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Exhibit R-2, RDT&E Budget Item Justification: PB 2023 Office of the Secretary Of Defense **Date:** April 2022

Appropriation/Budget Activity 0400: <i>Research, Development, Test & Evaluation, Defense-Wide I BA 3: Advanced Technology Development (ATD)</i>	R-1 Program Element (Number/Name) PE 0603338D8Z / <i>Defense Modernization and Prototyping</i>
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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	0.000	150.480	96.579	141.561	-	141.561	140.554	143.910	125.091	127.781	-	-
<i>720: Quick Reaction Special Projects (QRSP)</i>	0.000	40.432	49.044	72.316	-	72.316	69.133	70.829	50.275	51.281	-	-
<i>721: Emerging Capabilities Tech Dev (ECTD)</i>	0.000	86.958	47.535	69.245	-	69.245	71.421	73.081	74.816	76.500	-	-
<i>722: Time Sensitive Targeting Defeat (TSTD)</i>	0.000	17.768	-	-	-	-	-	-	-	-	-	-
<i>723: Red Teaming (RT)</i>	0.000	5.322	-	-	-	-	-	-	-	-	-	-

Note

New Start (Y/N): No

In FY 2022, funding for the Time Sensitive Targeting Defeat (TSTD) project transferred to Program Element 0603648D8Z Joint Capability Technology Demonstration (JCTD) for proper alignment and execution.

In FY 2022, the Red Teaming project code transitioned to a focus area under Project Code 721 Emerging Capabilities Technology Development (ECTD).

A. Mission Description and Budget Item Justification

In alignment with the National Defense Strategy, the Defense Modernization and Prototyping (DM&P) Program Element (PE) supports the Under Secretary of Defense for Research and Engineering (USD(R&E)) with innovation-focused prototyping from non-traditional sources that are applicable to Great Power Competition (GPC). Activities focus on early exploration of potentially game-changing emerging technologies and concepts; harnessing small and non-traditional business innovation to address Department of Defense (DoD) challenges; and, mid-term, mission-focused capability development of advanced systems to address DoD modernization needs. DM&P places an emphasis on fully transitioning these innovations and emerging technologies as capabilities to the Services, Combatant Commands (CCMDs), and other end users, with a target transition rate of 80 percent.

Executed in partnership with the Services, Joint Staff, and CCMDs, DM&P programs increase the speed of innovation through the use of an uncharacteristic RDT&E execution model that disburses funding across the four fiscal quarters following receipt of the appropriation. With funds available throughout the year of execution, DM&P enables the USD(R&E) to nurture innovation from small businesses and non-traditional performers, and to accelerate emerging and disruptive technologies. Accordingly, DM&P programs can be responsive and flexible to the DoD and warfighter needs, supporting rapid prototyping to meet immediate capability needs or prototyping game-changing technology for the purposes of GPC. Since program inception in 2006, this atypical execution model has enabled Quick Reaction Special Projects (QRSP) and Emerging Capabilities Technology Development (ECTD) to successfully act as innovation engines for the DoD. This execution model causes the

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DM&P PE to lag traditional RDT&E PE obligation and execution benchmarks; however, since inception both the QRSP and ECTD programs have achieved an unbroken 100 percent obligation rate.

With an emphasis on joint and interagency partnerships, DM&P project selection is guided by Department-level strategies and priorities, such as the Joint Warfighting Concept, the National Defense Strategy, DoD modernization, and the Combatant Commands' Integrated Priority Lists (IPLs). New projects are selected with inputs from the Services and Agencies, the Joint Staff, the CCMDs, the Strategic Capabilities Office, the Defense Innovation Unit, and other organizations within the DoD innovation ecosystem to deliver capabilities with the widest benefit to the joint warfighter; synchronize prototyping efforts across the DoD; and reduce duplication.

Leveraging innovative ideas from small business and non-traditional performers, academia, government labs, and the industrial base, DM&P funding supports development of risk-reducing joint prototypes to test and validate innovative technologies and concepts. ECTD prototyping projects increase the speed of technology innovation by reducing technology risk for emerging capabilities, enabling innovative developers to showcase new and maturing technologies. By exploring vulnerabilities in emerging technologies, ECTD red teaming activities enable the Department to make informed decisions early in the capability development cycle when design changes are cost effective and programs can be re-directed if developmental dead ends are discovered. QRSP prototypes quickly explore new, higher-risk technology areas, by partnering with small and non-traditional businesses that have the potential for immediate, game-changing impacts. Due to the relatively low average cost of projects, QRSP is able to explore higher-risk opportunities with potentially higher reward.

Completed DM&P projects transition to joint programs and joint warfighters through early operationally relevant prototypes; technology adoption into programs of record; integration into system level, multi-year joint demonstrations; multi-Service joint experiments like the Rapid Defense Experimentation Reserve; and, the Warfighting Lab Incentive Fund for further development of tactics, techniques, procedures (TTPs), and concepts of operation (CONOPs). DM&P targets a transition rate of about 80 percent to strike the optimal balance between pushing technical boundaries, and delivering prototypes with enduring value to the Department.

B. Program Change Summary (\$ in Millions)	FY 2021	FY 2022	FY 2023 Base	FY 2023 OCO	FY 2023 Total
Previous President's Budget	155.505	115.443	0.000	-	0.000
Current President's Budget	150.480	96.579	141.561	-	141.561
Total Adjustments	-5.025	-18.864	141.561	-	141.561
• Congressional General Reductions	-	-			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	-	15.600			
• Congressional Directed Transfers	-	-34.100			
• Reprogrammings	-	-			
• SBIR/STTR Transfer	-4.995	-			
• Adjustments to Budget Year	-	-	136.678	-	136.678
• Other Program Adjustments	-0.030	-	4.883	-	4.883
• FFRDC Reduction	-	-0.364	-	-	-

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Congressional Add Details (\$ in Millions, and Includes General Reductions)

	FY 2021	FY 2022
Project: 721: <i>Emerging Capabilities Tech Dev (ECTD)</i>		
Congressional Add: <i>Emerging Capabilities Technology Support</i>	7.500	-
Congressional Add: <i>Disruptive Air and Missile Defense</i>	5.000	-
Congressional Add: <i>Open Source Intelligence (OSI)</i>	3.000	3.000
Congressional Add: <i>Remote Advise and Assist (RAA) Technology Development</i>	8.000	-
Congressional Add: <i>Artificial Intelligence Enabled Sensor Network (AIESN)</i>	8.400	-
Congressional Add: <i>Hypersonic Modeling and Simulation Center of Excellence</i>	-	4.600
Congressional Add: <i>Ship-Based Multi-Sensor Prototype Development and Demonstration</i>	-	8.000
Congressional Add Subtotals for Project: 721	31.900	15.600
Project: 722: <i>Time Sensitive Targeting Defeat (TSTD)</i>		
Congressional Add: <i>Stratospheric Balloon Research</i>	10.000	-
Congressional Add Subtotals for Project: 722	10.000	-
Congressional Add Totals for all Projects	41.900	15.600

Change Summary Explanation

FY 2023 funding increase reflects the fact that the FY 2022 President's Budget request did not include out-year funding.

\$4.883 million FY 2023 Program Adjustment is an economic assumption inflation increase. \$34.100 million Congressional Directed Transfer in FY 2022 realigns funds from Project 721 to Program Element 0604331D8Z Rapid Prototyping Program (RPP) for execution of the Rapid Defense Experimentation Reserve (RDER).

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Appropriation/Budget Activity 0400 / 3					R-1 Program Element (Number/Name) PE 0603338D8Z / <i>Defense Modernization and Prototyping</i>				Project (Number/Name) 720 / <i>Quick Reaction Special Projects (QRSP)</i>			
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
<i>720: Quick Reaction Special Projects (QRSP)</i>	0.000	40.432	49.044	72.316	-	72.316	69.133	70.829	50.275	51.281	-	-
Quantity of RDT&E Articles	-	-	-	-	-	-	-	-	-	-		

A. Mission Description and Budget Item Justification

QRSP funds the development of risk-reducing prototypes to expedite delivery of effective, affordable, and critically needed technologies and warfighting concepts that maintain the Department’s advantage against peer and near-peer competitors. These lower-cost prototypes and QRSP’s innovative business processes give the Under Secretary of Defense for Research and Engineering (USD(R&E)) the agility to quickly explore new disruptive technology areas that have the potential for immediate, game-changing impacts. QRSP also enables the Department of Defense (DoD) to identify innovative solutions from small and non-traditional businesses not normally engaged by the DoD to address gaps and identify emerging technology trends. Providing innovative small and non-traditional businesses the opportunity to engage with various government audiences enables the DoD to quickly harness innovative solutions that could solve DoD challenges. Project selection is guided by department-level strategies and priorities, such as the Joint Warfighting Concept, the National Defense Strategy, and DoD’s modernization areas. Needs are identified and prototype projects are funded throughout the year of execution to demonstrate the feasibility of new technologies, enable integration into larger systems, and deliver affordable capabilities faster than standard acquisition cycles. With an emphasis on joint and interagency partnerships, QRSP matures capability options to anticipate and inform new acquisition pathways in addition to formal requirements and acquisition processes. Investing in high risk/high reward concepts, QRSP projects are typically phased with clear developmental milestones. This approach enables QRSP to rapidly mature innovative technologies; quickly identifying technological dead ends and prioritizing investment in projects demonstrating results. Individual projects generally span twelve to twenty-four months and typically at a cost of less than \$1.000 million per phase.

Recent success stories and significant transitions of note include:

- Virtual Raptor developed a suite of artificial intelligence (AI)-based tools to perform data analysis. Virtual Raptor’s tools can identify, visualize, and share phenomena, anomalies, and patterns in large and complex sets of mission data. The program successfully transitioned to the U.S. Air Force and U.S. Special Operations Command.
- Smart Sensor is an autonomous sensor platform that significantly accelerates the time it takes to conduct object identification, target recognition, and placement of effects on target tasks. The Smart Sensor capability successfully transitioned to the U.S. Air Force.

B. Accomplishments/Planned Programs (\$ in Millions)

	FY 2021	FY 2022	FY 2023
Title: Low Cost Innovative Projects (Projects less than \$1.000 million dollars per phase)	18.507	3.340	-
Description: Investing in high risk/high reward concepts, QRSP projects are typically phased with clear developmental milestones. This approach enables QRSP to rapidly mature innovative technologies; quickly identifying technological dead ends and prioritizing investment in projects demonstrating results. Individual projects generally span twelve to twenty-four months and at a cost of less than \$1.000 million per phase. In FY 2021, QRSP selected, executed, and transitioned multiple low cost projects, including:			

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B. Accomplishments/Planned Programs (\$ in Millions)	FY 2021	FY 2022	FY 2023
<ul style="list-style-type: none"> • Compact Micro-Electromechanical Systems (MEMS) LiDAR: This project developed and demonstrated a low-size, weight, and power (SWaP), MEMS LiDAR prototype to provide enhanced battlefield situational awareness for autonomous systems. The prototype transitioned to the Defense Threat Reduction Agency (DTRA). • Next Generation Imagers: This project prototyped a novel charge-coupled-device imager providing enhanced spectral and interface performance for surveillance applications. Development of the prototype capability will continue in FY 2022 with final transition to the U.S. Space Force and the National Aeronautics and Space Administration. • High Performance Solid Rocket Propellant: This project developed a novel, aluminum-lithium alloy to be evaluated as a fuel in solid rocket propellant. This new ingredient could increase munition performance, and removes a dangerous emission common in alternative formulations. This project transitioned to the U.S. Army. • Jaded Unicorn: This project developed and demonstrated an innovative electronic-warfare capability, easily deployable on existing platforms, to address modern challenges. The capability successfully transitioned to the U.S. Army, U.S. Navy, and U.S. Air Force. • SATURN Waveform: This project developed and demonstrated prototype waveforms for Second-generation Anti-jam Tactical Ultra High Frequency (UHF) Radio for NATO (SATURN) transceivers, used by the DoD and North Atlantic Treaty Organization (NATO) Partners. The waveforms offer increased anti-jam performance in contested environments, for effective Fully Networked Command, Control and Communication (FNC3). Development of the prototype capability will continue in FY 2022 with final transition to the Services through the U.S. Air Force. • Arcadia: This project is developing and demonstrating a prototype, low-SWaP, radio-frequency (RF) transceiver, leveraging a Modular Open System Approach (MOSA) architecture. Development of the prototype capability will continue in FY 2022 with final transition to the U.S. Air Force. • CAROUSEL: This project performed rapid analysis, modeling, and simulation to identify opportunities to optimize DoD multi-domain targeting systems. The results transitioned to the Services and Combatant Commands (CCMDs) to inform future development. • Global IoT Data Exploitation on the Network (GIDEON): This project developed and demonstrated a prototype for discovery, classification, and analysis of Internet of Things (IoT) devices to enhance warfighter situational awareness. The prototype transitioned to the U.S. Army. • Advanced Electronic Warfare (EW): This project developed a cohesive end-to-end EW technology designed to attack priority threat systems. The prototype transitioned to the U.S. Navy. • Intelligent Power Distribution System: This project prototyped an intelligent power distribution unit leveraging AI/ML to reduce power grid failures. This project transitioned to the U.S. Army. • Vulnerability Analysis and Testing Tools: This project developed a software toolset that allows the warfighter to rapidly identify cyber vulnerabilities. The project transitioned to the U.S. Navy and U.S. Marines Corps. 			

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B. Accomplishments/Planned Programs (\$ in Millions)

	FY 2021	FY 2022	FY 2023
<ul style="list-style-type: none"> • Advanced Off-board Payload: This project developed and successfully demonstrated an advanced payload prototype for use in off-board expendables. This prototype transitioned to the U.S. Air Force and U.S. Navy. • Autonomous Dynamic Control for Improved Intelligence, Surveillance, and Reconnaissance (ADCII): This project developed and demonstrated new sensing and target verification techniques for applications at the tactical-edge. This project transitioned to the Joint AI Intelligence Center (JAIC) Smart Sensor Program. • Bullseye: This project developed and demonstrated novel web-based tools to significantly reduce the targeting time line. Development of the prototype capability will continue in FY 2022 with final transition to the U.S. Air Force and joint partners. • Tactical Identification System: This project developed and demonstrated a compact, cellular phone or ATAK chassis compatible Raman spectrometer that rapidly identifies unknown chemical substances. The prototype transitioned to the U. S. Special Operations Command (USSOCOM). • Interpretable Machine Learning for Adversarial Attack Detection and Mitigation: This project developed autonomy algorithms to enhance operator decision making when mitigating cyber-attacks. Development of the capability will continue in FY 2022 with final transition to the U.S. Navy. • Non-Traditional Sensors: This project developed a novel method to leverage payloads as non-traditional sensors. This project transitioned to the U.S. Navy. • Over the Firewall Horizon Cyber Defense: This project developed a novel cyber sensing and analysis capability to detect malicious cyber activity in advance of an actual attack. This capability transitioned to DoD and interagency partners. • Millimeter-Wave Signal Processor (MMWSP): This project developed a microwave subsystem comprising a high-performance integrated circuit (IC) and associated control electronics to enhance traditional radio frequency (RF) front ends. This project successfully transitioned to the U.S. Navy. • Advanced Security Tag: This project is a novel capability to mark, scan, and catalog military components that will be used to track and control inventories while eliminating or mitigating the risks associated with parts tracking, quality control, and security management within maintenance and operational chains. This project successfully transitioned to the U.S. Navy. • Weapon System Virtual Reality (VR): This project executed risk reduction activities on new low-cost standalone VR headsets and cloud-based computing to inform the development of virtual training for pilots and aircrew. This capability will optimize flight training, and reduce flight hours and full-scale simulator training time. The project transitioned to the U.S. Air Force. • High Performance Propulsion System for Picosatellites: This project prototyped an innovative, low-cost nanoscale electrospray propulsion system that provides high thrust density for small satellites. Development of the prototype capability will continue in FY 2022 with final transition to multiple U.S. Government agencies. • Smart Probe: This project developed new tools and software for executing a novel approach to protocol modeling and analysis. This project successfully transitioned to the U.S. Navy and interagency partners. • Red Claw: This project developed and demonstrated the capability to detect, classify, locate, and track signals of interest. The capability transitioned to the U.S. Navy, U.S. Army, and USSOCOM. 			

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B. Accomplishments/Planned Programs (\$ in Millions)		FY 2021	FY 2022	FY 2023
<p>• Enhanced Low Resource Language Identification: This project developed novel tools and algorithms to identify low-resource/low-density languages in austere environments. This technology successfully transitioned to DoD agencies in support of U.S. Africa Command.</p> <p>FY 2022 Plans: In FY 2022, QRSP will complete execution and transition the following low cost projects:</p> <ul style="list-style-type: none"> • Next Generation Imagers: Development of the prototype capability will continue in FY 2022 with final transition to the U.S. Space Force and the National Aeronautics and Space Administration. • SATURN Waveform: Development of the prototype capability will continue in FY 2022 with final transition to the Services through the U.S. Air Force. • Arcadia: Development of the prototype capability will continue in FY 2022 with final transition to the U.S. Air Force. • High Performance Propulsion System for Picosatellites: Development of the prototype capability will continue in FY 2022 with final transition to multiple U.S. Government agencies. • Interpretable Machine Learning for Adversarial Attack Detection and Mitigation: Development of the capability will continue in FY 2022 with final transition to the U.S. Navy. • Bullseye: Development of the prototype capability will continue in FY 2022 with final transition to the U.S. Air Force and joint partners. <p>FY 2022 to FY 2023 Increase/Decrease Statement: The respective phase 2 projects will be completed in FY 2022.</p>				
<p>Title: Intelligent Sensing for Remote and Field Care (IS4RFC)</p> <p>Description: The IS4RFC project is prototyping an innovative ultrasound imaging system to enhance small unit medical self-sufficiency at the tactical edge in support of future distributed warfighting concepts such as the Army Multi-Domain Operations (MDO) and the USMC Expeditionary Advanced Base Operations (EABO). These concepts involve units separated by large geographic distances, operating in austere environments with area denial challenges which necessitate the need for intelligent medical devices that support trauma care in the field by overwhelmed or inexperienced care providers. Access to imaging systems at the tactical edge is a critical enabler, providing combat medical personnel with a new and more accurate tool to diagnose and triage the wounded. The IS4RFC project develops and demonstrates an innovative distributed aperture, high-precision 3D volume ultrasound imaging system that is easy-to-use, with drastically reduced cost and space, weight, and power (SWaP). In FY 2021, the prototype design of the integrated circuit (IC) was completed and work began to develop the initial benchtop prototype.</p> <p>FY 2022 Plans:</p>		1.000	1.000	-

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B. Accomplishments/Planned Programs (\$ in Millions)		FY 2021	FY 2022	FY 2023
<p>In FY 2022, the design and development of the MEMS transducer and the initial engineering tests of the integrated circuits (IC) will be completed. The team will complete the integration of the IC, MEMS transducer, and supporting ultrasound into an integrated prototype comprised of two-to-four imaging tiles with supporting circuitry to combine individual imaging tile data into one combined 3D image.</p> <p>FY 2022 to FY 2023 Increase/Decrease Statement: This project will transition to the U.S. Army and U.S. Special Operations Command (USSOCOM) in FY 2023.</p>				
<p>Title: Tactical Grade-Inertial Measurement Unit (TG-IMU)</p> <p>Description: The TG-IMU project developed and demonstrated a millimeter-scale, tactical grade IMU providing a 1,000 times reduction in volume and 10,000 times reduction in power compared to existing IMUs. The TG-IMU enables improved navigation in GPS-contested environments for small caliber munitions such as the Army Precision Guidance Kit-Anti-Jam (PGK-AJ), XM1155, and Excalibur HTK. In FY 2021, the project successfully demonstrated a low power ASIC and a six degree of freedom microelectromechanical system (MEMS) chip operating together to provide near tactical grade inertial performance. The Tactical Grade IMU project transitioned to the U.S. Army for further development and integration into their selected platforms.</p>		1.500	-	-
<p>Title: Automated Mitigation of Disinformation Amplifiers (AMDA)</p> <p>Description: The AMDA project developed and demonstrated a novel capability to counter Internet of Things (IOT)-based botnets relevant to Great Power Competition at scale by applying recent technology breakthroughs in automated vulnerability analysis. By targeting botnets that are being used to amplify disinformation messages, AMDA, in coordination with other government agencies, will provide a means of combating disinformation at scale. In FY 2021, AMDA completed the development of a proof-of-concept system for automating vulnerability research and transitioned to U.S. Air Force developers.</p>		1.575	-	-
<p>Title: Enhanced Geo-Registration for Edge Targeting Support (EGETS)</p> <p>Description: The EGETS project will develop a containerized Electro-optical (EO) and Infrared (IR) still imagery auto-mensuration and EO Full Motion Video (FMV) geo-registration software capability that is deployable to multiple target platforms. The system will demonstrate the ability to perform real-time precision geo-registration capabilities at the tactical edge. In FY 2021, the project developed a containerized capability that is deployable in multiple environments, including for tactical edge users. Tactical forces will be able to use imagery data in real-time for time-critical mission needs without requiring time-intensive reach back processing in the National System for GEOINT (NSG) enterprise, while also supporting enterprise users with reach-back.</p> <p>FY 2022 Plans:</p>		1.000	1.000	-

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B. Accomplishments/Planned Programs (\$ in Millions)		FY 2021	FY 2022	FY 2023
Work continues in FY 2022, to demonstrate EGETS's ability to perform real-time precision geo-registration capabilities at the tactical edge. FY 2022 to FY 2023 Increase/Decrease Statement: This project will transition to the U.S. Air Force, National Geospatial-Intelligence Agency, and DTRA in FY 2023.				
Title: The Gates Description: This is a classified program. Additional information is available upon request. FY 2022 Plans: This is a classified program. Additional information is available upon request. FY 2022 to FY 2023 Increase/Decrease Statement: The Gates will be completed in FY 2022.		1.500	1.500	-
Title: Project 2106 Description: This is a classified program. Additional information is available upon request. FY 2022 Plans: This is a classified program. Additional information is available upon request. FY 2022 to FY 2023 Increase/Decrease Statement: Project 2106 activities will be completed in FY 2022.		1.300	0.700	-
Title: Tactical Agency Capability - Human/Machine Team (TAC-H) Description: TAC-H is developing human-machine collaborative decision making tools to provide Special Operations Forces (SOF) units with faster-than-human response to threats. As battlefield environments become more complex and lethal the joint force requires capabilities which reduce cognitive burden and accelerate decision making by leveraging autonomous platforms and human-machine collaborative systems at the tactical edge. TAC-H will develop and demonstrate a real time decision making engine fusing disparate data sources and providing the warfighter recommended Courses of Action (COAs) based on the current operating environment. In FY 2021, the project completed the preliminary design review for the software components and conducted initial tests to improve the accuracy/efficiency of the software. FY 2022 Plans:		1.050	1.050	-

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B. Accomplishments/Planned Programs (\$ in Millions)		FY 2021	FY 2022	FY 2023
<p>In FY 2022, the TAC-H project plans to complete the development of the software package and will integrate it with the TAC-H hardware to conduct laboratory and field testing to validate the hardware and software system performance.</p> <p>FY 2022 to FY 2023 Increase/Decrease Statement: In FY 2023, the TAC-H project will transition to the United States Army Special Operations Command (USASOC).</p>				
<p>Title: Direct to Retina AR/VR Eyewear</p> <p>Description: The Direct to Retina project is developing the first and only Augmented Reality/Virtual Reality (AR/VR) eyewear glasses that will directly project images right onto the retina. This revolutionary technology will replace current day mixed reality technology which requires O-LED screens, heavy head gear, and bulky lenses. By directly projecting the image onto the retina, the operator will have complete 220 degrees' field of view, infinite depth of view, reduction in lag time, and increase battery life to at least ten hours of consistent usage. In FY 2021, the project completed the design and fabrication of the initial prototype components.</p> <p>FY 2022 Plans: In FY 2022, the Direct to Retina project will to continue to mature and test an operational prototype.</p> <p>FY 2022 to FY 2023 Increase/Decrease Statement: In FY 2023, the prototype will transition to a formal Program of Record within the U.S. Air Force Education and Training Command.</p>		1.000	1.000	-
<p>Title: Autonomy at the Tactical Edge Focus Area</p> <p>Description: This focus area explores technologies and capability concepts to enhance the lethality of the joint force, reduce the time to make critical decisions, autonomously distribute tasking and orders, and protect warfighters through increased use of intelligent networks, autonomous sensing platforms, and human-machine collaborative systems. Selected projects target key capabilities that enable leap-ahead improvements and intelligent autonomous systems with cost effective investments. These projects leverage advances in high performance computing, autonomy, and machine learning to transfer cognitive burden closer to the point of collection and action. Examples include agile computer vision systems; enhanced capabilities for multiple autonomous systems to cooperatively interact; tools to fuse and infer information from a wide variety of sensors and datasets; autonomous task discrimination and prioritization; autonomous operation in complex terrain; collaborative systems for efficient distribution of contested logistics; data preprocessing to reduce bandwidth requirements for fully integrated command and control; and human-machine collaborative decision making providing faster-than-human response to threats. These projects will also examine common software platforms and modular open architecture systems to reduce development cost, increase collaboration among manned and unmanned platforms, and inform requirements.</p> <p>FY 2022 Plans:</p>		-	6.676	12.000

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B. Accomplishments/Planned Programs (\$ in Millions)		FY 2021	FY 2022	FY 2023
<p>QRSP investment decisions are made during the execution year in response to DoD, CCMD, Service, and other government priorities. QRSP anticipates supporting eight to twelve projects in FY 2022.</p> <p>FY 2023 Plans: QRSP investment decisions are made during the execution year in response to DoD, CCMD, Service, and other government priorities. QRSP anticipates supporting thirteen to sixteen projects in FY 2023.</p> <p>FY 2022 to FY 2023 Increase/Decrease Statement: Funding for this focus area in FY 2023 increases to support acceleration of high priority autonomy prototyping efforts.</p>				
<p>Title: Targeted Prototyping for Increased Lethality and Survivability Focus Area</p> <p>Description: This focus area leverages opportunities for collaboration to rapidly mature and demonstrate advanced weapon systems through targeted prototyping of key enabling technologies. Selected projects extend Service and Defense Agency investments partnering with U.S. Special Operations Command (USSOCOM), Defense Innovation Unit (DIU), Service Rapid Capability Offices, Service laboratories, and other organizations that seek to mature technologies and future capabilities through near-term operational concepts. Example projects include dynamic data links for re-tasking and coordination of small munitions; new propellant formulations for extended range fire support; advanced materials to increase weapon system survivability; novel warhead designs to increase lethality; and low cost, extended range, swarming, loitering munitions. Through co-funding and invested transition partners, developed concepts will be rapidly deployed to assess utility and inform concepts of operation prior to initial operation, and to inform future acquisition programs.</p> <p>FY 2022 Plans: QRSP investment decisions are made during the execution year in response to DoD, CCMD, Service, and other government priorities. QRSP anticipates supporting seven to ten projects in FY 2022.</p> <p>FY 2023 Plans: QRSP investment decisions are made during the execution year in response to DoD, CCMD, Service, and other government priorities. QRSP anticipates supporting thirteen to seventeen projects in FY 2023.</p> <p>FY 2022 to FY 2023 Increase/Decrease Statement: Funding for this focus area in FY 2023 increases to support acceleration of high priority prototyping efforts.</p>		-	5.601	12.498
<p>Title: Persistent Intelligence, Surveillance and Reconnaissance (ISR) Focus Area</p> <p>Description: ISR sensor networks are critical for providing an asymmetric advantage against peer adversaries. Advances in distributed, interconnected sensors with fully networked command, control, and communications provide opportunities for new solutions to anti-access/area denial and persistent surveillance challenges. This focus area addresses emerging needs for persistent ISR capabilities, which provide improved ground, air, sea, and space situational awareness. Projects will mature</p>		-	5.166	10.820

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B. Accomplishments/Planned Programs (\$ in Millions)		FY 2021	FY 2022	FY 2023
<p>technologies and future capability concepts by developing platforms, sensors, and communication architectures that explore new or improved methods for robust, ad-hoc sensors networks; reliable communications; and collaboratively networked sensors to persistently operate within denied areas.</p> <p>FY 2022 Plans: QRSP investment decisions are made during the execution year in response to DoD, CCMD, Service, and other government priorities. QRSP anticipates supporting seven to ten projects in FY 2022.</p> <p>FY 2023 Plans: QRSP investment decisions are made during the execution year in response to DoD, CCMD, Service, and other government priorities. QRSP anticipates supporting eleven to fourteen projects in FY 2023.</p> <p>FY 2022 to FY 2023 Increase/Decrease Statement: Funding for this focus area in FY 2023 increases to support acceleration of high priority persistent ISR prototyping efforts.</p>				
<p>Title: Realizing Disruptive Technologies for DoD Modernization Focus Area</p> <p>Description: This focus area matures key capabilities that augment platforms, weapons, sensors, and other solutions to modernization challenges. Selected projects leverage investment from traditional and non-traditional industry partners; proven commercial- and government- off-the-shelf technologies; rapidly maturing technologies within Service laboratories, academia, and Federally Funded Research and Development Centers (FFRDCs); technologies from allied nations; and direct warfighter feedback to identify and address gaps within current and developing capabilities. These targeted investments accelerate capabilities to the warfighter and realize new disruptive technologies through low cost, rapid innovation within the development process of major system prototypes through the Strategic Capabilities Office, Defense Innovation Unit, and Service programs of record. Example projects include novel learning algorithms and next generation computing; adaptation of commercial cyber tools; proof of concept demonstrations of quantum sensors; unique applications of active and passive radio frequency architectures; and, early-stage concepts for highly-efficient directed energy subsystems.</p> <p>FY 2022 Plans: QRSP investment decisions are made during the execution year in response to DoD, CCMD, Service, and other government priorities. QRSP anticipates supporting eight to twelve projects in FY 2022.</p> <p>FY 2023 Plans: QRSP investment decisions are made during the execution year in response to DoD, CCMD, Service, and other government priorities. QRSP anticipates supporting sixteen to twenty projects in FY 2023.</p> <p>FY 2022 to FY 2023 Increase/Decrease Statement:</p>		-	6.456	15.500

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B. Accomplishments/Planned Programs (\$ in Millions)		FY 2021	FY 2022	FY 2023
Funding for this focus area in FY 2023 increases to support acceleration of high priority prototyping efforts.				
<p>Title: Distributed, Collaborative, Multi-Function Devices for Electromagnetic Spectrum Agility Focus Area</p> <p>Description: This focus area explores integrated, multi-function, net-centric electromagnetic spectrum (ES) concepts and technologies to enable a multi-domain, flexible, diverse, and interoperable ES architecture. In the modern battlespace, the ES is both a contested resource and unique domain requiring advanced maneuver. Tactics, techniques, and procedures are necessary to maintain access to ES and ensure maneuverability. Selected projects provide the architecture to ensure allied access, deny enemy use, and enable future capabilities for ES dominance. Examples include waveform agnostic apertures, amplifiers, and digital signal processing for multi-use systems (radar, communications, electronic warfare, sensing); advanced routing and artificial intelligence task and network routing for increase efficiency; and, ad hoc distributed apertures for collaborative electronic warfare (EW) distributed radar. Activities include refining software and algorithms; novel hardware and electronic components; and advanced timing and networking technologies that directly support emerging common standards for next generation distributed, collaborative, and multi-function devices.</p> <p>FY 2022 Plans: QRSP investment decisions are made during the execution year in response to DoD, CCMD, Service, and other government priorities. QRSP anticipates supporting seven to ten projects in FY 2022.</p> <p>FY 2023 Plans: QRSP investment decisions are made during the execution year in response to DoD, CCMD, Service, and other government priorities. QRSP anticipates supporting fourteen to eighteen projects in FY 2023.</p> <p>FY 2022 to FY 2023 Increase/Decrease Statement: Funding for this focus area in FY 2023 increases to support acceleration of high priority prototyping efforts.</p>		-	5.555	13.498
<p>Title: Multi-domain Experimentation and Demonstration Venues</p> <p>Description: Agile and flexible experimentation and demonstration venues for innovation discovery enable DoD to rapidly discover nascent novel technologies and emerging capabilities, particularly from small businesses and non-traditional performers. Leveraging a streamlined multi-domain process enables system developers to engage directly with the warfighter supporting the rapid discovery and transition of emerging technologies to Services, Defense Agencies and Combatant Command users.</p> <p>In FY 2021, 13 demonstration and early experimentation events were conducted featuring 223 innovative technologies from focus areas including autonomous technologies, virtual reality, machine learning, signature management, and cybersecurity. 105 of the technologies transitioned directly to DoD operational users or were leveraged by formal programs of record, including U.S. Army Maneuver Support Vessel (light) and U.S. Marine Corps (USMC) Amphibious Combat Vehicle. The venues also provided</p>		5.000	5.000	5.000

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B. Accomplishments/Planned Programs (\$ in Millions)		FY 2021	FY 2022	FY 2023
68 small businesses and non-traditional innovators with warfighter feedback critical to rapidly mature their technologies into viable prototypes.				
<p>FY 2022 Plans: Building on previous experience, six to eight demonstrations to accelerate innovation are planned for FY 2022. These demonstrations will focus on contested logistics, joint fires, information advantage, and fully networked command and control technologies. Capabilities evaluated will include: multimodal antenna systems; multi-domain autonomous systems; red teaming resilient networks; and, other priorities identified through engagement with stakeholders.</p> <p>FY 2023 Plans: Building on previous experience, six to eight demonstrations to accelerate innovation are planned for FY 2023. These demonstrations will focus on contested logistics, joint fires, information advantage, and fully networked command and control technologies. Capabilities evaluated will include: fully autonomous logistics systems; resilient command control networks for fires and secure communications in the denied environment; and, other priorities identified through engagement with stakeholders.</p>				
<p>Title: Strategic Multi-Layered Assessment (SMA) Reach Back Cell</p> <p>Description: The SMA Cell supports senior leadership in the Combatant Commands (CCMDs) with actionable assessments of complex operational and technical challenges. SMA efforts leverage multi-agency, multi-disciplinary approaches to answer the Combatant Commanders' key strategic questions that are not within the DoD's core competency. The assessments help maintain our competitive advantage in an increasingly complex global environment. The SMA Cell was established by the Joint Staff Deputy Director for Global Operations at the request of the Commander, U.S. Central Command (USCENTCOM). SMA assessments are framed during the year of execution and are in response to specific tasking from senior leadership in the CCMDs. The SMA Cell identifies options from across the U.S. Government, academia, and the private sector. SMA efforts are facilitated by the Joint Chiefs of Staff/J-3 Operations and are executed by the Office of the Under Secretary of Defense, Research and Engineering. The SMA Cell provides USCENTCOM with population-based and regional expertise in support of ongoing operations in the USCENTCOM area of responsibility.</p> <p>FY 2022 Plans: SMA will continue to actively work with the CCMDs and the Joint Staff to identify challenging problems that are not within the traditional areas of DoD expertise. These problems will be in direct support of CCMD senior leadership.</p> <p>FY 2022 to FY 2023 Increase/Decrease Statement: Funding for the SMA Reach Back Cell is realigned to support the development of hardware and software prototypes that address the Joint Warfighting Concepts and other DoD priorities.</p>		4.000	2.000	-
Title: Prototyping Through Non-Traditional Pathways		3.000	3.000	3.000

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B. Accomplishments/Planned Programs (\$ in Millions)	FY 2021	FY 2022	FY 2023
<p>Description: Prototyping Through Non-Traditional Pathways leverages technologies and emerging products developed by small, innovative businesses in the commercial sector including information technologies; internet-of-things sensors and adaptive networks; bio-medical advances; emerging quantum applications; and novel microelectronic/microelectromechanical system innovations. Ideas from non-traditional emerging technology companies are matched against DoD, Combatant Command, Service, and other government priorities. Promising solutions are selected for further test and evaluation and, if successful, rapid prototyping or fielding to transition commercial ideas with military utility. These efforts support the Department's objectives of leveraging commercial innovation to maintain technology superiority; increasing rate of technology maturation; exploring alternative and faster pathways for acquisition; and fielding affordable and effective joint mission capabilities.</p> <p>FY 2022 Plans: Prototyping Through Non-Traditional Pathways anticipates four to six reviews in FY 2022 with 20 to 25 resulting evaluations with potential for future prototypes. Each review focuses on identifying ideas in a specific topic area that can transition to meet joint operational needs through rapid prototyping. These reviews will be executed with DoD users and interagency partners.</p> <p>FY 2023 Plans: Prototyping Through Non-Traditional Pathways anticipates four to six reviews in FY 2023 with 20 to 25 resulting evaluations with potential for future prototypes. Each review focuses on identifying ideas in a specific topic area that can transition to meet joint operational needs through rapid prototyping. These reviews will be executed with DoD users and interagency partners.</p>			
Accomplishments/Planned Programs Subtotals	40.432	49.044	72.316

C. Other Program Funding Summary (\$ in Millions)

N/A

Remarks

D. Acquisition Strategy

Quick Reaction Special Projects (QRSP) will support FY 2023 performance metrics to transition projects to the joint warfighter and enable DoD modernization capabilities.

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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
721: Emerging Capabilities Tech Dev (ECTD)	0.000	86.958	47.535	69.245	-	69.245	71.421	73.081	74.816	76.500	-	-
Quantity of RDT&E Articles	-	-	-	-	-	-	-	-	-	-		

A. Mission Description and Budget Item Justification

ECTD funding supports the Under Secretary of Defense for Research and Engineering (USD(R&E)) mission to accelerate the development and fielding of overmatch capabilities to the warfighter by rapidly identifying and exploiting emerging technologies that are relevant to Great Power Competition (GPC). Prototyping activities focus on achieving capabilities required to implement the Joint Warfighting Concept, the National Defense Strategy, and meet key Defense modernization challenges in mission areas identified by the Joint Staff and USD(R&E) leadership. ECTD prototype activities enable developers to showcase new and maturing capabilities in realistic environments and against realistic threats with operational user involvement. Executed in close coordination with the Services, Combatant Commands (CCMDs), and Joint Staff, ECTD activities refine future warfighting concepts; inform Service program of record (PoR) capability requirements; and, provide residual joint warfighting capability through leave-behind prototypes.

Anticipated FY 2023 investments areas target the following key mission areas: Contested Logistics Operations; Advanced Electronic Warfare (EW); Fully Networked Command, Control, and Communication (FNC3); Joint Fires and Targeting; and Intelligence, Surveillance, and Reconnaissance (ISR) to support Time-Critical Targeting. Projects are identified through concepts received from the Services, CCMDs, industry, academia, Federally Funded Research and Development Centers (FFRDCs), University Affiliated Research Centers (UARCs), and Department of Defense (DoD) laboratories. Efforts are designed to encourage teaming between organizations to generate integrated concepts that result in leap-ahead warfighting capabilities. This process also focuses related Service and Defense Agency projects to a common set of gaps addressing peer engagements. Individual projects generally span two to three years, typically at a cost of less than \$15.000 million.

B. Accomplishments/Planned Programs (\$ in Millions)

	FY 2021	FY 2022	FY 2023
Title: Fully Networked Command, Control, and Communications (FNC3) Universal Command & Control (UC2)	28.033	5.000	-
Description: UC2 will provide an interface that enables future commanders to dynamically connect any sensor in any domain to any shooter. The FNC3 UC2 project addresses a Secretary of Defense priority for integrated communications and networking. By focusing on a DoD-wide standard for the data layer of machine-to-machine (M2M) Command and Control (C2), the project will develop and demonstrate an efficient, evolvable, and broadly applicable standard to increase the interoperability, flexibility, and resiliency of FNC3 systems. Aligned with the Joint All-Domain Command & Control (JADC2) concept, UC2 compliant systems will dynamically respond by forming new systems and system combinations to address unanticipated, asymmetric, and evolving threats. The FNC3 UC2 project will provide warfighters faster access to new capabilities, while simplifying development and sustainment life cycles, and lower operating and training costs. In FY 2021, development of the UC2 language and functional architecture continued forward towards the major version release 2.0. Initial implementation, unit testing, and integration activities to incorporate the UC2 standard into Service systems was completed. The initial phase of the UC2 project culminates			

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B. Accomplishments/Planned Programs (\$ in Millions)		FY 2021	FY 2022
<p>in an integrated, Joint-Service experiment planned for early FY 2022, which will assess the individual and interconnected performance of the UC2-adapted technologies and capabilities now resident within participating Service systems in a testing range environment.</p> <p>FY 2022 Plans: Building on the early FY 2022 experiment results, the UC2 standard language and functional architecture will continue to be iteratively refined to enable further integrated, Joint-Service experimentation more closely associated with an operationally relevant environment.</p> <p>FY 2022 to FY 2023 Increase/Decrease Statement: In FY 2023, the UC2 project transitions to the Services for further development and integration.</p>			
<p>Title: High-Altitude Optical Reconnaissance Unit and Sensor (HORUS)</p> <p>Description: HORUS is a prototype electro-optical/infrared system incorporating a modular open system architecture to provide an adaptable and evolvable capability. The HORUS prototype supports day or night operations providing multi-spectral, high-definition full motion video from extreme slant ranges. In FY 2021, fabrication of the two prototype HORUS units started. Work continues in FY 2022 using FY 2021 funds to complete prototype fabrication and testing prior to transitioning to U.S. Special Operations Command (USSOCOM) for final evaluation and operational use.</p>		10.000	-
<p>Title: Mission Engineering for Optimized Warfighting</p> <p>Description: Mission Engineering for Optimized Warfighting leverages modeling and simulation, wargaming, intelligence forecasts, mission design, and system engineering activities to refine Mission Prototyping Concepts to the Joint Warfighting Concept. Mission Engineering for Optimized Warfighting deconvolves Joint Warfighting Concepts into core capabilities assessing how each capability provided by a Mission Prototyping Concept aligns to achieve the overall mission objective. In FY 2021, analysis was completed on multiple promising concepts to refine system requirements and inform investment decisions for prototyping concepts.</p>		3.000	-
<p>Title: FNC3 Communications & Networking Infrastructure (C&NI) Broad Area Announcement (BAA) Task Area #3</p> <p>Description: This project executes prototyping activities to mature communication concepts that enable multi-domain communications. Prototyping activities focus on increasing communications resiliency to tactical and strategic assets. Prototype systems will inform the development of Service-specific solutions required to provide fully-networked, command, control, and communications (FNC3). In FY 2021, engineering studies for two concepts were completed prior to down-selection to single prototype concept. Maturation of the system design and initial prototype development was initiated in late FY 2021. Prototype</p>		5.950	-

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B. Accomplishments/Planned Programs (\$ in Millions)		FY 2021	FY 2022	FY 2023
development transitions to the U.S. Navy in FY 2022 to complete prototype development and demonstration by FY 2025. Additional details are classified.				
<p>Title: Polar Skywave Radar (PSR)</p> <p>Description: PSR directly supports the National Defense Strategy’s priority for increased lethality through persistent long range sensors to address the limitations of the current North Warning Systems and emerging threats. PSR matures radio frequency (RF) hardware and advanced radar processing algorithms to validate that over-the-horizon skywave radar is viable for a future surveillance system in the polar region. PSR focused on ten major tasks to extend skywave radar to the polar region including deployment of high frequency (HF) radar hardware for a scaled model and refinement of signal processing techniques. In FY 2021, PSR initiated efforts for expansion of the scaled model system to support higher fidelity testing and validation. Antenna arrays were enlarged and supporting components (amplifiers, receivers, sounder system) prepared for deployment. Performance prediction software models were compared to collected data for model verification and improvement.</p> <p>FY 2022 Plans: In FY 2022, PSR will complete system expansion to four times the initial size. Data collections will begin in the Spring, with additional collections in Summer and Fall. Adaptive algorithms will be tested and improved against collected data. Results will be incorporated into physics based and empirical models to enable operational performance predictions.</p> <p>FY 2022 to FY 2023 Increase/Decrease Statement: In FY 2023, PSR transitions to the U.S. Air Force Life Cycle Management Center (AFLCMC) for further development.</p>		0.500	1.800	-
<p>Title: Flying Self Emplacement Sea Glider (FSG) Unmanned Undersea Vehicle (UUV)</p> <p>Description: The FSG UUV merges two distinct unmanned systems: unmanned undersea vehicles (UUVs) and unmanned air vehicles (UAVs) resulting in a hybrid unmanned system capable of autonomous flight followed by transition to underwater operation. Flying emplacement allows these UUVs to avoid adverse ocean currents and long transit times to arrive at a needed location quickly, and without the logistic burden of a traditional manned deployment. Leveraging a novel Naval Research Laboratory (NRL) design, the FSG UUV will demonstrate this new capability to rapidly deploy undersea vehicles for a wide range of scientific and operational applications. This effort includes vehicle operation with a newly developed multi-mode avionics suite capable of command and control in both operating regimes, new power management architecture, and representative payloads. In FY 2021, a new avionics suite was integrated into the existing vehicles and the new multi-mode vehicle was vetted through a series of tests to include flights and swims up to and including a full weight flight to water landing.</p> <p>FY 2022 Plans:</p>		0.925	1.075	-

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B. Accomplishments/Planned Programs (\$ in Millions)		FY 2021	FY 2022	FY 2023
<p>Building on the initial series of flights and swims, further development and integration will be completed to optimize system performance, and to integrate a representative payload. In late FY 2022, prototype development will complete, transitioning to the U.S. Navy for a FY 2023 operational demonstration to validate system performance in an operationally relevant environment.</p> <p>FY 2022 to FY 2023 Increase/Decrease Statement: Development of the FSG UUV prototype completes in FY 2022 prior to transitioning to the U.S. Navy for further development and integration.</p>				
<p>Title: Echelon</p> <p>Description: This project will develop a common digital twin technical framework capable of supporting a wide variety of military RF systems. Echelon will support virtual testing of digital twin prototypes, enabling the Department of Defense to evaluate the effectiveness of prototype systems or subsystems in realistic environments and against red threats early in development. The developed high-fidelity multi-physics framework/testbed will enable Service research and acquisition programs to mature digital twin prototypes prior to purchasing extensive hardware enabling programs to shorten the development lifecycle of current system upgrades and next generation systems. This effort includes the hardware and software implementation of the first instantiation of the Echelon technical framework. During FY 2021, the Echelon project completed use case definitions, requirements derivation, and assessed/identified available tools to be leveraged for the digital twin framework baseline. In addition, the Echelon project established an initial model based systems engineering (MBSE) model for the project. This MBSE model will evolve as the digital twin framework is further developed in FY 2022 and FY 2023.</p> <p>FY 2022 Plans: Building on the initial MBSE Echelon model, FY 2022 activities will focus on developing and delivering the first release of the Echelon framework and testbed. This first release will enable project transition partners to begin building their respective Echelon compliant digital twins. In FY 2022, initial work will begin to validate the framework and testbed.</p> <p>FY 2023 Plans: FY 2023 tasks will complete the validation of the initial Echelon framework and testbed. Building on the first release of the Echelon framework, FY 2023 activities will focus on further development and validation of the framework's extensibility to support multi-function digital twins. Additional activities include mission engineering interfaces integration with the digital twin and testbed. FY 2023 will conclude with a multi-service demonstration of a digital twin within the Echelon testbed.</p> <p>FY 2022 to FY 2023 Increase/Decrease Statement: Funds support the demonstration of a digital twin in the Echelon framework to validate the prototype's capability to provide a virtual integrated, multi-function, net-centric environment. The majority of hardware and software development, integration, and</p>		1.400	5.500	7.900

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B. Accomplishments/Planned Programs (\$ in Millions)		FY 2021	FY 2022	FY 2023
testing occurs during FY 2023 with a surge during the final quarter to support final system development and validation. The developed capability will transition to the U.S. Air Force and U.S. Army upon project completion in FY 2023.				
<p>Title: Alternate Resilient Communications (ARC)</p> <p>Description: The ARC project is developing and demonstrating a prototype, communication capability to send and receive select command and control (C2) messages to users operating in challenging RF environments. In FY 2021, the project coordinated with adjacent systems and programs, the system was designed, and development of the initial prototype began. Additional details are classified.</p> <p>FY 2022 Plans: In FY 2022, activities will continue to develop a fully-integrated, functionally-relevant prototype system. Integration, assembly, and test of the ARC prototype will be conducted in laboratory and representative environments with operational components, subsystems and adjacent systems. Additional details are classified.</p> <p>FY 2022 to FY 2023 Increase/Decrease Statement: In FY 2023, the prototype will transition to the U.S. Navy and the U.S. Air Force for platform integration and demonstration in operationally-relevant environments. Additional details are classified.</p>		1.250	1.250	-
<p>Title: Conceptual Prototyping to Support DoD Modernization Needs</p> <p>Description: This focus area supports in-year identification and execution of innovative prototyping for cutting-edge land, sea, undersea, air, and space capabilities critical to the National Defense Strategy and modernization needs and objectives of the Department of Defense (DoD). This effort matures key component technologies and representative prototypes of fully networked command, control, and communications; 5G; space; autonomy; hypersonics; microelectronics; cyber; quantum science; directed energy; bio-technology; and machine learning systems to accelerate development and adoption of cost effective and interoperable solutions for defense challenges. Selected limited duration projects design, mature, and deliver conceptual prototypes to reduce the time from idea to demonstrated capability; mitigate risk in DoD programs; and help characterize potential concepts of operations. Conceptual prototyping activities seek to rapidly develop and demonstrate capabilities that can help maintain the U.S. technological edge. These prototypes will be delivered to joint Service users to evaluate operational capabilities and inform requirements and technical feasibility of future acquisition programs. Development of advanced prototypes will involve partnerships with the Services, industry, academia, and non-traditional DoD partners.</p> <p>FY 2022 Plans: Projects will be selected in the year of execution to support National Defense Strategy priorities, DoD modernization needs, and gaps in the joint Services' investments. Projects will focus on cost-effective, mission-focused efforts to design, mature, and deliver</p>		-	9.122	53.356

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B. Accomplishments/Planned Programs (\$ in Millions)		FY 2021	FY 2022	FY 2023
<p>new concepts and technology prototypes aimed at supporting the Joint Force. Two to four prototype efforts are anticipated in FY 2022 leveraging Joint, Service, and interagency partnerships.</p> <p>FY 2023 Plans: Projects will be selected in the year of execution to support National Defense Strategy priorities, DoD modernization needs, and gaps in the joint Services' investments. Projects will focus on cost-effective, mission-focused efforts to design, mature, and deliver new concepts and technology prototypes aimed at supporting the Joint Force. Eight to fourteen prototype efforts are anticipated in FY 2023 leveraging Joint, Service, and interagency partnerships.</p> <p>FY 2022 to FY 2023 Increase/Decrease Statement: The change in funding reflected from FY 2022 to FY 2023 is the result of the FY 2022 Congressional reduction and the completion of four prototyping projects. FY 2022 was reduced by \$34.100 million via Congressional Directed Transfer to Program Element 0604331D8Z Rapid Prototyping Program (RPP) for execution of the Rapid Defense Experimentation Reserve (RDER).</p>				
<p>Title: Red Teaming to Support DoD Modernization Needs</p> <p>Description: This focus area supports investigations, evaluations, and validations that assess the susceptibility and vulnerability of emerging technology fields, to quickly identify unanticipated disruptive opportunities and technological dead ends. Efforts include: (1) Early investigations and red teaming to identify and understand potential vulnerabilities and opportunities from emerging and conceptual technologies. Projects will help define and anticipate impacts from new technologies, including current DoD investments and external technologies, to understand operational utility and identify threats from tangentially related sectors that can have significant negative impacts on current DoD investments. (2) Maturation of Service and Defense Agency identified prototypes to enable red teaming validations and concept of operations (CONOPS) much earlier in the development cycle. These prototypes increase agility and rate of innovation for emerging capabilities, while reducing cost, schedule, and risk. (3) Exploring unconventional approaches to counter current DoD and adversary technologies through red teams; war games; simulation exercises; and studies that employ government laboratory scientists, subject matter experts, and students of science, technology, engineering, and math disciplines. Red teaming events range from distributed table-top games to simulated and live field exercises with non-traditional and operationally experienced participants. Deliverables include characterizations of future prototypes, requirement definitions, recommendations on system operational employment, potential strategic vulnerabilities, and likely countermeasures that could be taken by the threat, as well as potential counter-countermeasures to increase functionality or operational effectiveness of the system. The USD(R&E) will leverage these products to inform how technologies and integrated systems can perform in hostile environments; chart new investment paths; and, develop new CONOPS.</p> <p>FY 2022 Plans: Investment decisions for red teaming are made during the execution year in response to Department, Combatant Command, Service, and other government organization priorities and as new threats emerge or new opportunities are presented. In FY 2022,</p>		-	8.188	7.989

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Exhibit R-2A, RDT&E Project Justification: PB 2023 Office of the Secretary Of Defense	Date: April 2022
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Appropriation/Budget Activity 0400 / 3	R-1 Program Element (Number/Name) PE 0603338D8Z / <i>Defense Modernization and Prototyping</i>	Project (Number/Name) 721 / <i>Emerging Capabilities Tech Dev (ECTD)</i>
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B. Accomplishments/Planned Programs (\$ in Millions)	FY 2021	FY 2022	FY 2023
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<p>this project anticipates funding four to seven efforts to investigate red and blue impacts of technologies associated with DoD modernization needs. Project selection will be guided by DoD modernization needs, the National Defense Strategy, and priorities and gaps identified by the Department, Combatant Commands, Services, other government organizations, FFRDCs, academia, and industry as new threats emerge or new opportunities are presented.</p> <p>FY 2023 Plans: Investment decisions for red teaming are made during the execution year in response to Department, Combatant Command, Service, and other government organization priorities and as new threats emerge or new opportunities are presented. In FY 2023, this project anticipates funding four to six efforts to investigate red and blue impacts of technologies associated with DoD modernization needs. Project selection will be guided by DoD modernization needs, the National Defense Strategy, and priorities and gaps identified by the Department, Combatant Commands, Services, other government organizations, FFRDCs, academia, and industry as new threats emerge or new opportunities are presented.</p> <p>FY 2022 to FY 2023 Increase/Decrease Statement: There is no significant change between FY 2022 and FY 2023.</p>			
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<p>Title: Silent Hammer (SH)</p> <p>Description: SH is a multi-year, multi-agency, series of field experimentation activities. SH explores and demonstrates new electronic warfare (EW) and cyber technologies and approaches through the use of large-scale, dynamic field experiments. SH includes scripted and dynamic scenarios to experiment with the efficacy of both existing and new capabilities to engage emerging electromagnetic spectrum threats. The EW Community of Interest, Executive Committees, and warfighters are involved in the selection of follow-on experimentation topics, technology demonstrations, and scoping of these efforts to ensure maximum relevance and value. The Joint Electronic Advanced Technology (JEAT) Program Element 0603618D8Z supports the experiment concept development and planning efforts for SH events, while DM&P supports SH experiment execution efforts.</p> <p>In FY 2021, SH completed experiment-planning and preparation for the second experiment which was executed in late-FY 2021. Work continues in FY 2022 using FY 2021 funds to complete data post-processing and analysis, and submit results and findings in the SH final report.</p>	4.000	-	-
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Accomplishments/Planned Programs Subtotals	55.058	31.935	69.245
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	FY 2021	FY 2022
Congressional Add: Emerging Capabilities Technology Support	7.500	-
FY 2021 Accomplishments: This project supports the continued execution of an ongoing U.S. Air Force communications prototyping project. Previous resources provided above the President's budget in FY 2018,		

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		FY 2021	FY 2022
FY 2019, and FY 2020 prototyped and assessed the utility, operational user interest, and potential to transition these technologies to the warfighter. In FY 2021, the project further refined the prototype software and hardware. Work continues in FY 2022 and FY 2023 using FY 2021 funds to refine the prototype and complete testing with operational users. The capability developed will transition to the U.S. Special Operations Command (USSOCOM) for further development. This technology area is a congressional interest item and additional resources were provided above the President's budget.			
Congressional Add: Disruptive Air and Missile Defense FY 2021 Accomplishments: The Disruptive Air and Missile Defense project explores advanced sensor system concepts to enhance detection and tracking of threat systems. Previous resources provided above the President's budget in FY 2016, FY 2017, FY 2018, FY 2019, and FY 2020 developed an advanced sensor chip assembly (SCA) and prototype test units (PTU) incorporating the SCA to enable experimentation and validation of expected performance in operationally-relevant environments. In FY 2021, development of the PTUs continued with plans for several test and evaluation (T&E) events planned for FY 2022. Work continues in FY 2022 using FY 2021 funds to execute multiple T&E events, in both laboratory and operationally-relevant environments to validate system performance for operational concepts of interest to the Services and Combatant Commands. This technology area is a congressional interest item and additional resources were provided above the President's budget. Details of this project are classified.		5.000	-
Congressional Add: Open Source Intelligence (OSI) FY 2021 Accomplishments: Leveraging emerging open source intelligence tools and techniques, the OSI project provides the joint warfighter with the capability to rapidly winnow down open source data to actionable intelligence. Previous resources provided above the President's budget in FY 2018, FY 2019, and FY 2020 demonstrated a novel open source intelligence capability. In FY 2021, the project further developed strategies for collecting and exploiting open source information from various domains; and, algorithms/automated tools to prioritize threats and enhance data mining speeds. Work continues in FY 2022, FY 2023, and FY 2024 using FY 2021 funds to demonstrate how machine learning data analytic techniques and open source data can be leveraged to address enduring Great Power Competition (GPC) challenges. The capability developed will transition to the U.S. Army and USSOCOM for further development. This technology area is a congressional interest item and additional resources were provided above the President's budget. FY 2022 Plans: Leveraging the additional funds provided in FY 2022, the OSI project will identify and integrate additional open sources domains to provide a more robust intelligence tool. The scope of work resourced with		3.000	3.000

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Exhibit R-2A, RDT&E Project Justification: PB 2023 Office of the Secretary Of Defense		Date: April 2022
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	FY 2021	FY 2022
FY 2021 and FY 2022 funds is anticipated to complete in FY 2024. This technology area is a congressional interest item and additional resources were provided above the President's budget.		
Congressional Add: Remote Advise and Assist (RAA) Technology Development FY 2021 Accomplishments: RAA directly supports critical decision and coordination processes enabling increased survivability for the joint warfighter and partners. Previous resources provided above the President's budget in FY 2019 and FY 2020 developed and validated system performance for RAA prototypes to provide threat detection and classification of airborne and ground-based threats in operationally-relevant environments. In FY 2021, the project initiated design changes to enable higher forms of machine autonomy to increase the depth of analysis and the speed at which decisions can be executed. Work continues in FY 2022, FY 2023, and FY 2024 using FY 2021 funds to implement and test the design changes. The additional capabilities will be demonstrated in a final demonstration tentatively planned for October 2022. The prototypes developed will transition to the U.S. Army and USSOCOM for further development. This technology area is a congressional interest item and additional resources were provided above the President's budget.	8.000	-
Congressional Add: Artificial Intelligence Enabled Sensor Network (AIESN) FY 2021 Accomplishments: AIESN streamlines warfighter decision-making, reducing cognitive burden to provide unparalleled information advantage at the tactical edge. Previous resources provided above the President's budget in FY 2019 and FY 2020 initiated development of a laboratory prototype to characterize potential processing and data distribution enhancements achievable at the tactical edge. In FY 2021, collection of data in operationally-relevant environments was initiated; and, early proof-of-concept demonstrations were conducted with the warfighter to refine the AIESN concept and system architecture. Development of AIESN continues in FY 2022, FY 2023, and FY 2024 using FY 2021 funds to: finalize the AIESN system concept and architecture; develop the prototype; and, demonstrate the capability in an operationally-relevant environment. These activities will be executed in coordination with the United States European Command (USEUCOM) to align the prototype capabilities with future Great Power Competition (GPC) problem sets. Specific demonstrations and activities will be finalized within the period of performance of execution. The prototype will transition to the U.S. Army and USSOCOM for further development. This technology area is a congressional interest item and additional resources were provided above the President's budget.	8.400	-
Congressional Add: Hypersonic Modeling and Simulation Center of Excellence FY 2022 Plans: In FY 2022, the project will establish a Hypersonics Research Center of Excellence focused on experimental and computational analysis of hypersonic flows, thermal protection systems, and other hypersonic phenomenology to support advanced hypersonic technology prototyping. Specific demonstrations and activities	-	4.600

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Appropriation/Budget Activity 0400 / 3	R-1 Program Element (Number/Name) PE 0603338D8Z / <i>Defense Modernization and Prototyping</i>	Project (Number/Name) 721 / <i>Emerging Capabilities Tech Dev (ECTD)</i>
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	FY 2021	FY 2022
will be finalized within the project execution period of performance. This technology area is a congressional interest item and additional resources were provided above the President's budget.		
Congressional Add: Ship-Based Multi-Sensor Prototype Development and Demonstration	-	8.000
FY 2022 Plans: In FY 2022, the project will identify novel sensor technologies for integration into a multimodal sensor prototype. Combining multiple sensor technologies will enable the prototype to provide a more accurate and robust capability to detect, identify, classify, and track targets in a maritime environment. An at-sea demonstration of the prototype is anticipated to evaluate its performance in operationally-relevant environments. Demonstrations and activities will be finalized within the project execution period of performance. This technology area is a congressional interest item and additional resources were provided above the President's budget.		
Congressional Adds Subtotals	31.900	15.600

C. Other Program Funding Summary (\$ in Millions)

N/A

Remarks

D. Acquisition Strategy

ECTD leverages the DoD's most efficient and effective acquisition approaches for rapid prototyping. This includes using Other Transaction Authorities, Broad Area Announcements, and new or existing contract vehicles.

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Exhibit R-2A, RDT&E Project Justification: PB 2023 Office of the Secretary Of Defense **Date:** April 2022

Appropriation/Budget Activity 0400 / 3					R-1 Program Element (Number/Name) PE 0603338D8Z / Defense Modernization and Prototyping				Project (Number/Name) 722 / Time Sensitive Targeting Defeat (TSTD)			
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
<i>722: Time Sensitive Targeting Defeat (TSTD)</i>	0.000	17.768	-	-	-	-	-	-	-	-	-	-
Quantity of RDT&E Articles	-	-	-	-	-	-	-	-	-	-		

Note

In FY 2022, funding and appropriate project investment areas from Project Code 722 Time Sensitive Targeting Defeat (TSTD) transferred to Program Element 0603648D8Z Joint Capability Technology Demonstration (JCTD) for proper alignment and execution. As part of the President’s Budget 2023, all out year funding associated with the TSTD project code transfers to Program Element 0603648D8Z, JCTD program.

A. Mission Description and Budget Item Justification

TSTD funds prototyping and experimentation activities that accelerate the development and fielding of capabilities to address the find, fix, and finish kill-web against high-value targets. TSTD prototyping and experimentation activities employ the military utility of prototypes and experiments by leveraging technical demonstration programs to evaluate innovative capabilities in operationally-relevant environments with direct warfighter involvement and feedback. TSTD leverages major exercise series, such as Northern Edge and Valiant Shield, as it executes the Joint Combined Demonstration Campaign (JCDC) and Tactical Responsive Intelligence, Surveillance, and Reconnaissance (ISR) Platforms and Payloads Watching Isolated Remote Environments (TRIPPWIRE) prototype and experiment venues. JCDC is a multi-year campaign that integrates prototypes and experiments into operational demonstrations and exercises to facilitate transition of prototype capabilities aligned with the DoD modernization priorities. TRIPPWIRE is a DoD initiative to operationalize the stratosphere by offering increased demonstrations of high-altitude ISR and communication systems.

Selected projects and experiments extend Service and Defense Agency investments by leveraging prototypes developed by traditional and non-traditional industry partners, utilizing proven commercial- and government-off-the-shelf technologies, rapidly maturing technologies within Service laboratories and Federally Funded Research and Development Centers (FFRDCs), and, leveraging technologies from allied nations to rapidly identify and address gaps within current and developing kill chain capabilities identified by the Services, Combatant Commands (CCMDs), and Joint Staff. Projects inform Service programs of record in addition to providing Services and CCMDs with residual leave behind capabilities for rapid fielding.

B. Accomplishments/Planned Programs (\$ in Millions)

	FY 2021	FY 2022	FY 2023
Title: Time-Sensitive Target Defeat Focus Area	7.768	-	-
Description: This project addresses the need for distributed, rapidly-deployed capabilities that can provide persistent sensing to find, fix, and finish time-sensitive threats by integrating prototypes and experiments into a series of multi-domain operational demonstrations. Demonstrations focus on evaluating how the Joint Force can leverage modernization technologies, commercial space-based capability, and operationalization of the stratosphere to refine hypersonic and long-range fires kill chains to counter time-sensitive targets. In FY 2021, multiple prototype demonstrations were completed in the U.S. Indo-Pacific Command			

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Appropriation/Budget Activity 0400 / 3	R-1 Program Element (Number/Name) PE 0603338D8Z / <i>Defense Modernization and Prototyping</i>	Project (Number/Name) 722 / <i>Time Sensitive Targeting Defeat (TSTD)</i>
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B. Accomplishments/Planned Programs (\$ in Millions)	FY 2021	FY 2022	FY 2023
(USINDOPACOM) and U.S. European Command (USEUCOM) regions. Integrating communication, ISR sensors and platforms from both commercial and DoD entities, these experiments developed new concepts of employment and informed Service acquisition programs.			
Accomplishments/Planned Programs Subtotals	7.768	-	-

	FY 2021	FY 2022
Congressional Add: Stratospheric Balloon Research	10.000	-
FY 2021 Accomplishments: The Stratospheric Balloon Research project directly supports the National Defense Strategy’s priority for delivering innovative stratospheric prototyping capabilities and operationally demonstrating Joint Warfighting Concepts to increase our military advantage across the force. In coordination with Services, Combatant Commands, and Allied partners, an experimentation campaign was completed in FY 2021 to validate that high-altitude balloon (HAB) platforms can meet operational needs and define performance requirements for out-year Service programs. Integrating HAB platforms into operational exercises enabled direct warfighter involvement to mature future HAB Concept of Operation and refine requirements for Service programs. Additional details of this project are classified.		
Congressional Adds Subtotals	10.000	-

C. Other Program Funding Summary (\$ in Millions)

N/A

Remarks

D. Acquisition Strategy

Time Sensitive Target Defeat (TSTD) leverages the DoD's most efficient and effective acquisition approaches for rapid prototyping to align with the Department modernization priorities. Prototyping partners include small businesses and non-traditional performers, industry, Federally Funded Research and Development Centers, and University Affiliated Research Centers.

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Appropriation/Budget Activity 0400 / 3	R-1 Program Element (Number/Name) PE 0603338D8Z / Defense Modernization and Prototyping	Project (Number/Name) 723 / Red Teaming (RT)
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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
723: Red Teaming (RT)	0.000	5.322	-	-	-	-	-	-	-	-	-	-
Quantity of RDT&E Articles	-	-	-	-	-	-	-	-	-	-	-	-

Note

In FY 2022, the Red Teaming project code transitioned to a focus area under Project Code 721 Emerging Capabilities Technology Development (ECTD).

A. Mission Description and Budget Item Justification

The Red Teaming project supports assessments and validations to stress and assess emerging systems with the intent of gaining or maintaining overmatch earlier in the life cycle. The project helps to assess the susceptibility and vulnerability of emerging technologies and newly developed systems and to identify unanticipated disruptive opportunities and technological dead ends. The project improves systems by reducing vulnerabilities and providing a holistic understanding of employment risks in operationally representative environments and against potential threats prior to full funding commitments. The Red Teaming project supports three broad types of red teaming: (1) Early stage technology discovery and assessments of weaknesses and opportunities of pre-development technologies from an adversary perspective; (2) Targeted, low-fidelity prototypes to assess utility and inform design choices prior to funding commitments; and (3) Red teams, war games, and field tests with maturing technology to understand how to implement new technologies and adapt to adversary responses. This effort leverages the innovative capabilities of other defense red teaming organizations within the Department, Federally Funded Research and Development Centers (FFRDCs), government laboratories, and academia. Deliverables will inform requirements, develop new concepts of operations (CONOPS), and help accelerate technology acquisition pathways for joint missions.

B. Accomplishments/Planned Programs (\$ in Millions)

	FY 2021	FY 2022	FY 2023
Title: Red Teaming to Support DoD Modernization Priorities	3.877	-	-
Description: The project funds efforts to explore new joint mission capabilities in a competitive environment. Efforts include: (1) Early investigations and red teaming to identify and understand potential vulnerabilities and opportunities from emerging and conceptual technologies. Projects will help define and anticipate impacts from new technologies, including current DoD investments and external technologies, to understand operational utility and identify threats from tangentially related sectors that can have significant negative impacts on current DoD investments. (2) Maturation of Service and Defense Agency identified prototypes to enable red teaming validations and CONOPS earlier in the development cycle. These prototypes increase agility and rate of innovation for emerging capabilities, while reducing cost and risk. (3) Exploring unconventional approaches to counter current DoD and adversary technologies through red teams, war games, simulation exercises, and studies that employ government laboratory scientists, subject matter experts, and students of science, technology, engineering, and math disciplines. Red teaming events range from distributed table-top games to simulated and live field exercises with non-traditional and operationally experienced participants. Deliverables include characterizations of future prototypes, requirement definitions, recommendations on system operational employment, potential vulnerabilities, and likely countermeasures that could be taken by the threat, as well as potential counter-countermeasures to increase functionality or operational effectiveness of the system. The			

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Appropriation/Budget Activity 0400 / 3	R-1 Program Element (Number/Name) PE 0603338D8Z / <i>Defense Modernization and Prototyping</i>	Project (Number/Name) 723 / <i>Red Teaming (RT)</i>
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B. Accomplishments/Planned Programs (\$ in Millions)	FY 2021	FY 2022	FY 2023
<p>USD(R&E) will leverage these products to inform how technologies and integrated systems can perform in hostile environments and develop new CONOPS.</p> <p>In FY 2021, red teaming efforts were conducted to support the National Defense Strategy’s priority for increased lethality and the Department of Defense’s modernization priorities for cyber, autonomy, energy, and contested logistics. Prototypes were assessed for vulnerabilities at red teaming events with operationally-experienced participants. A test was conducted to further assess radar vulnerabilities using a low-altitude, low-speed aircraft. Maturing technologies, in support of artificial intelligence and contested logistics, were red teamed to, either understand how best to implement and adapt the technology into CONOPS, or determine how best to counter adversary responses to the technology.</p>			
<p>Title: Tactical Network Outsider Threat</p> <p>Description: The Tactical Network Outsider Threat project is developing a prototype device to enable red teaming organizations to portray outsider threats on tactical networks that do not use IP-based communications. The prototype can be placed on systems under test to better portray outside threats during adversarial cybersecurity development tests and adversarial assessments, thereby ensuring U.S. systems are more robust and secure when faced with near-peer cyber adversaries. In FY 2021, the project developed the initial system requirements and began design, implementation, and testing of the software and hardware components. Work continues in FY 2022 using FY 2021 funds to finalize system design, fabrication, and complete final testing before the prototype transitions to the U.S. Army for additional testing.</p>	1.445	-	-
Accomplishments/Planned Programs Subtotals	5.322	-	-

C. Other Program Funding Summary (\$ in Millions)
N/A

Remarks

D. Acquisition Strategy
N/A