Exhibit R-2, RDT&E Budget Item Justification: PB 2022 Office of the Secretary Of Defense	Date: May 2021
Appropriation/Budget Activity 0400: *Research, Development, Test & Evaluation, Defense-Wide* / BA 6: *RDT&E Management Support*	**R-1 Program Element (Number/Name)** PE 0604940D8Z / *Central Test and Evaluation Investment Program (CTEIP)*

COST ($ in Millions)	Prior Years	FY 2020	FY 2021	FY 2022 Base	FY 2022 OCO	FY 2022 Total	FY 2023	FY 2024	FY 2025	FY 2026	Cost To Complete	Total Cost
Total Program Element	1,633.538	381.356	423.206	550.140	-	550.140	-	-	-	-	-	-
940: *Central Test and Evaluation Investment Program (CTEIP)*	1,633.538	381.356	423.206	550.140	-	550.140	-	-	-	-	-	-

A. Mission Description and Budget Item Justification

Since its inception in FY 1990, Central Test and Evaluation Investment Program (CTEIP) provides the development of critically needed, high-priority Test and Evaluation (T&E) capabilities for joint/multi-Service requirements. CTEIP projects include Hypersonics, Directed Energy, Cyber Security, Electronic Warfare, Missile Defense, Nuclear Effects, Space, Autonomy and Command/Control and Communications. Other Investments in test infrastructure align with objectives in the Strategic Plan for DoD T&E Resources for high priority test needs and common range Infrastructure. The CTEIP uses a corporate investment approach to combine T&E needs from Service, Defense, and other Government agencies in order to maximize opportunities for joint efforts and avoid unwarranted duplication of test capabilities. CTEIP evaluates and selects for execution, project proposals that align to the NDS and USD(R&E) priorities, provide the greatest return on investment, make efficient use of limited test resources, leverage Service investment, and promote joint solutions to fill test capability gaps.

CTEIP provides enterprise solutions that benefit the whole Department. These investments are needed so that test capabilities keep pace with U.S. and adversary technical advances as well as, with quickly changing threats. The CTEIP includes special studies, analyses, project improvements, quick reaction efforts and strategic planning related to test capabilities and infrastructure. CTEIP investments increase efficiency and reduce the cost of testing on DoD's major ranges and test facilities. CTEIP continues to serve as the focal point for fostering common architectures throughout the test and training communities to enhance the sharing of resources and linkages between test and training ranges. CTEIP investments in FY 2022 will modernize Long Range Fires and Nuclear Test & Evaluation infrastructures. Long Range Fires modernization will develop new capabilities to test the effectiveness of new materials and designs for long range ballistic/hypersonic weapon systems. Nuclear Enterprise modernization will revitalize DoD's nuclear effects test and evaluation simulators, M&S and other test capabilities needed to assess existing weapon systems, weapons modernization programs and other mission critical systems that must be tested against these effects. CTEIP investments in FY 2022 will also include increased investments in high-priority hypersonic ground and open-air range test capability, critically needed upgrades to DoD Threat Models and Simulations, High Energy Laser test facilities, Nuclear Effects simulators, and live/virtual unmanned autonomous systems.

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B. Program Change Summary ($ in Millions)	FY 2020	FY 2021	FY 2022 Base	FY 2022 OCO	FY 2022 Total
Previous President's Budget	390.692	422.451	410.939	-	410.939
Current President's Budget	381.356	423.206	550.140	-	550.140
Total Adjustments	-9.336	0.755	139.201	-	139.201
• Congressional General Reductions	-	-0.295			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	-	1.050			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-9.336	-			
• SBIR/STTR Transfer	-	-			
• Program Adjustment	-	-	139.201	-	139.201

Change Summary Explanation

FY 2022 increase to invest in modernization of Long Range Fires and Nuclear Test & Evaluation infrastructures.

Exhibit R-2A, RDT&E Project Justification: PB 2022 Office of the Secretary Of Defense			Date: May 2021
Appropriation/Budget Activity 0400 / 6	R-1 Program Element (Number/Name) PE 0604940D8Z / *Central Test and Evaluation Investment Program (CTEIP)*	Project (Number/Name) 940 / *Central Test and Evaluation Investment Program (CTEIP)*	

COST ($ in Millions)	Prior Years	FY 2020	FY 2021	FY 2022 Base	FY 2022 OCO	FY 2022 Total	FY 2023	FY 2024	FY 2025	FY 2026	Cost To Complete	Total Cost
940: *Central Test and Evaluation Investment Program (CTEIP)*	1,633.538	381.356	423.206	550.140	-	550.140	-	-	-	-	-	-
Quantity of RDT&E Articles	-	-	-	-	-	-	-	-	-	-		

A. Mission Description and Budget Item Justification

The Central Test and Evaluation Investment Program (CTEIP) develops critically needed, high-priority Test and Evaluation (T&E) capabilities for joint/multi-Service requirements. CTEIP projects include Hypersonics, Directed Energy, Cyber Security, Electronic Warfare, Missile Defense, Nuclear Effects, Space, Autonomy and Command/Control and Communications. Other Investments in test infrastructure align with objectives in the Strategic Plan for DoD T&E Resources for high priority test needs and common range Infrastructure.

The CTEIP uses a corporate investment approach to combine T&E needs from Service, Defense, and other Government agencies in order to maximize opportunities for joint efforts and avoid unwarranted duplication of test capabilities. CTEIP evaluates and selects for execution, project proposals that align to the NDS and USD(R&E) priorities, provide the greatest return on investment, make efficient use of limited test resources, leverage Service investment; and promote joint solutions to fill test capability gaps. CTEIP provides enterprise solutions that benefit the Department as a whole.

The CTEIP provides critically needed T&E investments which align to USD(R&E) priorities and the Strategic Plan for DoD T&E Resources. These investments are needed so that test capabilities keep pace with U.S. and adversary technical advances as well as with quickly changing threats. The CTEIP includes special studies, analyses, project improvements, quick reaction efforts and strategic planning related to test capabilities and infrastructure. CTEIP investments increase efficiency and reduce the cost of testing on DoD's major ranges and test facilities. CTEIP continues to serve as the focal point for fostering common architectures throughout the test and training communities to enhance the sharing of resources and linkages between test and training ranges.

CTEIP investments in FY 2022 will modernize Long Range Fires and Nuclear Test & Evaluation infrastructures. Long Range Fires modernization develops new capabilities to test the effectiveness of new materials and designs for long range ballistic/hypersonic weapon systems. Nuclear Enterprise modernization funding is directed at revitalizing DoD's nuclear effects test and evaluation simulators, M&S and other test capabilities needed to assess existing weapon systems, weapons modernization programs and other mission critical systems that must be tested against these effects.

FY 2022 includes increased investments in high-priority hypersonic ground and open-air range test capability, critically needed upgrades to DoD Threat Models and Simulations, High Energy Laser test facilities, Nuclear Effects simulators, and live/virtual unmanned autonomous systems.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2020	FY 2021	FY 2022
Title: Central Test and Evaluation Investment Program	381.356	423.206	550.140

Exhibit R-2A, RDT&E Project Justification: PB 2022 Office of the Secretary Of Defense		Date: May 2021
Appropriation/Budget Activity 0400 / 6	**R-1 Program Element (Number/Name)** PE 0604940D8Z / *Central Test and Evaluation Investment Program (CTEIP)*	**Project (Number/Name)** 940 / *Central Test and Evaluation Investment Program (CTEIP)*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2020	FY 2021	FY 2022
Description: Long Range Fires modernization will develop new capabilities to test the effectiveness of new materials and designs used in the leading edges and control surfaces of long range ballistic and hypersonic weapon systems in representative ground test environments. Repeated ground testing under a variety of simulated flight conditions is essential to developing designs with good mass properties and high survivability before undergoing expensive and time-consuming flight testing. Nuclear Enterprise modernization is directed at revitalizing DoD's nuclear effects test and evaluation simulators, M&S and other test capabilities needed to assess existing weapon systems, weapons modernization programs and mission critical system components that must be tested against these effects. Advanced Communication Threat Testing Suites Uplink Capability project develops an EW threat representative uplink jamming system for T&E of satellite system responsiveness against threat systems. In FY20, the project development initiated, procured material and a prime mover and conducted an interface subsystem test. Full Operation Capability (FOC) is planned in FY22. Accelerated Vehicle Durability Testing project develops a multi-axle vehicle chassis simulator and a drive train simulator in order to test 4 and 5 axle vehicle performance and reliability. In FY20, the project completed preliminary and critical design review and began construction of the simulator foundation. FOC is planned in FY22. Advanced Dynamic Transmitter Array project develops a suite of active electronically scanned array antennas to conduct EW testing using unique classified threat signals and dense EW environment at the Benefield Anechoic Chamber that cannot be conducted in open air testing. During FY20, the project completed a single stream test of RF components, continued subassembly manufacturing, assembly and test. The design has been transferred to the Air Force 412th EWG to assess options for future development. Advanced Range Tracking and Imaging System project develops an integrated next generation suite of optical tracking systems to increase performance, reduce costs and establish secure reliable optical tracking capability on DoD open-air ranges. During FY20, the project completed a capability demonstration of the Fly-Out System and the Initial Design Review of the Close-In System. Initial Operational Capability is planned in FY22. The Short-Wave Infrared Zoom Lens project develops a short-wave infrared metric zoom lens to be mounted on multiple DoD tracking systems to track, determine effects phenomenology, and TSPI of aerial directed energy targets at night and in obscuration. During FY20, the project finalized the requirement, awarded the contract, and the developer completed design and initial manufacturing of the lens. FOC planned in FY21. Advanced Weapons Effects Test Capability project develops an array of high-speed cameras and fragment tracking software to accurately measure warhead fragments 2mm and above to establish higher fidelity for Joint Munitions Effects Manual (JMEM) damage and safety zones improving the warfighters' ability to effectively use the mix of weapons systems available. Capabilities will be delivered at Eglin AFB, FL, Aberdeen Proving Grounds, MD and China Lake, CA. During FY20, the project completed testing and installation at all three ranges. IOC was achieved in FY 2020. Air Warfare Battle Shaping project is a joint Navy, JSF, and TRMC development to provide a telemetry and real time casualty assessment capability similar to AARI-2 for F-35 OT at Pt Mugu, China Lake, and Edwards AFB. IOC was achieved in FY20.			

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2020	FY 2021	FY 2022
Airborne Early-warning Interoperability Simulator project establishes an ISTF capability to emulate an operationally representative, dense radar target environment for injection-mode ground-testing of the E-2D mission system. In FY20, the project finalized the Clutter and Multipath remediation, site integration and FOC at NAS Patuxent River, MD. Autonomous Systems Test Capability - Ground project develops a Digital Robotic and Autonomous Systems Integrated Virtual Environment (DRIVE) for testing DoD autonomous ground vehicle systems and an open-air range Safety Environment, Engagement and Response (SEER) capability to safely test full scale autonomous vehicles. During FY20, the DRIVE sub-project completed architecture design, awarded development contracts and started work on Software Release 1. The SEER sub-project awarded the development contract. IOC is planned in FY22. Autonomy Integration and Teaming project develops a suite of capabilities furthering UAS systems integration into controlled airspace and the test tools for integrating manned-unmanned teaming between ranges. Capabilities will be delivered to NAS Patuxent River, MD, Redstone Arsenal, AL and Edwards AFB, CA. During FY20, the project completed CDR for the Guardian airspace control subproject and system requirements reviews for other subprojects. Subprojects will achieve FOC between FY22-25. Battlefield Awareness Testbed project develops a full-spectrum mobile laboratory with cross-domain tactical communications and network, data link, video, and mission data collection capability. In FY20, the project completed panning and long lead item procurements. IOC is planned in FY22. Closed Loop PESA Simulator project develops two transportable, closed-loop threat radar systems replicating the performance of a classified, widely fielded long-range surface-to-air missile system. IOC is planned in FY21 at Nevada Test and Training Range. FOC is at Eglin AFB, FL in FY22. The Navy has already fielded a fixed-site configuration at the Advanced Anti-aircraft Threat Simulator at China Lake, CA. The Air Force funded ARTV-2 mobile variant is based on this design. Common Modeling and Simulation Threat Environment for Long Range Strike (LRS) Family of Systems project upgrades constructive mission-level models to evaluate LRS Family of Systems survivability performance against a modern threat Integrated Air Defense System. IOC is planned in FY21. Common Range Integrated Instrumentation System (CRIIS) develops the next generation tracking system for DoD aircraft providing sub-meter Time-Space-Positioning Information (TSPI) accuracy and data bus information with four levels of Multiple Independent Levels of Security for testing aeronautical systems. CRIIS fielding to seven DoD ranges is underway during FY20. Also, during FY20, the CRIIS Operating System is being upgraded to Windows 10 compliance with DoD CIO requirements. IOC is FY21 with modernization efforts continuing FY21-26. Common Vehicle and Engagement Real-Time Test Instrumentation project reduces the size, weight and power for vehicle test data collection by replacing three unique data collectors with one modular, scalable data collector with increased storage capacity. In FY20, the project finished final modifications and completed production. This capability supported Abrams M1A2 System Enhancement Package (SEP) V3 and Bradley M2/M3A4 FOT&E during FY20, and will support future vehicle tests FY21-26.			

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2020	FY 2021	FY 2022
Directed Energy Advanced Wideband System develops a wideband VHF test source to illuminate a full-sized aircraft for MIL-STD 464C vulnerability testing. During FY20, the project accelerated the build-out of 50 and 100 MHz modules. IOC is planned in FY21. Directed Energy S-Band Threat Source project develops a frequency agile S-band HPM threat source for MIL-STD 464C vulnerability testing. During FY20, the project completed requirements analysis and started the source selection process. IOC is planned in FY23. Dynamic DIADS Control of CEESIM software development project networks nodes of an existing classified threat air defense system. In FY20, this project completed a feasibility analysis and initiated development. IOC is planned in FY21. General Threat Torpedo project develops a threat representative torpedo vehicle that tactically and acoustically emulates threat torpedoes that are not currently available for surface or sub-surface ship testing. In FY20, the project completed demonstration of the High Speed Quiet Propulsion System. IOC planned in FY23. Government Radiometrically-Accurate Instrument for Laser Evaluation project develops a radiometrically accurate HEL diagnostic system for confirming performance of current and future HELs. During FY20, the project completed requirements analysis, contract award, and contract kick-off. IOC is planned in FY23. High Power Microwave E-Field Sensor project develops a portable wide area measurement system to test blue HPM effectiveness against airborne threats. During FY20, the project completed requirements analysis and contract award. IOC is planned in FY21. High Power Microwave VHF Threat Simulator project develops a test source to support wideband VHF MIL STD 464C testing of a full-sized target such as an aircraft. During FY20 the project started requirements development and planning. IOC is planned in FY23. Directed Energy High Speed Data Recorder project develops a high-speed data recording system for High Power Microwave directed energy testing. During FY20 the project started requirements development and planning. IOC in FY22. Directed Energy Remote Target Status Sensor develops a system capable of measuring HPM effects on internal components attacked by HPM systems. During FY20 the project started requirements development and planning. IOC in FY22. Directed Energy Tethered High-Power Microwave Recorder and Electronic Attack Target project accelerates development of instrumentation necessary for testing UAS vulnerabilities in an HPM threat environment. During FY20 the project started requirements development and planning. IOC in FY23. Dense Plasma Focus project develops an ultra-short pulse simulation capability to test the vulnerability of missile components to very short, intense bursts of neutrons from a fusion-based nuclear weapon. During FY20, the project conducted facility planning at White Sands Missile Range and prototype testing. IOC is planned in FY25. Direct Inject Jammer Common Operating Picture project develops a real-time situational awareness, data collection and analysis system for the Army Integrated Threat Force Direct Inject Jammer system to track health, status and geolocation information for test and training at JRTC, Ft Polk, LA and JMRC, Hohenfels, Germany. Development continued during FY20. FOC is planned in FY21.			

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2020	FY 2021	FY 2022
Fast Burst Reactor Upgrade project develops new high purity, high enriched uranium rings and safety blocks for the fast burst reactor at White Sands Missile Range, NM to conduct neutron vulnerability testing of missile and other components. In FY20, the project completed the casting, machining, coating and delivery of two safety blocks and started development of the four rings. IOC is planned in FY24. Ground Based Radar Upgrade project funds design work to accelerate the radar radome replacement at the Reagan Test Site and provide system upgrades to enhance safety of flight and position information accuracies. During FY 20, the project started development of necessary engineering design drawings. Global Position System Localized EW Emitter develops a low power, vehicle mounted GPS jamming capability for testing of ground vehicle communications and navigation systems against GPS jamming. System to be fielded to the Army's Integrated Threat Force. FOC FY20. Hypersonic Test Capability Improvement project develops a clean air, variable Mach ground test capability from Mach 4 to Mach 7.5 in 3 Blocks for DT&E of hypersonic boost glide and scramjet weapon systems. In FY20, the project continued the development of Block 1. IOC is planned in FY23. Mid Pressure Arc Heater Upgrade develops and installs a new Power Supply in the DoD H2 Hypersonic Test Facility at Arnold AFB, TN and enables this arc heater to conduct longer run times on larger test articles to support thermal protection system testing of hypersonic systems. In FY20, the project awarded the development contract and completed 10% and 30% design reviews. IOC is planned in FY23. Mach 18 test capability at the AEDC Tunnel 9 development provides aerodynamic and aerothermal data to support boost glide weapon systems, conventional prompt strike, and maneuvering reentry vehicles. IOC achieved in FY20. G Range Weather Effects project upgrades the current G-Range test track to provide a small-scale rain and snow erosion test capability to validate vehicle structural design. In FY20, the project completed the design, development, and delivery of rain and ice shakers. IOC is planned in FY21. High Speed Test Track Weather Effects project develops a full-scale rain erosion capability to validate vehicle structural design and qualify hypersonic weapon systems for flight in an open-air facility at Holloman AFB. In FY20, the project completed installation and acceptance testing at the High-Speed Test Track. In FY21, the project plans to conduct full system demonstration runs. IOC FY21. High Altitude LIDAR Atmospheric Sensing - Ground Based project provides DOD test ranges with the design for a LIDAR-based instrumentation system that improves measurements of atmospheric conditions for launch and recovery operations. In FY20, the project completed the PDR. M&S for Maneuvering Boost Glide Vehicles - Transient Thermal Analysis Software project upgrades a tool set improving capabilities for predicting aerothermal and ablation response to high speed, high temperature flow in ground and flight test environments. In FY20, the project completed delivery of Level 2 software to over 20 customers for IOC.			

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2020	FY 2021	FY 2022
M&S Enhancements Weather Effects project develops advanced material response models validated with ground test data to predict weather erosion in flight. In FY20, the project completed upgrade of the Particle Impact Test Facility and completed weather test planning support for G-Range and the High-Speed Test Track. Reconfigurable RF Target Simulator project upgrades an Eglin AFB facility to test prototype sensors in a simulated hypersonic target and scene environment. In FY20, the project completed development of the array wall and integration of RF sensors. Aerodynamic and Propulsion Test Unit -Freejet Calibration project develops instrumentation for and calibrates the APTU Mach 6.4 freeject nozzle pressure and temperature profiles as a baseline for customer testing. In FY20, the project completed planning and initiated development. High Pressure Air Compressor project provides additional air compressor capability at AEDC to reduce recharge time from 13 to 8 hours resulting in more test runs per week at the AEDC Aerodynamic and Propulsion Test Unit (APTU) and J5 facilities. In FY20, air compressor development was completed and delivered. IOC is planned in FY23. Hypersonic Tunnel Facility Plum Brook project initiates efforts to re-activate the NASA Glenn hypersonic wind tunnel in Sandusky, Ohio. In FY20, the project secured an Interagency Agreement with NASA to complete an engineering study of the facility. IOC is planned in FY26. Joint Economical Sled Track Rocket project develops a new modular propulsion system for the three DoD high speed test tracks including an improved capability to ground test full scale components at hypersonic speeds. In FY20, the project completed requirements development and acquisition planning. Development contract will be awarded in FY21. IOC in FY23. Improved Encrypted Flight Termination System for hypersonic weapons tracking and flight safety development was initiated in FY20 as part of a larger Range Safety system upgrade for the Reagan Test Site for supporting hypersonic weapons testing. IOC is planned in FY22. Reagan Test Site Non-Ballistic Radar Tracking project develops advanced, non-ballistic tracking algorithms and the supporting infrastructure to track non-ballistic Hypersonic vehicles vs. current ballistic re-entry vehicle flight paths. Development was initiated in FY20. IOC is planned in FY22. Integrated Air Defense Systems Enhancements and Networked Threat Emulation project develops a comprehensive threat-representative Integrated Air Defense System capability at the Electronic Combat Range, China Lake and other facilities providing four threat-representative Command Posts to existing EW capabilities. FOC is planned in FY21. IR and RF Threat Modeling and Simulation Project upgrades 10 Radio Frequency and 10 Infrared authoritative Intelligence Community missile models supporting the DoD Threat Model Analysis Program (TMAP), Enhanced Missile SIGnature (EMSIG) and other high-fidelity seeker models. FOC is planned in FY23. Joint Electronic Warfare Cyber Techniques, Effects and Characteristics development provides an EW Radio Frequency and Cyber effects test environment for Electromagnetic Maneuver Warfare. Development was initiated in FY20. IOC is planned in FY22. Joint Electronic Warfare Digital Integrated Air Defense System (DIADS) Integration upgrades DoD's DIADS System M&S capacities to support expansion of EW testing across western test ranges. Development was imitated in FY20. IOC is planned in FY21.			

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2020	FY 2021	FY 2022
Joint Electronic Warfare Mobile Radar System Target Engagement Radar development was initiated in FY20 to evaluate alternatives and prototype development. Initial results in FY21. Joint Electronic Warfare Advanced Programmable Threat Radar AoA was initiated in FY20, and will be complete in FY21. Joint Electronic Warfare Airborne Instrumentation Interoperability development was initiated in FY20 to maximize airborne instrumentation interoperability between the CTEIP developed Common Range Integrated Instrumentation Systems (CRIIS) and Air Force/Navy Tactical Combat Training System-II (TCTS-II), and establish blueprint for merging baselines into a common system. Development will continue in FY21-26. Joint Electronic Warfare Open Air Battle Shaping development was initiated in FY20 to establish an enterprise architecture and approach to implement multi-range aircraft instrumentation interoperability and network connectivity to meet test and training needs for air warfare missions. This includes upgrading aircraft instrumentation and multi-range aircraft compatibility needed to provide enlarged, interoperable battlespace as aircraft transit multiple ranges during a large-scale test and training scenarios. Development will continue FY21-26. Joint Electronic Warfare Multi-Lab EW Integration development was initiated in FY20 to integrate key EW test facilities and assets at NAS Pt. Mugu, CA in order to expand land and sea range EW testing. IOC is planned in FY21. Mid- Pressure Arc Heater project development expands the DoD H2 Hypersonic Test Facility to provide higher enthalpy at the mid-pressure altitudes to enable ground testing of Prompt Global Strike, Maneuvering Reentry Vehicles, and SCRamJet components such as nose cones, other leading-edge surfaces, and fins. IOC was achieved in FY 2020. Mobile High Energy Laser Measurement project is comprised of seven development efforts for testing High Energy Lasers including: the measurement of beam irradiance on various classes of UAV targets (Subsonic, Supersonic, Small UAS, etc.), mobile ground diagnostics, and test tools. During FY20 all subprojects continued development. IOCs related to each development effort FY21-25. Naval Autonomous Systems Test Capability project establishes an M&S capability to test the performance of Naval surface ship autonomous systems software. During FY20 project requirements and planning was initiated. IOC is planned in FY24. Next Generation Electronic Warfare Environment Generator project develops a high fidelity, modular, scalable, reconfigurable EW environment generator for HWIL and ISTF EW systems testing. Development was completed in FY20 with IOC at NAS Patuxent River, MD. Additional systems to be fielded at DoD test facilities FY21-26. Net Centric Warfare T&E Environment project develops an operationally representative modeling and simulation environment to evaluate the full kill chain for net-centric weapons with realistic network loading and radio frequency effects. FOC in FY20. Open-Air Multi-Spectral Data Collection project develops an open-air test capability for T&E of integrated multi-spectral threat warning receivers and infrared countermeasures against complex multi-spectral threats. Development includes the ability to characterize performance of FLIR targeting, laser designator, illuminator and laser range finder systems. Project planning was completed in FY20. Sub-project IOCs are planned FY22-23. Over Water Impact and Location Scoring System project develops an ocean-going weapons impact scoring system to provide persistent, relocatable range capability for open-ocean, beyond line of sight, high precision weapon scoring and range			

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2020	FY 2021	FY 2022
surveillance. Development was initiated and project planning completed and long lead material items were procured in FY20. IOC is planned in FY24. Radar Air-to-Ground Environment project development is comprised of three blocks for testing high-density air-to-air (A/A), air-to-ground (A/G) and advanced signals (AS) in an ISTF environment. The radar environment simulator will provide digital radio frequency memory devices that capture, store, delay, scale, and return radar signals to the radar under test. During FY20, all three blocks of development completed separate Critical Design Reviews. FOC is planned in FY22. Radar Cross Section Range Relevance project is comprised of eleven development efforts providing upgraded and new RCS measurement capabilities to measure and evaluate advanced low observable technologies in increasingly complex and cluttered environments. During FY20, the Atlantic Test Range completed PDR and the National RCS Test Facility completed the digital signal processing, fiber optic, full site perimeter security subprojects. FOC is planned in FY24. Swarm Autonomy and Scoring project develops semi-autonomous control for the Navy's High-Speed Maneuverable Surface Target (HSMST) enabling a single operator to control up to 8 HSMST providing cost savings and significantly greater formation accuracy and a new UAV-based overhead scoring capability for testing ship self-defense ship weapon systems and weapon impacts against representative surface swarming threats. FOC FY20. Scene Projector development to improve high fidelity, high temperature scene protectors for installed system and hardware in the loop laboratory testing of sensors and seekers for high speed weapons and missile engagements continued development during FY20. IOC is planned in FY26. Counter Unmanned Aerial System (cUAS) project develops of a prototype high-fidelity X-band radar for tracking cUAS capabilities against commercially available small UAS. The project provides a Common Operating Picture system for real-time awareness, data collection and analysis. Development was initiated and CDR completed in FY20. IOC is planned in FY21. Adaptable Multi-Band Asset for Global Navigation Satellite System project develops a threat representative multi-modal global navigation satellite system jammer to provide denial and deception jamming of PNT information during operational test and training. In FY20, development was initiated with design complete through CDR. IOC is planned in FY21. Quantum Encryption Key project is a proof of concept prototype demonstration of quantum technology encryption key distribution to secure communication system's transmissions. QKD completed CDR and a brass board bench test capability in FY20. Prototype IOC is planned in FY22. Threat High Output Repeater Extender project develops a threat representative, high-power, cover/knock-off jammer to provide denial and deception jamming during operational test and training. A prototype system completed site acceptance testing during FY20. IOC is planned in FY21. Ground Unattended Threat Sensor Suite project develops an array of threat representative acoustic, seismic, magnetic, and video sensors with real time awareness, data collection and analysis for test and training. Development was initiated during FY20, and an analysis of alternatives completed. IOC is planned in FY21.			

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Appropriation/Budget Activity 0400 / 6	**R-1 Program Element (Number/Name)** PE 0604940D8Z / *Central Test and Evaluation Investment Program (CTEIP)*	**Project (Number/Name)** 940 / *Central Test and Evaluation Investment Program (CTEIP)*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2020	FY 2021	FY 2022
Cyber Operational Resiliency Assessment Platform project develops a cyber- electronic warfare operational resiliency assessment capability for the Army Threat Systems Management Office. Development was initiated in FY20. IOC is planned in FY21. Capability assessments will continue FY21-23. Electronic Attack-5G development provides a threat representative Electronic Attack capability against 5G systems for denial, degradation and deception of service attacks during operational test and training. In FY20, development was initiated and initial project planning completed. FOC is planned in FY23. RF-enabled Cyber-Physical Toolkit development provides an RF-enabled attack and exploitation, data collection and analysis capability to evaluate systems under test during operational test and training. In FY20, development was initiated and project planning completed. FOC is planned in FY23. Cyber Tools for Aviation RF Access Points project develops a suite of cyber-attack tools to stimulate both civil and military IFF/ GPS RF access points and semi-automatically identify abnormalities in the MIL-STD-1553 data traffic from cyber-attacks. This project was completed and successfully demonstrated the cyber test capability on an Apache helicopter in FY20. Cyber Battlefield Operations Support System BOSS develops a Mil-Std compliant data link test application to validate platform interoperability across Link 16, VMF, SADL and JREAP as well as other data link protocols. During, FY20, the project validated requirements and awarded the contract for cyber applications. IOC is planned in FY21. Full Authority Digital Engine Control (FADEC) Tool project develops an MH-53K Sea Stallion FADEC test bench and cyber tools to assess the cyber vulnerabilities of the main communication and control channels and data links. In FY20, the project delivered the MH-53K FADEC test bench. IOC is planned in FY21. Network, System Integration and Test Environment (NSITE) – Cyber Test Capabilities project expands the NSITE application to include cyber capabilities to: monitor, check for, alert on, identify messaging, and identify the source of the messaging, that is modified, or indicates a modification (“tip-off” capability). During FY20, the project was completed and available to NSITE users. IOC is FY20. Radio Frequency (RF) Replay Tool develops cyber tool set to support evaluation of 1 to 5GHz systems by providing streaming file access for both read and write of multiple signal formats as well as FPGA support for very short capture and replay where time is of the essence. During FY20, the project completed development, was demonstrated a representative test environment and delivered a complete hardware list, software suite, and accurate installation directions. IOC is FY20. Satellite Communications Tool project acquires two SATCOM systems (INMARSAT and Iridium) and develops of a common toolset to evaluate the impact of cyber-attacks against SATCOM systems on air platform performance. The project was initiated in FY20. IOC is planned in FY21. Weapon Cyber Test Tool Set project develops cyber test capability for weapon and aircraft systems for MIL-STD-1553B (Ripley and OSCAR enhancement), Controller Area Network (CAN) bus in fire control and stores management roles 1553 Enhanced Bit Rate (EBR) and IEEE 1394 (FireWire). The project was initiated in FY20. IOC is planned in FY22. X-Ray Simulator for Test and Evaluation of Nuclear Survivability project replaces and upgrades three DoD X-ray simulators that measure the susceptibility of missile components to damage from high dose warm and cold x-rays experienced in space. In FY20,			

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Appropriation/Budget Activity 0400 / 6	**R-1 Program Element (Number/Name)** PE 0604940D8Z / *Central Test and Evaluation Investment Program (CTEIP)*	**Project (Number/Name)** 940 / *Central Test and Evaluation Investment Program (CTEIP)*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2020	FY 2021	FY 2022
the project completed project planning, source selection and contract award for replacing DTRA's Double Eagle simulator. IOC is planned in FY23. ***FY 2021 Plans:*** Advanced Communication Threat Testing Suites Uplink Capability. During FY21, the project will complete development and begin integration and testing. This capability will support Family of Advanced Beyond-Line-Of-Sight Terminals FOT&E in FY22. Accelerated Vehicle Durability Testing project will perform initial demonstrations for both the chassis and drivetrain simulators are planned for FY 21 and Full Operational Capability (FOC) is planned in FY22. Advanced Dynamic Transmitter Array project. During FY21-22 the 1st unit will complete manufacturing, Factory Acceptance Test, Site integration and acceptance for Initial Operational Capability (IOC) at Edwards AFB with the production contract for remaining to be awarded in FY22. FOC is planned for FY25. Advanced Range Tracking and Imaging System project. During FY21 the Fly-Out System will complete assembly and testing. The Close-In System will complete its Final Design Review, assembly and test and deployment to the White Sands Missile Range, NM. The Short-Wave Infrared Zoom Lens project. During FY21 lens development will complete contractor testing, delivery, and integration. IOC/FOC is planned in FY21. Air Warfare Battle Shaping project. Initial capability was delivered in FY20, with follow-on projects planned over FY21-24 expanding this capability across land and sea ranges. Autonomous Systems Test Capability. In FY21 the DRIVE sub-project will compete Release 1 and 2, and start Release 3. The SEER sub-project will complete its System Requirements Review, PDR and CDR. During FY22 the DRIVE sub-project will complete Releases 3, 4, and 5. The SEER sub-project will complete assembly and test. Both sub-systems will be fielded at Aberdeen Proving Grounds, MD. IOC of both systems is planned in FY22. Autonomy Integration and Teaming project. During FY21 all subprojects will complete PDR and CDR. The Navy SATCOM test tools subproject will complete in FY21. In FY21 the Manned-Unmanned Teaming (MUMT) project will field early testing capability between Redstone Test Center and Dugway Proving Grounds enabling testing without ferrying Apache helicopters between sites, reducing cost of test. Remaining subprojects will achieve FOC FY22-25. Battlefield Awareness Testbed project. In FY21, the project will complete design and development. IOC is planned in FY22. Big Data/Knowledge Management project will continue development of Big Data/Knowledge Management tools, analytic techniques, resources, policies and procedures needed to more efficiently and effectively use T&E data during FY21-26. Closed Loop PESA Simulator project develops two transportable, closed-loop threat radar systems replicating the performance of a classified, widely fielded long-range surface-to-air missile system. IOC is planned in FY21 at Nevada Test and Training Range. FOC is at Eglin AFB, FL in FY22. The Navy has fielded a fixed-site configuration at the Advanced Anti-aircraft Threat Simulator at China Lake, CA. The Air Force funded ARTV-2 mobile variant is based on this design.			

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Appropriation/Budget Activity 0400 / 6	**R-1 Program Element (Number/Name)** PE 0604940D8Z / *Central Test and Evaluation Investment Program (CTEIP)*	**Project (Number/Name)** 940 / *Central Test and Evaluation Investment Program (CTEIP)*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2020	FY 2021	FY 2022
Common Modeling and Simulation Threat Environment for Long Range Strike (LRS) Family of Systems project. IOC is planned in FY21. Common Range Integrated Instrumentation System (CRIIS). In FY21 over 400 CRIIS subsystems will be delivered and CRIIS integration on the F-15E, F-16, F-18, F-22 will be IOC. CRIIS fielding to seven DoD ranges completes in FY21 for FOC. CRIIS will be interoperable with the Tactical Combat Training System (TCTS)-II system expanding usable range space and assets for multi-range missions once TCTS-II is fielded in FY23. Modernization efforts will continue FY23-26. CRIIS Operating System Upgrade is a development upgrading the CRIIS pod fleet to Windows 10 in compliance with DoD CIO requirements. In FY21 the upgrade will be tested and installed in CRIIS systems at all seven ranges. IOC in FY21. CRIIS Users Post Mission Processing Tool development provides advanced GPS correction techniques to achieve greater post flight TSPI accuracy for onboard GPS-IMU data captured during a CRIIS supported mission. Development will be initiated in FY21 and delivered during FY22. Common Vehicle and Engagement Real-Time Test Instrumentation project will support future vehicle tests FY21-26. Directed Energy Advanced Wideband System develops a wideband VHF test source to illuminate a full-sized aircraft for MIL-STD 464C vulnerability testing. In FY21 the 50 and 100 MHz modules will be delivered and tested. IOC is planned in FY21. Directed Energy S-Band Threat Source project. In FY21, the project will award a development contract and complete PDR and CDR. In FY22, the project will complete assembly, and contractor testing. In FY23, the project will conduct final integration and system acceptance testing and achieve IOC. Dynamic DIADS Control of CEESIM software development project. During FY21, the project will complete Factory Acceptance Test and FOC at Tinker AFB. General Threat Torpedo project. During FY21-22, the project will continue development with IOC planned in 2QFY23. Government Radiometrically-Accurate Instrument for Laser Evaluation project. In FY21 the project will complete its System Requirements and Preliminary Design Reviews. Project will achieve IOC in FY22. High Power Microwave E-Field Sensor project. In FY21 the project will complete design, build, and system acceptance testing. IOC is planned in FY21. High Power Microwave VHF Threat Simulator project. Development will continue during FY21-23. IOC is planned in FY23. Directed Energy High Speed Data Recorder project. Development will continue during FY21-22. IOC is planned in FY22. Directed Energy Remote Target Status Sensor project. Development will continue during FY21-22. IOC is planned in FY22. Directed Energy Tethered High-Power Microwave Recorder and Electronic Attack Target project. Development will continue during FY21-22. IOC is planned in FY23. Dense Plasma Focus project. During FY21 full development is expected to start with PDR late in the year. In FY22 detailed design will continue with a CDR in FY23. Full fabrication and integration are planned for FY24 with IOC in FY25. Direct Inject Jammer Common Operating Picture project. FOC FY2021. Fast Burst Reactor Upgrade project. In FY21 ring development and production will continue sequentially with final delivery and FOC planned in FY24.			

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2020	FY 2021	FY 2022
Ground Based Radar Upgrade project. During FY21, the project will complete the necessary engineering design drawings will be completed and provided to Army for use to establish a production contract. Hypersonic Test Capability Improvement project. In FY21 and FY22, the project will continue design, development, and fabrication, and testing with an IOC demonstration in FY23. Mid Pressure Arc Heater Upgrade project. Development will continue FY21-22 with IOC planned in FY23. Mach 18 test capability at the AEDC Tunnel 9. During FY21 additional materials needed to meet customer test requirements will be procured. G Range Weather Effects project. In FY21, the project will complete integration and conduct test runs as well as procure the long lead consumables and spare parts necessary to re-activate the facility and meet customer test needs. IOC is planned in FY21. High Speed Test Track Weather Effects project. In FY21, the project will conduct full system demonstrations. IOC is planned in FY21. High Altitude LIDAR Atmospheric Sensing - Ground Based project. In FY21 the project plans to complete the design, have it approved by the Government, and make the design available to ranges for purchase. M&S for Maneuvering Boost Glide Vehicles - Transient Thermal Analysis Software project. In FY21, the project plans to deliver FOC Level 3 software and complete the project. M&S Enhancements Weather Effects project. In FY21 the project will complete the weather database and provide analysis in support of weather test events concluding the project. Reconfigurable RF Target Simulator project. In FY21 the project will complete development of representative target scenes and complete integration and test of the facility concluding the project. Aerodynamic and Propulsion Test Unit-Freejet Calibration project. In FY21, the project will install and test the instrumentation and complete calibration. High Pressure Air Compressor project provides. In FY21-22, the air compressors will be installed and tested. Hypersonic Tunnel Facility Plum Brook project. In FY21, the project will complete the engineering study and start re-activation planning. Follow-on development activities will take place FY22-26. Joint Economical Sled Track Rocket project. In FY21, the project will complete source selection, contract award and Increment 1 PDR. In FY22, the project plans to complete Increment 1 CDR, prototype development and test. If ready, development on Increments 2 thru 4 will also start in FY22. Development and test of Increments 2 thru 4 will continue in FY23 and FY24. Improved Encrypted Flight Termination System for hypersonic weapons tracking and flight safety. Development will continue during FY21-22. IOC is FY22. Reagan Test Site Non-Ballistic Radar Tracking project. Design, development and testing will be completed in FY21. IOC is planned in FY22. Integrated Air Defense Systems Enhancements and Networked Threat Emulation project. FOC is planned in FY21 with a large multi-range demonstration. IR and RF Threat Modeling and Simulation Project continues upgrades in FY21. FOC is planned in FY23.			

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2020	FY 2021	FY 2022
Joint Electronic Warfare Threat Integrated Air Defense Systems Radar Simulator development to expand open air test capability will be initiated in FY2021. This development acquires additional X, VHF, and UHF RF open-loop, transmit-only radar simulators to meet customer and threat laydown requirements. Acquisition and integration of these simulators onto multiple land ranges will continue in FY22-25. FOC is planned in FY25. Joint Electronic Warfare Cyber Techniques, Effects and Characteristics program. Development will continue FY21-22. IOC is planned in FY22 at NAS Pt Mugu, CA. Joint Electronic Warfare Digital Integrated Air Defense System (DIADS) Integration upgrades. Phase I will complete in FY21 with FY22-25 developments to be determined. Joint Electronic Warfare Mobile Radar System Target Engagement Radar will continue during FY21 with a PDR level design to establish cost and risk of continued development. A decision on continued development FY22-25 will be made in FY21. Joint Electronic Warfare Advanced Programmable Threat Radar AoA will be complete in FY21 with a decision on continued FY22-26 development during FY21. Joint Electronic Warfare Airborne Instrumentation Interoperability will continue development during FY21-23 to maximize airborne instrumentation interoperability between the CTEIP developed Common Range Integrated Instrumentation Systems (CRIIS) and Air Force/Navy Tactical Combat Training System-II (TCTS-II), and establish blueprint for merging baselines into a common system when TCTS-II is fielded in FY23. Joint Electronic Warfare Open Air Battle Shaping development to establish an enterprise architecture and approach to implement multi-range aircraft instrumentation interoperability and network connectivity to meet test and training needs for air warfare missions will continue FY21-26. This includes upgrading aircraft instrumentation and multi-range aircraft compatibility needed to provide enlarged, interoperable battlespace as aircraft transit multiple ranges during a large-scale test and training scenarios. Joint Electronic Warfare Multi-Lab EW Integration development will complete for IOC in FY21, with follow-on efforts planned in FY22-26. Mid- Pressure Arc Heater project development. During FY21, CTEIP will continue to support customer testing man power needs, order additional spares and start work on an additional Control Room. Mobile High Energy Laser Measurement project. In FY21, three sub-projects plan to complete development, test and achieve IOC including two laser target boards. In FY21-22, the project will initiate four sub-projects including a supersonic target board and portable laser instrumentation called Range-in-a-Box. In FY23, the project will complete development, testing and achieve IOC on the final four sub-projects including tools to support range safety and small target boards for a variety of targets. Naval Autonomous Systems Test Capability project. During FY21, the project will establish system requirements, conduct project planning, and initiate development. Development will continue in FY22-24. IOC is planned in FY24. Next Generation Electronic Warfare Environment Generator project. Acquisition and integration at the Navy's ECSEL will take place in FY21 and Air Force BAF in FY22. FOC is planned in FY22. Open-Air Multi-Spectral Data Collection project. Development of multiple subsystems will be initiated in FY21, with sub-project IOCs in the FY22-23 timeframe.			

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Appropriation/Budget Activity 0400 / 6	**R-1 Program Element (Number/Name)** PE 0604940D8Z / *Central Test and Evaluation Investment Program (CTEIP)*	**Project (Number/Name)** 940 / *Central Test and Evaluation Investment Program (CTEIP)*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2020	FY 2021	FY 2022
Over Water Impact and Location Scoring System project. During FY21, the project will complete and demonstrate an initial prototype capability and continue spiral 2 development. During FY21-23, each spiral will demonstrate incremental capability. FOC FY24. Radar Air-to-Ground Environment project. In FY21, both the A/A and A/G blocks will achieve FOC. The A/S block will IOC in FY21 and FOC in FY22. Radar Cross Section Range Relevance project. During FY21-23 the Atlantic Test Range will complete CDR and system development with FOC in FY24. In FY21 the National RCS Test will complete and the dynamic RCS measurement system subproject will be initiated. NRTF subprojects will reach FOC in FY22. Spectrum Stewardship project will continue participation FY21-25 in domestic and international forums for spectrum management, frequency allocations and spectrum interference that impact DoD test and evaluation ranges to ensure DoD T&E spectrum concerns are addressed. Scene Projector development will continue FY21-26. Counter Unmanned Aerial System (cUAS) project. During FY21, a prototype will be demonstrated and fielded. Adaptable Multi-Band Asset for Global Navigation Satellite System project. During FY21, the project will complete a laboratory unit, finalize software integration, acceptance testing and deliver three systems. Quantum Encryption Key project. In FY21, prototype factory acceptance testing and proof of concept demonstration will be completed. IOC is planned in FY22. Threat High Output Repeater Extender project. During FY21, the production contract will be awarded and three units delivered. IOC is planned in FY21. Ground Unattended Threat Sensor Suite project. During FY21, development, integration and site acceptance will be completed. IOC is planned in FY21. Cyber Operational Resiliency Assessment Platform project. During FY21, the analysis tool and database will be delivered and assessment team established and training. IOC is planned in FY21. Electronic Attack-5G development. During FY21, the project will complete a Threat Validation Report and digital attack system CDR. In FY22, the project will complete site acceptance of the digital attack system and CDR for the Physical RF Interface Electronic Attack System. FOC is planned in FYF23. RF-enabled Cyber-Physical Toolkit development. During FY21, a Threat Support Package and two classified effects payloads will be delivered. During FY22, digital access development for attack payloads will be completed. During FY23, the RF access development for attack payloads will complete. FOC is planned in FY23. Cyber Battlefield Operations Support System BOSS. The project will complete in FY21 and be available to any BOSS User. Full Authority Digital Engine Control (FADEC) Tool project. In FY21, the project will complete development and reach IOC. Satellite Communications Tool project. In FY21, the project will deliver INMARSAT and Iridium SATCOM cyber test benches and common cyber tools. IOC is planned in FY21.			

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2020	FY 2021	FY 2022
Weapon Cyber Test Tool Set project. During FY21-22, the project will deliver hardware interface devices, associated software packages and User Manuals. IOC is FY22. X-Ray Simulator for Test and Evaluation of Nuclear Survivability project. In FY21, the project plans to complete PDR for DTRA's Double Eagle simulator, order long lead parts and start critical design. In FY22-23, the project will complete critical design, and conduct fabrication and testing with IOC in FY23. Also, in FY22-23, project planning will start on the second and third simulator developments, Pithon II and Gamble III. During FY21-26 CTEIP will initiate additional development activities for testing critical weapon systems that align to the NDS, USD(R&E) and Service priorities. These efforts will be in the areas of Hypersonics, Directed Energy, Cyber Security, Electronic Warfare, Missile Defense, Nuclear Effects, Space, Autonomy, Command/Control and Communications and critical range instrumentation infrastructure. FY21 new efforts include: Bindle Linux Harness Automation cyber test tools for evaluating Linux based Systems Under Test. Instrumentation for Cyber EW Test Assets to validate Cyber-EW techniques, attack surface, and protection-measures for Systems Under Test. Lawrence Livermore Labs Independent Diagnostic Scoring System (LIDSS) Radar on a Raft Motion Compensation to test the Doppler Radar and stabilization system. Transportable Space Range Operations to develop a standardized, deployable system for generating complex, realistic SATCOM environments (open air and closed loop), range control, and instrumented data collection to support test, training and evaluation of Space EW systems and operators. Counter UAS Jamming Operations to establish a signal generation capability for testing counter UAS systems in representative open-air range electronic warfare environments. Single Event Effects Facility for Rare Isotope Beams upgrade increasing capabilities and capacity for evaluating radiation hardening of electronic components.			
FY 2022 Plans: Long Range Fires modernization funding develops new capabilities to test the effectiveness of new materials and designs used in the leading edges and control surfaces of long range ballistic and hypersonic weapon systems in representative ground test environment. Repeated ground testing under a variety of simulated flight conditions is essential to developing designs with good mass properties and high survivability before undergoing expensive and time-consuming flight testing. Nuclear Enterprise modernization funding is directed at revitalizing DoD's nuclear effects test and evaluation simulators, M&S and other test capabilities needed to assess existing weapon systems, weapons modernization programs and mission critical system components that must be tested against these effects. In addition to already ongoing projects, other efforts being evaluated for FY22 include: Hybrid Tracking Systems for use in GPS denied environments.			

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Appropriation/Budget Activity 0400 / 6	**R-1 Program Element (Number/Name)** PE 0604940D8Z / *Central Test and Evaluation Investment Program (CTEIP)*	**Project (Number/Name)** 940 / *Central Test and Evaluation Investment Program (CTEIP)*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2020	FY 2021	FY 2022
Technology Refresh for the Reagan Test Site Kiernan Reentry Measurements Site. Interactive CNI RF Environment Stimulator for testing IFF and other CNI signals in HWIL and ISTF. Development of a reprogrammable closed-loop threat radar prototype for RF system test and evaluation in all digital HWIL, ISTF. Development of a federated test bed to evaluate Defensive / Offensive Capability for Space. ***FY 2021 to FY 2022 Increase/Decrease Statement:*** Increased investments for high-priority hypersonic ground and open air range test capability developments and increased investments for critically needed upgrades to DoD Threat Models and Simulations. Joint Electronic Warfare Test Initiatives are projects on a DoD approved investment roadmap resulting from the JETS study that identified vital test capabilities needed in order to maintain and advance air superiority as a critical component of EW Air Dominance and the National Defense Strategy. Initial investment projects develop and field the RF threat emulation systems needed to keep up with evolving advanced, sophisticated threats to support planned MRTFB open air range test events. The investment roadmap also incorporates multi-year initiatives to provide expanded land range coverage enabling airborne participants to operate seamlessly across test or training ranges and initiatives to develop the aircraft and ground instrumentation, distributed LVC simulation environments, data collection and processing to enable interoperability across multiple ranges and platforms.			
Accomplishments/Planned Programs Subtotals	381.356	423.206	550.140

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A