Exhibit R-2, RDT&E Budget Item Justification: PB 2024 Office of the Secretary Of Defense	Date: March 2023
Appropriation/Budget Activity 0400: *Research, Development, Test & Evaluation, Defense-Wide* / BA 3: *Advanced Technology Development (ATD)*	**R-1 Program Element (Number/Name)** PE 0603941D8Z / *Test and Evaluation Science and Technology*

COST ($ in Millions)	Prior Years	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total	FY 2025	FY 2026	FY 2027	FY 2028	Cost To Complete	Total Cost
Total Program Element	1,101.401	463.080	972.372	345.384	-	345.384	302.052	245.922	250.175	258.479	-	-
090: *Nuclear Test*	-	0.000	0.000	11.000	-	11.000	11.500	11.500	11.500	11.500	-	-
091: *High Speed Systems Test*	410.129	173.080	299.744	112.682	-	112.682	106.624	79.395	80.983	82.603	-	-
092: *Spectrum Efficient Technology*	82.996	25.000	49.975	10.053	-	10.053	10.192	9.586	9.777	9.972	-	-
093: *Electronic Warfare Test*	127.792	106.000	417.765	105.055	-	105.055	71.619	40.073	40.874	41.692	-	-
094: *Advanced Instrumentation Systems Technology*	102.721	42.000	12.180	19.957	-	19.957	21.455	20.880	21.223	22.549	-	-
095: *Directed Energy Test*	90.737	24.000	30.072	10.475	-	10.475	10.205	10.450	10.688	10.932	-	-
096: *C4I & Software Intensive Systems Test*	144.356	49.000	13.088	13.246	-	13.246	13.511	13.794	14.070	14.351	-	-
097: *Autonomy and Artificial Intelligence Test*	74.599	21.000	98.992	47.379	-	47.379	41.038	43.787	44.275	47.760	-	-
098: *Cyberspace Test*	68.071	23.000	18.431	14.707	-	14.707	15.000	15.315	15.620	15.932	-	-
099: *Space Test*	0.000	-	32.125	0.830	-	0.830	0.908	1.142	1.165	1.188	-	-

Note

New Start (Y/N): Partial - New Nuclear Test Project for FY 2024.

A. Mission Description and Budget Item Justification

This program supports the Department's initiatives to defend the homeland, deter strategic attacks and aggression, prevail in conflict, build enduring advantage, and build a resilient joint force and defense eco system. The Test and Evaluation/Science and Technology (T&E/S&T) program seeks out and develops test technologies to keep pace with evolving weapons technologies. Aligned with the National Defense Strategy, this program is critical to ensure that the Department of Defense (DoD) has the ability to adequately test the advanced systems that will be fielded in the future, building a more lethal force. To meet this objective, the T&E/S&T Program performs the following activities:

• Exploits new technologies and processes to meet important T&E requirements.
• Expedites the transition of new technologies from the laboratory environment to the T&E community.
• Leverages industry advances in equipment, modeling and simulation, and networking to support T&E.

Exhibit R-2, RDT&E Budget Item Justification: PB 2024 Office of the Secretary Of Defense	Date: March 2023
Appropriation/Budget Activity 0400: *Research, Development, Test & Evaluation, Defense-Wide I* BA 3: *Advanced Technology Development (ATD)*	**R-1 Program Element (Number/Name)** PE 0603941D8Z *I Test and Evaluation Science and Technology*

Additionally, the T&E/S&T Program examines emerging T&E requirements resulting from Joint Service initiatives to identify T&E technology needs and develop a long-range roadmap for technology insertion. The program leverages and employs applicable applied research efforts from the highly developed technology base in the DoD laboratories and test centers, other Government agencies, and industry to accelerate development of new test capabilities. The program outreaches and engages academia to address test technology challenges in DoD testing, advancing Science, Technology, Engineering and Mathematics (STEM) initiatives at Historically Black Colleges and Universities (HBCU) and other minority serving institutions. This program provides travel funds for T&E/S&T program oversight, special studies, analyses, and strategic planning related to test capabilities and infrastructure. The T&E/S&T Program aligns with the science and technology (S&T) Communities of Interest (COI) to prepare the T&E community to test warfighting capabilities that emerge from priority S&T investments. The T&E/S&T Program utilizes Advanced Technology Development funding because which supports the development and demonstration of high payoff technologies for current and future DoD test capabilities.

B. Program Change Summary ($ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
Previous President's Budget	464.850	315.090	304.538	-	304.538
Current President's Budget	463.080	972.372	345.384	-	345.384
Total Adjustments	-1.770	657.282	40.846	-	40.846
• Congressional General Reductions	-	-0.268			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	-	657.550			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-	-			
• SBIR/STTR Transfer	-	-			
• Program Adjustments	-1.770	-	40.846	-	40.846

Congressional Add Details ($ in Millions, and Includes General Reductions)	FY 2022	FY 2023
Project: 091: *High Speed Systems Test*		
Congressional Add: *Test & Evaluation Science & Technology (TRMC)*	-	188.650
Congressional Add Subtotals for Project: 091	-	188.650
Project: 092: *Spectrum Efficient Technology*		
Congressional Add: *Test & Evaluation Science & Technology (TRMC)*	-	40.000
Congressional Add Subtotals for Project: 092	-	40.000
Project: 093: *Electronic Warfare Test*		
Congressional Add: *Test & Evaluation Science & Technology (TRMC)*	-	298.500

Exhibit R-2, RDT&E Budget Item Justification: PB 2024 Office of the Secretary Of Defense	Date: March 2023
Appropriation/Budget Activity 0400: *Research, Development, Test & Evaluation, Defense-Wide I* BA 3: *Advanced Technology Development (ATD)*	**R-1 Program Element (Number/Name)** PE 0603941D8Z *I Test and Evaluation Science and Technology*

Congressional Add Details ($ in Millions, and Includes General Reductions)	FY 2022	FY 2023
Congressional Add Subtotals for Project: 093	-	298.500
Project: 095: *Directed Energy Test*		
Congressional Add: *Test & Evaluation Science & Technology (TRMC)*	-	18.750
Congressional Add Subtotals for Project: 095	-	18.750
Project: 097: *Autonomy and Artificial Intelligence Test*		
Congressional Add: *Test & Evaluation Science & Technology (TRMC)*	-	76.250
Congressional Add Subtotals for Project: 097	-	76.250
Project: 098: *Cyberspace Test*		
Congressional Add: *Test & Evaluation Science & Technology (TRMC)*	-	4.000
Congressional Add Subtotals for Project: 098	-	4.000
Project: 099: *Space Test*		
Congressional Add: *Test & Evaluation Science & Technology (TRMC)*	-	31.400
Congressional Add Subtotals for Project: 099	-	31.400
Congressional Add Totals for all Projects	-	657.550

Change Summary Explanation

The FY 2023 increase of $657.282 million is comprised of a realignment of $0.268 million for other Departmental priorities and Congressional adds to improve the following capabilities: 1) enhance hypersonic testing capabilities, 2) advance cybersecurity signal generation, 3) improve hypersonic thermal protection test equipment, 4) enhance hypersonic wave heat facilities, 5) upgrade electronicmagnetic spectrum test emitters, 6) upgrade electronicmagnetic spectrum sensor fusion, 7) improve airborne 5G, 8) upgrade 5G range instrumentation, 9) develop additional hypersonics sensor packages for RQ-4 and MQ-9 platforms, 10) advance directed energy airborne high-power testbed, 11) improve space-based range tracking, 12) advance 5th generation aerial target, 13) upgrade artificial intelligence hubs technology development, and 14) upgrade all-domain autonomous modeling and simulation. The top-line increase of $657.282M will provide enhanced capabilities and increased throughput to meet increasing test demand.

The FY 2024 increase of $40.846 million is comprised of an economic assumption increase and an increase to address Department priorities in: 1) enhancement of critical defense microelectronics infrastructure testbeds, and 2) development of artificial intelligence T&E high-performance computing resources to support continued enhancement of artificial intelligence hubs technology.

Exhibit R-2A, RDT&E Project Justification: PB 2024 Office of the Secretary Of Defense			Date: March 2023
Appropriation/Budget Activity 0400 / 3	R-1 Program Element (Number/Name) PE 0603941D8Z / *Test and Evaluation Science and Technology*	Project (Number/Name) 090 / *Nuclear Test*	

COST ($ in Millions)	Prior Years	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total	FY 2025	FY 2026	FY 2027	FY 2028	Cost To Complete	Total Cost
090: *Nuclear Test*	-	0.000	0.000	11.000	-	11.000	11.500	11.500	11.500	11.500	-	-
Quantity of RDT&E Articles	-	-	-	-	-	-	-	-	-	-		

A. Mission Description and Budget Item Justification

As a new start in FY 2024, the Nuclear Test (NT) project mission is to address national test capability gaps by providing accurate, robust, and efficient T&E solutions to successfully develop, validate, and inform the employment of a modernized nuclear enterprise. The Department of Defense (DoD) is prioritizing investments to modernize the nuclear enterprise while sustaining and increasing the resiliency of legacy systems. Current developments focus on deploying capabilities and systems to validate new designs and new materials in a complex threat-representative environment. Current testing infrastructure and methodologies to assess nuclear enterprise systems and microelectronics resilience against emerging threats is limited. Many test capabilities used in the past for acquisition are no longer available, either stopped by policy decisions or dismantled for cost savings. The NT project addresses test technology needs for adequate assessment of nuclear enterprise resiliency and aligns with the DoD S&T priority investments. The NT project is supporting the development of a strategic roadmap and investment strategy to establish nuclear test environments for microelectronics, ground test environments for system level testing, and flight test range enhancements for end-to-end testing needs. The NT project develops technologies to enable robust, accurate, and timely T&E of a modernized nuclear enterprise, and to ensure system suitability and survivability.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024
Title: Nuclear Test (NT)	-	-	11.000
Description: The NT project is conducting a test infrastructure gap analysis on the needs of testing the nuclear enterprise. The analysis will result in a time-phased investment strategy based on those requirements. Work includes engaging the nuclear environments test community on needs and gaps to ensure traceability between strategic objectives and test technology development required for relevant microelectronic nuclear test environments such as single event effects, combined effects, electromagnetic pulse and others. ***FY 2024 Plans:*** The Nuclear Test project is new in FY 2024 and will initiate efforts to address test technology needs identified in the Nuclear T&E investment roadmap and time-phased investment strategy. ***FY 2023 to FY 2024 Increase/Decrease Statement:*** New start, FY 2024 increase reflects planned start of nuclear test technology development with multiple phases.			
Accomplishments/Planned Programs Subtotals	-	-	11.000

C. Other Program Funding Summary ($ in Millions)

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2024 Office of the Secretary Of Defense		Date: March 2023
Appropriation/Budget Activity 0400 / 3	**R-1 Program Element (Number/Name)** PE 0603941D8Z / *Test and Evaluation Science and Technology*	**Project (Number/Name)** 090 / *Nuclear Test*

C. Other Program Funding Summary ($ in Millions)

Remarks

D. Acquisition Strategy

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2024 Office of the Secretary Of Defense			Date: March 2023
Appropriation/Budget Activity 0400 / 3	R-1 Program Element (Number/Name) PE 0603941D8Z / *Test and Evaluation Science and Technology*	Project (Number/Name) 091 / *High Speed Systems Test*	

COST ($ in Millions)	Prior Years	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total	FY 2025	FY 2026	FY 2027	FY 2028	Cost To Complete	Total Cost
091: *High Speed Systems Test*	410.129	173.080	299.744	112.682	-	112.682	106.624	79.395	80.983	82.603	-	-
Quantity of RDT&E Articles	-	-	-	-	-	-	-	-	-	-		

A. Mission Description and Budget Item Justification

High-speed/hypersonic weapons are being developed to ensure the continued military superiority and strike capability of the United States including freedom of movement and freedom of action in areas protected by anti-access/area denial defenses. Current weapon system demonstrations and technology development programs include high-speed and hypersonic air-breathing missiles, maneuvering reentry and boost-glide weapons, hypersonic gun-launched projectiles, and air-breathing space access vehicles. These systems require development of conventional and high-speed turbine, ramjet, scramjet, and combined cycle engines; high temperature materials; thermal protection systems (TPS); and thermal management systems. The High Speed Systems Test (HSST) project addresses test technology needs including propulsion, aerodynamic and aerothermal testing, so the test community has the technology to support the required test scenarios for concepts under development in the S&T community. The technology developments within the HSST project align with the Department of Defense (DoD) S&T priority investments. As such, the HSST project is developing, validating and transitioning advanced T&E technologies for ground test, open-air range flight test, and advanced computational tools, along with instrumentation and diagnostics systems for use in both ground tests and flight tests of high speed systems.

The HSST project develops technologies to enable robust, accurate, and timely T&E of these future weapon systems. DoD acquisition regulations require weapon systems to undergo a thorough T&E process to detect deficiencies early and to ensure system suitability and survivability. However, the extreme environments in which these weapons operate preclude accurate determination of their performance and operability with today's T&E assets. Current national test capabilities have deficiencies in data accuracy, flight condition replication and simulation, test methods, productivity, modeling and simulation (M&S) fidelity, and range safety.

The HSST mission is to address these national test capability gaps by providing test technology solutions that will enable high-speed and hypersonic weapon systems to be successfully developed through accurate, robust, and efficient T&E.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024
Title: High Speed Systems Test (HSST)	173.080	111.094	112.682
Description: The HSST project continued to advance ground and flight test technologies, techniques, instrumentation, and modeling and simulation capabilities required for the development of hypersonic weapon systems. In FY22, HSST continued to address critical technology shortfalls for hypersonic test and evaluation in aerothermal and propulsion ground testing capabilities and advanced instrumentation to support hypersonic flight tests. Several other technology development efforts also progressed throughout the year. To address the technology shortfall involving aerothermal and propulsion testing, HSST is developing a new test facility that utilizes clean-air heat addition (non-vitiated air) and a variable Mach number nozzle (VMN) capability to provide the representative			

Exhibit R-2A, RDT&E Project Justification: PB 2024 Office of the Secretary Of Defense		Date: March 2023
Appropriation/Budget Activity 0400 / 3	**R-1 Program Element (Number/Name)** PE 0603941D8Z / *Test and Evaluation Science and Technology*	**Project (Number/Name)** 091 / *High Speed Systems Test*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024
high-temperature conditions for characterizing weapon systems, including air-breathing propulsion capabilities. The clean-air heat addition is especially important to the characterization of air-breathing propulsion systems, as previous HSST efforts demonstrated that vitiated air provides different gas properties than clean air found in the atmosphere and thus is not representative of what the vehicle would experience in flight. This significantly affects the engine's performance and operability in the test environment and results in erroneous flight predictions. Additionally, characterization of advanced sensors for hypersonic systems also benefits from clean-air heat addition as it provides a more representative environment for the sensor to operate in. The variable Mach number capability provides a more representative trajectory simulation for the system under test, permitting more accurate predictions before conducting flight tests. Assembly of the new test facility, called the Hypersonic Aerothermal and Propulsion Clean-Air Testbed (HAPCAT), was completed in FY 2022, enabling the plan for operational facility checkouts starting in FY 2023 to demonstrate the facility envelope and test techniques. Initial testing in HAPCAT will involve the characterization of advanced hypersonic sensors in a combined aerodynamic and aerothermal effects environment. All of the efforts associated with HAPCAT also serve as pathfinders for the development of a larger-scale, more capable facility at the AEDC. To address capacity constraints involved with aerothermal material characterization ground testing, HSST initiated a new aerothermal test technology development effort to prototype alternative high enthalpy test technologies, to include a plasmatron test capability. This effort involves the advancement of inductively-coupled plasma ground test facilities that can serve as a complement to arc-jet heater capabilities. Significant progress was achieved in the development of the SkyRange capability, an unmanned aerial vehicle-based range to support hypersonic flight tests and other missions for the Department of Defense. SkyRange provides a more agile, flexible, and cost-effective method for providing support to long-range hypersonic flight tests with increased data collection capabilities beyond the current state-of-the-art. It also addresses a critical throughput shortfall for supporting the number of hypersonic flight tests required, as a sufficient number of existing assets does not exist. RQ-4 Global Hawks and MQ-9 Reapers comprise the platforms used for SkyRange, taking advantage of their long-endurance, flexibility, and high-payload capability. SkyRange augments existing air, sea, and land test support assets referred to as the "string of pearls," reducing the high costs associated with traditional flight test support and increasing mission flexibility. Novel sensor suites are being developed in the areas of telemetry capture and relay, multispectral imaging, atmospheric sensing, terminal scoring, and other areas to aid in the development of hypersonic systems. Several of these sensors are being developed through HSST for integration into the SkyRange capability. Achievements were made for both SkyRange aircraft platforms in FY 2022. Three RQ-4s were fully modified into a SkyRange configuration, called RangeHawks, making them available for sensor suite integration. Two of these RangeHawks were equipped with advanced phased-array telemetry antennas and provided data collection support to multiple hypersonic flight test missions.			

Exhibit R-2A, RDT&E Project Justification: PB 2024 Office of the Secretary Of Defense		Date: March 2023
Appropriation/Budget Activity 0400 / 3	**R-1 Program Element (Number/Name)** PE 0603941D8Z / *Test and Evaluation Science and Technology*	**Project (Number/Name)** 091 / *High Speed Systems Test*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024
Additional RQ-4s were added to the SkyRange RangeHawk fleet by leveraging Air Force divestments in operational RQ-4 aircraft. SkyRange initiated conversion of the additional RQ-4 platforms into the RangeHawk configuration. Throughout FY 2022, the RangeHawks completed several milestones, including the first simultaneous operation of two RangeHawks, the first simultaneous operation of two sensor suites on two RangeHawks, and the first deployment of two RangeHawks to a forward operating location. For the MQ-9s, five aircraft were stationed at the main operating base in California. These MQ-9s, called RangeReapers, will be used for integrating various sensors, generally through the use of pylon-carried pods. Necessary agreements to enable flight operations were established with multiple entities, paving the way for the first flight operations as a part of SkyRange in FY 2023. The development, integration, and operation of multiple phased-array telemetry capabilities continued as part of SkyRange in FY 2022. One variant was integrated and operated on two RangeHawks, achieving initial operating capability by successfully collecting data during long range missile flight tests. These telemetry antennas will continue to support flight test missions in FY 2023. A second variant was fully fabricated in FY 2022 and is planned for integration onto a RangeHawk in FY 2023. A third variant that will be developed for both RangeHawks and RangeReapers will continue design and fabrication and is scheduled for integration onto both SkyRange platforms in FY 2023. RangeLynx module installation was completed on all three RangeHawks in FY 2022, providing real-time, secure satellite-based telemetry and data relay to ground stations and other SkyRange assets. RangeLynx will also be integrated onto RangeReapers by including the modules in the sensor suite pods. Progress continued on the development of a high-fidelity automated and reconfigurable multispectral imaging tracking system for integration into an RQ-4 Global Hawk as part of the overall SkyRange capability. Fabrication of the system was completed and an initial fit-check on a RangeHawk was successfully executed, enabling a planned installation of the system in FY 2023. Ground checkouts were successfully completed in preparation for full installation as well. The High-Altitude LIDAR Atmospheric Sensing (HALAS) system for improved atmospheric measurements continued to make progress in FY 2022. A version installed on a Gulfstream G-IV performed multiple airborne data collection missions as part of a technology risk reduction effort for the eventual HALAS system for the RangeHawk. The RangeHawk variant completed its critical design review and progressed to full fabrication. Additional upgrades and technology development continued at the CUBRC hypersonic shock and expansion wind tunnels to support hypersonic ground testing. These included the design and integration of an aero-optic instrumentation suite to enable the evaluation of sensor and seeker systems for hypersonic vehicles, the initial conceptual design of a jet interactions test capability using the CUBRC facilities, and the continued development of a fast-response force and moment balances for use in the CUBRC facilities. In addition to these upgrades, a new wave rotor facility development continued. Progress with this new facility included			

Exhibit R-2A, RDT&E Project Justification: PB 2024 Office of the Secretary Of Defense		Date: March 2023
Appropriation/Budget Activity 0400 / 3	**R-1 Program Element (Number/Name)** PE 0603941D8Z / *Test and Evaluation Science and Technology*	**Project (Number/Name)** 091 / *High Speed Systems Test*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024

the successful development and demonstration of a small-scale pathfinder facility that provided critical risk reduction to the full-scale facility and the initial development of the full-scale facility at its chosen location at the CUBRC site. This facility will provide important test capabilities for aero-optic and aerothermal ground testing required for hypersonic weapon system development.

FY 2023 Plans:

The HAPCAT facility will achieve initial operating capability after its checkout campaign is completed, allowing the facility to provide support to hypersonic weapon system development. Multiple tests supporting hypersonic seeker systems will be conducted, taking advantage of the combined aerothermal and aero-optic effects using clean-air the facility provides. The operation of HAPCAT will also continue risk reducing test technologies as a pathfinder for the development of the larger-scale, more capable facility at the AEDC. In addition to air-on operations, the VMN development will continue, with the nozzle fabrication planned to be completed at the end of FY 2023, making it available for installation into the facility. Other test techniques to support directed energy and other propulsion system characterizations will also be developed.

SkyRange will continue providing critical test support to hypersonic and other DoD flight tests, further demonstrating the novel sensor suites integrated onto the SkyRange platforms. This will involve multiple RangeHawks equipped with telemetry antennas supporting missions and a RangeHawk with the multispectral imaging system collecting in-flight imagery. SkyRange will continue conversion of additional RQ-4 platforms into the RangeHawk configuration. Additionally, the RangeReapers will achieve first flight operations and will begin providing telemetry data collection support to flight tests using wing-mounted pods. The atmospheric sensing capability will complete fabrication and be ready for integration onto a RangeHawk at the end of FY 2023. Additionally, new capabilities will begin development in FY 2023, including a flight termination support capability, an increased bandwidth satellite communication capability, RangeReaper multispectral imaging support, and terminal scoring system development. Finally, additional technology development of hypersonic sensor packages for RQ-4 and MQ-9 platforms will begin.

The full-scale wave rotor facility at CUBRC will be completed and undergo a checkout and characterization campaign to reach initial operating capability. Once achieving this milestone, the facility will begin supporting aero-optic and aerothermal ground testing for hypersonic weapon system development efforts. Additionally, the development of a jet interactions test capability will continue, with upgrades made to the CUBRC facilities to enable such testing. Enhancements will deliver a prototype high-Mach, high-enthalpy ground test capability increasing the run time and matching flight conditions.

Further technology upgrades to aerothermal test capabilities will continue to include prototyping of plasma heated hypersonic thermal protection system test equipment. Enhancements to address small scale hypersonic air-breathing ground test capabilities gaps improving altitude simulation will also start in FY 2023 Other test and evaluation gaps associated with ground and flight test, modeling and simulation, and instrumentation will be addressed through new efforts.

FY 2024 Plans:

Exhibit R-2A, RDT&E Project Justification: PB 2024 Office of the Secretary Of Defense		Date: March 2023
Appropriation/Budget Activity 0400 / 3	**R-1 Program Element (Number/Name)** PE 0603941D8Z / *Test and Evaluation Science and Technology*	**Project (Number/Name)** 091 / *High Speed Systems Test*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024
New test techniques for the HAPCAT facility will be developed and demonstrated, taking advantage of the clean-air, long-duration run-time capability. The VMN will be completed, installed, and demonstrated as a capability for the facility. Additionally, the HAPCAT facility will provide critical test and evaluation support to various DoD hypersonic development efforts. SkyRange will further mature its capabilities supporting DoD flight tests. This will include next generation versions of the original telemetry antennas, providing additional spectrum coverage for telemetry collection. The HALAS atmospheric measurement capability will be fully integrated and demonstrated on a RangeHawk platform. An upgraded satellite communication capability that provides large bandwidth data relay will be fully integrated onto the RangeHawks. Development of a flight termination capability and a terminal scoring system will continue. SkyRange will continue conversion of additional RQ-4 platforms into the RangeHawk configuration. A multispectral imaging capability for the RangeReaper will be completed and integrated onto the platform. SkyRange support involving both RangeHawk and RangeReaper platforms for the same flight test will be demonstrated. Continued development of the wave rotor facility at CUBRC will occur, to include studies for higher Mach number capabilities using this technology. The facility will also provide critical test and evaluation support to various hypersonic development efforts. Other technology development efforts involving the CUBRC facilities will also be conducted to address test and evaluation requirements involving these facilities. ***FY 2023 to FY 2024 Increase/Decrease Statement:*** Increase supports improvements in hypersonic ground test and flight test capability and program adjustments due to economic assumptions.			
Accomplishments/Planned Programs Subtotals	173.080	111.094	112.682

	FY 2022	FY 2023
Congressional Add: Test & Evaluation Science & Technology (TRMC)	-	188.650
FY 2023 Plans: Program increase to support the improvement of hypersonic ground test and flight test capability.		
Congressional Adds Subtotals	-	188.650

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

Exhibit R-2A, RDT&E Project Justification: PB 2024 Office of the Secretary Of Defense		Date: March 2023
Appropriation/Budget Activity 0400 / 3	**R-1 Program Element (Number/Name)** PE 0603941D8Z / *Test and Evaluation Science and Technology*	**Project (Number/Name)** 091 / *High Speed Systems Test*

D. Acquisition Strategy

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2024 Office of the Secretary Of Defense			Date: March 2023
Appropriation/Budget Activity 0400 / 3	R-1 Program Element (Number/Name) PE 0603941D8Z / *Test and Evaluation Science and Technology*	Project (Number/Name) 092 / *Spectrum Efficient Technology*	

COST ($ in Millions)	Prior Years	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total	FY 2025	FY 2026	FY 2027	FY 2028	Cost To Complete	Total Cost
092: *Spectrum Efficient Technology*	82.996	25.000	49.975	10.053	-	10.053	10.192	9.586	9.777	9.972	-	-
Quantity of RDT&E Articles	-	-	-	-	-	-	-	-	-	-		

A. Mission Description and Budget Item Justification

Weapon systems have become increasingly complex in recent years, resulting in the need for significantly more data to be passed among these systems as well as between the systems and our test infrastructure. A vast amount of data must be collected, transmitted, and analyzed, which requires a large amount of radio frequency (RF) spectrum resources. However, the amount of RF spectrum designated to support test and evaluation (T&E) is decreasing, most notably due to reallocation of spectrum for commercial use. The combination of decreasing RF spectrum and increasing data requirements results in an urgent need to develop test technologies that maximize the use of spectrum resources for the Department of Defense (DoD) T&E operations.

The L- and S- Band frequencies are the traditional spectrum allotted for military T&E use. The explosive need for spectrum in the commercial sector has resulted in reallocation of portions of these bands to industry. To compensate, the DoD is now authorized to use the C-Band spectrum which offers numerous benefits, including the potential for a large increase in available bandwidth, but the C-Band spectrum comes with technical challenges and regulatory constraints. Most notably, our current test infrastructure for telemetry is not designed to accommodate C-Band and the band is heavily shared for alternate uses. Technologies are required to implement innovative techniques that efficiently facilitate our use of C-Band without a major overhaul to our national test infrastructure. For instance, commercial telemetry transmitters operate in C-Band but do not have the form factor (size, weight and power) nor ruggedized packaging to survive airborne test applications.

Traditional telemetry applications employ streaming telemetry where data is moved one-way from the instrumented system under test to our test range infrastructure. Modern network based telemetry and cellular based telemetry capabilities enable more robust, efficient bidirectional transfer of data. The DoD strategy is to create technologies for implementing a telemetry capability in C-Band, using the legacy L- and S-Bands for both streaming and networked telemetry, and researching the feasibility of using higher frequency bands to augment telemetry operations.

The Spectrum Efficient Technology (SET) project is developing test technologies that enable more efficient use of legacy telemetry bands and expansion into non-traditional areas of the RF and optical spectra at DoD test ranges. The technology development efforts within the SET project have been prioritized to align with the Department of Defense guidance on science and technology priority investments. As such, the SET project is focusing on growing data requirements of warfighting systems and the limited availability of spectrum for testing. The SET project is structured to develop test technologies to advance range communications, networked and cellular based telemetry capabilities, and enhanced management of spectrum at DoD test ranges

B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024
Title: Spectrum Efficient Technology	25.000	9.975	10.053

Exhibit R-2A, RDT&E Project Justification: PB 2024 Office of the Secretary Of Defense		Date: March 2023
Appropriation/Budget Activity 0400 / 3	**R-1 Program Element (Number/Name)** PE 0603941D8Z / *Test and Evaluation Science and Technology*	**Project (Number/Name)** 092 / *Spectrum Efficient Technology*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024
Description: The SET project continued to mature technologies required for network and cellular based telemetry. Airborne phased array telemetry antenna technologies were matured for both manned and unmanned platforms, to include demonstration of airborne phased array telemetry data collection. The SET project upgraded the small, lightweight data recorder and data transmission scheme integrated onto unmanned airborne platforms to support long range flight test telemetry data collection. The data recorder addressed long range flight test requirements for data recording and storage during flight testing. ***FY 2023 Plans:*** The SET project will continue development of technologies required for network and cellular based telemetry. Airborne and ground based phased array telemetry antenna technologies will continue to be matured and integrated onto unmanned airborne platforms and transportable ground based systems. Ground based phased array telemetry antenna technologies to support large footprint test events will be demonstrated. The SET project will initiate test technology development of airborne 5G test capability and improve 5G range instrumentation. ***FY 2024 Plans:*** The SET project will continue development of technologies required for network and cellular based telemetry. The SET project will begin transition of cellular technologies to support aeronautical telemetry requirements at open air test ranges. Airborne and ground based phased array telemetry antenna technologies will continue to be matured. Ground based phased array telemetry antenna technologies to support large footprint test events will be transitioned to support multiple long range flight test corridors. ***FY 2023 to FY 2024 Increase/Decrease Statement:*** The slight increase between FY 2023 and FY 2024 is due to program adjustments related to economic assumptions.			
Accomplishments/Planned Programs Subtotals	25.000	9.975	10.053

	FY 2022	FY 2023
Congressional Add: Test & Evaluation Science & Technology (TRMC) ***FY 2023 Plans:*** Program increase in support of airborne 5G test capability and 5G range instrumentation.	-	40.000
Congressional Adds Subtotals	-	40.000

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

Exhibit R-2A, RDT&E Project Justification: PB 2024 Office of the Secretary Of Defense		Date: March 2023
Appropriation/Budget Activity 0400 / 3	**R-1 Program Element (Number/Name)** PE 0603941D8Z / *Test and Evaluation Science and Technology*	**Project (Number/Name)** 092 / *Spectrum Efficient Technology*

D. Acquisition Strategy

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2024 Office of the Secretary Of Defense			Date: March 2023
Appropriation/Budget Activity 0400 / 3	R-1 Program Element (Number/Name) PE 0603941D8Z / *Test and Evaluation Science and Technology*	Project (Number/Name) 093 / *Electronic Warfare Test*	

COST ($ in Millions)	Prior Years	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total	FY 2025	FY 2026	FY 2027	FY 2028	Cost To Complete	Total Cost
093: *Electronic Warfare Test*	127.792	106.000	417.765	105.055	-	105.055	71.619	40.073	40.874	41.692	-	-
Quantity of RDT&E Articles	-	-	-	-	-	-	-	-	-	-		

A. Mission Description and Budget Item Justification

In order to establish dominance in the modern battlespace, our offensive and defensive electronic warfare systems must be capable against advanced radio frequency (RF) directed threats and electro-optic (EO) guided threats, which include infrared (IR) guidance. Ensured dominance in these areas requires more robust test and evaluation (T&E) with technologies that are rapidly adaptable to changing threats.

Readily available, IR seeking, man-portable air defense systems (MANPADS) are difficult to detect and pose an imminent and lethal threat to military aircraft of all types. Our ability to counter such threats is essential to owning the battlespace in theater. Therefore, the ability to test missile warning systems (MWS), hostile fire indicator (HFI) systems, IR countermeasures (IRCM), and advanced threat sensors is critical to our national defense. Additionally, a new generation of enemy RF missile seekers is both currently fielded and in further development, requiring a correspondingly new generation of test technologies to test the latest countermeasures. The T&E community is required to test IRCM and RF countermeasure systems in a repeatable manner with ground-truth data before and after integration into warfighting systems. Without new test technologies, the Department of Defense (DoD) will be unable to perform adequate T&E of advanced warning and countermeasure systems.

The Electronic Warfare Electronic attack and Electronic protect (EP) community is developing jammers and EP measures that are more sophisticated and take advantage of newer technology that allows adaptive waveforms and artificial intelligence and autonomy to respond to threats more rapidly and robustly. In addition, the testing of these systems in realistic many on many environments that are more threat representative requires new technology investment.

The technology development efforts within the Electronic Warfare Test (EWT) project have been prioritized to align with DoD guidance on science and technology priority investments. As such, the EWT project is focusing on the test needs in both the EO, including IR, and the RF threat domains. Additionally, development of core test technologies in this area can be leveraged to meet other EO and RF test requirements, such as in fire control systems; intelligence, surveillance and reconnaissance (ISR) sensors, and weapon seekers.

The EWT project develops test technologies to stimulate IRCM and RF system sensors through the high-fidelity simulation of scenes viewed by the sensors. Stimulation can be as simple as testing to see if a system under test responds to an image or as complex as simulating complex battle space phenomena to measure the response of a system under test in a more relevant, cluttered scenario. Simulations and stimulations are used at open air ranges and in installed system test facilities (ISTF), and in hardware-in-the-loop (HWIL) test beds.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024
Title: Electronic Warfare Test	106.000	119.265	105.055

Exhibit R-2A, RDT&E Project Justification: PB 2024 Office of the Secretary Of Defense		Date: March 2023
Appropriation/Budget Activity 0400 / 3	**R-1 Program Element (Number/Name)** PE 0603941D8Z / *Test and Evaluation Science and Technology*	**Project (Number/Name)** 093 / *Electronic Warfare Test*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024
Description: EWT initiated joint Electronic Warfare (EW) test technology developments to address Electronic Attack (EA) test technology needs, to expand the battlespace, and to enable improved assessment of EW platforms. This includes efforts to address inadequate laboratory and secure Installed System Test Facility (ISTF) modeling and simulation (M&S) representing evolving and changing RF threat systems, simulator and stimulator test technology. These joint EW test technologies initiated will also address shortfalls with open-air-range complex radar emitters, models, and RF threats inability to represent emerging and changing threat systems. The EWT project initiated efforts to address the inability to test EA techniques in secure environments and replicate modern threat signals through Hardware-In-the-Loop (HITL) and Installed System Test Facility (ISTF) simulations. Also, EWT initiated efforts to expand current range play-boxes to enable test and training with EW platforms that stress modern threat radar acquisition and detection ranges. The EWT project also began to address test technology needs for EW platforms and systems to have representative scale and depth for test and training of real-world missions. The EWT project continued to develop high fidelity scene generation technology for both EO and RF environments. The EWT project continued to develop high fidelity scene generation technology for both EO and RF environments. Work continued on the development of hardware and software that generates large number of independent radar targets in a high fidelity HITL facility. This enabled chamber testing of radars in more dense target environments by generating large numbers of dissimilar false targets. Work continued on high temperature IR scene projectors. The EWT project developed a dynamic infrared (IR) scene projector to enable chamber testing of missile warning systems and directional infrared countermeasure systems. The new scene projector creates scenes with higher temperatures and higher resolution creating a more threat representative environment for sensor test. The effort transitioned and delivered scene projectors to the Air Force Guided Weapons Evaluation Facility (GWEF). Work continued on increasing the efficiency of LED pixels for use in IR scene projectors. Work continued on development of interfaces for use of Active Electronically scanned arrays for open air range threat simulators. ***FY 2023 Plans:*** EWT will continue joint electronic warfare test technology developments to address Electronic Attack (EA) test technology needs, to expand the battlespace, and to enable improved assessment of EW platforms. The EWT project will continue investments in technologies related to Cognitive EW, Cognitive Radar, and EW sensors that feed Artificial Intelligence uses of EW data. EWT will initiate technology developments to improve Ground EW systems and cUAS EW testing. Prototype open air range threat emitter with wider frequency coverage and agility will be demonstrated. The EWT project will initiate technology development to develop threat representative electronicmagnetic spectrum warfare test emitters and associated sensor fusion. The EWT project will also advance 5th generation aerial target technology development. ***FY 2024 Plans:*** EWT will continue joint electronic warfare test technology developments to address Electronic Attack (EA) test technology needs, to expand the battlespace, and to enable improved assessment of EW platforms. The EWT project will continue investments in			

Exhibit R-2A, RDT&E Project Justification: PB 2024 Office of the Secretary Of Defense		Date: March 2023
Appropriation/Budget Activity 0400 / 3	**R-1 Program Element (Number/Name)** PE 0603941D8Z / *Test and Evaluation Science and Technology*	**Project (Number/Name)** 093 / *Electronic Warfare Test*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024
technologies related to Cognitive EW, Cognitive Radar, and EW sensors that feed Artificial Intelligence uses of EW data. EWT will continue technology developments to improve Ground EW systems and cUAS EW testing. Prototype open air range threat emitter with wider frequency coverage and agility will be matured. ***FY 2023 to FY 2024 Increase/Decrease Statement:*** Decrease from FY 2023 to FY 2024 due to the completion of an upgrade to electronic warfare threat emitter technology.			
Accomplishments/Planned Programs Subtotals	106.000	119.265	105.055

	FY 2022	FY 2023
Congressional Add: Test & Evaluation Science & Technology (TRMC)	-	298.500
FY 2023 Plans: Program increase to support improvement of electronic magnetic spectrum test emitters, sensor fusion, and 5th generation aerial target test technology development.		
Congressional Adds Subtotals	-	298.500

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2024 Office of the Secretary Of Defense			Date: March 2023
Appropriation/Budget Activity 0400 / 3	R-1 Program Element (Number/Name) PE 0603941D8Z / *Test and Evaluation Science and Technology*	Project (Number/Name) 094 / *Advanced Instrumentation Systems Technology*	

COST ($ in Millions)	Prior Years	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total	FY 2025	FY 2026	FY 2027	FY 2028	Cost To Complete	Total Cost
094: *Advanced Instrumentation Systems Technology*	102.721	42.000	12.180	19.957	-	19.957	21.455	20.880	21.223	22.549	-	-
Quantity of RDT&E Articles	-	-	-	-	-	-	-	-	-	-		

A. Mission Description and Budget Item Justification

The Advanced Instrumentation Systems Technology (AIST) project addresses the test technology gaps resulting from emerging weapon systems that need to be assessed at the Department of Defense (DoD) installed systems test facility and hardware-in-the-loop testing (ISTF/HITL) and open-air range test facilities (including tropospheric, land-based, open-ocean, and undersea ranges). Instrumentation requirements for systems under test are increasing exponentially for new weapons systems. System-borne, warfighter-wearable, and remote sensing instrumentation packages are required. This instrumentation is for sensing and collecting critical performance data; determining accurate time, space, position information (TSPI) and attitude information; interfacing with command and control data links; monitoring and reporting system-wide communications; recording human operator physical and cognitive performance; and storing and transmitting data.

The technology development efforts within the AIST project have been prioritized to align with the DoD guidance on science and technology (S&T) communities of interest (COIs). The AIST project is focused on developing technologies for advanced TSPI instrumentation (especially with limited or no availability of Global Positioning System (GPS)), advanced sensors, advanced energy and power systems for instrumentation, micro-electronics, mitigating range encroachment issues, and measuring warfighter physical and cognitive performance. The AIST project addresses requirements for miniaturized, non-intrusive instrumentation suites with increased survivability in harsh environments. Such instrumentation is an urgent need because minimal space is available to add instrumentation to new or existing weapon systems subsequent to their development; furthermore, additional weight and power needs for instrumentation can adversely affect weapon system signature and performance. Instrumentation for humans-in-the-loop, especially dismounted warfighters, must not adversely affect performance, induce artificiality in the test environment, or create any operational burdens. New technologies can be exploited to integrate small, non-intrusive instrumentation (micro-technology) into emerging platforms during design and development, and, in some cases, into existing platforms. This class of instrumentation will provide critical system performance data during operational test (OT) and continuous assessment throughout a system's lifecycle. Technology developed under AIST can also benefit training and combat missions by enabling a continual feedback loop between the developer, training staff, operators, and commanders.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024
Title: Advanced Instrumentation Systems Technology	42.000	12.180	19.957
Description: Description: Major thrusts included efforts in advanced sensors and TSPI instrumentation. The AIST projected continued three efforts to design a test technology for weapon testing use cases impacting the broad ocean area to collect TSPI, lethality, and scoring data; one technology uses optics, another leverages an imaging radar and a third employs underwater acoustic technology.			

Exhibit R-2A, RDT&E Project Justification: PB 2024 Office of the Secretary Of Defense		Date: March 2023
Appropriation/Budget Activity 0400 / 3	**R-1 Program Element (Number/Name)** PE 0603941D8Z / *Test and Evaluation Science and Technology*	**Project (Number/Name)** 094 / *Advanced Instrumentation Systems Technology*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024
The AIST project continued an effort to develop a sensor to collect acceleration measurement data during high-speed flight tests, enabling the gathering of accurate position and attitude, 6 Degrees of Freedom (6DOF) data over very long ranges and into the exo-atmosphere to measure the aerodynamics and internal guidance and control systems of new munitions in an ultra-high dynamic environment. The AIST project completed the development of an effort to support testing of military aircraft using externally mounted sound pressure instrumentation to gather data for analysis in all weather conditions, to overcome current constraints to flight testing in dry environments. Flight testing in a relevant environment is planned to take place at the Naval Air Warfare Center Aircraft Division, Patuxent River, MD. The AIST project continued a portable technology development effort using acoustic splash signatures to measure weapon location and attitude to characterize high dynamic weapon end-game maneuvers, and to evaluate impact location & velocity of attacking projectiles and resolving (scoring) very large quantities of impacts occurring closely spaced in position and/or time. This system has participated in at-sea system checkout activities and is planned to be an auxiliary sensor on an upcoming at-sea test of a weapon system impacting the ocean. ***FY 2023 Plans:*** The AIST project will initiate several new technology development efforts: a sweater battery prototype technology to store or convert energy and deliver useful power in austere ocean environments to support T&E sensor employment beyond the extents of existing test ranges; enhancements in electromagnetic (EM) propagation modeling for Atlantic Test Range radars; and a GPS-denied navigation prototype that uses a network of terrestrial-based transmitters. The AIST project will continue development of: multi-disciplinary technologies addressing T&E requirements for real-time casualty assessment (RTCA) of warfighter and weapon engagements, sensors to support advanced hypervelocity projectile testing, TSPI data fusion algorithms and technologies, high precision range radar technology, improved energy and power density systems for T&E, advanced non-intrusive data management techniques, and mitigation technologies for monitoring effects from encroachment on test ranges. The AIST project will also continue the investigation and development of advanced instrumentation technologies to support lethality testing and end-game scoring in the broad ocean area. ***FY 2024 Plans:*** The AIST project will initiate an effort to develop a mobile shallow water range to evaluate unmanned undersea vehicles (UUV) sensors and systems for high-resolution ocean environmental sensing, monitoring, and prediction systems. The AIST project plans to initiate a soft catch system for large caliber munitions to assess munitions internal ballistics, strength of design, and			

Exhibit R-2A, RDT&E Project Justification: PB 2024 Office of the Secretary Of Defense		Date: March 2023
Appropriation/Budget Activity 0400 / 3	**R-1 Program Element (Number/Name)** PE 0603941D8Z / *Test and Evaluation Science and Technology*	**Project (Number/Name)** 094 / *Advanced Instrumentation Systems Technology*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024
function of critical components, where the munition can be fired at operational velocities, and captured in a way that does not damage the projectile or the environment. ***FY 2023 to FY 2024 Increase/Decrease Statement:*** The increase between FY 2023 and FY 2024 provides new test instrumentation technology development technologies and program adjustments due to economic assumptions.			
Accomplishments/Planned Programs Subtotals	42.000	12.180	19.957

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2024 Office of the Secretary Of Defense			Date: March 2023
Appropriation/Budget Activity 0400 / 3	R-1 Program Element (Number/Name) PE 0603941D8Z / *Test and Evaluation Science and Technology*	Project (Number/Name) 095 / *Directed Energy Test*	

COST ($ in Millions)	Prior Years	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total	FY 2025	FY 2026	FY 2027	FY 2028	Cost To Complete	Total Cost
095: *Directed Energy Test*	90.737	24.000	30.072	10.475	-	10.475	10.205	10.450	10.688	10.932	-	-
Quantity of RDT&E Articles	-	-	-	-	-	-	-	-	-	-		

A. Mission Description and Budget Item Justification

The Department of Defense (DoD) is exploring the military utility, safety, and suitability of directed energy weapons. A robust test capability to assess directed energy weapons is essential to understanding their effectiveness and limitations, including determining their effectiveness in performing counter improvised explosive device (C-IED) operations and counter UAS operations. Such assessments will depend upon knowledge acquired through the test and evaluation (T&E) of directed energy technologies and testing of operational concepts. Directed energy weapon technologies, primarily consisting of high energy lasers (HEL) and high powered microwaves (HPM), are outpacing available test capabilities. Traditional test techniques for evaluating conventional munitions (with flight times ranging from seconds to minutes) are not sufficient for the T&E of directed energy weapons that place energy on target instantaneously. Consequently, new test technology solutions are needed to ensure that adequate developmental, live-fire, and operational test capabilities are available when directed energy programs are ready to test.

Directed energy system and component testing requires three principal assessments: (1) energy or power on target; (2) the effects on the target; and (3) the propagation of the directed energy to the target through the atmosphere. In addition, the vulnerabilities of DoD systems to directed energy threats are required to be characterized, such as those requirements captured in Military Standard (MIL-STD)-464C. Equally as important, current test capabilities do not provide the detailed data required to understand U.S. directed energy system performance and effects. The technology development efforts within the Directed Energy Test (DET) project have been prioritized to align with DoD guidance on science and technology priority investments. As such, the DET project is developing the technologies necessary for quantitative assessment of United States (U.S.) HEL and HPM performance, as well as the vulnerability of DoD weapon systems to enemy directed energy threats.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024
Title: Directed Energy Test	24.000	11.322	10.475
Description: The DET project initiated efforts to upgrade directed energy lab and test range infrastructure. The DET project continued efforts to measure HEL energy on small targets such as mortars, rockets, artillery, and UAS. The effort designed a recoverable mortar prototype to address Army and Navy requirements and an Air Force requirement for a missile-mounted target board. The DET project continued efforts to develop M&S capability for assessing effects of threat HEL systems on blue aircraft. The DET project completed efforts to mature a dense plasma focus technology to produce strategically relevant, ultra-short pulse neutron fluence levels for nuclear vulnerability testing. The DET project successfully demonstrated neutron production and dense plasma focus technology development continues to be optimized to support neutron production rates scalable to a test facility to be developed by the Central Test and Evaluation Investment Program (CTEIP). A larger chamber was integrated into the facility to test obtaining higher			

Exhibit R-2A, RDT&E Project Justification: PB 2024 Office of the Secretary Of Defense		Date: March 2023
Appropriation/Budget Activity 0400 / 3	**R-1 Program Element (Number/Name)** PE 0603941D8Z / *Test and Evaluation Science and Technology*	**Project (Number/Name)** 095 / *Directed Energy Test*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024
FY 2023 Plans: The DET project will continue developments in HEL test technologies and HPM test technologies to characterize the performance and effectiveness of HEL and HPM systems as they engage small targets, such as enemy rockets, missiles, artillery, and unmanned aerial vehicles, as well as electronic systems and other targets of interest and expand into larger UAS classes. This will include sensor and associated data collection systems that can survive an HPM environment. Finally, the DET project will continue development of HELSTF capability to engage missile targets for a demonstration in FY 2023 against supersonic targets. The DET project will also develop a directed energy airborne high-power testbed ***FY 2024 Plans:*** The DET project will continue developments in HEL test technologies and HPM test technologies to characterize the performance and effectiveness of HEL and HPM systems as they engage small targets, such as enemy rockets, missiles, artillery, and unmanned aerial vehicles, as well as electronic systems and other targets of interest and expand into larger UAS classes. This will include sensor and associated data collection systems that can survive an HPM environment, near surface laser weapon system propagation measurement sensors, atmospheric absorption sensors for high energy lasers, and target swarm tracking. ***FY 2023 to FY 2024 Increase/Decrease Statement:*** The slight increase between FY 2023 and FY 2024 is due to program adjustments related to economic assumptions.			
Accomplishments/Planned Programs Subtotals	24.000	11.322	10.475

	FY 2022	FY 2023
Congressional Add: Test & Evaluation Science & Technology (TRMC)	-	18.750
FY 2023 Plans: Program increase to develop a directed energy airborne high-power testbed.		
Congressional Adds Subtotals	-	18.750

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2024 Office of the Secretary Of Defense											Date: March 2023	
Appropriation/Budget Activity 0400 / 3					R-1 Program Element (Number/Name) PE 0603941D8Z / *Test and Evaluation Science and Technology*				Project (Number/Name) 096 / *C4I & Software Intensive Systems Test*			
COST ($ in Millions)	**Prior Years**	**FY 2022**	**FY 2023**	**FY 2024 Base**	**FY 2024 OCO**	**FY 2024 Total**	**FY 2025**	**FY 2026**	**FY 2027**	**FY 2028**	**Cost To Complete**	**Total Cost**
096: *C4I & Software Intensive Systems Test*	144.356	49.000	13.088	13.246	-	13.246	13.511	13.794	14.070	14.351	-	-
Quantity of RDT&E Articles	-	-	-	-	-	-	-	-	-	-		

A. Mission Description and Budget Item Justification

The Command, Control, Communications, Computers, Intelligence (C4I) and Software Intensive Systems (SIS) (C4T) project addresses test technology for next generation resilient, survivable, federated networks and information ecosystems (information superiority) from the tactical level up to strategic planning. The technology development efforts within the C4T project have been prioritized to align with DoD guidance of S&T Communities of Interest (CoIs) and the National Defense Strategy. Gaps are driven by more complex warfare environments and distributed systems; large quantities of data and intelligence (e.g., Big Data, Artificial General Intelligence (AGI) and Machine Learning Algorithms (MLA)); and more software intensive systems (e.g. F-35, CVN, IBCS)).

C4T addresses gaps in Big Data Analytics technologies to gain knowledge from massive amounts of structured and unstructured data collected over a single test, but also expanded to look at the systems' performance over the acquisition lifecycle. The technologies are required when testing sensor platforms, command and control systems and weapon platforms that support the kill chain in a Joint multi-domain operation. These systems must be evaluated for their ability to provide the accurate, timely transfer of data (e.g., target tracks, weapons allocation, mission tasking, and situational awareness) as the data passes among the Services, Warfighting Domains, and Coalition Partners.

C4T also addresses gaps in Live and Simulated Environments, these technologies are required to increase the use of a distributed test environment for new warfare concepts leveraging simulated entities (e.g. modeling and simulation) for more thorough joint mission context platform T&E (e.g., Anti-Access Arial Denial (A2AD)and Manned and Unmanned Systems (MUM-T)). The technologies within C4T will remove undesired distributed testing biases while improving test agility and the tester's ability to effectively support knowledge management, rapid analysis of "Big Data," and automated test reporting. The C4T project advances these test technologies as well as Big Data collection, analysis, and visualization that enable the virtual integration of Department of Defense (DoD) weapon laboratories and open air ranges. Using Modeling and Simulation (M&S) along with hardware-in-the-loop (HWIL) laboratories, the effectiveness of Joint missions can be assessed in terms of system-of-systems interoperability and effectiveness in executing Joint mission operations, including testing of weapons and C4I and SIS systems accessing and providing information.

Lastly C4T addresses technologies to support C2 Analysis in Multi-Domain Operations (MDO), specifically at scale and density to fully assessed the mission kill web with new test design, planning and assessment technologies utilizing artificial intelligence and machine learning to not only plan assessments within a domain, but also to enable assessments of "what-if" testing cascading across the other domains of warfare. This will enable full assessment of multi-domain operations to ensure information superiority to accomplish mission objectives. New intelligent testing technologies are required for assessment of MDO missions for our future warfighter AI/ML-enabled C2 Warfighter Systems to ensure the battlefield will not be the testing field. These new MDO focused technologies are vital to creation of a robust operationally relevant Joint Service All Domain Test Range.

Exhibit R-2A, RDT&E Project Justification: PB 2024 Office of the Secretary Of Defense		Date: March 2023
Appropriation/Budget Activity 0400 / 3	**R-1 Program Element (Number/Name)** PE 0603941D8Z / *Test and Evaluation Science and Technology*	**Project (Number/Name)** 096 / *C4I & Software Intensive Systems Test*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024
Title: C4I and Software Intensive Systems Test	49.000	13.088	13.246

Description: The C4T Threat Submarine Modeling Validation project transitioned advanced modeling and simulation technology capabilities to the Naval Undersea Warfare Center (NUWC) Weapons Analysis Facility (WAF) validated (by COTF and DOT&E) modeling capabilities that resulted in over $150 million of saving by reducing the number of live in-water runs required for the MK 48 Heavy Torpedo. These technologies will be instrumental to all future next generation torpedo developments as well as current torpedo system upgrades. With these advanced M&S capabilities we can now finally assess performance of torpedoes in all underwater bathometry (e.g. deep, shallow, and varying ocean ecology).

The C4T MultiVariate Data Workbench (MVDW) is transitioning to the US Army Fort Sills Test Directorate providing advanced AI/ML technologies to support near real-time data collection and validation for the US Army indirect fire doctrine. Data collection includes structured and unstructured datasets which currently requires multiple days to validate after collection and often resulting in retesting cycles as anomalies are not recognized during execution. MVDW will provide these answers after the completion of each test day. This exciting technology product is being used to support US Army Bold Quest 2022.

The C4T Multivariate Algorithms for Optimized Test Heuristics and Real-time Analysis (MAOTHRA) is transitioning to the Redstone Test Center ATEC providing advanced statistical analytic techniques in a parallel processing computing environment to automatically calibrate cameras (low-cost, high-speed) to support generation of TSPI on weapon systems test events, resulting in cost savings from existing high-cost cameras with lengthy (hours) calibration techniques to low-cost cameras that are calibrated within minutes. MAORTHRA AI/ML techniques for analysis of large multivariant data sets to provide valuable insights from time-series weapon systems sensor are presently supporting the US Army Project Convergence 2022.

The C4T project continued the development of several big data analytics (BDA) efforts implementing artificial intelligence/ machine learning (AI/ML) techniques for multi-variant time series sensor datasets, unstructured dataset analytics (audio, video, and imagery), and advanced visualizations of large T&E datasets.

These efforts include: traditional statistical and machine learning/artificial intelligence (ML/AI) techniques to deal with massive complex datasets; the software execution has been focused on the use of containerized microservices architecture for ease of technology transfer across all T&E organizations. Common technologies across C4T project also supports advanced data synchronization and fusion frameworks to automate development of assessment metrics and to quickly recall synchronized segments from large T&E datasets (e.g., multivariate time series, audio, video, and imagery. Lastly, C4T project is creating advanced visualization techniques; to support the presentation of information by abstracting data into particles to optimally exploit current vision and neuroscience research. This allows the T&E analyst to visualize anomalies, trends, patterns, and failure conditions found across the entirety of the T&E dataset and not be focused on an individual dataset. These technologies are being

Exhibit R-2A, RDT&E Project Justification: PB 2024 Office of the Secretary Of Defense		Date: March 2023
Appropriation/Budget Activity 0400 / 3	**R-1 Program Element (Number/Name)** PE 0603941D8Z / *Test and Evaluation Science and Technology*	**Project (Number/Name)** 096 / *C4I & Software Intensive Systems Test*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024
developed to support test and evaluation of future warfighter C4I and Software Intensive Systems (4th and 5th generation military platforms). ***FY 2023 Plans:*** The C4T project will continue development of technologies to enable the next generation resilient, survivable, federated networks and information ecosystems (information superiority) from the tactical level up to strategic planning across three domains: BDA, Live and Simulated Environments, and C2 Analysis in Multi-Domain Environments. The C4T project will continue to focus on testing more advanced BDA technologies to support rapid data-to-decisions across complex and distributed warfighter systems environments and in support of each warfighter platform's acquisition lifecycle. The C4T project will investigate the increased use of live and simulated test participants using test environment driven M&S validation techniques. The C4T project TSMV will be maturing M&S technologies to enable updates to the Office of Naval Intelligence threat submarine models to allow a better vision of threat submarines structural vulnerabilities as these targets are tracked and engaged by the U.S. Fleet. The C4T project will initiate investments to support C2 Analysis in Multi-Domain Environments and investigate the increased use of test automation utilizing virtualization and cloud environments. ***FY 2024 Plans:*** The C4T project will continue development of technologies to enable the next generation resilient, survivable, federated networks and information ecosystems (information superiority) from the tactical level up to strategic planning. The C4T project will continue to focus on testing more advanced BDA technologies to support rapid data-to-decisions across complex and distributed warfighter systems environments and in support of each warfighter platform's acquisition lifecycle. The C4T project will initiate investments to support C2 Analysis in Multi-Domain Environments and investigate the increased use of test automation utilizing virtualization and cloud environments. C4T will initiate test technology development to enable a test, training, and experimentation continuum supporting all aspects of multi-domain operations. The C4T project will investigate the increased use of live and simulated test participants using test environment driven M&S validation techniques. ***FY 2023 to FY 2024 Increase/Decrease Statement:*** The slight increase between FY 2023 and FY 2024 is due to program adjustments related to economic assumptions.			
Accomplishments/Planned Programs Subtotals	49.000	13.088	13.246

Exhibit R-2A, RDT&E Project Justification: PB 2024 Office of the Secretary Of Defense		Date: March 2023
Appropriation/Budget Activity 0400 / 3	**R-1 Program Element (Number/Name)** PE 0603941D8Z / *Test and Evaluation Science and Technology*	**Project (Number/Name)** 096 / *C4I & Software Intensive Systems Test*

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2024 Office of the Secretary Of Defense			Date: March 2023
Appropriation/Budget Activity 0400 / 3	R-1 Program Element (Number/Name) PE 0603941D8Z / *Test and Evaluation Science and Technology*	Project (Number/Name) 097 / *Autonomy and Artificial Intelligence Test*	

COST ($ in Millions)	Prior Years	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total	FY 2025	FY 2026	FY 2027	FY 2028	Cost To Complete	Total Cost
097: *Autonomy and Artificial Intelligence Test*	74.599	21.000	98.992	47.379	-	47.379	41.038	43.787	44.275	47.760	-	-
Quantity of RDT&E Articles	-	-	-	-	-	-	-	-	-	-		

A. Mission Description and Budget Item Justification

Unmanned and autonomous systems support every domain of warfare -- operating in space, in air, on land, on the sea surface, undersea, and in subterranean conditions to support a vast variety of missions. The emergence of Artificial Intelligence (AI) brings a host of revolutionary capabilities that will profoundly influence warfare, and bring special challenges for testers of Artificial Intelligence systems. The Unmanned Autonomous System Test (UAST) project addresses current and emerging challenges associated with the test and evaluation (T&E) of unmanned systems, particularly in testing autonomy, artificial intelligence, and machine learning. As such, the UAST project is developing test technologies to simulate, stimulate, instrument, measure, and assess an autonomous system's ability to perceive its environment, process information, adapt to dynamic conditions, make decisions, and effectively act on those decisions in the context of mission execution.

The AAIT project will provide the test technologies to effectively measure performance and characterize risk, thereby increasing warfighter trust in autonomous systems and artificial intelligence tools. This program will improve DoD test capabilities and methodologies to address the testing of increasingly autonomous units operating in unstructured, dynamic, battlespace environments. Furthermore, advancements are being made in developing collaborating, system-of-autonomous-systems that will work in concert as a swarm or pack, and in close proximity with humans. New test technologies are needed to stress the collective set of autonomous systems under realistic conditions, predict emergent behavior of autonomous systems, emulate the complex environment, and assess mission performance of these highly-coupled and artificially-intelligent systems.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024
Title: Autonomy and Artificial Intelligence Test	21.000	22.742	47.379
Description: The AAIT Project continued test technology development supporting testers in the DoD of Unmanned and Artificial Intelligence-Based Systems. AAIT develops technology to improve ability to develop salient and high-value test plans, increasing safety during live test, to identify safety defects deep inside complex autonomy software, and to improve performance of machine vision systems. The AAIT project collaborated with the Autonomy Community of Interest (COI) Test and Evaluation, Verification and Validation (TEVV) Working Group to ensure that the AAIT project is investing in technologies relevant to the future of autonomous systems. The AAIT Project seeks solutions for legacy topics (test planning, test execution, safety, and performance assessment) but has also expanded interest to find solutions for Artificial Intelligence and Machine Learning systems, topics identified by the intelligence community, and any other topics that are priority for TRMC and OUSD(R&E). The AAIT project continued the Assured DevSecOps of Autonomous Systems (ADAS) effort. ADAS addresses the unique challenges of Autonomy test & evaluation to provide enterprise solutions in support of future programs and joint initiatives. ADAS			

Exhibit R-2A, RDT&E Project Justification: PB 2024 Office of the Secretary Of Defense		Date: March 2023
Appropriation/Budget Activity 0400 / 3	**R-1 Program Element (Number/Name)** PE 0603941D8Z / *Test and Evaluation Science and Technology*	**Project (Number/Name)** 097 / *Autonomy and Artificial Intelligence Test*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024
addresses autonomy test and evaluation verification and validation (TEV&V) needs across the life cycle beginning with mission analysis and engineering and ending with the mission operations. ADAS is a leading pathfinder effort to address gaps identified by the National Security Commission on Artificial Intelligence. The AAIT Project continued investments in robustness testing technology to detect and predict safety-related vulnerabilities and failures within UAS software, in advance of live test. The AAIT project provided the key S&T technology as a basis for the Navy-led CTEIP, “Autonomy, Integration, and Teaming” (AIT), which developed test capabilities to be demonstrated on the Airborne Collision Avoidance System (ACAS-Xu) on Triton, and as a basis for Guardian, a Ground Based Detect and Avoid system, which will allow UAS to achieve certification for use during live test (DO-278A/NAVAIR Cert). The same core technologies are used as a basis for the Army-led CTEIP “Autonomous Systems Test Capability” (ASTC). The AAIT project give testers a more comprehensive means of identifying and reporting on safety vulnerabilities found deep within the UAS software, allowing testers to test for defects that may not have ever been found by traditional testing techniques. The AAIT Project completed development of test technology to improve test planning for surface, sub-surface, ground, and airborne autonomy using optimization algorithms to rapidly generate salient test scenarios. The AAIT project provided the key S&T technology (for test planning) as a basis for the Navy-led CTEIP, “Autonomy, Integration, and Teaming” (AIT). The same core technologies are used as a basis for the Army-led CTEIP “Autonomous Systems Test Capability” (ASTC). The AAIT project, via the CTEIP programs, give testers information about how to choose high-value test conditions. AAIT technology shows exactly where software-based systems are on a performance edge (between mission success and mission failure) and a safety edge (between safety success and safety failure). AAIT helps testers see critical test conditions that they might not have chosen by traditional means. The AAIT Project initiated development of technology to create machine-learned, behavioral copies of autonomy software. This technology creates faster-than-real-time versions of a given autonomy that can then be tested in an accelerated timeline in a simulated environment, and can also be cloned to be tested in parallel-processing fashion. This technology will provide faster, better, and more statistically significant testing data for testers. This technology can also capture human performance, for example a pilot, or a ground radar operator) to be used as more realistic elements of a simulated environment. The AAIT project developed machine vision test technologies to identify where a machine vision system shows brittleness – inconsistent identification – of elements in its field of view. This technology can be used to improve performance of machine vision systems by identifying test data (images or video) to be used for focused testing and also can be used to re-train a brittle system for improved performance.			

Exhibit R-2A, RDT&E Project Justification: PB 2024 Office of the Secretary Of Defense		Date: March 2023
Appropriation/Budget Activity 0400 / 3	**R-1 Program Element (Number/Name)** PE 0603941D8Z / *Test and Evaluation Science and Technology*	**Project (Number/Name)** 097 / *Autonomy and Artificial Intelligence Test*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024
The AAIT Project developed technology to use functional architecture data to identify safety faults, and build safety fault trees) for complex autonomy software systems. Fault tree development has been traditionally built by hand. This technology will identify faults and build a fault tree more comprehensively and thoroughly than humanly possible, saving resources and improving the identification of safety risks in advance of live test. The AAIT Project developed technology to assist with the validation and verification of a learning-in-the-field AI-based system. This technology will assist testers by advising when a learning system has learned sufficiently different information to the point where it is no longer valid for use. This technology can also be used to determine if a system trained in one domain (urban, for example) is valid for use in another domain (desert). ***FY 2023 Plans:*** The AAIT Project will continue development of test technology for machine vision systems, learning systems, improved safety awareness, and measure of effectiveness of Counter-UAS systems. AAIT will initiate technology development to generate relevant synthetic data to train AI algorithms. AAIT will also develop and deploy new test techniques, referred to as data collection at the edge, to automate the collection, storage, tagging, and analysis of data during live DoD test events with systems under test employing autonomy and artificial intelligence algorithms. AAIT will also initiate artificial intelligence hubs and all-domain autonomous M&S technology development. The AAIT Project will continue to initiate and develop technologies to support test planning, test execution, and performance assessment of unmanned, autonomous, artificial intelligence, and machine learning systems. ADAS will continue to deliver pathfinding solutions of transformational capabilities addressing the full spectrum of TEV&V needs. AAIT will continue to transition technologies to end users at the labs and ranges of the MRTFB. AAIT will continue to risk reduce test capability development. AAIT will investigate concepts to verify the autonomy design models against design requirements using formal methods, and a Test-Case Execution Environment based on AI-guided Testing, using machine-learning in the test planning process to make recommendations of test conditions for evaluation of machine learning image classifiers. ***FY 2024 Plans:*** The AAIT Project will continue development of test technology for machine vision systems, learning systems, and improved safety awareness, and synthetic imagery generation. AAIT will initiate technology development for measures of trust/confidence in autonomous/AI-based systems, also measures of effectiveness of human/machine teams. The AAIT project will develop AI test and evaluation (T&E) high-performance computing resources to support continued enhancement of artificial intelligence hubs technology. The AAIT Project will continue to initiate and develop technologies to support test planning, test execution, and performance assessment of unmanned, autonomous, artificial intelligence, and machine learning systems. ***FY 2023 to FY 2024 Increase/Decrease Statement:***			

Exhibit R-2A, RDT&E Project Justification: PB 2024 Office of the Secretary Of Defense		Date: March 2023
Appropriation/Budget Activity 0400 / 3	**R-1 Program Element (Number/Name)** PE 0603941D8Z / *Test and Evaluation Science and Technology*	**Project (Number/Name)** 097 / *Autonomy and Artificial Intelligence Test*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024
The increase between FY 2023 and FY 2024 supports enhanced Cyber Security and IT for Artificial Intelligence Assurance.			
Accomplishments/Planned Programs Subtotals	21.000	22.742	47.379

	FY 2022	FY 2023
Congressional Add: Test & Evaluation Science & Technology (TRMC)	-	76.250
FY 2023 Plans: Program increase to support the initiation of AI hubs, all-domain autonomous M&S technology development		
Congressional Adds Subtotals	-	76.250

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2024 Office of the Secretary Of Defense			Date: March 2023
Appropriation/Budget Activity 0400 / 3	R-1 Program Element (Number/Name) PE 0603941D8Z / *Test and Evaluation Science and Technology*	Project (Number/Name) 098 / *Cyberspace Test*	

COST ($ in Millions)	Prior Years	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total	FY 2025	FY 2026	FY 2027	FY 2028	Cost To Complete	Total Cost
098: *Cyberspace Test*	68.071	23.000	18.431	14.707	-	14.707	15.000	15.315	15.620	15.932	-	-
Quantity of RDT&E Articles	-	-	-	-	-	-	-	-	-	-		

A. Mission Description and Budget Item Justification

The Department of Defense (DoD) ability to use cyberspace for rapid communication and information sharing in support of operations is a critical enabler of DoD military missions. Advancements in utilizing cyberspace are outpacing the technologies needed for test and evaluation (T&E). The Cyberspace Test Technology (CTT) project develops advanced technologies and methodologies to test and evaluate DoD capabilities and information networks to defend and conduct full-spectrum military operations across cyberspace. This program will improve cyberspace T&E capabilities to support the continual experimental, contractor, developmental, operational, and live-fire testing requirements of warfighter systems operating in cyberspace. Many of the test tools and infrastructure items required for systems in cyberspace will require advancement and maturation of nascent test technologies. The CTT project will address test technology shortfalls in cyberspace testing, including planning cyberspace tests, creating representative cyberspace threats and test environments, executing cyberspace tests, and performing cyberspace test analysis and evaluation.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024
Title: Cyberspace Test	23.000	14.431	14.707
Description: The CTT project developed a next generation Traffic Generation and Content System that used modern Artificial Intelligence techniques and detailed network, human social, and work flow models to generate traffic. This technology development worked to ensure host and network traffic that was easily distinguished from human generated traffic. The CTT project developed the novel capability to fuzz targets' virtual machine state. This technology enabled exploring an entirely new class of attacks compared to existing fuzzers which fuzzed only the program inputs. The CTT project developed a framework to provide the red team and other DoD test organizations an automated attack capability. This technology development enabled red team personnel to focus on more challenging problems and other test organizations to conduct automated testing.			
FY 2023 Plans: The CTT project will continue to pursue technology developments addressing needs in Cyber-Physical Systems, in Tactical Edge Networks, and in Enterprise Information Systems. This includes the development of fuzzing tools and tools to measure the efficacy of cyber testing events and share anonymized results for all DoD testing. CTT also plans to develop more tools for red team automation. In addition, CTT plans to demonstrate the new traffic generation and content system in a relevant test environment. CTT plans to start projects in the Cyber-Physical System domain such as Cyber-Physical System virtualization and Cyber-Physical System Test Automation.			
FY 2024 Plans:			

Exhibit R-2A, RDT&E Project Justification: PB 2024 Office of the Secretary Of Defense		Date: March 2023
Appropriation/Budget Activity 0400 / 3	**R-1 Program Element (Number/Name)** PE 0603941D8Z / *Test and Evaluation Science and Technology*	**Project (Number/Name)** 098 / *Cyberspace Test*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024
The CTT project will continue developing and demonstrating technology to address needs in the Cyber-Physical Systems, Tactical Edge Networks, and Enterprise Information Systems domains. ***FY 2023 to FY 2024 Increase/Decrease Statement:*** The slight increase between FY 2023 and FY 2024 is due to program adjustments related to economic assumptions.			
Accomplishments/Planned Programs Subtotals	23.000	14.431	14.707

	FY 2022	FY 2023
Congressional Add: Test & Evaluation Science & Technology (TRMC)	-	4.000
FY 2023 Plans: Program increase to advance cybersecurity signal generation.		
Congressional Adds Subtotals	-	4.000

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2024 Office of the Secretary Of Defense			Date: March 2023
Appropriation/Budget Activity 0400 / 3	R-1 Program Element (Number/Name) PE 0603941D8Z / *Test and Evaluation Science and Technology*	Project (Number/Name) 099 / *Space Test*	

COST ($ in Millions)	Prior Years	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total	FY 2025	FY 2026	FY 2027	FY 2028	Cost To Complete	Total Cost
099: *Space Test*	0.000	-	32.125	0.830	-	0.830	0.908	1.142	1.165	1.188	-	-
Quantity of RDT&E Articles	-	-	-	-	-	-	-	-	-	-		

A. Mission Description and Budget Item Justification

The space domain has become a competitive, congested, and contested environment dominated by global economics and key to national security. With the creation of the United States Space Force, the Department of Defense (DoD) is prioritizing investments to maintain space superiority and increase resiliency of space systems. Current testing infrastructure and methodologies to assess space system resilience against emerging threats is limited. The Space Test (ST) project mission is to address national test capability gaps by providing accurate, robust, and efficient T&E solutions to successfully develop, validate, and inform the employment of new space control systems. The ST project addresses test technology needs for adequate realism for space systems and aligns with the DoD S&T priority investments and is developing a strategic roadmap and investment strategy to establish live and virtual range environments, develop space and ground-based threat emulation capabilities. The ST project seeks to develop technologies that will enable robust, accurate, and timely T&E of future space weapon systems.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024
Title: Space Test	-	0.725	0.830
Description: The Space Test (ST) project has conducted a test infrastructure analysis of space systems test needs and developed a time-phased investment strategy based on those requirements. Work included engaging the space test community on needs and gaps to ensure traceability of test technology development to strategic objectives. Space Test continued design and initial development of a Space Based Telemetry (SBTM) system to support long rang flight test needs. Work continued to develop the Tactical Aerospace Laser Optical Simulator – High Altitude (TALOS-High), successfully passing Critical Design Review (CDR). Development work for the TALOS-High dynamic laser test bed will continue.			
FY 2023 Plans: The Space Test project will begin to address test technology needs identified in the Space T&E investment roadmap and time-phased investment strategy. Development of a Space Based Telemetry (SBTM) system to support long rang flight test needs will continue. SBTM payload, bus, and orbit design continues with partnerships between Army Futures Command and the Space Development Agency. Additional improvements to SBTM space based range tracking test technology development will also start under STT. In coordination with Laurence Livermore National Laboratory (LLNL), TRMC will begin the initial phase development of a mobile space system test bed. Lastly, TRMC plans to begin laboratory upgrades to the Kirtland AFB laboratory facility, Monzano Mountain, to support space test needs.			
FY 2024 Plans:			

Exhibit R-2A, RDT&E Project Justification: PB 2024 Office of the Secretary Of Defense		Date: March 2023
Appropriation/Budget Activity 0400 / 3	**R-1 Program Element (Number/Name)** PE 0603941D8Z / *Test and Evaluation Science and Technology*	**Project (Number/Name)** 099 / *Space Test*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024
SBTM payload/bus integration and initial deployment to support long rang flight test needs is planned. The next phase of the mobile space system test bed is planned to start in FY24 to enhance capacity and capability of the test bed. ***FY 2023 to FY 2024 Increase/Decrease Statement:*** The slight increase between FY 2023 and FY 2024 is due to program adjustments related to economic assumptions.			
Accomplishments/Planned Programs Subtotals	-	0.725	0.830

	FY 2022	FY 2023
Congressional Add: Test & Evaluation Science & Technology (TRMC) ***FY 2023 Plans:*** Program increase to improve space based range tracking.	-	31.400
Congressional Adds Subtotals	-	31.400

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A