Exhibit R-2, RDT&E Budget Item Justification: PB 2021 Office of the Secretary Of Defense	Date: February 2020
Appropriation/Budget Activity 0400: *Research, Development, Test & Evaluation, Defense-Wide* / BA 3: *Advanced Technology Development (ATD)*	**R-1 Program Element (Number/Name)** PE 0603122D8Z / *Combating Terrorism Technology Support*

COST ($ in Millions)	Prior Years	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total	FY 2022	FY 2023	FY 2024	FY 2025	Cost To Complete	Total Cost
Total Program Element	789.148	168.012	116.747	51.089	19.288	70.377	72.317	73.085	75.446	76.965	Continuing	Continuing
484: *Combating Terrorism Technology Support (CTTS)*	789.148	168.012	116.747	51.089	19.288	70.377	72.317	73.085	75.446	76.965	Continuing	Continuing

Note

OCO for Base Requirements ($19,288 thousand): OCO for Base Requirements is funding to pay for base budget requirements, that are financed in the OCO budget in order for the Department to comply with the Bipartisan Budget Act (BBA) of 2019.

Defense-Wide Reviews (DWR) - Funding for the CTTS Initiative was reduced by $23,492 thousand resulting from the DWR, which focused on the Secretary's guidance to streamline operations, increase efficiency, and promote greater affordability within the OSD and Defense Agencies and Field Activities in order to ensure the Department's optimum alignment to the National Defense Strategy and DoD strategic guidance, with particular focus on building a more lethal, resilient, agile, and ready force while strengthening alliances, prioritizing cyber and space capabilities, and focusing on innovation to maintain the technological advantage. Base reduction of 17,062 thousand and OCO reduction of 6,430 thousand.

A. Mission Description and Budget Item Justification

The Combating Terrorism Technical Support (CTTS) program supports the National Defense Strategy (NDS) and will give those identified peer-to-peer high interest areas increased priority. CTTS also recognizes that many of the combating terrorism requirements already supports many of these high interest areas; to include, increasing lethal capability of U.S. forces at the squad and small unit level; countering Small Unmanned Aerial Systems (drones) overseas and domestically; tunnel detection and mapping in theater and along the Southwest U.S. border; novel body and vehicle armor; detecting and mitigating novel chemical threats against commercial transportation; telematics; covert communications; and the use of machine learning and artificial intelligence.

From a broader perspective, projects remain distributed among 10 mission categories, in line with the interagency Technical Support Working Group (TSWG): Advanced Analytic Capabilities; Chemical, Biological, Radiological, Nuclear, and Explosives; Improvised Device Defeat/Explosives Countermeasures; Investigative and Forensic Science; Irregular Warfare and Evolving Threats; Personnel Protection; Physical Security; Surveillance, Collection, and Operations Support; Tactical Operations Support; and Training Technology Development.

While supporting the NDS, the CTTS program will also continue to identify capabilities to combat terrorism and irregular adversaries and quickly delivers these capabilities to U.S. Defense and interagency users, as well as international partners through rapid research and development, advanced studies, and technical innovation. CTTS continues to expand its partnerships with other Defense and Interagency, as well as with our foreign partners' rapid development and acquisition organizations to leverage their expertise and prevent duplication as it tries to expedite and transition new and innovative capabilities for Defense and interagency users. CTTS is unique in its approach, annually obtaining joint requirements directly from military and law enforcement operators, intelligence analyst, and first responders. The CTTS program is a diverse, advanced technology development effort that capitalizes on interagency and international participation to demonstrate the utility and effectiveness of technology when applied to combating terrorism requirements. This includes rapid technology capability development, testing products, proof-of-concept demonstrations in field applications, operational test and evaluations, and coordinating the transition from development to operational use. For FY 2021, the time from requirements to contracts has been shortened in order to provide solutions even more rapidly to the users. CTTS normally manages approximately 250 individual

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projects in support of defense, federal, state, local, and international customers and partners; while also reviewing proposals and negotiating contracts for another 100 requirements prior to the next fiscal year.

The CTTS program justified in the R-2 exhibit identifies the projects fully or partially funded by Congressional appropriations for the CTTS program. However, CTTS also develops technology and provides support using external funds provided by other DoD and federal departments and international partnerships. These projects and support activities are not necessarily reflected in this justification R-2; but the number of activities do reflect positively on the trust and competence that CTTS has earned throughout the Department of Defense and interagency to rapidly conduct critical RDT&E and provide innovative products. The funding and number of requirements from users that CTTS will be able to address in FY 2021 has been reduced by 25% in accordance with the Secretary's directed Defense Wide Review Task 266.

B. Program Change Summary ($ in Millions)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
Previous President's Budget	171.321	95.747	97.384	0.000	97.384
Current President's Budget	168.012	116.747	51.089	19.288	70.377
Total Adjustments	-3.309	21.000	-46.295	19.288	-27.007
• Congressional General Reductions	-	-			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	-	21.000			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-0.029	-			
• SBIR/STTR Transfer	-3.280	-			
• Funding transferred to O&M Labor account PE:0907388D8Z	-	-	-3.417	0.000	-3.417
• Negative Inflation Adjustment	-	-	-0.098	0.000	-0.098
• Defense Wide Review Reduction	-	-	-17.062	-6.430	-23.492
• Transfer OCO2Base to OCO	-	-	-25.718	25.718	0.000

C. Accomplishments/Planned Programs ($ in Millions)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
Title: Advanced Analytic Capabilities (AAC)	6.042	7.037	5.109	-	5.109
Description: The Advanced Analytic Capabilities (AAC) Subgroup's objective is to develop and deploy integrated analytic capabilities; enabling Commanders, Warfighters, and Mission Partners to share information and make better/faster decisions at the Strategic, Operational, and Tactical levels. AAC projects improve sense-making, decision-making, and data management across a range of mission areas.					
FY 2020 Plans:					

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C. Accomplishments/Planned Programs ($ in Millions)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
Enhance Survivability for Close Combat Formations. Initiate development of a system capable of detecting, locating, recording, and analyzing sources of radiated electromagnetic energy for autonomous RF signal collection management. Expand the Competitive Space. Complete the tagging and retrieval of objects from images for the purpose of analysis and real time alerts using machine learning. Complete drone based analytics for in-field mission planning support. Complete development and demonstration of software capable of using open source and other available information to develop a detailed country model comprising iterative models for national, provincial, and local organizational elements across political, economic, military, socioeconomic and cultural domains. Complete development of a computer vision algorithm in order to provide a capability to tag and track objects in a region of interest, such as individuals of interest, vehicles, and/or friendly forces. Complete development of a mesh network of field programmable gate array-based mobile devices for conducting high-performance mobile edge analytics without reach-back to the cloud, enabling support of edge analytics in end-user designated use-cases. Complete development of means of social network analysis to improve understanding of current academic and nontraditional research, contributing to the development of a secure web portal that allows Israeli and U.S. experts to identify early scientific efforts that may relate to Counter Terrorism. Complete the Special Operations Requirement Tool-Operational Environment modeling and visual platform for financial analytics, leveraging the existing visualization tools to conduct robust cost analysis modeling. Initiate development of a data ingestion, storage, formatting and processing system which refines and stores information-products both in a high-throughput data and application environment and deployable as remotely accessible images in support of edge analytics. Initiate development of a capability to inform crisis responses on how to assess the potential for social manipulation via bot networks during a crisis-situation, and develop intervention strategies for reducing the potential for social hysteria and violence. Sustain Combating Terrorism. Completed efforts to enhance capability of experimental software to meet SOF requirements and improve the probability of the software's rapid and successful integration or transition to operational use at SOFWERX in a sandbox-style environment which sources end-users feedback to the vendor. Complete enhancement of Study of Terrorism and Responses to Terrorism (START) Database, updating data, increasing the speed of data refinement, exploring new methodologies, optimizing extant methodologies, and providing data to other Research and Development groups inside and outside of government who similarly drive innovation. Initiate development of algorithms and machine learning methodologies that leverage all available data from multiple sensor platform for tunnel detection. Initiate research and development of new capabilities for investigating and tracing the source of crypto-currency transactions using both commercial tools and intelligence sources.					

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C. Accomplishments/Planned Programs ($ in Millions)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
Integrate with the U.S. Interagency. Complete development of automated software tools for data exploration and extrapolation to derive insight. Irregular Warfare as a Core Competency. Complete development and application of a deterministic open source information prototype that uses current anticipatory analytic approaches to enable forecasting over three to five years to better forecast and project geopolitical turmoil that will drive future Title 10 requirements. ***FY 2021 Base Plans:*** Enhance Survivability for Close Combat Formations. Complete development of a system capable of detecting, locating, recording, and analyzing sources of radiated electromagnetic energy for autonomous RF signal collection management. Expand the Competitive Space. Continue development of a data ingestion, storage, formatting and processing system which refines and stores information-products both in a high-throughput data and application environment and deployable as remotely accessible images in support of edge analytics. Continue development of a capability to inform crisis responses on how to assess the potential for social manipulation via bot networks during a crisis-situation, and develop intervention strategies for reducing the potential for social hysteria and violence. Sustain Combating Terrorism. Complete development of algorithms and machine learning methodologies that leverage all available data from multiple sensor platform for tunnel detection. Complete research and development of new capabilities for investigating and tracing the source of crypto-currency transactions using both commercial tools and intelligence sources. ***FY 2020 to FY 2021 Increase/Decrease Statement:*** Decreases are reflective of the Defense Wide Review reductions.					
Title: CHEMICAL, BIOLOGICAL, RADIOLOGICAL, NUCLEAR, AND EXPLOSIVES (CBRNE)	9.832	10.510	7.961	-	7.961
Description: The CBRNE subgroup's objective is to improve defense capabilities to meet tomorrow's CBRNE threats. To meet this objective, the subgroup focuses on rapid research, development, test and evaluation on threat characterization; materials attribution; personal protective equipment; detection of CBRNE materials at trace and bulk levels at point, proximity and stand-off distances; development of information resources and decision support tools to assist response elements with risk-based decision making; and consequence management for post-event activities. ***FY 2020 Plans:***					

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C. Accomplishments/Planned Programs ($ in Millions)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
Enhance Survivability for Close Combat Formations. Complete the development of a decontamination solution that can be used on skin and wounds and effectively decontaminate chemical and biological warfare agents. Complete development of a low-cost detect-to-identify wearable sensing technology to inform chemical-specialist first responders and warfighters of the presence of a broad range of TIC and CWA vapors. Continue development of a wearable solution that autonomously monitors, detects, and captures threat agents for identification. Sustain CBRNE Units for Defense and the Homeland. Complete development of a low profile tactical SCBA to allow for working in confined spaces, tunnels, and similar access denied environments while providing high quality breathing air. Complete NIOSH certification of a 15-min CBRN protection escape hood capable of fitting in the pocket of a suit jacket that also passes the flammability, heat resistance and CO protection requirements for a combination CBRN/CO capability. Complete development of an explosive trace detector with a limit of detection less than ten picograms for military and common homemade explosives. Complete the development of a novel, innovative non-encapsulating NFPA 1994 Class 1 protective ensemble that will provide Class 1 protection in a low-profile, tactical ensemble. Complete the development of low-cost, disposable multi agent detection paper (MADP) for the rapid, selective, and low cost detection of H, G, and V chemical warfare agents. The MADPs shall be able to detect HD, HN, GA, GB, GD, GF, VX, VR, and VS. Complete development of a CB glove providing National Fire Protection Association (NFPA) 1994, Class 3, protection with greater tactility, durability, dexterity, and comfort. Complete identifying successful operational guidance for decontaminating fentanyl and its analogs. Complete development of low cost chemical sensors for deployment in a network based sensor environment for large area coverage or temporary venue screening of vapor or aerosol chemical threats in transit or outdoor areas. Complete assessment of CBRN filter canister performance under various storage configurations. Continue development of a risk-based decision support model for skin decontamination in the case of dermal exposures to CWAs. Initiate and complete the redesign of the current vacuum sampling devices to accommodate collection of liquid samples for chemical or microbiological forensic analysis. Initiate development of a new USSI to accommodate a broader range of masks and personal protective ensembles. Initiate the development of a respiratory protective device designed for canines that can fit the general working dog population. Initiate the development of a containment system for rapidly encapsulating and transporting objects contaminated with chemical and biological (CB) hazards, such as chemical warfare agents (CWAs) and toxic industrial chemicals (TICs). Initiate validation methods to confirm routine decontamination of personal protection equipment is sufficient to remove emerging threats like toxins (ricin, abrin) or drugs (opioids, fentanyl analogs). Initiate the development of evidence and consensus-based guidance for laundry protocols and decontamination confirmation for personal protective equipment after ricin, abrin, and pharmaceutical-based agent incidents. Initiate the development of a practical application of Surface Enhanced Spatially Offset Raman					

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C. Accomplishments/Planned Programs ($ in Millions)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
Spectroscopy (SESORS) for trace threat detection. Initiate optimizing the methodology for using Alternative Light Sources (ALS) systems to visualize and screen for pharmaceutical-based agent (PBA) threats. Initiate validating laundering techniques for work duty uniforms, bunker gear and personal protective equipment (PPE) traditionally used to remove soot, dusts, blood and other bodily fluids are sufficient for the removal of more toxic compounds such as toxins (e.g. ricin, abrin) or drugs of concern (e.g. opioids, fentanyl analogs). Initiate the evaluation of the effectiveness of commercial bulk filter material for neutralizing or removing chemical gases of emerging threats from enclosed/indoor environments. Initiate improving the ability to detect and characterize chemical and biological (CB) hazards in various subterranean (Sub-T) environments. Initiate collecting empirical data on the transport of aerosol particles in an urban environment to improve mathematical models used for risk assessment and hazard response. Integrate with the U.S. Interagency. Complete development of a test bed for the evaluation of cargo for contraband including special nuclear materials, explosives, drugs, and other potential materials of interest, utilizing muon tomography and electron stopping. Complete development of a research and development test bed for the evaluation of high volume explosive sampling devices with a focus on cargo/container screening. Complete testing and evaluation of a next generation sensors for use in trace, bulk, proximity, and stand-off detection of explosives-based threats. Complete evaluation of enhanced sampling materials and systems for CBRNE threats. Complete development of an advanced analytical database of improvised CB agent production methods. Complete development of an interface that integrates chemical detection data in real time to a central data sharing, management, and storage platform. Continue a multi-year test and evaluation program for the identification and rapid laboratory and field evaluation of emerging commercial and near-commercial explosive detection technologies to facilitate the acceleration, improvement, and fielding of promising capabilities. Continue development of an online database containing feedback on CBRNE detector field performance and test data. Continue updating the current open source chemical and biological recipe inventory to include metadata on each discovered recipe and incorporating recipe and precursor information into a threat recognition guide. Initiate the development of a system to effectively collect, aggregate, and share critical information related to biological samples and laboratory analysis results using a standard format that integrates with currently deployed responder networks. Strengthen Alliances. Complete development of a UK commercialized capability to produce aerosolized chemical and biological hazards for threat characterization across the U.S. and UK government agencies. Complete improvement of a previous biological detector prototype to enhance performance and detection capabilities and align BWA detection capabilities. Continue to identify common research and development gaps and initiate projects that improve the capabilities of military and civilian first responders in handling chemical, biological and radiological					

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C. Accomplishments/Planned Programs ($ in Millions)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
events. Continue development of a man-portable system that can reliably detect explosives through continuous gas phase monitoring. Initiate the investigation of the detonation of improvised radiological dispersal devices (RDDs) in an urban environment to gain valuable emergency response and forensic information. Initiate international laboratory round robin testing for facilities that are involved with response to biological incidents (e.g. bioterrorism, bio-crimes) in a safe no-fault environment. Support Relationships to Address Significant Terrorist Threats. Continue the systematic evaluation of gas forming reactions that could be used in improvised chemical devices. Initiate the characterization of determining the effectiveness of novel delivery methods through empirical data to better understand the potential hazard and develop detection/mitigation methods for a broad range of materials delivered via those mechanisms. Establish an international/interagency burden sharing and coordination group to address emerging improvised CBR threats. Hazardous Improvised Threat Information Data Exchange (HI-TIDE) brings together the IC, TSA, Modelers, S&T and Policy community to rapidly address emerging current threats. Enable U.S. Interagency Counterparts to Advance U.S. Influence and National Security Interests. Continue enhancing mitigation techniques to reduce the impact of threat releases in transportation platforms and confined spaces. Continue determination of operationally deployed detection techniques and systems could be further developed or exploited to provide additional chemical detection capabilities in a search environment.					
FY 2021 Base Plans: Enhance Survivability for Close Combat Formations. Complete development of a wearable solution that autonomously monitors, detects, and captures threat agents for identification. Complete development of a new USSI to accommodate a broader range of masks and personal protective ensembles. Initiate development of a disposable system for the rapid detection and identification of biological threats without requiring sample preparation or buffer solutions from users. Initiate development of chemical detection tape that will classify both liquids and aerosols as G series, Blister, or V series agents. Initiate improvements to a nanopore sequencing (NPS) platform to develop a fieldable system for identifying and characterizing unexpected, modified, or undiscovered biothreat agents. Initiate the development of a screening system capable of simultaneously screening passengers and bags carried by passengers for mass casualty weapons. Initiate the development of PPE seamless clothing items such as socks and gloves to avoid bulk, discomfort, and loss of tactility and dexterity. Sustain CBRNE Units for Defense and the Homeland. Complete development of a risk-based decision support model for skin decontamination in the case of dermal exposures to CWAs. Complete validation methods to confirm routine decontamination of personal protection equipment is sufficient to remove emerging threats like toxins (ricin, abrin) or drugs (opioids, fentanyl analogs). Complete the development of evidence and					

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C. Accomplishments/Planned Programs ($ in Millions)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
consensus-based guidance for laundry protocols and decontamination confirmation for personal protective equipment after ricin, abrin, and pharmaceutical-based agent incidents. Complete the development of a practical application of Surface Enhanced Spatially Offset Raman Spectroscopy (SESORS) for trace threat detection. Complete optimizing the methodology for using Alternative Light Sources (ALS) systems to visualize and screen for pharmaceutical-based agent (PBA) threats. Complete validating laundering techniques for work duty uniforms, bunker gear and personal protective equipment (PPE) traditionally used to remove soot, dusts, blood and other bodily fluids are sufficient for the removal of more toxic compounds such as toxins (e.g. ricin, abrin) or drugs of concern (e.g. opioids, fentanyl analogs). Complete the evaluation of the effectiveness of commercial bulk filter material for neutralizing or removing chemical gases of emerging threats from enclosed/ indoor environments. Complete improving the ability to detect and characterize chemical and biological (CB) hazards in various subterranean (Sub-T) environments. Complete collecting empirical data on the transport of aerosol particles in an urban environment to improve mathematical models used for risk assessment and hazard response. Complete the development of a containment system for rapidly encapsulating and transporting objects contaminated with chemical and biological (CB) hazards, such as chemical warfare agents (CWAs) and toxic industrial chemicals (TICs). Continue the development of a respiratory protective device designed for canines that can fit the general working dog population. Initiate development of a garment-agnostic SCBA cover to allow for simplified decontamination for SCBA external garments. Integrate with the U.S. Interagency. Complete development of an online database containing feedback on CBRNE detector field performance and test data. Complete the development of a system to effectively collect, aggregate, and share critical information related to biological samples and laboratory analysis results using a standard format that integrates with currently deployed responder networks. Complete updating the current open source chemical and biological recipe inventory to include metadata on each discovered recipe and incorporating recipe and precursor information into a threat recognition guide. Continue a multi-year test and evaluation program for the identification and rapid laboratory and field evaluation of emerging commercial and near-commercial explosive detection technologies to facilitate the acceleration, improvement, and fielding of promising capabilities. Strengthen Alliances. Complete international laboratory round robin testing for facilities that are involved with response to biological incidents (e.g. bioterrorism, bio-crimes) in a safe no-fault environment. Continue to identify common research and development gaps and initiate projects that improve the capabilities of military and civilian first responders in handling chemical, biological and radiological events. Continue development of a man-portable system that can reliably detect explosives through continuous gas phase monitoring. Continue the investigation of the detonation of improvised radiological dispersal devices (RDDs) in an urban environment to gain valuable emergency response and forensic information.					

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C. Accomplishments/Planned Programs ($ in Millions)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
Support Relationships to Address Significant Terrorist Threats. Complete the systematic evaluation of gas forming reactions that could be used in improvised chemical devices. Continue the characterization of determining the effectiveness of novel delivery methods through empirical data to better understand the potential hazard and develop detection/mitigation methods for a broad range of materials delivered via those mechanisms. Enable U.S. Interagency Counterparts to Advance U.S. Influence and National Security Interests. Complete determination of operationally deployed detection techniques and systems could be further developed or exploited to provide additional chemical detection capabilities in a search environment. ***FY 2020 to FY 2021 Increase/Decrease Statement:*** Decreases are reflective of the Defense Wide Review reductions.					
Title: IMPROVISED DEVICE DEFEAT (IDD)	12.923	11.252	5.946	-	5.946
Description: The IDD/EC Subgroup's objective is to deliver capabilities to defeat or neutralize the continuum of terrorist improvised weapons and explosive devices. IDD/EC improves the operational capabilities of the bomb disposal community, consisting of military EOD, and federal, state, and local bomb squads, by developing and delivering advanced tools and technologies, and decision support information to defeat improvised terrorist devices. The IDD/EC Subgroup identifies and prioritizes multi-agency end-user requirements in collaboration with military units, and federal, state, and local agencies. IDD/EC actively works with vendors and end-users to deliver advanced prototype systems that provide greater efficiency and increased safety for Bomb Technicians who investigate, access, evaluate, and if needed, render safe or dispose of suspect devices. All development efforts undertaken are in support Presidential Policy Directive 17 (PPD-17), Countering Improvised Explosive Devices, and the National Bomb Squad Commanders Advisory Board (NBSCAB) National Strategic Plan. ***FY 2020 Plans:*** Integrate with the U.S. Interagency. Continue development of a robot-mounted X-ray Backscatter system for VBIED diagnostics. Complete development of a 3D X-ray Imaging System to interrogate a suspected improvised explosive device (IED) and locate critical components. Complete development of a small, high definition, live-streaming camera that displays images onto a wearable screen or heads-up display. Complete development of a mixed-reality visualization system for command post/up-range support that will allow bomb technicians and support personnel to see what is transpiring downrange and assist the bomb technician with on-scene analysis. Complete development of a low cost obstruction avoidance and proximity alert system for robotic platforms. Complete development of a rapidly mountable backscatter X-ray system for small to medium sized robotic platforms. Complete development of an optimized IED jamming system that includes					

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C. Accomplishments/Planned Programs ($ in Millions)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
updated frequencies and increased jamming power based on a pre-existing system. Complete development of a smartphone or tablet-based application that will allow bomb technicians to relay IED and IED incident information graphically to fellow bomb technicians in real-time. Continue development of a customizable energetic tools to disrupt explosive devices in high risk environments. Sustain Combating Terrorism. Continue bilateral information exchange between U.S. bomb technicians and members of the Israel National Police Bomb Disposal Division. Continue conducting workshops that integrate Explosive Ordnance Disposal (EOD) and Public Safety Bomb Technicians (PSTB) with engineers and roboticists to collaboratively design and develop new capabilities for VBIED response. Continue development of bomb disposal tools for deployment on, or by, small UAS-based platforms. Continue development of an electronic, user-updatable UAS Guidebook that can be used as a quick reference guide during response operations for identification and analysis of downed UAS platforms. Discontinue development of a humanoid robotic platform for use for IED Defeat operations in urban environments due to funding constraints.. Complete conducting requirement gathering events where bomb technicians evaluate and test current technologies in a real world scenario. Complete an operational test and evaluation of Laser Scanners on several different EOD robotic platforms. Continue development of a hands-free bomb suit heads-up display that projects mission and sensor data onto the bomb suit helmet screen. Initiate development of a digital night vision system capable of producing full color images of items, reflective of their actual color to aid component identification and diagnostics. Initiate development of library of IED circuits for training, which contains component lists, assembly instructions, and files for making printed circuit boards. Initiate development of a remote chemical detection capability for EOD operations that allows identification, analysis, and technical characterization of explosives.					
FY 2021 Base Plans: Integrate with the U.S. Interagency. Complete development of bomb disposal tools for deployment on, or by, small UAS-based platforms. Complete development of an electronic, user-updatable UAS Guidebook that can be used as a quick reference guide during response operations for identification and analysis of downed UAS platforms. Continue bilateral information exchange between U.S. bomb technicians and members of the Israel National Police Bomb Disposal Division. Continue development of a digital night vision system capable of producing full color images of items, reflective of their actual color to aid component identification and diagnostics. Continue conducting workshops that integrate Explosive Ordnance Disposal (EOD) and Public Safety Bomb Technicians (PSTB) with engineers and roboticists to collaboratively design and develop new capabilities for VBIED response. Sustain Combating Terrorism: Continue development of library of IED circuits for training, which contains component lists, assembly instructions, and files for making printed circuit boards. Continue development of					

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C. Accomplishments/Planned Programs ($ in Millions)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
a remote chemical detection capability for EOD operations that allows identification, analysis, and technical characterization of explosives. Continue development of a hands-free bomb suit heads-up display that projects mission and sensor data onto the bomb suit helmet screen. ***FY 2020 to FY 2021 Increase/Decrease Statement:*** Decreases are reflective of the Defense Wide Review reductions.					
Title: INVESTIGATIVE AND FORENSICS SCIENCE ***Description:*** The IFS subgroup's objective is to advance combating terrorism capabilities in investigative and forensic science. IFS supports joint, interagency, and other partners who apply investigative and forensic science methods, means, or practices to forensic intelligence or investigations. To meet this objective, the subgroup focuses on rapid research, development, test and evaluation of new and advanced technology, equipment, forensic techniques, and investigative tools, as well as development of information resources and on support tools for risk-based decision-making and rapid exploitation of evidence. Projects emphasize rapid and field deoxyribonucleic acid (DNA) analysis, identification of insider threat within agencies, pre-blast and post-blast forensic examination, electronic evidence data acquisition and analysis, sensitive site exploitation, forensic intelligence, and criminalistics. ***FY 2020 Plans:*** Sustain Combating Terrorism: Complete development and fielding of DNA collection and analysis procedures usable in sensitive sites and restricted areas without leaving any trace. Complete the development and evaluation of algorithms that increase the accuracy of NCCA's Avatar and thermal imaging credibility assessment systems. Complete development of and field a vehicle image search tool with artificial intelligence that automatically trains itself to identify new makes and models of vehicles for future analysis. Continue the development of a mobile instrument with a deep UV Raman laser that visualizes undetectable latent fingerprints and makes the images immediately available for analysis. Continue the development of techniques that increase the cognitive load in persons being interviewed to obtain more information and make better credibility assessments. Continue the development of a DNA analytic process that separates out DNA in mixed samples by using microhaplotype technology. Continue the development of a microwave DNA extraction process for faster and better field preparation of DNA samples. Continue the development of and field an automatic video file search and analysis tool for any user defined object to collect evidence and intelligence. Initiate the development of forensic procedures to collect and analyze both DNA evidence and latent fingerprint evidence found on adhesive tape and related media. Initiate development of an automated system that rapidly searches large data files to detect, classify, and retrieve weapons, symbols, and other objects. Initiate development of a	7.293	11.614	6.302	-	6.302

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C. Accomplishments/Planned Programs ($ in Millions)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
cross-domain digital forensics capability that utilizes smart filtering, artificial intelligence, automated multimedia analysis, and malware detection to create a comprehensive “clean” and relevant view of the exportable data and make it available to other operational networks. Initiate development of a system for audio recordings that finds and labels noises of law enforcement interest and intelligence value. Initiate development of advanced Latent Quality Metric software that standardizes and makes the latent print comparison workflow more efficient and accurate. Initiate development of an automated process to enhance the clarity, detail, and pixel level of low resolution images. Initiate development of an electro-optical handheld device that identifies persons at a distance using both infrared and visible light. Greater Affordability at the Speed of Relevance: Complete the development and fielding of a handheld device and its accessories that documents incident scenes and collects fingerprint images and other evidence and can make comparisons at the scene with other databases. Complete development and fielding of an advanced scalable facial recognition system based on a government developed model. Complete the development and fielding of automated methods to convert foreign fingerprint files into US compatible electronic files and anonymize the source. Complete the development and fielding of a facial recognition toolkit that can quickly identify facial images at sensitive sites. FY20 OCO Plans: Sustain Combating Terrorism. Initiate the development of a small rugged system that automatically documents incident sites and crime scenes with images, photos, sketches, and 3-D visualizations with accurate measurements. Initiate development of a rugged, mobile, forensic alternative light source for better visualization and photographing of trace evidence. ***FY 2021 Base Plans:*** Sustain Combating Terrorism: Complete the development of and field an automatic video file search and analysis tool for any user defined object to collect evidence and intelligence. Complete the development of forensic procedures to collect and analyze both DNA evidence and latent fingerprint evidence found on adhesive tape and related media. Complete development of a cross-domain digital forensics capability that utilizes smart filtering, artificial intelligence, automated multimedia analysis, and malware detection to create a comprehensive “clean” and relevant view of the exportable data and make it available to other operational networks. Complete development of a system for audio recordings that finds and labels noises of law enforcement interest and intelligence value. Complete development of advanced Latent Quality Metric software that standardizes and makes the latent print comparison workflow more efficient and accurate. Complete development of an automated process to enhance the clarity, detail, and pixel level of low resolution images. Complete the development					

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C. Accomplishments/Planned Programs ($ in Millions)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
of techniques that increases the cognitive load in persons being interviewed to obtain more information and make better credibility assessments. Complete the development of a DNA analytic process that separates out DNA in mixed samples by using microhaplotype technology. Complete the development of a microwave DNA extraction process for faster and better field preparation of DNA samples. Complete development of an electro-optical handheld device that identifies persons at a distance using both infrared and visible light. Complete the development of a small rugged system that automatically documents incident sites and crime scenes with images, photos, sketches, and 3-D visualizations with accurate measurements. Complete development of a rugged, mobile, forensic alternative light source for better visualization and photographing of trace evidence. Continue development of an automated system that rapidly searches large data files to detect, classify, and retrieve weapons, symbols, and other objects. Continue development of an automated system that rapidly searches large data files to detect, classify, and retrieve weapons, symbols, and other objects. Continue the development of and field a mobile instrument with a deep UV Raman laser that visualizes undetectable latent fingerprints and makes the images immediately available for analysis. ***FY 2020 to FY 2021 Increase/Decrease Statement:*** Decreases are reflective of the Defense Wide Review reductions.					
Title: Irregular Warfare and Evolving Threats (IW/ET) ***Description:*** The IW/ET subgroup develops new concepts and capabilities for warfighters and interagency partners. In accordance with the National Defense Strategy, projects emphasize preparation to defeat adversaries, including great powers' proxies and irregular surrogates, and succeed in a wide range of contingencies in both physical and informational domains. In order to establish and reinforce IW as a core competency, IW/ET will engage in operational assessment, concept development, and independent validation of unique prototype capabilities to identify, confront, and defeat evolving threats across the range of military operations as well as those below the threshold of conventional war. ***FY 2020 Plans:*** Expand the Competitive Space. Complete the development of a tool to support decision makers managing digital operations with some form of predictive advice as to how people will respond to a choice of different types of interventions. In this way decision making will be improved not only for planning purposes, but also for the development of capability underpinned by a behavioral science evidence base. This contributes to more effective cyber plans and ultimately operations in order to more effectively expand the competitive space. Complete a project characterizing the use of commercial technology by various actors (political actors, brands, competitors). Phase 2 will explore commercial technology identified in Phase 1 to develop at least one software prototype that	14.953	9.090	6.158	-	6.158

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C. Accomplishments/Planned Programs ($ in Millions)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
enables key U.S. information programs to expand the competitive space through more precise and adaptable inform and influence programs. Complete development of a capability that can deploy, through air drop, large quantities of electronic devices that will land within a predesignated area safely. The deployment containers will draw the attention of the local populace in both the air and on the ground, will float and be watertight. This will provide Military Information Support Operations (MISO) operators the ability to deliver more complex and tailored messages to targeted populations in a safe and controllable manner, advancing the current capability of leaflet drop operations and expanding the competitive space for inform and influence effects. Complete research exploring the rapidly evolving field of Deep Fakes to evaluate its effect and evaluate options for detecting and countering adversary actions in this emerging facet of the expanded competitive space. Continue an effort to provide a capability that enables DoD, Interagency, and international users to access and leverage publicly available information, providing increased situational awareness by leveraging Artificial Intelligence (AI)/Machine Learning (ML) technologies and state-of-the-art analytic Tool Kits in order to counter a range of threats in the information environment, effectively expanding the competitive space. Continue an effort to explore the emerging blockchain technologies and the risks and opportunities posed by them with respect to United States national security interests to improve US Government understanding of the Encrypted Ledger and expand options for emerging fronts in the competitive space. Initiate project to support MISO operators by integrating cutting edge commercial technologies and applications into a toolkit that consist of advanced equipment that reflect the technology and communications infrastructure in the diverse set of environments in which MISO operates to expand the competitive space and capabilities of our partners. The toolkit shall be influence-specific, standardized and by design be interchangeable, to include capabilities that can be procured on the local economy of the country of interest. Initiate project to understand advanced multimedia developments in order to broaden the U.S. Government's options to detect and counter the emerging threat of manipulated adversarial multimedia. Integrate with the U.S. Interagency. Complete transition to a new PE line an effort to manage, develop, enhance, integrate, test, deploy, and maintain a Secure, Unclassified, Network (SUNet) enterprise system that allows the user the ability to detect, monitor, understand, and act in the information environment through mission specific enclaves (partitioned mission or function information cells). This project enables unprecedented integration between DoD and the interagency for activities that help expand the competitive space while advancing U.S. influence and national security interests. Complete a plug-in for the Tactical Assault Kit (TAK) that will provide an operational Command, Control, Communications, Computers and Intelligence tool that is rapid, scalable, flexible, simple and collaborative in nature. It will run seamlessly between Android, Windows and iOS devices and will provide a secure, digital collaborative environment with planning tools that will provide					

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C. Accomplishments/Planned Programs ($ in Millions)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
Joint, Interagency, Intergovernmental and Multinational forces the ability to operate with increased agility in the joint, dynamic, and fluid operational environment with greater integration with the U.S. Interagency. Irregular Warfare as a Core Competency. Complete a study to review and evaluate existing Tactics, Techniques, and Procedures (TTP) for the integration and conduct of Operations in the Information Environment (OIE) at the tactical level of war. This effort will begin to identify requirements for OIE capabilities and integration at that level in order to identify effective TTPs for propagation across the joint force. The study will provide additional recommendations to help close identified gaps and supports the establishment of irregular warfare as a core competency. Strengthen Alliances. Complete the development of a combined, joint and multi-national information sharing platform to collect and analyze photographs, videos, audio recordings, and general text-based information via precise crowd sourcing techniques. The technical approach will provide the capability to conduct facial, object and ISIL branded recognition. An Android-based application will also be available that can be customized for a specific region, language, and purpose to use for crowd-sourced media collection. The project is enhancing the ability of information programs working with allied and/or partner nations to collect, search, retrieve, view and analyze photos, audio, and video for use, thereby strengthening cooperation, alliances and expanding the competitive space to confront terrorist and other threats in the information environment. Complete efforts with the United Kingdom's Defence Science and Technology Laboratory to sponsor field research and model development to determine if the theory of conceptual transfer can be repeated and, if so, incorporated into a model to better predict how non-western people will react to outside influence. Benefits of this research will include improved understanding of how language affects cognition, thereby enabling US forces to expand the competitive space as they better understand and prevent the bias that may be introduced into collection and analysis tools, particularly in cases where vast amounts of collected data will be used to train AI. Sustain Combating Terrorism. Continue a Remote Advise and Assist (RAA) project to examine conditions that would lead to successful RAA operations in a full spectrum environment and then develop and field advanced RAA prototypes in order to test the ability of advisors to continue mentoring partners remotely. By having a robust RAA capability, advisors will be able to significantly enhance time with their partners when physical access is severely restricted. By being able to advise partners in a real time operational environment, the time period needed to enhance that partner's capacity can be significantly reduced, leading to more sustainable and efficient combating terrorism operations. Observations will examine how to advance virtual communications between advisors and partners during operations, supporting crucial relationships to address significant terrorist threats at the tactical and operational levels.					
FY 2021 Base Plans:					

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C. Accomplishments/Planned Programs ($ in Millions)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
.Expand the Competitive Space. Complete an effort to provide a capability that enables DoD, Interagency, and international users to access and leverage publicly available information, providing increased situational awareness by leveraging Artificial Intelligence (AI)/Machine Learning (ML) technologies and state-of-the-art analytic Tool Kits in order to counter a range of threats in the information environment, effectively expanding the competitive space. Complete an effort to explore the emerging blockchain technologies and the risks and opportunities posed by them with respect to United States national security interests to improve US Government understanding of the Encrypted Ledger and expand options for emerging fronts in the competitive space. Continue project to understand advanced multimedia developments in order to broaden the U.S. Government's options to detect and counter the emerging threat of manipulated adversarial multimedia. Initiate new efforts to develop and deploy capabilities that support DoD, interagency and foreign partners and allies who are confronting evolving threat networks and complex global operational environments. ***FY 2020 to FY 2021 Increase/Decrease Statement:*** Decreases are reflective of the Defense Wide Review reductions.					
Title: PERSONNEL PROTECTION ***Description:*** The Personnel Protection Subgroup's objective is to develop new equipment, reference tools, and standards to improve the protection of personnel. Projects focus on putting innovative tools such as automated information management systems, communication devices, tagging, tracking and locating devices, mobile surveillance systems, as well as personal and vehicle protection equipment in the hands of personnel. As indicated below, many of these developments directly support the National Defense Strategy, as well as Combating Terrorism. ***FY 2020 Plans:*** Enhance Survivability for Close Combat Formations. Complete development of a mobile sensor suite that can detect subsonic and supersonic rounds that are fired at convoy and display it on a real time map to provide situational awareness to the operator. Complete development of standalone armor plates to defeat the 7.62 X 39mm, 124 grain, mild steel core (MSC) projectile. Complete development of a robust Electromyography (EMG) sensor system comprised of electrodes, sampling electronics and processing electronics capable of integration into a robotic/human augmentation platform. Completed the development of advanced systems to detect and mitigate unmanned aerial threats using novel detection and mitigation modalities. Complete development of an updated Armored Passenger Vehicle (APV) Handbook with regards to the current management of government APV programs. Complete the investigation of the root causes of poor armor fit among U.S law enforcement agencies. Identify corrective actions and standard procedures to ensure proper fit to body armor	19.689	17.165	7.281	1.363	8.644

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C. Accomplishments/Planned Programs ($ in Millions)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
users across the anthropometric spectrum of law enforcement professionals. Complete the development of a test fixture to validate the performance of non-pneumatic limb tourniquets. Continue development of biomarker identification for brain injury using magnetic resonance imaging (MRI) and magnetic resonance spectroscopy (MRS) to monitor neurochemical biomarkers for post-traumatic stress disorder and mild traumatic brain injury. Complete development of an air deployable unmanned aerial system that is capable of dashing ahead of the V-22 and providing at least 8.5 minutes of overhead intelligence, surveillance and reconnaissance (ISR) at the landing zone or drop zone prior to the force arrival. Continue development of enhanced performance personal body armor and production processes to enable successful completion of first articles tests and subsequent fielding. Continue development of a man packable system that reduces or eliminates the radar, electronic, thermal, infrared, visual or acoustic signatures of a dismounted soldier. Continue the development of a multi-modal system to detect, identify and mitigate unmanned aerial threats to tactile vehicles and other mobile platforms in terrestrial and maritime environments. Complete development of an active counter small unmanned aerial vehicle system that will employ a multi-rotor UAV to capture, retrieve and neutralize threat UAV systems. Continue the development of a vehicle mounted, tethered aerial platform capable of carrying a wide variety of payloads to fill various mission needs. Continue development of a system capable of UAS detection, geolocation, tracking and disruption for the protection of dismounted soldiers and operators. Complete development and testing of injection molded ceramic armor to provide interagency vehicle with ballistic protection from advanced projectile threats.. Continue development of advanced ceramic materials with enhanced mechanical properties for use in novel armor applications. Continue development of innovative materials for use in advanced armor systems. Continue development of a two dimensional polymer material bound by robust hydrogen bonds for use in lightweight armor applications. Initiate development of a self-adhesive layer to provide ballistic protection to the extremities from blast propelled fragmentation and debris. Initiated development of a standard 7.62 x 39mm projectile test surrogate to provide a standard test round for body armor test protocols. Initiated development of a multi-threat helmet to provide impact, ballistic and blast protection for law enforcement officers. Enhance Lethality for Close Combat Formations. Continue the development of a heads up display unit to be integrated into an existing helmet system and provide day and night display of data elements of interest to the operator. Integrate with the U.S. Interagency. Complete development of a small lightweight wearable device that securely transmits biometric and geolocation data to a common operating picture. Continue development of a discrete, self-adhesive patch that provides silent, tactile stimulation in order to alert embassy personnel alert notifications.					

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C. Accomplishments/Planned Programs ($ in Millions)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
Initiate development of a 360 degree, real time sensor system to provide streaming video and anomaly detection to vehicle platforms on the move.					
FY 2021 Base Plans: Enhance Survivability for Close Combat Formations Complete development of biomarker identification for brain injury using magnetic resonance imaging (MRI) and magnetic resonance spectroscopy (MRS) to monitor neurochemical biomarkers for post-traumatic stress disorder and mild traumatic brain injury. Complete development of an air deployable unmanned aerial system that is capable of dashing ahead of the V-22 and providing at least 8.5 minutes of overhead intelligence, surveillance and reconnaissance (ISR) at the landing zone or drop zone prior to the force arrival. Complete the development of a multi-modal system to detect, identify and mitigate unmanned aerial threats to tactile vehicles and other mobile platforms in terrestrial and maritime environments. Complete development of a two dimensional polymer material bound by robust hydrogen bonds for use in lightweight armor applications. Complete development of a standard 7.62 x 39mm projectile test surrogate to provide a standard test round for body armor test protocols. Continue development of advanced ceramic materials with enhanced mechanical properties for use in novel armor applications. Continue development of innovative materials for use in advanced armor systems. Continue development of a multi-threat helmet to provide impact, ballistic and blast protection for law enforcement officers. Initiate development to increase ballistic protection and reduce weight for body armor. Initiate development of a tracking device that will work in disadvantaged/denied GPS environments. Enhance Lethality for Close Combat Formations. Complete the development of a heads up display unit to be integrated into an existing helmet system and provide day and night display of data elements of interest to the operator. Integrate with the U.S. Interagency. Complete development of a 360 degree, real time sensor system to provide streaming video and anomaly detection to vehicle platforms on the move.					
FY 2021 OCO Plans: Enhance Survivability for Close Combat Formations. Complete development of enhanced performance personal body armor and production processes to enable successful completion of first articles tests and subsequent fielding. Complete the development of a vehicle mounted, tethered aerial platform capable of carrying a wide variety of payloads to fill various mission needs. Complete development of a system capable of UAS detection, geolocation, tracking and disruption for the protection of dismounted soldiers and operators. Continue development of a self-adhesive layer to provide ballistic protection to the extremities from blast propelled fragmentation and debris. Continue development of a man packable system that reduces or eliminates the radar, electronic, thermal, infrared, visual or acoustic signatures of a dismounted soldier.					

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C. Accomplishments/Planned Programs ($ in Millions)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
Integrate with the U.S. Interagency. Complete development of a discrete, self-adhesive patch that provides silent, tactile stimulation in order to alert embassy personnel alert notifications. ***FY 2020 to FY 2021 Increase/Decrease Statement:*** Decreases are reflective of the Defense Wide Review reductions.					
Title: PHYSICAL SECURITY ***Description:*** Rapidly develop and transition physical security/force protection capabilities and technologies to support forward deployed and domestic first responders, military, interagency, and international partners in the focus areas of Blast Effects and Mitigation; Maritime Security; Screening, Observation, Detection, and Protection; and, Subterranean Activities. Emphasize these technology development efforts primarily at U.S. embassies and consulates, forward operating bases, along the U.S. borders, at mass transportation and commerce nodes, in maritime port and littoral environments, and in support of large-scale public venues. ***FY 2020 Plans:*** Support Relationships to Address Significant Terrorist Threats. Complete development and false alarm rate testing of an automatic target recognition system for on the move, standoff IED detection. Continue development of a handheld anomaly detection wand to detect both non-metallic and metallic objects concealed under or in clothing to support checkpoint screening and security personnel. Continue development of algorithms using machine learning for the detection of threats in Computed Tomography (CT) and x-ray screening systems. Initiate development of additional capability for Anti-Terrorism Planner (ATP) Bridge with updates for high-pressure concrete and modern cables and stays for modeling and threat assessment of bridges in the US and overseas. Integrate with the U.S. Interagency. Complete development and testing of a small-unmanned aerial system (sUAS) to safely conduct reconnaissance of discovered illicit sites and conduct routine inspections. Complete development of reports compiling recent domestic and international terrorist events involving person-borne and vehicle-borne improvised explosive device (PBIED & VBIED) events, including location, threat, success or failure factors and overall impact. Complete development and testing of a less-than-lethal-weapon (LLW) prototype, which fires pepper projectiles with improved accuracy at extended ranges, enabling engagement of adversaries from a safer distance. Complete the development and testing of an algorithm that will automatically detect metallic and non-metallic weapons in baggage (e.g. guns and knives) and integrate the algorithm into an existing carry-on baggage x-ray system. Initiate test and evaluation of Ethylene-vinyl Acetate (EVA) laminated glass to determine its blast protection performance as compared to Polyvinyl Butyral (PVB) laminated glass.	55.650	7.955	6.851	-	6.851

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C. Accomplishments/Planned Programs ($ in Millions)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
Initiate development of a relocatable tower system with additional mast height, updated surveillance and communications technologies capable of transmitting real time imagery and geolocations between Command and Control sites and field operators. Strengthen Alliances. Complete development and testing of a fast-running ultra-high performance concrete slab model, WAC-U, and improved tools for design, protective use, and vulnerability assessments. Continue development of an advanced active diver thermal protection system for long exposure dives, including SEAL Delivery Vehicle (SDV) operations. Continue development and testing of an interoperable, detect-to-defeat capability to provide waterside security (ports and harbors) against threat divers (both open and closed circuit) and weaponized autonomous underwater vehicles (AUVs). Initiate and complete leveraging assets and capabilities to support research efforts in the area of Homemade Explosive (HME) materials characterization. Sustain Combating Terrorism. Complete the development of a novel ship-to-shore fuel transport system with two different designs for an amphibious towable container that mitigates risk to personnel and fuel loss in the event of an attack. Complete development and testing surveillance system with automated 360 degree scanning capability (optical radar) at long ranges to protect the force in tactical combat outposts. Initiate the development of a lighter and hardened ship-to-shore fuel transport prototype to address mobility and compatibility requirements. Initiate the development of an Unmanned Underwater Vehicle (UUV) prototype, used with existing US Navy Electronic Harbor Security System (EHSS) and Coastal Riverine Expeditionary Surveillance Command Center (ESCC), for swimmer/diver and UUV interdiction.					
FY 2021 Base Plans: Strengthen Alliances. Initiate development of vehicle threat modeling capability for VAPO to conduct vehicle ramming and IED threat assessments on Government and sensitive facilities. Integrate with the U.S. Interagency. Complete development and testing of a relocatable tower system with additional mast height, updated surveillance and communications technologies capable of transmitting real time imagery and geolocations between Command and Control sites and field operators. Initiate development of a commercially available access delay system for use at sensitive locations where the threat of manual attack and hostile incursions on the facility is high. Complete test and evaluation of Ethylene-vinyl Acetate (EVA) laminated glass to determine its blast protection performance as compared to Polyvinyl Butyral (PVB) laminated glass.					

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C. Accomplishments/Planned Programs ($ in Millions)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
Sustain Combating Terrorism. Complete test and evaluation of an interoperable, detect-to-defeat capability to provide waterside security (ports and harbors) against threat divers (both open and closed circuit) and weaponized autonomous underwater vehicles (AUVs). Continue the development of a lighter and hardened ship-to-shore fuel transport prototype to address mobility and compatibility requirements. Complete development and testing of an advanced active diver thermal protection system for long exposure dives, including SEAL Delivery Vehicle (SDV) operations. Continue the development and testing of an Unmanned Underwater Vehicle (UUV) prototype, used with existing US Navy Electronic Harbor Security System (EHSS) and Coastal Riverine Expeditionary Surveillance Command Center (ESCC), for swimmer/diver and UUV interdiction. Support Relationships to Address Significant Terrorist Threats. Complete development and testing of the Anti-Terrorism Planner (ATP) Bridge with updates for high-pressure concrete and modern cables and stays for modeling and threat assessment of bridges in the US and overseas. Complete development and testing of algorithms using machine learning for the detection of threats in Computed Tomography (CT) and x-ray screening systems. Complete development and testing of a handheld anomaly detection wand to detect both non-metallic and metallic objects concealed under or in clothing to support checkpoint screening and security personnel. ***FY 2020 to FY 2021 Increase/Decrease Statement:*** Decreases are reflective of the Defense Wide Review reductions.					
Title: SURVEILLANCE, COLLECTION AND OPERATIONS SUPPORT	10.322	13.008	0.000	8.733	8.733
Description: Identify high-priority user requirements and special technology initiatives that identify, understand, monitor and disrupt peer and near peer adversaries, state and non-state actors, who pose new and evolving threats through their development and use of emerging and disruptive technologies. Lead the development of new technologies in the areas of Signature Management, Cyber, Surveillance, Counter Surveillance, Technical Collection and Special Communications in support of Special Operations and the US Intelligence Community to advance U.S. Influence and National Security Interests and enable retaliatory or preemptive operations that reduce the capabilities and support available to peer and near peer adversaries and violent extremist or terrorist organizations as directed. ***FY 2020 Plans:*** Enhance Survivability for Close Combat Forces and Sustain Combating Terrorism to Advance U.S. Influence and National Security Interests: Completed development of a KA band small form factor electronically steerable array antenna system for maritime, air and ground mobile operations. Completed development of an Emergency					

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C. Accomplishments/Planned Programs ($ in Millions)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
Notification and Tracking communications capability. Completed Classified Project support of Social Media based collection capability. Completed classified feasibility assessment to design and develop a new Cube Satellite Communications System. Completed classified project to develop a new Personal Electronic Device Secured Note taking application. Completed classified project to develop a Wireless Alarm Defeat Capability. Strengthen Alliances and Sustain Combating Terrorism to Advance U.S. Influence and National Security Interests: Completed effort to develop a Hebrew Language Aptitude Battery (HILAB) Test capability. Continued development and demonstration of a low profile tactical radio system with optimized performance. Enhance Survivability for Close Combat Forces and Sustain Combating Terrorism to Advance U.S. Influence and National Security Interests: Completed development of a new miniaturized Ultra High Frequency Band antenna or family of antennas. Completed effort to develop a Facial Recognition and Manipulation Capability for Social Media. Completed Classified Cognitive Radio effort. Continued development of a single compact, gimbaled next generation Hyperspectral Imagery (HSI) aerial sensor in both SWIR and LWIR wavebands and provide industry standard data outputs. Continued classified project to develop a specialized antenna system. Continued classified project to develop wave form identification system. Continued classified project to develop a Media Exploitation capability. Continued spiral development of the Enhanced CALYPSO RFIC and integrated transceiver devices. Initiated Classified Personal Electronic Device (PED) Detect Signature Management effort. Initiated Classified Surveillance and Signature Management effort to develop a low observable High Definition (HD) and Audio Visual (AV) system. Initiated Classified Neural Net Special Communications effort. Initiated Classified Field Processing Technical Collection effort. Initiated Classified Alternative Waveform Special Communications effort. Initiated Classified Data Obscuration Special Communications effort. Initiated Classified Integrated Air Defense Geo-Location Technical Collection effort. . ***FY 2021 Base Plans:*** N/A ***FY 2021 OCO Plans:*** Strengthen Alliances and Sustain Combating Terrorism to Advance U.S. Influence and National Security Interests: Complete development and demonstration of a low profile tactical radio system with optimized performance.					

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C. Accomplishments/Planned Programs ($ in Millions)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
Enhance Survivability for Close Combat Forces and Sustain Combating Terrorism to Advance U.S. Influence and National Security Interests: Complete classified project to develop a specialized antenna system. Complete classified project to develop wave form identification system. Complete Classified Neural Net Special Communications effort. Complete Classified Field Processing Technical Collection effort. Complete Classified Alternative Waveform Special Communications effort. Complete Classified Data Obscuration Special Communications effort. Complete development of a single compact, gimbaled next generation Hyperspectral Imagery (HSI) aerial sensor in both SWIR and LWIR wavebands and provide industry standard data outputs. Complete classified project to develop a Media Exploitation capability. Complete spiral development of the Enhanced CALYPSO RFIC and integrated transceiver devices. Complete Classified PED Detect Signature Management effort. Complete Classified Surveillance and Signature Management effort to develop a low observable HD AV system. Continue Classified Integrated Air Defense Geo-Location Technical Collection effort. Initiate deployment of field technical surveillance capabilities against peer/ near peer adversaries and terrorist threats through development or enhancement of Multi-intelligence collection systems, customized tagging, tracking and locating capabilities. Initiate the development of non-standard and specialized communications capabilities to support retaliatory or preemptive operations against highly technical adversaries. Initiate development of signature management capabilities and new techniques that protect the force and support the collection and targeting process. Expand the Competitive Space, Enhance Survivability for Close Combat Forces and Sustain Combating Terrorism to Advance U.S. Influence and National Security Interests: Initiate development of enhanced capabilities against vehicular signals of interest and Cyber Convergent Technologies. ***FY 2020 to FY 2021 Increase/Decrease Statement:*** Decreases are reflective of the Defense Wide Review reductions.					
Title: TACTICAL OPERATIONS SUPPORT	25.374	21.058	0.000	9.192	9.192
Description: The Tactical Operations Support subgroup's mission is to execute rapid research and development projects that enhance capabilities of DoD and Interagency special operations tactical teams engaged in finding, fixing, and finishing terrorists. This includes support to state and local law enforcement agencies to combat domestic terrorism. The development focus is enabling small tactical units by providing state of the art overmatch capabilities in: Offensive Systems; Unconventional Warfare, Counter-Insurgency Support; Tactical Communications; Tactical Reconnaissance, Surveillance, and Target Acquisition Systems; Specialized Infiltration, Access and Exfiltration Systems; and Survivability Systems.					

Exhibit R-2, RDT&E Budget Item Justification: PB 2021 Office of the Secretary Of Defense	Date: February 2020
Appropriation/Budget Activity 0400: *Research, Development, Test & Evaluation, Defense-Wide* / BA 3: *Advanced Technology Development (ATD)*	**R-1 Program Element (Number/Name)** PE 0603122D8Z / *Combating Terrorism Technology Support*

C. Accomplishments/Planned Programs ($ in Millions)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
FY 2020 Plans: Enhance Lethality for close combat formations. Complete spiral development of integration of small unmanned aircraft system stabilized gimbal that integrates laser target designation technologies onto current program of record airframes. Complete spiral development of a next generation Lightweight Medium Machine Gun (LWMMG) and polymer .338 Norma Magnum ammunition to give Special Operations Forces a distinct advantage in both the extended and close-in fight and be able to transition rapidly from mounted operations to dismounted operations. Complete development of an accurized 120mm mortar system with an advanced targeting system for installation and employment on a 5-ton Medium Tactical Vehicle (MTV) capable of lethal target engagement from a short halt out to 7 kilometers. Complete testing and optimization of barrel length, rifling twist rate, and suppression of the .300 Blackout rifle platform in conjunction with an underwater supercavitating ammunition. Complete development of a compact, wide exit pupil direct view optic for use on lightweight medium machine guns to effectively engage targets at the maximum effective range of the weapon system. Complete development of lightweight ammunition packaging to replace the standard M2A1 ammunition for use in logistical re-supply by conventional and Special Operations Forces. Complete test and evaluation of a commercially available cluster munition to determine its efficacy in reducing the dud rate to less than one percent. Complete development of a vertical take-off and landing loitering munition for engagement of targets in urban areas and defilade for Special Operations Forces. Complete development of a clip-on in-line mid-wave infrared thermal sight for use on lightweight medium machine guns, sniper rifles, and for counter-UAS missions. Complete development of a new ballistic algorithm, projectile drag coefficient, and weapons system for lethal target engagement beyond current extreme distances. Continue test and evaluation of a stabilized weapon mount for employment on ground vehicles, airframes, and maritime platforms. Continue development of a family of intermediate caliber weapon systems, including ammunition, for use in close quarters combat, designated marksmen, and individual weapon system roles. Continue spiral development of integration of small unmanned aircraft system stabilized gimbal that integrates laser target designation technologies onto current program of record airframes. Continue development of a small unmanned aerial system gunship with a modular kinetic payload for lethal engagements. Initiate development of a low-cost tactical sUAS that complies with current DoD cyber hardening policy. Initiate development of a low-cost vertical takeoff and landing (VTOL) loitering munition capable of being transported and launched by a single operator and controlled using a small laptop/tablet or wearable device. Initiate development of a dual channel medium range weapon sight with the ability to overlay near infrared and long wave infrared sensor images within one device. Initiate development of highly accurate ammunition for next generation sniper systems. Initiate development of a window breaching kit for snipers that enables a single operator to remove glass obstructions prior to shooting. Initiate development of a remotely-					

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C. Accomplishments/Planned Programs ($ in Millions)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total

operated integrated lighting system for canines that is operated based on mission activities. Initiate development of an electronic warfare kit optimized for use in subterranean and complex urban terrain. Initiate development of an advanced weapon sight capable of ranging, tracking, and providing real-time ballistic shooting solutions for individual weapon systems. Initiate development of a system to enhance combatant craft in terms of additional payloads, environmental protection and signature management, providing additional tactical mobility options to Combatant Commanders.
Enhance Survivability for close combat formations. Complete development of an Air to Surface Employment Kit (A2SEEK), for the already developed Micro Weather Sensor (MWS), to be packaged into a complete system that will be air dropped out of military aircraft to support operators and C2 elements to receive sensed weather elements and formulate aviation reports in deep battlespace or denied areas. Complete development and testing of a thermal camouflage material for soldier uniforms, vehicles, and hide sites. Complete spiral development to improve form factor, interoperability, and battery life of a state-of-the-art amplified transceiver speaker unit to work with a number of military and commercial radio devices. Complete development of a wide field of view binocular night vision device. Continue development of a man-portable (dismounted/static), on-the-move (vehicle mounted), and kinetic kill anti-drone system kit that is capable of detection, tracking, identification, and defeating a small Unmanned Aircraft System (sUAS).

FY 2021 Base Plans:
N/A

FY 2021 OCO Plans:
Enhance Lethality for close combat formations. Complete development of a man-portable (dismounted/static), on-the-move (vehicle mounted), and kinetic kill anti-drone system kit that is capable of detection, tracking, identification, and defeating a small Unmanned Aircraft System (sUAS). Complete test and evaluation of a stabilized weapon mount for employment on ground vehicles, airframes, and maritime platforms. Complete spiral development of integration of small unmanned aircraft system stabilized gimbal that integrates laser target designation technologies onto current program of record airframes. Complete development of a window breaching kit for snipers that enables a single operator to remove glass obstructions prior to shooting. Complete development of a small unmanned aerial system gunship with a modular kinetic payload for lethal engagements. Complete development of a dual channel medium range weapon sight with the ability to overlay near infrared and long wave infrared sensor images within one device. Complete development of a family of intermediate caliber weapon systems, including ammunition, for use in close quarters combat, designated marksmen, and individual weapon system roles. Complete development of a remotely-operated integrated lighting system for canines that is operated based on mission activities. Continue development of a low-cost vertical takeoff

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C. Accomplishments/Planned Programs ($ in Millions)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
and landing (VTOL) loitering munition capable of being transported and launched by a single operator and controlled using a small laptop/tablet or wearable device. Continue development of a low-cost tactical sUAS that complies with current DoD cyber hardening policy. Continue development of highly accurate ammunition for next generation sniper systems. Continue development of an electronic warfare kit optimized for use in subterranean and complex urban terrain. Continue development of an advanced weapon sight capable of ranging, tracking, and providing real-time ballistic shooting solutions for individual weapon systems. Continue development of a system to enhance combatant craft in terms of additional payloads, environmental protection and signature management, providing additional tactical mobility options to Combatant Commanders. ***FY 2020 to FY 2021 Increase/Decrease Statement:*** Decreases are reflective of the Defense Wide Review reductions.					
Title: TRAINING TECHNOLOGY DEVELOPMENT	5.934	8.058	5.481	-	5.481
Description: The TTD Subgroup's objective is to provide SOF, DoD, and the interagency with agile, rapid response, R&D capabilities for optimizing performance in the operational environment and increasing readiness for tomorrow's threats. To meet this objective, the subgroup develops human-centered technologies that are performance outcome focused in the areas of immersive learning technology, human performance tools and techniques, and innovative training and educational concepts. TTD's capabilities contribute to building a more lethal force and prepare personnel for critical missions that identify, disrupt, and defeat threats in any operational environment. ***FY 2020 Plans:*** Build a More Lethal Force: Complete the development and evaluation of a synthetic intelligence, surveillance, and reconnaissance (ISR) system to train Full Motion Video (FMV) ISR operational knowledge, skills, and abilities without incurring the costs of utilizing live ISR platforms. Complete the enhancement of an existing human performance application to incorporate the recording and analysis of mental performance indicators such as stress, motivation, and fatigue thereby providing a common language for instructors, psychologists, and human performance coaches to understand and make decisions about training. Continue the development and evaluation of a synthetic Internet sandbox to enable intelligence analysts and information operations personnel to train on analytical tools and to tactics, techniques, and procedures used for the collection, analysis, and exploitation of adversary online information. This sandbox will incorporate the effects of online information into large-scale exercises, while mitigating the challenges and risks associated with training on the open, publicly visible Internet. Initiate the development of an interactive and dynamic Full Motion Video (FMV) Processing					

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C. Accomplishments/Planned Programs ($ in Millions)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
Exploitation, and Dissemination (PED) desktop training simulator and program of instruction that trains SOF analysts to SOF-specific FMV PED tactics, techniques, and procedures; methodologies; and product standards. Enhance Lethality for Close Combat Formations: Complete the development of an intelligent tutoring system that will instruct Soldiers in how to integrate and interpret operations, intelligence, and civil information within the Common Operating Picture for enhanced situational awareness and reduced cognitive workload. Sustain CBRNE Units for Defense and the Homeland: Complete the development of a virtual reality (VR) based training system for Public Safety Bomb Technicians and Military Explosive Ordnance Disposal forward teams to practice sensitive site exploitation skills with realistic lab equipment in simulated field and lab settings. Initiate the development of photorealistic immersive training environments to replicate high-risk scenarios and standardize curriculum for Explosive Ordnance Disposal technicians and other operators. Sustain Combating Terrorism: Continue the development of an immersive mixed reality (MR) simulator for training specific emergency procedures (EPs) for the MK-16 self-contained diving rig often used for Mine Countermeasures operations. Initiate the development of an AC-130J Virtual Reality Combat Mission Trainer to enable operational crews to engage in mission tasks within a simulated environment that replicates sensory information of real-world mission performance found in joint mission essential task (JMET) environments. Strengthen Alliances and Attract New Partners: Continue the development of a multi-sensory (e.g., visual, auditory, tactile) immersive tactical decision making training simulator that features realistic character representation, reaction, and interaction through natural language processing in response to force application. Expand the Competitive Space: Complete the development and delivery of a virtual reality simulated city environment for United States Department of Defense, Department of State, and Department of Homeland Security as well as international partners to train skillsets such as surveillance and emergency response by immersing students into realistic training scenarios with representative quantities and behaviors of non-player characters.					
FY 2021 Base Plans: Build a More Lethal Force: Complete the development and evaluation of a synthetic Internet sandbox to enable intelligence analysts and information operations personnel to train on analytical tools and to tactics, techniques, and procedures used for the collection, analysis, and exploitation of adversary online information. This sandbox will incorporate the effects of online information into large-scale exercises, while mitigating the challenges and risks associated with training on the open, publicly visible Internet. Initiate the development of innovative training and education for cyber defense, resilience, and the continued integration of cyber capabilities into the full spectrum of military operations.					

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C. Accomplishments/Planned Programs ($ in Millions)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
Sustain CBRNE Units for Defense and the Homeland: Complete the development of photorealistic immersive training environments to replicate high-risk scenarios and standardize curriculum for Explosive Ordnance Disposal technicians and other operators. Sustain Combating Terrorism: Complete the development of an immersive mixed reality (MR) simulator for training specific emergency procedures (EPs) for the MK-16 self-contained diving rig often used for Mine Countermeasures operations. Expand the Competitive Space: Complete the development of a multi-sensory (e.g. visual, auditory, tactile) immersive tactical decision making training simulator that features realistic character representation, reaction, and interaction through natural language processing in response to force application. Build a More Lethal Force: Complete the development of an interactive and dynamic Full Motion Video (FMV) Processing Exploitation, and Dissemination (PED) desktop training simulator and program of instruction that trains SOF analysts to SOF-specific FMV PED tactics, techniques, and procedures; methodologies; and product standards. Sustain Combating Terrorism: Complete the development of an AC-130J Virtual Reality Combat Mission Trainer to enable operational crews to engage in mission tasks within a simulated environment that replicates sensory information of real-world mission performance found in joint mission essential task (JMET) environments. ***FY 2020 to FY 2021 Increase/Decrease Statement:*** Decreases are reflective of the Defense Wide Review reductions.					
Accomplishments/Planned Programs Subtotals	168.012	116.747	51.089	19.288	70.377

D. Other Program Funding Summary ($ in Millions)

N/A

Remarks

N/A

E. Acquisition Strategy

N/A