and subject matter experts for quantifiable assurance. ***FY 2021 to FY 2022 Increase/Decrease Statement:*** Small changes reflect budget fluctuations.			
Title: Design ***Description:*** The enhancement will develop quantifiably assured design concepts in manufactured systems, access to advanced state-of-the-art technology through secure design centers, enabling a formal risk-based approach to protection techniques. Manufactured microelectronics will be tested to ensure that intellectual property (IP) protections meet or exceed current National Security Agency standards for IP protection, and to demonstrate DoD's ability to detect certain malicious supply chain attacks on DoD microelectronics. Successful implementation will continue to transition these technologies to use in DoD programs and maintain access to multiple (2) commercial microelectronics facilities, and solidify a data-driven approach to supply chain protection. ***FY 2021 Plans:*** Planned activities are as follows: • Establish vetted IP and electronic data automation (EDA) Repository, which is available for DoD use, and distribute assured tools via cloud services. • Enhance secure design and cloud capability with new tools/techniques.	-	42.625	0.000

Exhibit R-2A, RDT&E Project Justification: PB 2022 Office of the Secretary Of Defense		Date: May 2021
Appropriation/Budget Activity 0400 / 4	**R-1 Program Element (Number/Name)** PE 0604294D8Z / *Trusted and Assured Microelectronics*	**Project (Number/Name)** 907 / *Access to State-of-the-Art (SOTA) Microelectronics - Development*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2020	FY 2021	FY 2022
• Enable data management and analysis for lifecycle microelectronics assurance. ***FY 2022 Plans:*** These efforts are being merged into a combined program for both secure design and quantifiable assurance activities beginning with FY 2022. See “Secure Design and Quantifiable Assurance Development” program below. ***FY 2021 to FY 2022 Increase/Decrease Statement:*** These efforts are being merged into a combined program for both secure design and quantifiable assurance activities beginning with FY 2022. See “Secure Design and Quantifiable Assurance Development” program below.			
Title: Foundry ***Description:*** This activity will implement multiple foundries process design kit (PDK) environments ensuring the government is not dependent on one single source for critical components and enable regular dedicated and multi-project wafer runs with fabrication data products. Commercial foundries generate enormous amounts of data on their processes as a best practice for quality assurance to improve reliability and increase yield. It will collect and utilize this data to generate and allow quantitative comparison of performance and security metrics in the design and test stage of the microelectronics life cycle, thereby mitigating risk. ***FY 2021 Plans:*** Planned activities are as follows: • Pilot assured access to multiple SOTA domestic fabrication sources. • Continued build-out of secured design environments and persistent expertise. ***FY 2022 Plans:*** Planned activities are as follows: • Enhance access to SOTA fabrication ecosystem. • Develop program of record access to assured fabrication flow at multiple SOTA domestic sources. ***FY 2021 to FY 2022 Increase/Decrease Statement:*** Changes reflect minor budget fluctuations.	-	44.338	45.000
Title: Secure Design and Quantifiable Assurance Development ***Description:*** This activity includes verifying the ability to fabricate classified and/or export-controlled designs in on-shore commercial foundries and quantify integrity of designs and end products to include authentication and identification– funding will establish multiple strategic partnerships with existing commercial domestic foundries to develop a data-driven, risk-based approach to supply chain protection and demonstrate the assured manufacture of advanced electronic components.	-	185.821	243.195

Exhibit R-2A, RDT&E Project Justification: PB 2022 Office of the Secretary Of Defense		Date: May 2021
Appropriation/Budget Activity 0400 / 4	**R-1 Program Element (Number/Name)** PE 0604294D8Z / *Trusted and Assured Microelectronics*	**Project (Number/Name)** 907 / *Access to State-of-the-Art (SOTA) Microelectronics - Development*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2020	FY 2021	FY 2022
The project will continue to develop the technical means for protecting intellectual property (IP) and obfuscating the final user function from the supply chain. This result will be realized using personalization, programmability and software, following application specific integrated circuit (ASIC) manufacturing. Efforts are on-going to update International Traffic in Arms Regulations and Export Administration Regulations policy in this area. Funding will support activities to enhance the export control regime so that it maintains or strengthens current protections while enabling access to commercial capabilities, products, and IP. ***FY 2021 Plans:*** Planned activities are as follows: • Enhance design, physical, and functional test and verification infrastructure, tools, and capabilities in order to generate quantifiable assurance data at state-of-the-art (SOTA). • Improved logical and functional nondestructive analysis for SOTA field programmable gate arrays (FPGAs), System on Chips (SoCs), and ASICs. • Increased throughput and decreased data collection time for destructive physical analysis and inspection at SOTA. • Acquire verification equipment to compare measured test data to design information. • Scale simulation and emulation environment to compare design tool and IP artifacts to measure data. • Continuation of 2020 verification and test technologies refinement activities including: (1) technical capability, through the procurement of laboratory equipment, IP, analysis tools, such as imaging software, and highly skilled tradecraft, (2) capacity to perform microelectronics assessments. • Conduct mathematical model-based risk assessment for design, fabrication and packaging. ***FY 2022 Plans:*** Planned activities are as follows: • Continue to enhance secure design and cloud capability with new tools/techniques. • Utilize traceability and provenance mechanisms to verify and vet data sources in a zero-trust architecture and enhance ability of DoD/Defense Industrial Base to design SOTA microelectronics. • Quantify transition of designs to prototypes and programs of record and maintain persistence in lifecycle assurance data and intellectual property. • Instantiate authentication and protection workflows for design assurance. • Demonstrate rapid transition of DoD-relevant field programmable gate array-based capabilities to structured ASICs, with security capabilities to protect DoD intellectual property (IP) during manufacture. • Conduct enhanced IP analysis; data driven risk assessments utilizing independent verification and validation, data captures, intelligence reports, probability of detection and false alarm rates, and game theoretics; and authentication and protection workflows.			

Exhibit R-2A, RDT&E Project Justification: PB 2022 Office of the Secretary Of Defense		Date: May 2021
Appropriation/Budget Activity 0400 / 4	**R-1 Program Element (Number/Name)** PE 0604294D8Z / *Trusted and Assured Microelectronics*	**Project (Number/Name)** 907 / *Access to State-of-the-Art (SOTA) Microelectronics - Development*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2020	FY 2021	FY 2022
• Align program to provide persistent expertise delivery for application specific risk; compare design features to enhance verification and validation. • Develop a scalable classification system for design and verification ecosystem. • Analyze quantitative assurance data from pilot risk assessment demonstration. • In collaboration with industry standard bodies (Society of Automotive Engineers 32), promulgate new hardware assurance policy, best practices, and guidance via a navigable public library portal. ***FY 2021 to FY 2022 Increase/Decrease Statement:*** Changes reflect the combination of secure design efforts into these quantifiable assurance efforts. These efforts will deliver secure design capability concurrently with quantifiable assurance for the prototypes developed.			
Accomplishments/Planned Programs Subtotals	-	281.594	297.195

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

Exhibit R-3, RDT&E Project Cost Analysis: PB 2022 Office of the Secretary Of Defense			Date: May 2021
Appropriation/Budget Activity 0400 / 4	R-1 Program Element (Number/Name) PE 0604294D8Z / *Trusted and Assured Microelectronics*	Project (Number/Name) 907 / *Access to State-of-the-Art (SOTA) Microelectronics - Development*	

Product Development ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2020 Cost	FY 2020 Award Date	FY 2021 Cost	FY 2021 Award Date	FY 2022 Base Cost	FY 2022 Base Award Date	FY 2022 OCO Cost	FY 2022 OCO Award Date	FY 2022 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Access to SOTA Microelectronics - Development	MIPR	Defense Advanced Research Projects Agency, Air Force, Army, Navy, National Security Agency : Various	-	-		281.594	Mar 2021	297.195	Mar 2022	-		297.195	Continuing	Continuing	-
		Subtotal	-	-		281.594		297.195		-		297.195	Continuing	Continuing	N/A

	Prior Years	FY 2020		FY 2021		FY 2022 Base		FY 2022 OCO		FY 2022 Total	Cost To Complete	Total Cost	Target Value of Contract
Project Cost Totals	-	-		281.594		297.195		-		297.195	Continuing	Continuing	N/A

Remarks

Exhibit R-4, RDT&E Schedule Profile: PB 2022 Office of the Secretary Of Defense		Date: May 2021
Appropriation/Budget Activity 0400 / 4	**R-1 Program Element (Number/Name)** PE 0604294D8Z / *Trusted and Assured Microelectronics*	**Project (Number/Name)** 907 / *Access to State-of-the-Art (SOTA) Microelectronics - Development*

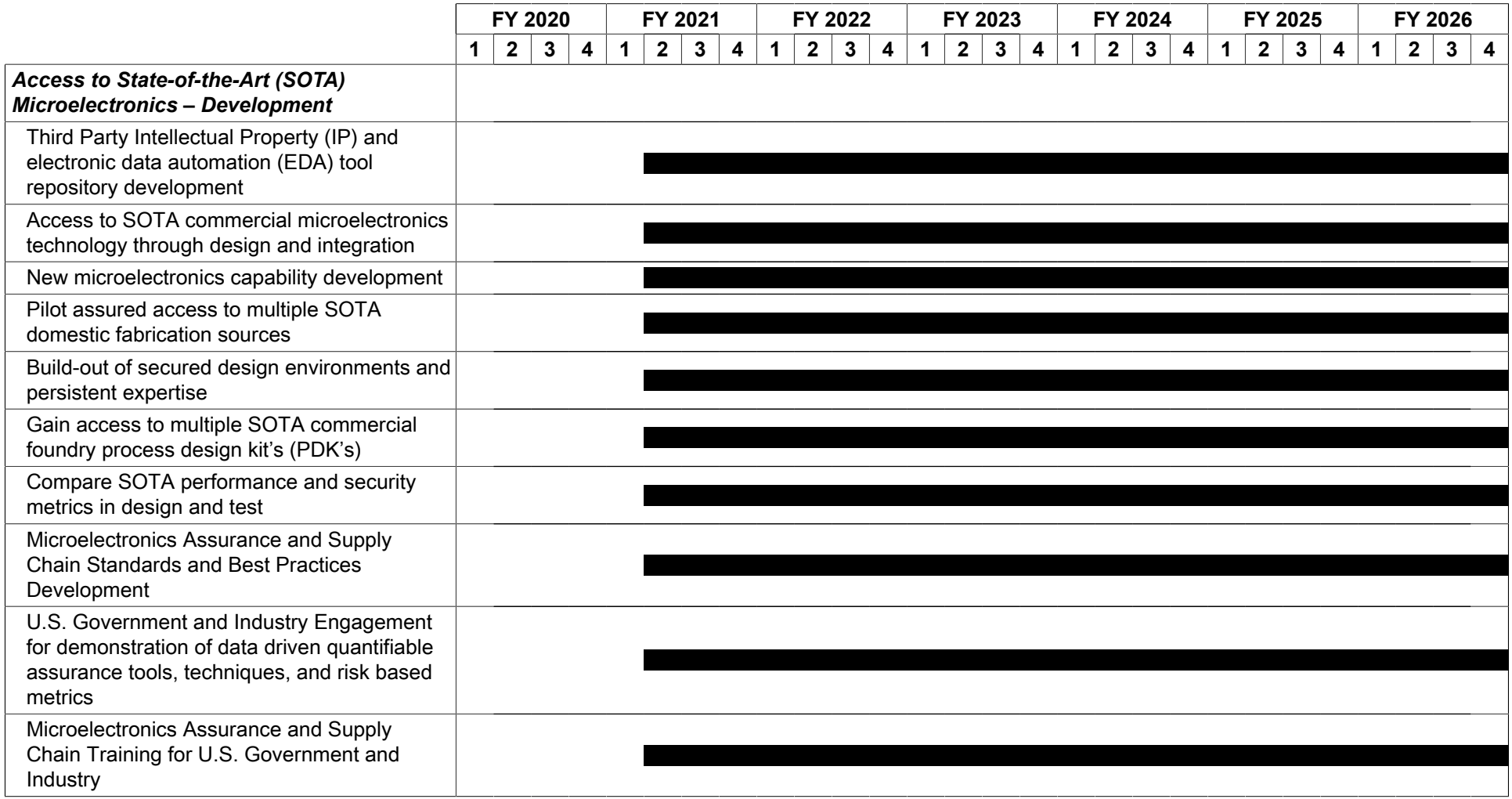

Exhibit R-4, RDT&E Schedule Profile: PB 2022 Office of the Secretary Of Defense		Date: May 2021
Appropriation/Budget Activity 0400 / 4	**R-1 Program Element (Number/Name)** PE 0604294D8Z / *Trusted and Assured Microelectronics*	**Project (Number/Name)** 907 / *Access to State-of-the-Art (SOTA) Microelectronics - Development*

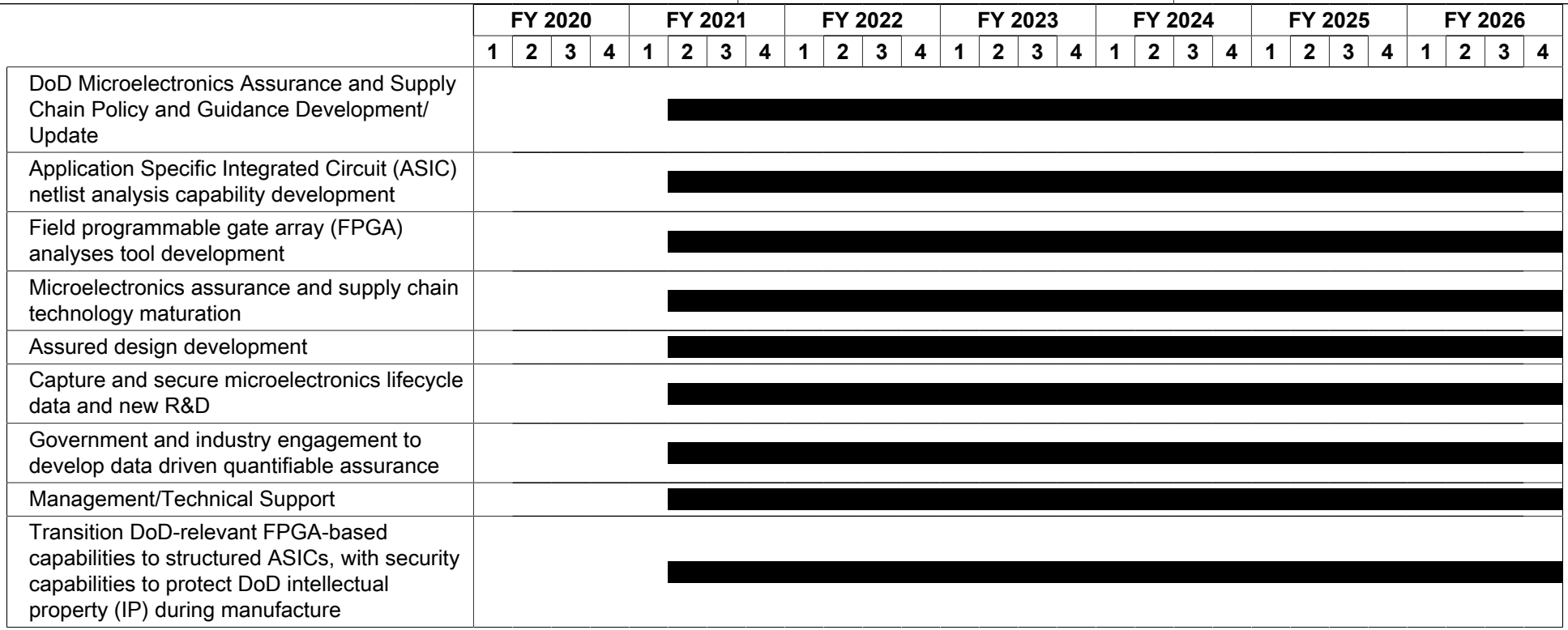

Exhibit R-4A, RDT&E Schedule Details: PB 2022 Office of the Secretary Of Defense		Date: May 2021
Appropriation/Budget Activity 0400 / 4	**R-1 Program Element (Number/Name)** PE 0604294D8Z / *Trusted and Assured Microelectronics*	**Project (Number/Name)** 907 / *Access to State-of-the-Art (SOTA) Microelectronics - Development*

Schedule Details

	Start		End	
Events by Sub Project	**Quarter**	**Year**	**Quarter**	**Year**
Access to State-of-the-Art (SOTA) Microelectronics – Development				
Third Party Intellectual Property (IP) and electronic data automation (EDA) tool repository development	2	2021	4	2026
Access to SOTA commercial microelectronics technology through design and integration	2	2021	4	2026
New microelectronics capability development	2	2021	4	2026
Pilot assured access to multiple SOTA domestic fabrication sources	2	2021	4	2026
Build-out of secured design environments and persistent expertise	2	2021	4	2026
Gain access to multiple SOTA commercial foundry process design kit's (PDK's)	2	2021	4	2026
Compare SOTA performance and security metrics in design and test	2	2021	4	2026
Microelectronics Assurance and Supply Chain Standards and Best Practices Development	2	2021	4	2026
U.S. Government and Industry Engagement for demonstration of data driven quantifiable assurance tools, techniques, and risk based metrics	2	2021	4	2026
Microelectronics Assurance and Supply Chain Training for U.S. Government and Industry	2	2021	4	2026
DoD Microelectronics Assurance and Supply Chain Policy and Guidance Development/Update	2	2021	4	2026
Application Specific Integrated Circuit (ASIC) netlist analysis capability development	2	2021	4	2026
Field programmable gate array (FPGA) analyses tool development	2	2021	4	2026
Microelectronics assurance and supply chain technology maturation	2	2021	4	2026
Assured design development	2	2021	4	2026
Capture and secure microelectronics lifecycle data and new R&D	2	2021	4	2026
Government and industry engagement to develop data driven quantifiable assurance	2	2021	4	2026

Exhibit R-4A, RDT&E Schedule Details: PB 2022 Office of the Secretary Of Defense		Date: May 2021
Appropriation/Budget Activity 0400 / 4	**R-1 Program Element (Number/Name)** PE 0604294D8Z / *Trusted and Assured Microelectronics*	**Project (Number/Name)** 907 / *Access to State-of-the-Art (SOTA) Microelectronics - Development*

	Start		End	
Events by Sub Project	**Quarter**	**Year**	**Quarter**	**Year**
Management/Technical Support	2	2021	4	2026
Transition DoD-relevant FPGA-based capabilities to structured ASICs, with security capabilities to protect DoD intellectual property (IP) during manufacture	2	2021	4	2026

Exhibit R-2A, RDT&E Project Justification: PB 2022 Office of the Secretary Of Defense			Date: May 2021
Appropriation/Budget Activity 0400 / 4	R-1 Program Element (Number/Name) PE 0604294D8Z / *Trusted and Assured Microelectronics*	Project (Number/Name) 908 / *Access to Advanced Packaging and Testing - Development*	

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
908: *Access to Advanced Packaging and Testing - Development*	0.000	0.000	81.438	112.600	-	112.600	-	-	-	-	-	-
Quantity of RDT&E Articles	-	-	-	-	-	-	-	-	-	-		

A. Mission Description and Budget Item Justification

This project will leverage existing commercially available expertise and capability to deliver self-sustaining digital and Radio Frequency (RF) state-of-the-art (SOTA) heterogeneous integrated packaging (SHIP), assembly, and test capability.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2020	FY 2021	FY 2022
Title: Access to Advanced Packaging and Testing - Development	-	81.438	112.600

Description: This project will utilize specialized DoD chiplets (small specialized die) in a heterogeneous integrated (HI) assembly, allowing the DoD to accelerate adoption of the most advanced microelectronics available. Working with world-class industrial partners will provide early access to proprietary information related to these technologies, giving DoD an asymmetrical advantage.

This project will deliver an on-shore SHIP, assembly, and test capability. It will provide access to, personalization of, and customization for supporting DoD programs. It will enable a revolutionary leap in system performance that will greatly reduce size, weight and power (SWaP) by incorporating the immense advances in SOTA commercial off the shelf (COTS) processing technologies, such as field programmable gate arrays (FPGAs), microprocessors, and Graphic Processing Units (GPUs).

FY 2021 Plans:

Planned activities are as follows:

• Enhance secure design and packaging capability with new tools/techniques.
• Qualify advanced heterogeneous packaging technology.
• Continued development of secure, accessible, and cost effective SOTA heterogeneous integration design, assembly and test capability.
• Develop prototype designs for SOTA Digital and radio frequency microelectronics applications.

FY 2022 Plans:

Planned activities are as follows:

• Enhance secure design and packaging capability with new tools/techniques.
• Continued development of secure, accessible, and cost effective SOTA heterogeneous integration design, assembly and test capability.

Exhibit R-2A, RDT&E Project Justification: PB 2022 Office of the Secretary Of Defense		Date: May 2021
Appropriation/Budget Activity 0400 / 4	**R-1 Program Element (Number/Name)** PE 0604294D8Z / *Trusted and Assured Microelectronics*	**Project (Number/Name)** 908 / *Access to Advanced Packaging and Testing - Development*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2020	FY 2021	FY 2022
• Establish a SOTA prototype packaging secure assembly and test source for SOTA digital and RF applications. ***FY 2021 to FY 2022 Increase/Decrease Statement:*** Funding will increase from $81.438 million to $112.600 million in order to begin to deliver proto-type designs and hardware for accelerating program adoption and for qualification, and establish infrastructure and process that supports ITAR/EAR, proprietary and security requirements.			
Accomplishments/Planned Programs Subtotals	-	81.438	112.600

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

Exhibit R-3, RDT&E Project Cost Analysis: PB 2022 Office of the Secretary Of Defense		Date: May 2021
Appropriation/Budget Activity 0400 / 4	**R-1 Program Element (Number/Name)** PE 0604294D8Z / *Trusted and Assured Microelectronics*	**Project (Number/Name)** 908 / *Access to Advanced Packaging and Testing - Development*

Product Development ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2020 Cost	FY 2020 Award Date	FY 2021 Cost	FY 2021 Award Date	FY 2022 Base Cost	FY 2022 Base Award Date	FY 2022 OCO Cost	FY 2022 OCO Award Date	FY 2022 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Access to Advanced Packaging and Testing - Development	MIPR	Defense Advanced Research Projects Agency, Air Force, Army, Navy, National Security Agency : Various	-	-		81.438	Mar 2021	112.600	Mar 2022	-		112.600	Continuing	Continuing	-
		Subtotal	-	-		81.438		112.600		-		112.600	Continuing	Continuing	N/A

	Prior Years	FY 2020		FY 2021		FY 2022 Base		FY 2022 OCO		FY 2022 Total	Cost To Complete	Total Cost	Target Value of Contract
Project Cost Totals	-	-		81.438		112.600		-		112.600	Continuing	Continuing	N/A

Remarks

Exhibit R-4, RDT&E Schedule Profile: PB 2022 Office of the Secretary Of Defense		Date: May 2021
Appropriation/Budget Activity 0400 / 4	**R-1 Program Element (Number/Name)** PE 0604294D8Z / *Trusted and Assured Microelectronics*	**Project (Number/Name)** 908 / *Access to Advanced Packaging and Testing - Development*

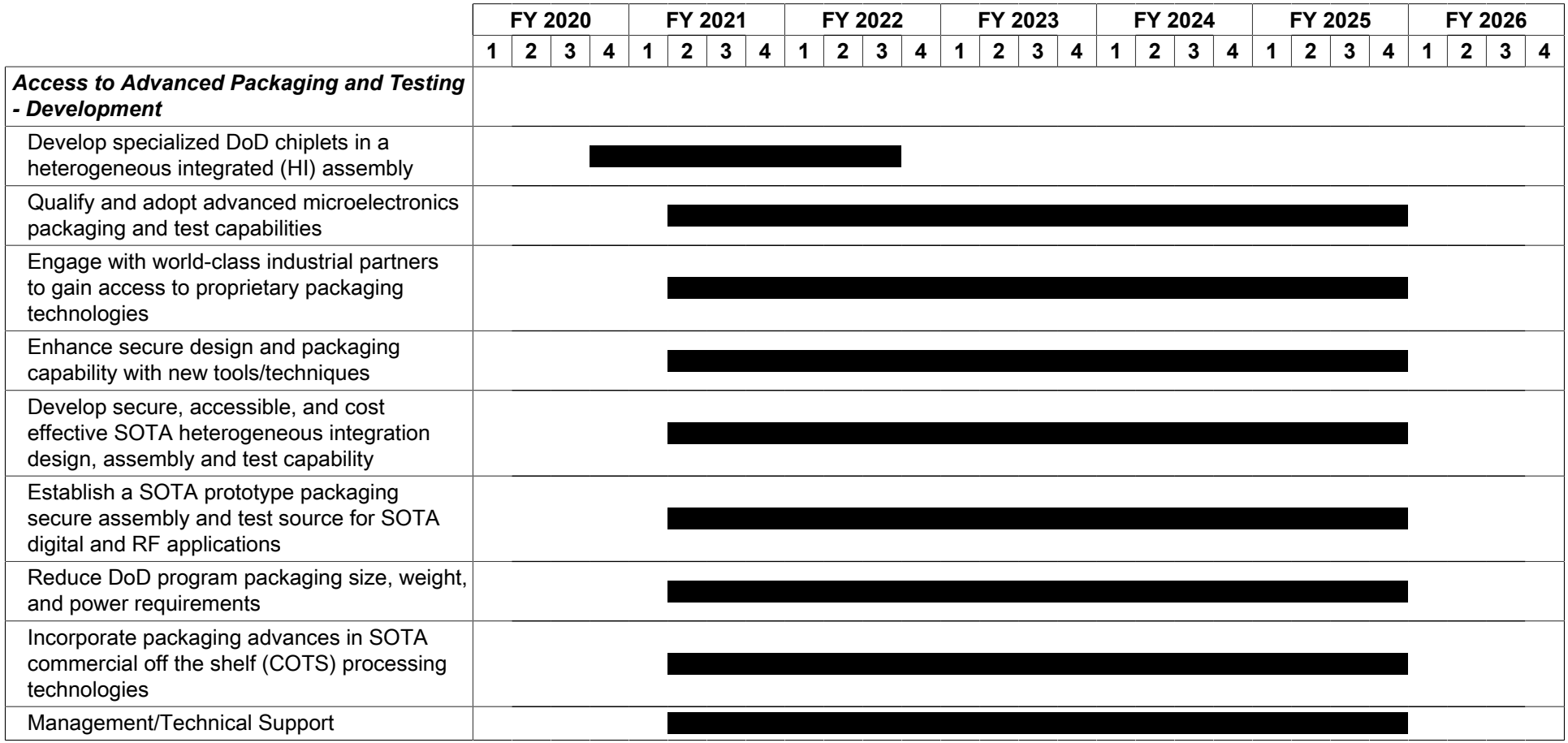

Exhibit R-4A, RDT&E Schedule Details: PB 2022 Office of the Secretary Of Defense		Date: May 2021
Appropriation/Budget Activity 0400 / 4	**R-1 Program Element (Number/Name)** PE 0604294D8Z / *Trusted and Assured Microelectronics*	**Project (Number/Name)** 908 / *Access to Advanced Packaging and Testing - Development*

Schedule Details

	Start		End	
Events by Sub Project	**Quarter**	**Year**	**Quarter**	**Year**
Access to Advanced Packaging and Testing - Development				
Develop specialized DoD chiplets in a heterogeneous integrated (HI) assembly	4	2020	3	2022
Qualify and adopt advanced microelectronics packaging and test capabilities	2	2021	4	2025
Engage with world-class industrial partners to gain access to proprietary packaging technologies	2	2021	4	2025
Enhance secure design and packaging capability with new tools/techniques	2	2021	4	2025
Develop secure, accessible, and cost effective SOTA heterogeneous integration design, assembly and test capability	2	2021	4	2025
Establish a SOTA prototype packaging secure assembly and test source for SOTA digital and RF applications	2	2021	4	2025
Reduce DoD program packaging size, weight, and power requirements	2	2021	4	2025
Incorporate packaging advances in SOTA commercial off the shelf (COTS) processing technologies	2	2021	4	2025
Management/Technical Support	2	2021	4	2025

Exhibit R-2A, RDT&E Project Justification: PB 2022 Office of the Secretary Of Defense			Date: May 2021
Appropriation/Budget Activity 0400 / 4	R-1 Program Element (Number/Name) PE 0604294D8Z / *Trusted and Assured Microelectronics*	Project (Number/Name) 911 / *Address DoD Unique Needs - Radiation Hardening and non-CMOS*	

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
911: *Address DoD Unique Needs - Radiation Hardening and non-CMOS*	0.000	0.000	50.500	82.700	-	82.700	-	-	-	-	-	-
Quantity of RDT&E Articles	-	-	-	-	-	-	-	-	-	-		

A. Mission Description and Budget Item Justification

This project addresses the dual problems of commanding only a small market share while requiring an expansive range of unique microelectronics needs, from boutique and legacy components to state-of-the-art (SOTA) technologies. The Government must sustain specialty suppliers, given their criticality to national security. In particular, DoD needs access to a diverse microelectronics ecosystem to develop and acquire the application specific integrated circuits (ASICs) and personalized commercial off the shelf (COTS) components required for military radiation hardened and radio frequency (RF) and optoelectronic (OE) needs.

The Department frequently relies on commercial suppliers to optimize performance and reduce costs for sophisticated weapon system and secure network functionality. It is critical to have DoD reliability access to subject matter expertise, technology, and manufacturing.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2020	FY 2021	FY 2022
Title: Address DoD Unique Needs Especially Radiation Hardening - Development	-	50.500	82.700
Description: Government-unique trusted design and manufacturing flows have been developed to enable a tier of trust for select ASIC parts; however, this approach addresses only a small subset of DoD microelectronics requirements (e.g., processors, memory, microcontrollers, field programmable gate arrays (FPGAs), and radiation-tolerant processors). DoD will partner with the intelligence community, the Department of Energy, and the National Aeronautics and Space Administration to develop radiation hardened components that permit systems to operate in space and other harsh environments. state-of-the-practice (SOTP) and state-of-the-art (SOTA) technologies will be characterized and developed in support of Radiation Hardened By Process (RHBP) and Radiation Hardened By Design (RHBD) activities in support DoD modernization programs with radiation hardened requirements. A similar situation exists for radio frequency and optical applications. These two applications reflect only a small market with unique costs and specifications, which does not inherently create incentive for industrial investment. ***FY 2021 Plans:*** Planned activities are as follows: • Establish assurance foundations for radio frequency (RF) designs.			

Exhibit R-2A, RDT&E Project Justification: PB 2022 Office of the Secretary Of Defense		Date: May 2021
Appropriation/Budget Activity 0400 / 4	**R-1 Program Element (Number/Name)** PE 0604294D8Z / *Trusted and Assured Microelectronics*	**Project (Number/Name)** 911 / *Address DoD Unique Needs - Radiation Hardening and non-CMOS*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2020	FY 2021	FY 2022
• Establish foundations of assurance for RF applications; deliverables include expansion into other discipline areas: RF, optoelectronic (OE), and Additive Manufacturing. • Continue to qualify sources for radiation hardened (RH) electronics to transition developed radiation hardened capabilities. • Qualify strategic RH sources; develop RH memories and system on chip; develop Radiation Hardened By Design (RHBD) techniques to meet strategic radiation environmental requirements utilizing SOTA technology nodes; develop additional sources for digital Radiation Hardened By Process (RHBP) capability. • Deliverables: Develop strategic RHBD techniques in at least 2 SOTA technologies with validated PDKs. • Major Milestone: Establish 2nd source for strategic RHBP state-of-the-practice (SOTP) fully depleted silicon on insulator source in support of nuclear modernization. • Develop new, SOTP and SOTA, sources (foundry process) for radiation hardened microelectronics. • Develop and enhance DoD Lab test and evaluation infrastructure required for verification and validation of radiation hardened microelectronics, technology characterization, and device modeling and simulation. • Provide coordination and subject matter expertise in support of the Strategic Radiation Hardened Electronics Council (SRHEC) for the identification of technology gaps, technology roadmap development, and inform future investments. • Develop and demonstrate RF and OE microelectronics using secured design environments, advanced non-complementary metal oxide semiconductor substrates, and optimized SOTA intellectual property (IP) and test articles for next generation advanced sensors and communications. • Develop enhanced materials, devices, and modules for RFOE devices. • Collaborate to establish and enhance domestic SOTA RFOE foundry capabilities. ***FY 2022 Plans:*** Planned activities are as follows: • Continue development of RHBD techniques in SOTA technologies with validated PDKs • Transition developed RH technologies into space and strategic programs. • Host secure design challenges to optimize SOTA RFOE IP and test articles for frequency, bandwidth, efficiency, power, etc. • Mature Gallium Nitride and Silicon Carbide substrate source offerings. • Continue development of RF and OE microelectronics using secured design environments and optimized SOTA IP. ***FY 2021 to FY 2022 Increase/Decrease Statement:*** Changes reflect increased emphasis within the department on the urgent need for SOTP and SOTA radiation hardened microelectronics.			
Accomplishments/Planned Programs Subtotals	-	50.500	82.700

Exhibit R-2A, RDT&E Project Justification: PB 2022 Office of the Secretary Of Defense		Date: May 2021
Appropriation/Budget Activity 0400 / 4	**R-1 Program Element (Number/Name)** PE 0604294D8Z / *Trusted and Assured Microelectronics*	**Project (Number/Name)** 911 / *Address DoD Unique Needs - Radiation Hardening and non-CMOS*

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

Exhibit R-3, RDT&E Project Cost Analysis: PB 2022 Office of the Secretary Of Defense		Date: May 2021
Appropriation/Budget Activity 0400 / 4	**R-1 Program Element (Number/Name)** PE 0604294D8Z / *Trusted and Assured Microelectronics*	**Project (Number/Name)** 911 / *Address DoD Unique Needs - Radiation Hardening and non-CMOS*

Product Development ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2020 Cost	FY 2020 Award Date	FY 2021 Cost	FY 2021 Award Date	FY 2022 Base Cost	FY 2022 Base Award Date	FY 2022 OCO Cost	FY 2022 OCO Award Date	FY 2022 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Address DoD Unique Needs - Development	MIPR	Defense Advanced Research Projects Agency, Air Force, Army, Navy, National Security Agency : Various	-	-		50.500	Mar 2021	82.700	Mar 2022	-		82.700	Continuing	Continuing	-
		Subtotal	-	-		50.500		82.700		-		82.700	Continuing	Continuing	N/A

	Prior Years	FY 2020		FY 2021		FY 2022 Base		FY 2022 OCO		FY 2022 Total	Cost To Complete	Total Cost	Target Value of Contract
Project Cost Totals	-	-		50.500		82.700		-		82.700	Continuing	Continuing	N/A

Remarks

Exhibit R-4, RDT&E Schedule Profile: PB 2022 Office of the Secretary Of Defense		Date: May 2021
Appropriation/Budget Activity 0400 / 4	**R-1 Program Element (Number/Name)** PE 0604294D8Z / *Trusted and Assured Microelectronics*	**Project (Number/Name)** 911 / *Address DoD Unique Needs - Radiation Hardening and non-CMOS*

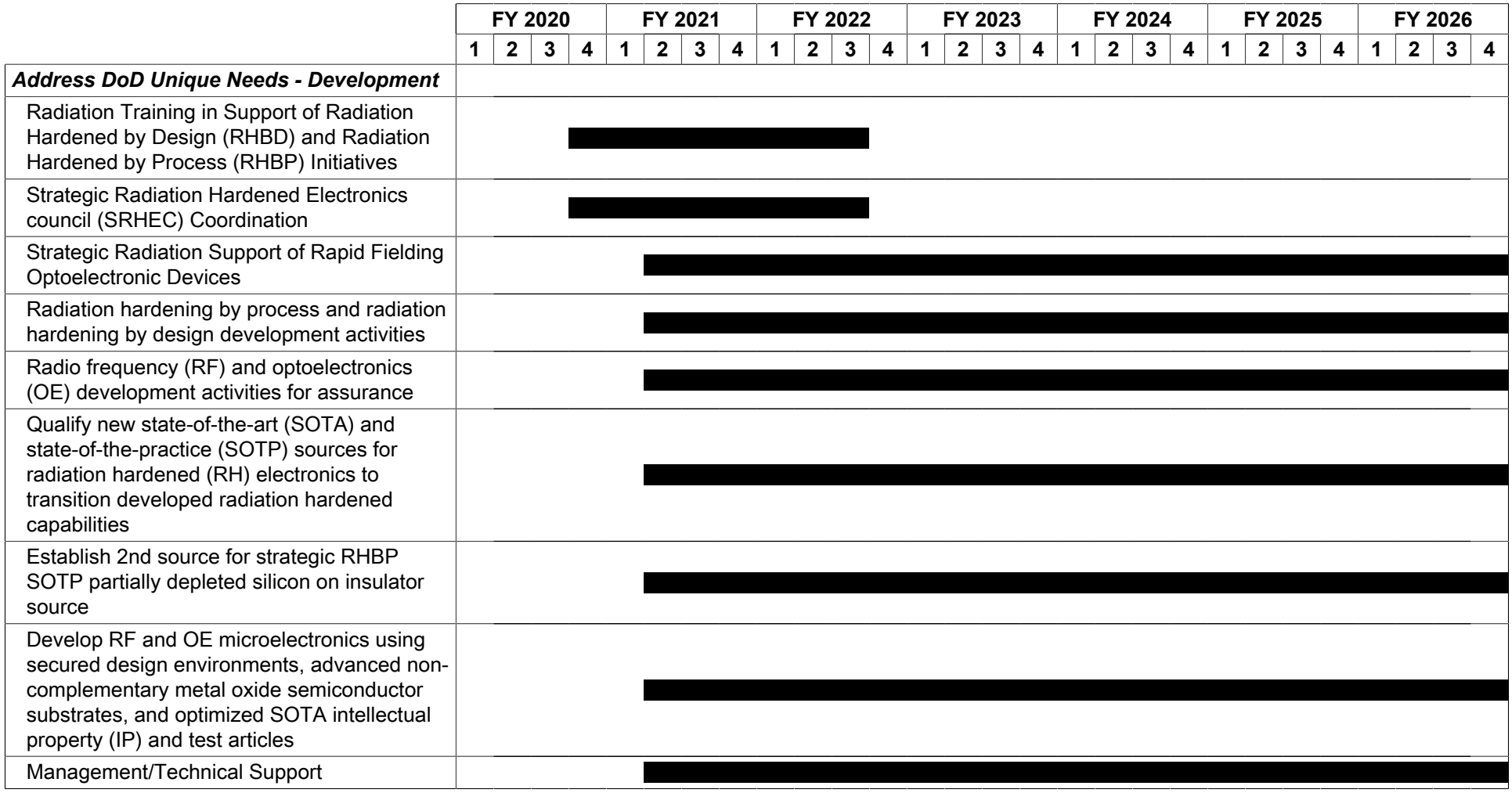

Exhibit R-4A, RDT&E Schedule Details: PB 2022 Office of the Secretary Of Defense		Date: May 2021
Appropriation/Budget Activity 0400 / 4	**R-1 Program Element (Number/Name)** PE 0604294D8Z / *Trusted and Assured Microelectronics*	**Project (Number/Name)** 911 / *Address DoD Unique Needs - Radiation Hardening and non-CMOS*

Schedule Details

	Start		End	
Events by Sub Project	**Quarter**	**Year**	**Quarter**	**Year**
Address DoD Unique Needs - Development				
Radiation Training in Support of Radiation Hardened by Design (RHBD) and Radiation Hardened by Process (RHBP) Initiatives	4	2020	3	2022
Strategic Radiation Hardened Electronics council (SRHEC) Coordination	4	2020	3	2022
Strategic Radiation Support of Rapid Fielding Optoelectronic Devices	2	2021	4	2026
Radiation hardening by process and radiation hardening by design development activities	2	2021	4	2026
Radio frequency (RF) and optoelectronics (OE) development activities for assurance	2	2021	4	2026
Qualify new state-of-the-art (SOTA) and state-of-the-practice (SOTP) sources for radiation hardened (RH) electronics to transition developed radiation hardened capabilities	2	2021	4	2026
Establish 2nd source for strategic RHBP SOTP partially depleted silicon on insulator source	2	2021	4	2026
Develop RF and OE microelectronics using secured design environments, advanced non-complementary metal oxide semiconductor substrates, and optimized SOTA intellectual property (IP) and test articles	2	2021	4	2026
Management/Technical Support	2	2021	4	2026

Exhibit R-2A, RDT&E Project Justification: PB 2022 Office of the Secretary Of Defense			Date: May 2021
Appropriation/Budget Activity 0400 / 4	R-1 Program Element (Number/Name) PE 0604294D8Z / *Trusted and Assured Microelectronics*	Project (Number/Name) 912 / *Create a Quantifiably Assured-Microelectronics Pipeline*	

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
912: *Create a Quantifiably Assured-Microelectronics Pipeline*	0.000	0.000	90.218	16.700	-	16.700	-	-	-	-	-	-
Quantity of RDT&E Articles	-	-	-	-	-	-	-	-	-	-		

A. Mission Description and Budget Item Justification

Microelectronics are critical technologies that drive the modern economy and enable the defense systems that allow warfighters to accomplish their missions. Other nations recognize the need to control the microelectronics supply chain and indigenous state-of-the-art (SOTA) manufacturing. Aggressive investments and licit and illicit actions by peer nations threaten U.S. leadership. China alone purports investment of $150 billion and a national strategy to achieve dominance in all major areas of microelectronics by 2030. Russia and China have publicly stated that advanced microelectronics, AI, and machine learning (ML) are the keys to economic and military dominance.

This project will promote microelectronics innovation and create resilient and robust Microelectronics pipeline including supplier chain, next generation technology and workforce. It will slow and in the long-term reverse offshoring trends by fostering commercial and Government alliances to preserve the U.S. ecosystem, lower barriers to innovation and adoption, strengthen workforce expertise, lead the next generation of advanced technology, and maintain the United States as the global source for high-end, secure, and reliable microelectronics components.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2020	FY 2021	FY 2022
Title: Create a Resilient and Robust Microelectronics Pipeline - Development	-	85.218	16.700
Description: DoD is investing in next-generation disruptive technology, leveraging U.S. innovation, and transitioning materials, architectures, and designs into prototype capabilities for use by multiple industrial sectors. This and additional targeted investments in workforce will begin to address long-term talent needs. In addition, the Department will continue to enhance its partnership with industry to mitigate supply chain risks. Significant increases in assurance and protection of DoD technical data and components will be achieved through improvements in design practices, modern commercial security practices, and advanced packaging and chain of custody technologies. This activity, along with continued engagements and partnerships with industry will foster necessary security features in commercial products and infrastructure that will facilitate long-term assured access for the U.S. Government to commercial advanced SOTA technology providers.			
FY 2021 Plans:			

Exhibit R-2A, RDT&E Project Justification: PB 2022 Office of the Secretary Of Defense		Date: May 2021
Appropriation/Budget Activity 0400 / 4	**R-1 Program Element (Number/Name)** PE 0604294D8Z / *Trusted and Assured Microelectronics*	**Project (Number/Name)** 912 / *Create a Quantifiably Assured-Microelectronics Pipeline*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2020	FY 2021	FY 2022
Planned activities are as follows: • Align stakeholder prototype demonstrators using assurance enabled SOTA fabrication. • Prototype modernization of existing systems with state of the art fabrication technologies with enhanced assurance techniques. • Continue established industry partnerships for assured technology co-development and prototype development. Perform modernization prototype demonstrations with DoD acquisition programs. • Demonstrate limited defensive measures for the protection of commercial wireless systems. • Initiate development of a tactical radio prototype, leveraging commercial and DoD-developed hardware and software. • Lower barriers to innovation (e.g. tools, IP, test capability) and formalize a sustainable manufacturing model for leading-edge DoD application specific integrated circuits (ASICs), following the demonstration of commercially-manufactured academic and DoD designs; [Domestic Foundries]. • Demonstrate advanced negative capacitance non-volatile memory devices, supporting the growing energy-efficient computational needs for many DoD applications. • Establish expertise, develop workforce and training ecosystems with academia, and build close connections within the U.S. Semiconductor industry to identify, report on, and mitigate supply chain threats. • Development of tools to trace parts through their supply chain and track the health of the U.S. semiconductor segments. ***FY 2022 Plans:*** • Development of DoD program relevant application prototypes. • Foster education and workforce development to include Industry-University Cooperative Research Centers Program (IUCRC) models with the National Science Foundation (NSF) and other partners. • Execute radiation hardened, heterogeneous integration/advanced packaging, and System On A Chip design Public-Private-Academic Partnership (PPAP) Models. Develop Supply Chain PPAP model. Expand PPAP partners and collaborators. • Stimulate rapid maturation and transition of emerging technologies and co-development with industry for assurance and security. • Continue to lower the barriers (e.g. cost, expertise, access) to microelectronics innovation for startups and small businesses. • Continue development of industry outreach strategy to address critical technologies identified by DoD assurance and intelligence analysis. Sharing developed technical threat information with industry partners. ***FY 2021 to FY 2022 Increase/Decrease Statement:*** Changes reflect reallocation of funds from this project to Advanced Packaging and Radiation Hardened microelectronics efforts.			
Accomplishments/Planned Programs Subtotals	-	85.218	16.700

	FY 2020	FY 2021
Congressional Add: Trusted Artificial Intelligence	-	5.000

Exhibit R-2A, RDT&E Project Justification: PB 2022 Office of the Secretary Of Defense		Date: May 2021
Appropriation/Budget Activity 0400 / 4	**R-1 Program Element (Number/Name)** PE 0604294D8Z / *Trusted and Assured Microelectronics*	**Project (Number/Name)** 912 / *Create a Quantifiably Assured-Microelectronics Pipeline*

	FY 2020	FY 2021
FY 2021 Plans: Develop the Trusted AI Consortium and Public-Private-Academic Partnership (PPAP) Model through five Graduate Research Projects across three Universities.		
Congressional Adds Subtotals	-	5.000

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

Exhibit R-3, RDT&E Project Cost Analysis: PB 2022 Office of the Secretary Of Defense		Date: May 2021
Appropriation/Budget Activity 0400 / 4	**R-1 Program Element (Number/Name)** PE 0604294D8Z / *Trusted and Assured Microelectronics*	**Project (Number/Name)** 912 / *Create a Quantifiably Assured-Microelectronics Pipeline*

Product Development ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2020 Cost	FY 2020 Award Date	FY 2021 Cost	FY 2021 Award Date	FY 2022 Base Cost	FY 2022 Base Award Date	FY 2022 OCO Cost	FY 2022 OCO Award Date	FY 2022 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Create a Resilient and Robust Microelectronics Pipeline	MIPR	Defense Advanced Research Projects Agency, Air Force, Army, Navy, National Security Agency : Various	-	-		90.218	Mar 2021	16.700	Mar 2022	-		16.700	Continuing	Continuing	-
		Subtotal	-	-		90.218		16.700		-		16.700	Continuing	Continuing	N/A

	Prior Years	FY 2020		FY 2021		FY 2022 Base		FY 2022 OCO		FY 2022 Total	Cost To Complete	Total Cost	Target Value of Contract
Project Cost Totals	-	-		90.218		16.700		-		16.700	Continuing	Continuing	N/A

Remarks

Exhibit R-4, RDT&E Schedule Profile: PB 2022 Office of the Secretary Of Defense		Date: May 2021
Appropriation/Budget Activity 0400 / 4	**R-1 Program Element (Number/Name)** PE 0604294D8Z / *Trusted and Assured Microelectronics*	**Project (Number/Name)** 912 / *Create a Quantifiably Assured-Microelectronics Pipeline*

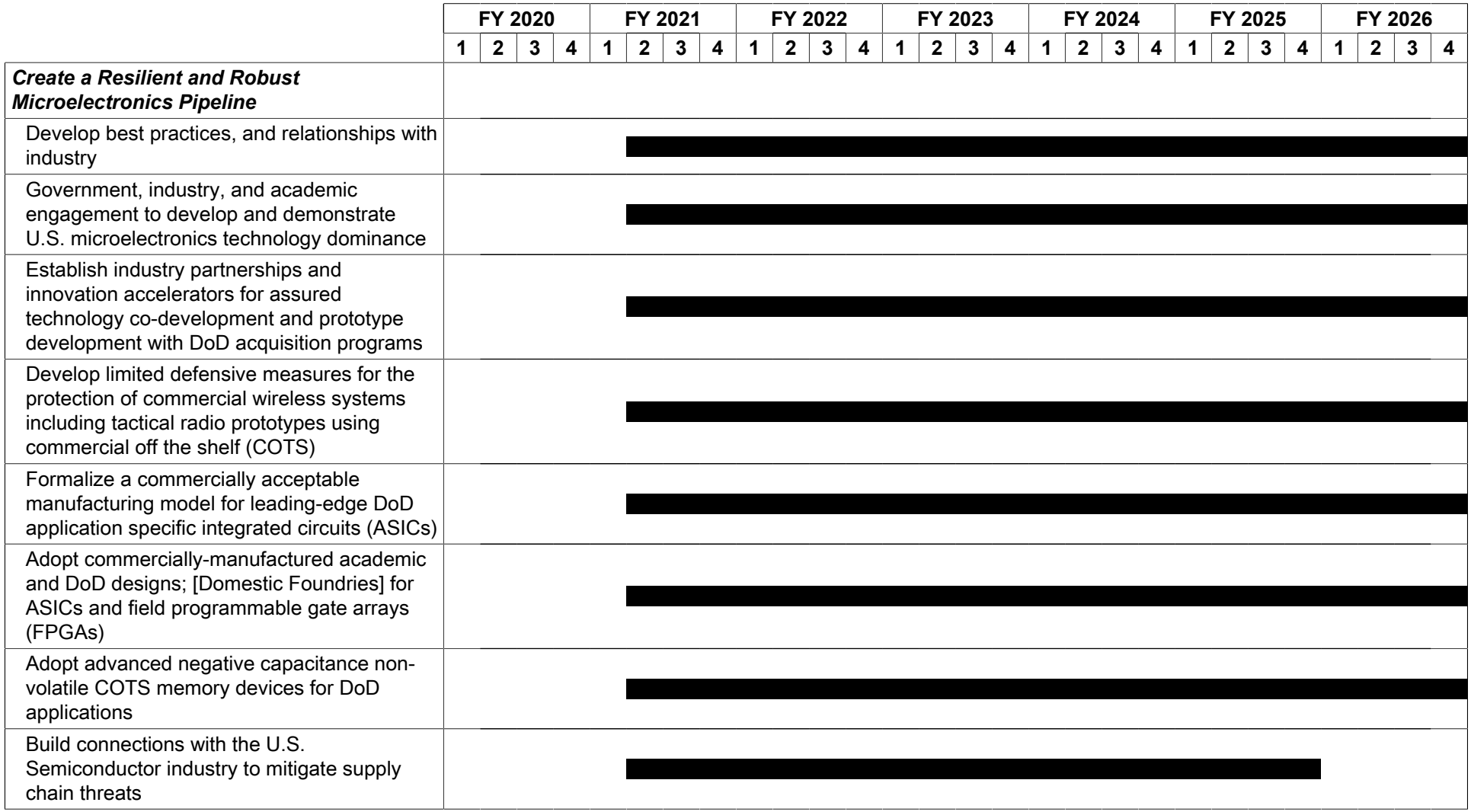

Exhibit R-4, RDT&E Schedule Profile: PB 2022 Office of the Secretary Of Defense		Date: May 2021
Appropriation/Budget Activity 0400 / 4	**R-1 Program Element (Number/Name)** PE 0604294D8Z / *Trusted and Assured Microelectronics*	**Project (Number/Name)** 912 / *Create a Quantifiably Assured-Microelectronics Pipeline*

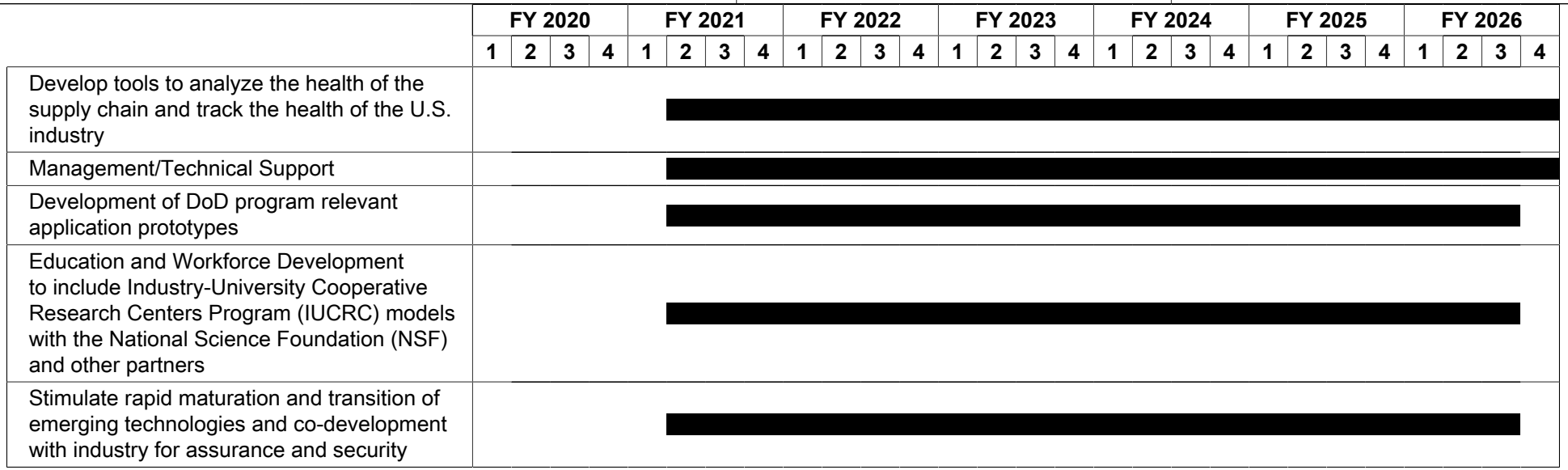

Exhibit R-4A, RDT&E Schedule Details: PB 2022 Office of the Secretary Of Defense		Date: May 2021
Appropriation/Budget Activity 0400 / 4	**R-1 Program Element (Number/Name)** PE 0604294D8Z / *Trusted and Assured Microelectronics*	**Project (Number/Name)** 912 / *Create a Quantifiably Assured-Microelectronics Pipeline*

Schedule Details

	Start		End	
Events by Sub Project	**Quarter**	**Year**	**Quarter**	**Year**
Create a Resilient and Robust Microelectronics Pipeline				
Develop best practices, and relationships with industry	2	2021	4	2026
Government, industry, and academic engagement to develop and demonstrate U.S. microelectronics technology dominance	2	2021	4	2026
Establish industry partnerships and innovation accelerators for assured technology co-development and prototype development with DoD acquisition programs	2	2021	4	2026
Develop limited defensive measures for the protection of commercial wireless systems including tactical radio prototypes using commercial off the shelf (COTS)	2	2021	4	2026
Formalize a commercially acceptable manufacturing model for leading-edge DoD application specific integrated circuits (ASICs)	2	2021	4	2026
Adopt commercially-manufactured academic and DoD designs; [Domestic Foundries] for ASICs and field programmable gate arrays (FPGAs)	2	2021	4	2026
Adopt advanced negative capacitance non-volatile COTS memory devices for DoD applications	2	2021	4	2026
Build connections with the U.S. Semiconductor industry to mitigate supply chain threats	2	2021	4	2025
Develop tools to analyze the health of the supply chain and track the health of the U.S. industry	2	2021	4	2026
Management/Technical Support	2	2021	4	2026
Development of DoD program relevant application prototypes	2	2021	3	2026
Education and Workforce Development to include Industry-University Cooperative Research Centers Program (IUCRC) models with the National Science Foundation (NSF) and other partners	2	2021	3	2026
Stimulate rapid maturation and transition of emerging technologies and co-development with industry for assurance and security	2	2021	3	2026