Exhibit R-2, RDT&E Budget Item Justification: PB 2022 Defense Advanced Research Projects Agency	**Date:** May 2021
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 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	-	107.259	95.864	116.716	-	116.716	-	-	-	-	-	-
MT-15: *MIXED TECHNOLOGY INTEGRATION*	-	35.108	36.131	27.854	-	27.854	-	-	-	-	-	-
MT-16: *BEYOND SCALING ADVANCED TECHNOLOGIES*	-	72.151	59.733	88.862	-	88.862	-	-	-	-	-	-

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: (1) 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 is a continuation of DARPA's basic and applied research in this area and will support activities in large scale co-development with leading industry players to enable and accelerate transformative computing interactions with industry. Funding under this project will include developing new technologies and capabilities in commercial settings, establishing access to these new processes and commercial state-of-the-art (SOTA) foundries, developing manufacturable processes for integrated photonics, 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 2022 Defense Advanced Research Projects Agency	**Date:** May 2021
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 2020**	**FY 2021**	**FY 2022 Base**	**FY 2022 OCO**	**FY 2022 Total**
Previous President's Budget	123.616	95.864	142.412	-	142.412
Current President's Budget	107.259	95.864	116.716	-	116.716
Total Adjustments	-16.357	0.000	-25.696	-	-25.696
• Congressional General Reductions	0.000	0.000			
• Congressional Directed Reductions	0.000	0.000			
• Congressional Rescissions	0.000	0.000			
• Congressional Adds	0.000	0.000			
• Congressional Directed Transfers	0.000	0.000			
• Reprogrammings	-4.407	0.000			
• SBIR/STTR Transfer	-11.950	0.000			
• TotalOtherAdjustments	-	-	-25.696	-	-25.696

Change Summary Explanation

FY 2020: Decrease reflects the SBIR/STTR transfer and reprogrammings.

FY 2021: N/A

FY 2022: Decrease reflects completion of the Precise Robust Inertial Guidance for Munitions (PRIGM) program in FY 2021, as well as, the transition from prototype development to final demonstrations in the Reconfigurable Imaging (ReImagine) program.

Exhibit R-2A, RDT&E Project Justification: PB 2022 Defense Advanced Research Projects Agency		**Date:** May 2021
Appropriation/Budget Activity 0400 / 3	**R-1 Program Element (Number/Name)** PE 0603739E / *ADVANCED ELECTRONI CS TECHNOLOGIES*	**Project (Number/Name)** MT-15 / *MIXED TECHNOLOGY INTEGRATION*

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
MT-15: *MIXED TECHNOLOGY INTEGRATION*	-	35.108	36.131	27.854	-	27.854	-	-	-	-	-	-
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: (1) 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)	FY 2020	FY 2021	FY 2022
Title: Reconfigurable Imaging (ReImagine)	14.000	12.000	6.000
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 are typically only desired 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 (i.e., foveated imaging), 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 2021 Plans:*** - Complete functional verification testing of second-generation (Gen-2) ROIC tier 1.			

B. Accomplishments/Planned Programs ($ in Millions)	FY 2020	FY 2021	FY 2022
- Complete the design and build of the Gen-2 prototype camera that integrates the Gen-2 ROIC. ***FY 2022 Plans:*** - Fully demonstrate the updated ReImagine reconfigurable sensing system concept. - Engage with potential transition partners for relevant applications. ***FY 2021 to FY 2022 Increase/Decrease Statement:*** The FY 2022 decrease reflects a shift from development of a multi-functional digital ROIC camera prototype to conducting final demonstrations.			
Title: Wideband Secured and Protected Emitter and Receiver (WiSPER) ***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 2021 Plans:*** - Complete first-generation architecture study of the ultra-broadband, secure communication system. - Implement proof-of-concept designs of antenna, integrated circuits, and waveform for system demonstration. - Simulate and optimize the secured radio transceiver design. ***FY 2022 Plans:*** - Integrate first-generation functional test prototype of the secured radio transceiver. - Prepare laboratory environment for prototype secured radio transceiver testing. - Test prototype secured radio transceiver in laboratory environment. - Prepare to implement second-generation functional test prototype of the secured radio transceiver. ***FY 2021 to FY 2022 Increase/Decrease Statement:*** The FY 2022 increase reflects the program shifting from study and design to demonstrating and testing secured radio transceiver.	9.000	20.131	21.854
Title: Precise Robust Inertial Guidance for Munitions (PRIGM)	9.000	4.000	-

Exhibit R-2A, RDT&E Project Justification: PB 2022 Defense Advanced Research Projects Agency		Date: May 2021
Appropriation/Budget Activity 0400 / 3	**R-1 Program Element (Number/Name)** PE 0603739E / *ADVANCED ELECTRONI CS TECHNOLOGIES*	**Project (Number/Name)** MT-15 / *MIXED TECHNOLOGY INTEGRATION*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2020	FY 2021	FY 2022
Description: The Precise Robust Inertial Guidance for Munitions (PRIGM) program is developing inertial sensor technologies for positioning, navigation, and timing (PNT) in GPS-denied environments. These inertial sensors can provide autonomous PNT information when GPS is unavailable. The program exploits recent 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. Whereas conventional MEMS inertial sensors suffer from inaccuracies due to factors such as temperature sensitivity, photonics-based PNT techniques have demonstrated the ability to mitigate these inaccuracies. PRIGM is focused on developing and transitioning a Navigation-Grade Inertial Measurement Unit (NGIMU), a state-of-the-art MEMS device, to DoD platforms in 2022. PRIGM will advance state-of-the-art MEMS gyros from TRL 3 devices to a TRL 6 transition platform. The ultimate goal is to develop a complete MEMS-based NGIMU with a mechanical/electronic interface identical to existing DoD-standard tactical-grade MEMS IMUs, providing a drop-in replacement for existing DoD systems. Service laboratories have been actively involved throughout program development and remain engaged to facilitate transition of NGIMU prototypes, which will be delivered at the program conclusion. This program has applied research efforts funded in PE 0602716E, Project ELT-01. ***FY 2021 Plans:*** - Develop initial designs and simulations for millimeter-scale two-chip, low-power, near tactical grade Inertial Measurement Unit (IMU). - Deliver NGIMU prototypes to Service transition partners. ***FY 2021 to FY 2022 Increase/Decrease Statement:*** The FY 2022 decrease reflects program completion.			
Title: Rapid Array Development (RAD) ***Description:*** The Rapid Array Development (RAD) program investigated utilizing an immersive electromagnetic environment to understand the effects of electronic maneuvers and develop new electronic maneuver warfare (EMW) techniques for warfighter training. The program leveraged developments in flexible and adaptive radio frequency (RF) hardware, access to a larger variety of more powerful computing platforms, and advances in software virtualization to allow radical change to the development and deployment cycle for EMW techniques. Technologies developed under the RAD program were transitioned to the Services.	3.108	-	-
Accomplishments/Planned Programs Subtotals	35.108	36.131	27.854

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

Exhibit R-2A, RDT&E Project Justification: PB 2022 Defense Advanced Research Projects Agency		Date: May 2021
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D. Acquisition Strategy

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2022 Defense Advanced Research Projects Agency		**Date:** May 2021
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 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
MT-16: *BEYOND SCALING ADVANCED TECHNOLOGIES*	-	72.151	59.733	88.862	-	88.862	-	-	-	-	-	-
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 (SOTA) 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.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2020	FY 2021	FY 2022
Title: Beyond Scaling - Access	12.137	7.733	5.000
Description: The Beyond Scaling - Access program demonstrates design and fabrication of advanced electronics, including through collaborations with leading industry players. Although the United States has led the development of advanced electronics and is 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 2021 Plans:*** - Demonstrate application of Electronics Resurgence Initiative technologies in DoD-relevant applications. - Engage with relevant transition partners in the Services. - Produce prototype millimeter wave transmitter chips with high reliability and low cycle time. ***FY 2022 Plans:***			

Exhibit R-2A, RDT&E Project Justification: PB 2022 Defense Advanced Research Projects Agency		Date: May 2021
Appropriation/Budget Activity 0400 / 3	**R-1 Program Element (Number/Name)** PE 0603739E / *ADVANCED ELECTRONI CS TECHNOLOGIES*	**Project (Number/Name)** MT-16 / *BEYOND SCALING ADVANCED TECHNOLOGIES*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2020	FY 2021	FY 2022
- Explore the development of a domestic microelectronics prototyping infrastructure, to enable the rapid transition of advanced microelectronics technologies out of the laboratory and into systems. ***FY 2021 to FY 2022 Increase/Decrease Statement:*** The FY 2022 decrease reflects shift from developing technologies to supporting opportunities for domestic production of the technologies.			
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 18-50 gigahertz 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. We see this applied to 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 in mobile applications is the problem of knowing where to point the antenna when both platforms are mobile. This can be solved with digital beamforming to enable a mobile platform to listen in all directions with many antenna beams to facilitate neighbor discovery when transmitting. Digital beamforming also enables multiple beams to communicate with several neighbors simultaneously. This capability will increase the network throughput and robustness that will be tolerant to 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. The program is executed in two primary technical areas. First, advanced complementary metal oxide semiconductor (CMOS) technology is used to develop the core transceiver elements at a size and power consumption that is required to fit in the small size required by current millimeter wave systems. Second, a combination of advanced packaging and high-performance compound semiconductors is used to build the wideband antenna and front-end amplifiers necessary to make a complete system. Technologies from this program are intended for transition through commercial industry to the Services. ***FY 2021 Plans:*** - Finalize designs, fabricate, and test millimeter wave 64-element digital phased arrays in advanced CMOS co-integrated with compound semiconductor power amplifiers and wideband apertures. - Begin designs of millimeter wave 256-element digital phased arrays in advanced CMOS co-integrated with compound semiconductor power amplifiers and wideband apertures. - Finalize advancements in the fundamental technologies relevant to millimeter wave digital arrays in the areas of converters, filters, oscillators, and broadband apertures. ***FY 2022 Plans:*** - Begin fabrication of 256-element digital phased arrays in advanced CMOS co-integrated with compound semiconductor power amplifiers and wideband apertures.	17.200	12.000	8.050

Exhibit R-2A, RDT&E Project Justification: PB 2022 Defense Advanced Research Projects Agency		Date: May 2021
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B. Accomplishments/Planned Programs ($ in Millions)	FY 2020	FY 2021	FY 2022
- Demonstrate 256-element digital phased arrays for communications or remoting sensing applications. - Engage with transition partners for relevant applications. ***FY 2021 to FY 2022 Increase/Decrease Statement:*** The FY 2022 decrease reflects the shift from finalizing design and fabrication to demonstration.			
Title: Photonics in the Package for Extreme Scalability (PIPES) ***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 a factor of 100 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 2021 Plans:*** - Integrate silicon photonics and electronic drive circuitry, and characterize packaged photonic interconnect demonstrator performance to enable FPGAs with photonic interfaces. - Define system integration concepts that leverage PIPES photonic connectivity for defense applications. - Integrate and demonstrate innovative component technologies and characterize link performance of next-generation photonic interconnect capabilities. ***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 relevant transition partners from the Services.	7.000	10.000	10.000
Title: Technologies for Mixed-mode Ultra Scaled Integrated Circuits (T-MUSIC)	20.814	13.000	17.000

Exhibit R-2A, RDT&E Project Justification: PB 2022 Defense Advanced Research Projects Agency		Date: May 2021
Appropriation/Budget Activity 0400 / 3	**R-1 Program Element (Number/Name)** PE 0603739E / *ADVANCED ELECTRONI CS TECHNOLOGIES*	**Project (Number/Name)** MT-16 / *BEYOND SCALING ADVANCED TECHNOLOGIES*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2020	FY 2021	FY 2022
Description: The Technologies for Mixed-mode Ultra Scaled Integrated Circuits (T-MUSIC) program is developing an on-shore ultra-broadband radio frequency (RF) mixed-mode semiconductor integrated circuits foundry platform for the critical interface to convert high speed analog signals to a digital representation 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 integration and performance needed for DoD-relevant and commercial 5G/6G applications. A goal of the T-MUSIC program is to enable wireless operations beyond 100 gigahertz with very wide bandwidth with low noise and high dynamic range. In addition, T-MUSIC aims to develop next-generation terahertz 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 2021 Plans:*** - Fabricate and demonstrate foundational mixed-mode analog/digital circuit building blocks in domestic foundries. - Develop the processes and specifications for next-generation 400 gigahertz high speed mixed-mode device technology. - Demonstrate advanced materials, preliminary device structures, and integration process for terahertz transistors based on domestic CMOS process platform. ***FY 2022 Plans:*** - Fabricate and demonstrate foundational mixed-mode analog/digital circuit building blocks based on the developed 400 gigahertz processes in domestic foundries. - Develop the processes and specifications for next-generation 600 gigahertz high speed mixed-mode device technology. - Optimize and demonstrate advanced materials, scaled terahertz device structures, and integration process based on domestic CMOS process platform. - Work with potential transition partners on applications of T-MUSIC technologies. ***FY 2021 to FY 2022 Increase/Decrease Statement:*** The FY 2022 increase reflects the shift to fabricating and demonstrating foundational mixed-mode analog/digital building blocks in domestic foundries.			
Title: Programmable Logic for Applications In Defense (PLAID)* ***Description:*** *Previously part of Beyond Scaling - Access	15.000	17.000	35.000

Exhibit R-2A, **RDT&E Project Justification:** PB 2022 Defense Advanced Research Projects Agency		**Date:** May 2021
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B. Accomplishments/Planned Programs ($ in Millions)	**FY 2020**	**FY 2021**	**FY 2022**
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 achieve more than a 10X bandwidth increase on-chip. 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 used by the defense industrial base in emerging applications. ***FY 2021 Plans:*** - Demonstrate direct current power delivery, thermal management, and signal integrity solutions for the proposed device. - Finalize architecture for the new heterogeneous computing platform. - Identify key DoD algorithms for mapping into the new device. ***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 in Vivado design environment. - Quantify DoD system applications trade-offs with respect to how algorithms map into the device programming. - Engage with transition partners to identify relevant applications. ***FY 2021 to FY 2022 Increase/Decrease Statement:*** The FY 2022 increase reflects a shift from initial concept to fabrication.			
Title: Dense Electronic Packaging for Heterogeneous Integration (DELPHI) ***Description:*** The Dense Electronic Packaging for Heterogeneous Integration (DELPHI) program will address the inherent limits of conventional two-dimensional (2D) electronics. Typically, electronics consisted of either single materials such as silicon or of compound semiconductors such as gallium arsenide (GaAs), indium phosphide (InP) or gallium nitride and featured device and circuit architectures in 2D. However, recent developments in the heterogenous integration of different materials systems and advancements in 3D fabrication establish the path to achieving electronic devices and circuits with dramatic increases in performance. This program will harness these advancements and expand on them by developing new semiconductor interconnect materials, heterogeneous integration approaches, and 3D fabrication techniques for advanced devices and circuits. This program will also create robust, compact, low loss passive components and combining networks necessary to realize efficient power	-	-	13.812

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B. Accomplishments/Planned Programs ($ in Millions)	**FY 2020**	**FY 2021**	**FY 2022**
amplifiers with heterogeneous integration. The technologies developed will support transitions including enabling emerging satellite communication and sensing missions to provide enhanced situational awareness. ***FY 2022 Plans:*** - Perform initial development of process flows for scaled transistor and interconnect technology for complex, heterogeneously integrated circuits. - Develop and refine approaches that facilitate integration of compound semiconductor devices/circuits with silicon technologies. ***FY 2021 to FY 2022 Increase/Decrease Statement:*** The FY 2022 increase reflects program initiation.			
Accomplishments/Planned Programs Subtotals	72.151	59.733	88.862

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A