Exhibit R-2, **RDT&E Budget Item Justification:** PB 2023 Defense Advanced Research Projects Agency	**Date:** April 2022
Appropriation/Budget Activity 0400: *Research, Development, Test & Evaluation, Defense-Wide* / BA 3: *Advanced Technology Development (ATD)*	**R-1 Program Element (Number/Name)** PE 0603739E / *ADVANCED ELECTRONICS TECHNOLOGIES*

COST ($ in Millions)	Prior Years	FY 2021	FY 2022	FY 2023 Base	FY 2023 OCO	FY 2023 Total	FY 2024	FY 2025	FY 2026	FY 2027	Cost To Complete	Total Cost
Total Program Element	-	92.989	140.716	250.917	-	250.917	313.030	333.025	336.068	346.768	-	-
MT-15: *MIXED TECHNOLOGY INTEGRATION*	-	16.701	27.854	33.406	-	33.406	89.030	105.175	112.332	120.832	-	-
MT-16: *BEYOND SCALING ADVANCED TECHNOLOGIES*	-	76.288	112.862	217.511	-	217.511	224.000	227.850	223.736	225.936	-	-

A. Mission Description and Budget Item Justification

The Advanced Electronics Technologies Program Element is budgeted in the Advanced Technology Development Budget Activity because it seeks to design and demonstrate state-of-the-art manufacturing and processing technologies for the production of various electronics and microelectronic devices, sensor systems, integrated photonic-electronic components that have military applications and potential commercial utility. Introduction of advanced product design capability and flexible, scalable manufacturing techniques will enable the commercial sector to rapidly and cost-effectively satisfy military requirements.

The Mixed Technology Integration project funds the advanced development and demonstration of selected basic and applied electronics research programs. Examples of technologies with funded development and demonstration activities include, but are not limited to: reducing the size, weight, and power (SWaP) of components for laser weapon systems that will protect airborne platforms from emerging surface-to-air missiles; integrated photonic-electronic components for positioning, navigation and timing in GPS-denied environments; flexible, software-defined cameras that enable real-time image analysis of complex scenes to provide more actionable information; and optical communications systems that rely on no moving parts enabling their use on SWaP-restricted platforms. Funding under this project is intended to advance transitioning novel technologies to use, providing advanced components compatible with mid-term and other future warfighting requirements.

The Beyond Scaling Advanced Technologies Project supports activities to enable and accelerate the transition of disruptive microelectronics advancement, including those developed under the Beyond Scaling Sciences (ES-02) and Beyond Scaling Technology (ELT-02) projects. Funding under this project will include developing new technologies and capabilities in commercial settings, establishing access to these new processes and to commercial state-of-the-art foundries, enabling prototyping, developing manufacturable processes for integrated photonics, advancing new architectures and integration technologies for advanced field programmable gate arrays (FPGAs), and innovating back end of line technologies for wide bandgap semiconductors.

Exhibit R-2, **RDT&E Budget Item Justification:** PB 2023 Defense Advanced Research Projects Agency	**Date:** April 2022
Appropriation/Budget Activity 0400: *Research, Development, Test & Evaluation, Defense-Wide* / BA 3: *Advanced Technology Development (ATD)*	**R-1 Program Element (Number/Name)** PE 0603739E / *ADVANCED ELECTRONICS TECHNOLOGIES*

B. Program Change Summary ($ in Millions)	**FY 2021**	**FY 2022**	**FY 2023 Base**	**FY 2023 OCO**	**FY 2023 Total**
Previous President's Budget	95.864	116.716	0.000	-	0.000
Current President's Budget	92.989	140.716	250.917	-	250.917
Total Adjustments	-2.875	24.000	250.917	-	250.917
• Congressional General Reductions	0.000	0.000			
• Congressional Directed Reductions	0.000	0.000			
• Congressional Rescissions	0.000	0.000			
• Congressional Adds	0.000	24.000			
• Congressional Directed Transfers	0.000	0.000			
• Reprogrammings	0.212	0.000			
• SBIR/STTR Transfer	-3.087	0.000			
• Adjustments to Budget Year	-	-	250.917	-	250.917

Congressional Add Details ($ in Millions, and Includes General Reductions)	**FY 2021**	**FY 2022**
Project: MT-16: *BEYOND SCALING ADVANCED TECHNOLOGIES*		
Congressional Add: *ERI 2.0 - Congressional Add*	-	24.000
Congressional Add Subtotals for Project: MT-16	-	24.000
Congressional Add Totals for all Projects	-	24.000

Change Summary Explanation

FY 2021: Decrease reflects SBIR/STTR transfer offset by reprogrammings.
FY 2022: Increase reflects a Congressional add for ERI 2.0.
FY 2023: FY 2023 funding increase reflects the fact that the FY 2022 President's Budget request did not include out-year funding.

Exhibit R-2A, **RDT&E Project Justification:** PB 2023 Defense Advanced Research Projects Agency		**Date:** April 2022
Appropriation/Budget Activity 0400 **/** 3	**R-1 Program Element (Number/Name)** PE 0603739E **/** *ADVANCED ELECTRONICS TECHNOLOGIES*	**Project (Number/Name)** MT-15 **/** *MIXED TECHNOLOGY INTEGRATION*

COST ($ in Millions)	Prior Years	FY 2021	FY 2022	FY 2023 Base	FY 2023 OCO	FY 2023 Total	FY 2024	FY 2025	FY 2026	FY 2027	Cost To Complete	Total Cost
MT-15: *MIXED TECHNOLOGY INTEGRATION*	-	16.701	27.854	33.406	-	33.406	89.030	105.175	112.332	120.832	-	-
Quantity of RDT&E Articles	-	-	-	-	-	-	-	-	-	-		

A. Mission Description and Budget Item Justification

The Mixed Technology Integration project funds the advanced development and demonstration of selected basic and applied electronics research programs. Examples of technologies with funded development and demonstration activities include, but are not limited to: reducing the size, weight, and power (SWaP) of components for laser weapon systems that will protect airborne platforms from emerging surface-to-air missiles; integrated photonic-electronic components for positioning, navigation and timing in GPS-denied environments; flexible, software-defined cameras that enable real-time image analysis of complex scenes to provide more actionable information; and optical communications systems that rely on no moving parts enabling their use on SWaP-restricted platforms. Funding under this project is intended to advance transitioning novel technologies to use, providing advanced components compatible with mid-term and other future warfighting requirements.

B. Accomplishments/Planned Programs ($ in Millions)

B. Accomplishments/Planned Programs ($ in Millions)	FY 2021	FY 2022	FY 2023
Title: Wideband Secured and Protected Emitter and Receiver (WiSPER)	8.701	21.854	21.000

Description: The Wideband Secured and Protected Emitter and Receiver (WiSPER) program aims to develop an ultra-broadband technology platform to demonstrate a robust, secure, and protected communication link. WiSPER technology provides high signal coding gain to deliver a secured and protected link with significantly enhanced capacity for next generation DoD communications. Current terrestrial tactical radios operate with limited bandwidth at prescribed low frequency bands, which are unable to support high capacity with multiple users and are vulnerable to interference and jamming. WiSPER technology addresses military needs for assured communications, throughput, security, and size, weight, and power limitations of future command, control, communications, computers, intelligence, surveillance and reconnaissance missions. The program will develop an ultra-broadband compact antenna, radio frequency front-end electronics, mixed-signal circuits, and waveform technologies. The WiSPER program will culminate with the integration and demonstration of a secured communication link. Technologies developed under the WiSPER program are planned for transition to the Services.

FY 2022 Plans:
- Optimize the secured radio transceiver design using modeling and simulation.
- Integrate first-generation functional test prototype of the secured radio transceiver.
- Test bench-top prototype secured radio transceiver in a laboratory environment, demonstrating spatial coding and first-generation featureless packet generation, transmission, and reception.

FY 2023 Plans:
- Design second-generation functional test prototype of the secured radio transceiver.

B. Accomplishments/Planned Programs ($ in Millions)	**FY 2021**	**FY 2022**	**FY 2023**
- Begin implementation of second-generation functional test prototype secured radio transceiver doubling accessible bandwidth with increased dynamic range and diversity. - Optimize the second-generation secured radio transceiver design using modeling and simulation. - Integrate second-generation functional test prototype of the secured radio transceiver into a transportable unit. ***FY 2022 to FY 2023 Increase/Decrease Statement:*** The FY 2023 decrease reflects minor program repricing.			
Title: Reconfigurable Imaging (ReImagine) ***Description:*** The Reconfigurable Imaging (ReImagine) program aims to create multi-functional readout integrated circuits (ROICs) that fundamentally change the way camera systems collect, process, and relay image information. This is accomplished by adding multifunctional flexibility in the ROIC. Today, most cameras are designed to capture high quality imagery at standard frame rates. These traditional camera architectures collect a single type of data across the full image frame. Specialty cameras can be used to capture different spatial, spectral, or temporal data but are rarely deployed because of the cost and complexity of adding imaging subsystems for niche measurements. Although these measurements typically are desired only for specific features or regions of interest (ROIs) in a scene, the cameras collect specialized data over the full image frame. The ReImagine architecture, conversely, would enable a single, real-time reconfigurable, software-defined camera system with the ability to collect different data in different ROIs. Depending on the need, a ReImagine imager would be able to selectively collect and simultaneously process data from a specific ROI, for example, at a higher resolution, at a higher frame rate, or with 3-D depth information. The system would interface with virtually any sensor and could therefore be used in any spectral band. By demonstrating more efficient data collection and computation across ROIs, ReImagine ROICs will enable real-time analysis of much more complex scenes and provide more actionable information than has ever been possible. Technologies from this program are intended for transition to the Air Force, Navy, and Army. ***FY 2022 Plans:*** - Fully demonstrate the updated ReImagine reconfigurable sensing system concept. - Engage with potential transition partners for relevant applications. ***FY 2022 to FY 2023 Increase/Decrease Statement:*** The FY 2023 decrease reflects program completion.	6.000	6.000	-
Title: Modular Efficient Laser Technology (MELT) ***Description:*** The Modular Efficient Laser Technology (MELT) program will demonstrate the first compact, high-power laser tile as the key building block to enable the next generation of scalable high energy laser (HEL) sources for laser weapon systems (LWS). Today's LWS use fiber laser array HEL sources, complex optical benches, and beam directors. These systems are large	-	-	12.406

Exhibit R-2A, **RDT&E Project Justification:** PB 2023 Defense Advanced Research Projects Agency		**Date:** April 2022
Appropriation/Budget Activity 0400 **/** 3	**R-1 Program Element (Number/Name)** PE 0603739E **/** *ADVANCED ELECTRONICS TECHNOLOGIES*	**Project (Number/Name)** MT-15 **/** *MIXED TECHNOLOGY INTEGRATION*

B. Accomplishments/Planned Programs ($ in Millions)	**FY 2021**	**FY 2022**	**FY 2023**
and heavy, contain large numbers of individual components, and require skilled labor to fabricate and integrate. This makes current LWS difficult and costly to manufacture, limiting their deployment and application. MELT will leverage recent advances in coherent beam combining and photonic integrated circuits (PICs) fabrication techniques to develop tiled arrays integrated with semiconductor-based optical systems, low-loss waveguides, optical interconnects, and application-specific integrated circuit (ASIC) into a compact laser tile that can be integrated with a supporting backplane to provide scalable HEL sources. This will provide the LWS developer a scalable HEL architecture that maintains excellent beam quality and allow LWS deployment on SWaP-constrained platforms. MELT will leverage a mature industrial base for semiconductor manufacturing, as well as recent advances in photonic integrated circuits, coherent beam combining algorithms, semiconductor cooling techniques, and optical lithography to achieve its program goals. Technologies from this program are intended for transition to Army, Air Force, and Navy. ***FY 2023 Plans:*** - Design semiconductor emitters with improved electrical-to-optical efficiency. - Demonstrate efficient beam combining with individual semiconductor emitters. - Develop algorithm and sensing architecture to control beam coherence. ***FY 2022 to FY 2023 Increase/Decrease Statement:*** The FY 2023 increase reflects program initiation.			
Title: Precise Robust Inertial Guidance for Munitions (PRIGM) ***Description:*** The Precise Robust Inertial Guidance for Munitions (PRIGM) program developed inertial sensor technologies for positioning, navigation, and timing (PNT) in GPS-denied environments. The program exploited advances in integrating photonic (light-manipulating) components into electronics and in employing microelectromechanical systems (MEMS) as high-performance inertial sensors for use in extreme environments. PRIGM focused on developing and transitioning a Navigation-Grade Inertial Measurement Unit (NGIMU), a state-of-the-art MEMS device, and advancing state-of-the-art MEMS gyros from Technology Readiness Level (TRL) 3 devices to a TRL 6 transition platform. Service laboratories were actively involved throughout program development and remain engaged to facilitate transition of NGIMU prototypes, which will be delivered at the program conclusion.	2.000	-	-
Accomplishments/Planned Programs Subtotals	16.701	27.854	33.406

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

Exhibit R-2A, **RDT&E Project Justification:** PB 2023 Defense Advanced Research Projects Agency		**Date:** April 2022
Appropriation/Budget Activity 0400 **/** 3	**R-1 Program Element (Number/Name)** PE 0603739E **/** *ADVANCED ELECTRONICS TECHNOLOGIES*	**Project (Number/Name)** MT-16 **/** *BEYOND SCALING ADVANCED TECHNOLOGIES*

COST ($ in Millions)	Prior Years	FY 2021	FY 2022	FY 2023 Base	FY 2023 OCO	FY 2023 Total	FY 2024	FY 2025	FY 2026	FY 2027	Cost To Complete	Total Cost
MT-16: *BEYOND SCALING ADVANCED TECHNOLOGIES*	-	76.288	112.862	217.511	-	217.511	224.000	227.850	223.736	225.936	-	-
Quantity of RDT&E Articles	-	-	-	-	-	-	-	-	-	-		

A. Mission Description and Budget Item Justification

The Beyond Scaling Advanced Technologies Project supports activities to enable and accelerate the transition of disruptive microelectronics advancement, including those developed under the Beyond Scaling Sciences (ES-02) and Beyond Scaling Technology (ELT-02) projects. Funding under this project will include developing new technologies and capabilities in commercial settings, establishing access to these new processes and to commercial state-of-the-art foundries, enabling prototyping, developing manufacturable processes for three-dimensional heterogeneous integration (including integrated photonics), advancing new architectures and integration technologies for advanced field programmable gate arrays (FPGAs), and innovating back end of line technologies for wide bandgap semiconductors.

B. Accomplishments/Planned Programs ($ in Millions)

B. Accomplishments/Planned Programs ($ in Millions)	FY 2021	FY 2022	FY 2023
Title: Programmable Logic for Applications In Defense (PLAID)	30.000	38.500	30.000

Description: The Programmable Logic for Applications In Defense (PLAID) program is developing a heterogeneous compute platform that can support processing of large data arrays. Current computing architectures are subject to scaling, bandwidth, and memory limitations, and the large size of today's chips limits the movement of data resulting in a fundamental trade-off between circuit size and data throughput. The PLAID program will break this paradigm with new architecture development and will achieve more than a 10X increase in on-chip bandwidth. In addition to the development of this new device, the PLAID program will expedite deployment into DoD systems by engaging the defense industrial base to map DoD-relevant radio frequency (RF) processing problems onto the new architecture. These RF problems may include element-level digital beamforming, multi-target tracking radar applications, and synthetic aperture radar processing. Once applications are mapped onto the new processor, the implementation will be programmed and tested with the intent that the use of the new device developed by commercial industry will directly transition into an asymmetric advantage for the DoD and will be used by the defense industrial base in emerging applications.

FY 2022 Plans:
- Demonstrate five-wafer stack with a complete reliability assessment.
- Freeze device definition in preparation for completion of physical design.
- Demonstrate full-chip model with fabric place and route using a commercial design environment.
- Engage with transition partners to identify relevant applications.
- Quantify DoD system application trade-offs with respect to how algorithms map into the device programming.

FY 2023 Plans:

B. Accomplishments/Planned Programs ($ in Millions)

- Complete device verification and characterization for production quality.
- Release completed designs for fabrication.
- Demonstrate early functional tests in a commercial design environment.
- Expand engagement with transition partners to include planning for memoranda of understanding and agreement.

FY 2022 to FY 2023 Increase/Decrease Statement:
The FY 2023 decrease reflects a shift from fabrication to final testing.

	FY 2021	FY 2022	FY 2023
Title: Technologies for Mixed-mode Ultra Scaled Integrated Circuits (T-MUSIC)	13.000	20.500	7.511

Description: The Technologies for Mixed-mode Ultra Scaled Integrated Circuits (T-MUSIC) program is developing an on-shore semiconductor foundry platform for very wide band radio frequency (RF) mixed-mode integrated circuit analog-to-digital converters for commercial and military systems. Mixed-mode circuits take analog and RF signals and transform them to digital data for processing in computing systems. As defense and commercial wireless applications move to higher frequencies in order to carry more data traffic, integrating the broadband mixed-mode circuitry with high speed digital processing logic onto one chip becomes imperative to avoid data transfer bottlenecks. T-MUSIC seeks to integrate high-speed, high-performance analog and digital electronics together in highly-scaled silicon complementary metal-oxide semiconductor (CMOS) foundries on-shore. Such processes will enable the high levels of integration and performance needed for DoD-relevant and commercial 5G/6G applications. A goal of the T-MUSIC program is to enable very wide bandwidth wireless operations beyond 100 gigahertz (GHz) with low noise and high dynamic range. In addition, T-MUSIC aims to develop next-generation terahertz (THz) mixed-mode devices based on the advanced digital CMOS fabrication platform. The T-MUSIC program will establish advanced on-shore foundry capabilities to establish a long-term domestic world-class RF mixed-mode system-on-chip technology for intended transition to DoD and commercial applications.

FY 2022 Plans:
- Demonstrate foundational mixed-mode analog and digital circuit building blocks at 400 GHz fabricated in domestic foundries.
- Develop the processes and specifications for next-generation 600 GHz high speed mixed-mode device technologies.
- Optimize and demonstrate advanced materials, scaled THz device structures, and integration processes based on program-developed domestic CMOS process platform.
- Work with potential transition partners to identify applications of T-MUSIC technologies.

FY 2023 Plans:
- Demonstrate foundational mixed-mode analog and digital circuit building blocks at 600 GHz fabricated in domestic foundries.
- Continue to optimize and demonstrate advanced materials, scaled THz device structures, and integration process based on program-developed domestic CMOS process platform.

Exhibit R-2A, **RDT&E Project Justification:** PB 2023 Defense Advanced Research Projects Agency		**Date:** April 2022
Appropriation/Budget Activity 0400 / 3	**R-1 Program Element (Number/Name)** PE 0603739E / *ADVANCED ELECTRONICS TECHNOLOGIES*	**Project (Number/Name)** MT-16 / *BEYOND SCALING ADVANCED TECHNOLOGIES*

B. Accomplishments/Planned Programs ($ in Millions)	**FY 2021**	**FY 2022**	**FY 2023**
- Work towards transition of T-MUSIC technologies for application in commercial and defense sectors. ***FY 2022 to FY 2023 Increase/Decrease Statement:*** The FY 2023 decrease reflects the shift from demonstrating foundational mixed-mode analog/digital building blocks in domestic foundries to transition.			
Title: Photonics in the Package for Extreme Scalability (PIPES)	11.000	13.000	5.000

Description: The Photonics in the Package for Extreme Scalability (PIPES) program aims to develop optical signaling technologies for digital microelectronics. Distributed and parallel computing architectures are now pervasive across all size scales, from personal-scale multicore processing units to enterprise-scale high performance computing systems, and span application domains from consumer electronics to DoD systems. Increasingly, however, the benefits of parallelism are constrained not by the limits of computation at individual nodes but by the movement of data between nodes. PIPES will advance microelectronics capabilities by intimately integrating photonics with advanced integrated electronics to yield system connectivity with an unprecedented combination of high aggregate bandwidth, power efficiency, channel density, and link reach. Specifically, PIPES will develop photonic input/output (I/O) capability for application-specific integrated circuits and Field-Programmable Gate Arrays (FPGAs) that are widely used in advanced DoD sensors and radio frequency systems. The goal of the program is improving I/O bandwidth density, efficiency, and reach by more than 100X to enable disruptive DoD system parallelism and performance scaling. As PIPES technologies mature, they are anticipated to proliferate into central processing units, graphical processing units, and emerging tensor-flow processing units that will impact a wide range of dual-use applications including artificial intelligence, machine learning, large scale emulation, and high performance computing. Technologies from this program are intended for transition to larger scale commercial performers and the Services.

FY 2022 Plans:
- Mature FPGAs with optical interfaces for transition to commercial and DoD applications.
- Develop domestic photonics interconnect capabilities to facilitate DoD access to key silicon photonics fabrication and packaging resources.
- Engage with Service transition partners.

FY 2023 Plans:
- Deliver prototype units of leading FPGAs with integrated photonic interconnect for Government evaluation.
- Continue to develop domestic photonic interconnect capabilities with emphasis on an accessible ecosystem for integration, assembly and packaging.
- Mature next-generation photonic link capabilities with ten times better efficiency through novel low-loss optical designs and closer electronic-photonic integration.

B. Accomplishments/Planned Programs ($ in Millions)	**FY 2021**	**FY 2022**	**FY 2023**
- Continue to develop transition opportunities within the DoD. ***FY 2022 to FY 2023 Increase/Decrease Statement:*** The FY 2023 decrease reflects the shift from integration and demonstration to commercialization.			
Title: Next Generation Microelectronics Prototyping - Public-Private Partnerships	-	-	175.000

Description: Next Generation Microelectronics Prototyping - Public-Private Partnerships plans, establishes, and supports public-private partnerships to manufacture next-generation microsystems using three-dimensional heterogeneous integration (3DHI), including design, fabrication, packaging, assembly, and testing. This capability, a National Network for Next Generation Microelectronics Manufacturing, will emphasize design innovations to sustain U.S. leadership in semiconductors and enhance the use of manufacturing automation in the design, assembly, and testing of 3DHI prototypes. The baseline capability will allow users from across the country to quickly and efficiently develop working prototypes based on early-stage R&D. This will enable a wide range of organizations and stakeholders to accelerate a domestic 3DHI ecosystem, similar to how foundry access enabled fabless design companies and their associated ecosystems to proliferate.

This research service will feature a baseline fabrication capability for research prototypes via a stable 3DHI process design kit. Users of the research service will have the ability to join multi-project demonstrations runs or dedicated taxi runs. This national accelerator will remove a major impediment to the domestic development of next-generation three-dimensional microsystems and will extend research capabilities beyond those currently being developed worldwide. The research services will incorporate the ability to fabricate unique microsystem prototypes using a wide range of devices and materials, integrating the most advanced manufacturing and assembly technologies across silicon, compound semiconductors, photonics, MEMS, and other advanced microelectronics technologies. Applied research related to this effort is funded within PE 0602716E, Project ELT-02.

FY 2023 Plans:
- Determine the capabilities needed to support 3DHI prototyping, including electronic design automation, security, metrology, and advanced packaging toolsets.
- Identify facilities with base capabilities suited to expanding to new 3DHI manufacturing techniques.
- Create a development plan for automated assembly and advanced packaging toolsets.
- Prepare a maturation plan for electronic design automation for custom assembly and advanced packaging.
- Establish a National Network for Next Generation Microelectronics Manufacturing public-private partnership for developing pre-competitive technologies that enables the next generation of manufacturing and accelerates the transfer of innovation from research to prototyping, by enhancing the ability of users to access design, metrology, assembly and advanced packaging resources.

Exhibit R-2A, **RDT&E Project Justification:** PB 2023 Defense Advanced Research Projects Agency		**Date:** April 2022
Appropriation/Budget Activity 0400 **/** 3	**R-1 Program Element (Number/Name)** PE 0603739E **/** *ADVANCED ELECTRONICS TECHNOLOGIES*	**Project (Number/Name)** MT-16 **/** *BEYOND SCALING ADVANCED TECHNOLOGIES*

B. Accomplishments/Planned Programs ($ in Millions)	**FY 2021**	**FY 2022**	**FY 2023**
- Coordinate with interagency forums to implement the national strategy for microelectronics research and development including planning for the National Network for Next Generation Microelectronics Manufacturing public-private partnership goals to be coordinated with the other public-private partnerships under development within DoD and other agencies. ***FY 2022 to FY 2023 Increase/Decrease Statement:*** The FY2023 increase reflects program initiation.			
Title: Millimeter Wave Digital Arrays (MIDAS) ***Description:*** The Millimeter Wave Digital Arrays (MIDAS) program is developing a common millimeter wave phased array tile that is scalable to large arrays to provide wideband frequency agility from 18 gigahertz (GHz) to 50 GHz with element-level digital beamforming. Millimeter wave systems are used today to achieve physical security through the use of narrow antenna beams in a small form-factor for applications that include satellite communications and tactical line-of-sight communications such as in the F-22 and F-35. One of the challenges of using directional communications is establishing a link when both platforms are mobile. Element-level digital beamforming allows a platform to listen in all directions to facilitate discovering and linking with neighboring platforms. Digital beamforming also enables multiple beams so that one platform can communicate with several neighbors simultaneously, increasing network throughput and robustness against unexpected outages. To achieve these goals, MIDAS is developing a common digital phased array tile that can be used to build large arrays from this common block. MIDAS uses advanced complementary metal oxide semiconductor (CMOS) technology to develop the core transceiver elements at a size and power consumption compatible with current millimeter wave systems, and employs a combination of advanced packaging and high-performance compound semiconductors to build the power amplifiers and wideband apertures necessary to make a complete system. Technologies from this program are intended for transition through commercial industry to the Services. ***FY 2022 Plans:*** - Complete fabrication of millimeter wave 64-element digital phased arrays in advanced CMOS co-integrated with compound semiconductor power amplifiers and wideband apertures and begin array testing. - Begin scaling 64-element designs and create test plans for millimeter wave 256-element digital phased arrays. - Complete advancements in the fundamental technologies relevant to millimeter wave digital arrays in the areas of converters, filters, oscillators, and wideband apertures. ***FY 2022 to FY 2023 Increase/Decrease Statement:*** The FY 2023 decrease reflects program completion.	14.555	10.862	-
Title: Beyond Scaling - Access ***Description:*** The Beyond Scaling - Access program demonstrates design and fabrication of advanced electronics, to include collaborations with leading industry players. Although the United States has led the development of advanced electronics and is	7.733	6.000	-

Exhibit R-2A, **RDT&E Project Justification:** PB 2023 Defense Advanced Research Projects Agency		**Date:** April 2022
Appropriation/Budget Activity 0400 **/** 3	**R-1 Program Element (Number/Name)** PE 0603739E **/** *ADVANCED ELECTRONICS TECHNOLOGIES*	**Project (Number/Name)** MT-16 **/** *BEYOND SCALING ADVANCED TECHNOLOGIES*

B. Accomplishments/Planned Programs ($ in Millions)	**FY 2021**	**FY 2022**	**FY 2023**
home to three of the five leading-edge silicon foundries, recent investments by foreign competitors are threatening this leadership. Additionally, the fabrication cost of next-generation microelectronics has increased at an alarming rate. While the commercial sector is able to spread these costs over a large volume of products, the low volumes used by the DoD creates a cost barrier to meeting its future technology needs. The Beyond Scaling - Access program forges forward-looking collaborations among the commercial electronics community, defense industrial base, university researchers, and the DoD to address domestic and DoD-available microelectronics capabilities. Activities include establishing design capabilities for advanced digital logic in state-of-the-art foundries; enabling domestic production of millimeter wave circuits for 5G applications, military communication systems, and DoD radar sensors; initializing prototyping facilities and other activities to enhance the likelihood for domestic production and implementation of leading edge technologies; and exploring microelectronics development and manufacturing capabilities aligned to DoD-specific environments. ***FY 2022 Plans:*** - Demonstrate architectures for systems-on-chip with improved computing efficiency for DoD embedded processing needs. - Engage with Service transition partners on novel circuit and memory architectures. ***FY 2022 to FY 2023 Increase/Decrease Statement:*** The FY 2023 decrease reflects program completion.			
Accomplishments/Planned Programs Subtotals	76.288	88.862	217.511

	FY 2021	**FY 2022**
Congressional Add: ERI 2.0 - Congressional Add	-	24.000
FY 2022 Plans: - Perform survey of potential user base, including defense, commercial and academic organizations, to assess three-dimensional heterogeneous integration (3DHI) capabilities that a public-private partnership should service. - Analyze projected commercial 3DHI packaging capabilities available in five years. - Determine baseline facility requirements needed to offer prototyping service of new 3DHI manufacturing techniques. - Define objectives for development plan for automated assembly and advanced packaging toolsets.		
Congressional Adds Subtotals	-	24.000

C. Other Program Funding Summary ($ in Millions)

N/A

Exhibit R-2A, **RDT&E Project Justification:** PB 2023 Defense Advanced Research Projects Agency		**Date:** April 2022
Appropriation/Budget Activity 0400 **/** 3	**R-1 Program Element (Number/Name)** PE 0603739E **/** *ADVANCED ELECTRONICS TECHNOLOGIES*	**Project (Number/Name)** MT-16 **/** *BEYOND SCALING ADVANCED TECHNOLOGIES*

C. Other Program Funding Summary ($ in Millions)

Remarks

D. Acquisition Strategy

N/A