Exhibit R-2, RDT&E Budget Item Justification: PB 2020 Operational Test and Evaluation, Defense	Date: February 2019
Appropriation/Budget Activity 0460: *Operational Test and Evaluation, Defense* / BA 6: *RDT&E Management Support*	**R-1 Program Element (Number/Name)** PE 0605131OTE / *Live Fire Test and Evaluation (LFT&E)*

COST ($ in Millions)	Prior Years	FY 2018	FY 2019	FY 2020 Base	FY 2020 OCO	FY 2020 Total	FY 2021	FY 2022	FY 2023	FY 2024	Cost To Complete	Total Cost
Total Program Element	48.316	58.950	64.332	69.172	-	69.172	72.043	71.191	73.396	74.434	Continuing	Continuing
000311: *LFT&E*	48.316	58.950	64.332	69.172	-	69.172	72.043	71.191	73.396	74.434	Continuing	Continuing

A. Mission Description and Budget Item Justification

This Program Element consists of three programs: Live Fire Test and Evaluation, Joint Aircraft Survivability Program (JASP), and Joint Technical Coordinating Group for Munitions Effectiveness (JTCG/ME).

This Program Element directly supports the Congressional statutory requirements for oversight of Live Fire Test and Evaluation (LFT&E). The primary objective of LFT&E is to assure that the vulnerability and survivability of Department of Defense (DoD) crew-carrying platforms and the lethality of our conventional munitions are known and acceptable before entering full-rate production. LFT&E encompasses realistic tests involving actual United States (U.S.) and foreign threat hardware or, if not available, acceptable surrogate threat hardware. The objective is to identify and correct design deficiencies early in the development process. A completed LFT&E program and test report is required before programs proceed beyond low-rate initial production (BLRIP). LFT&E also includes realistic modeling and simulation (M&S) to examine survivability and lethality attributes not assessed during testing.

This Program Element also supports DoD's Joint Live Fire (JLF) Program and other LFT&E related initiatives. JLF was initiated in 1984 under an Office of the Secretary of Defense charter to test fielded front-line combat aircraft and armor systems for their vulnerabilities as well as fielded weapons, both U.S. and foreign, for their lethality against their respective targets. Funds are also used to support other initiatives related to quick reaction requests from theater and other areas of personnel survivability.

The Joint Aircraft Survivability Program is the DoD's focal point for joint service enhancement of military aircraft non-nuclear survivability. The JASP is chartered by the commanders of the USN Naval Air Systems Command, USA Aviation and Missile Command, and USAF Life Cycle Management Center to increase the affordability, readiness, and effectiveness of Tri-Service aircraft through joint coordination and development of survivability technologies, design tools and assessment methodologies. The JASP coordinates and conducts RDT&E to improve military aircraft survivability, develop and standardize aircraft survivability modeling and simulation (M&S), facilitate information exchange on aircraft survivability, and support aircraft survivability education for the DoD and U.S. aircraft community. Each chartering command provides a senior aircraft survivability expert for the JASP Principal Members Steering Group (PMSG), which guides the program and approves projects for funding. The JASP assesses and reports on combat damage incidents through the Joint Combat Assessment Team (JCAT) and is the Executive Agent for the Joint Live Fire Aircraft Systems Program managed by the Live Fire Test office of DOT&E.

The Joint Technical Coordinating Group for Munitions Effectiveness (JTCG/ME) was chartered 50 years ago to serve as Department of Defense's (DoD's) focal point for munitions effectiveness information. The JTCG/ME produces Joint Munitions Effectiveness Manuals (JMEMs) that are the sole source for all Joint Service Authenticated non-nuclear weapons effectiveness data and methodology for DoD. The JMEMs are the "how to" manuals for putting ordnance on target and as such, directly impacts combat readiness, effectiveness, and survivability. JMEMs are used by the Warfighters in operational weaponeering and collateral damage estimation calls in direct support of operations, mission planning, and training; by the DoD, Joint, and Service planners in force-on-force modeling, mission area analysis, requirements studies and weapon procurement planning; and by the service acquisition community in performance assessment, analysis of alternatives and survivability enhancement

studies. The JTCG/ME continually evolves weapons effectiveness and target vulnerability data, standards, methodologies, and processes based on the strategic environment for better munitions effectiveness evaluation and support to a more lethal force. JTCG/ME also increases efficiency by leveraging ongoing Department efforts and supporting the Department's intent to complement U.S. interest and capabilities by providing weaponeering and targeting capability to Coalition partners. The JMEM requirements and development processes are driven by operational lessons learned (Inherent Resolve, Resolute Support and Freedom Sentinel), Joint Staff Data Call and the needs of Combatant Commands (CCMDs), Services, Military Targeting Committee (MTC) guided by Chairman of the Joint Chiefs of Staff Instruction (CJCSI) 5140.01, Munitions Requirements Process (MRP) - DoD Instruction (DoDI) 3000.04 and Operational Users Working Groups (OUWGs) input for specific weapon-target pairings and methodologies. Considerable effort goes into these User forums to establish Warfighter requirements for current and future JTCG/ME products, as well as continued training events and day-to-day support -- all with the goal of enabling greater force lethality, strengthening partner capabilities, and optimal use of resources.

This program element also includes funds to obtain Federally Funded Research and Development Center (FFRDC) expertise in performing analyses in support of described Live Fire Test and Evaluation tasks, as well as travel funds to carry out the LFT&E, JASP and JTCG/ME programs.

B. Program Change Summary ($ in Millions)	FY 2018	FY 2019	FY 2020 Base	FY 2020 OCO	FY 2020 Total
Previous President's Budget	59.500	64.332	58.781	-	58.781
Current President's Budget	58.950	64.332	69.172	-	69.172
Total Adjustments	-0.550	0.000	10.391	-	10.391
• Congressional General Reductions	-	-			
• Congressional Directed Reductions	-0.550	-			
• Congressional Rescissions	-	-			
• Congressional Adds	-	-			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-	-			
• SBIR/STTR Transfer	-	-			
• Pricing adjustment due to inflation	-	-	-0.609	-	-0.609
• Joint Munitions Manual for Directed Energy and Electromagnetic Spectrum Fires	-	-	11.000	-	11.000

Change Summary Explanation

FY 2018 change due to congressional directed FFRDC reduction

FY 2020 change due to small changes in inflation

FY 2020 change due to Joint Munitions Manual for Directed Energy and Electromagnetic Spectrum Fires +$11M

Exhibit R-2A, RDT&E Project Justification: PB 2020 Operational Test and Evaluation, Defense			Date: February 2019
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COST ($ in Millions)	Prior Years	FY 2018	FY 2019	FY 2020 Base	FY 2020 OCO	FY 2020 Total	FY 2021	FY 2022	FY 2023	FY 2024	Cost To Complete	Total Cost
000311: *LFT&E*	48.316	58.950	64.332	69.172	-	69.172	72.043	71.191	73.396	74.434	Continuing	Continuing
Quantity of RDT&E Articles	-	-	-	-	-	-	-	-	-	-		

A. Mission Description and Budget Item Justification

This Program Element consists of three programs: Live Fire Test and Evaluation, Joint Aircraft Survivability Program (JASP) and Joint Technical Coordinating Group for Munitions Effectiveness (JTCG/ME).

This Program Element directly supports the Congressional statutory requirements for oversight of Live Fire Test and Evaluation (LFT&E). The primary objective of LFT&E is to assure that the vulnerability and survivability of Department of Defense (DoD) crew-carrying platforms and the lethality of our conventional munitions are known and acceptable before entering full-rate production. LFT&E encompasses realistic tests involving actual United States (U.S.) and foreign threat hardware or, if not available, acceptable surrogate threat hardware. The objective is to identify and correct design deficiencies early in the development process. A completed LFT&E program and test report is required before programs proceed beyond low-rate initial production (BLRIP). LFT&E also includes realistic modeling and simulation (M&S) to examine survivability and lethality attributes not assessed during testing.

This Program Element also supports DoD's Joint Live Fire (JLF) Program and other LFT&E related initiatives. JLF was begun in 1984 under an Office of the Secretary of Defense (OSD) charter to test fielded front-line combat aircraft and armor systems for their vulnerabilities as well as fielded weapons, both U.S. and foreign, for their lethality against their respective targets. Funds are also used to support other initiatives related to quick reaction requests from theater and other areas of personnel survivability.

The Joint Aircraft Survivability Program is the DoD's focal point for joint service enhancement of military aircraft non-nuclear survivability. The JASP is chartered by the commanders of the USN Naval Air Systems Command, USA Aviation and Missile Command and USAF Life Cycle Management Center to coordinate and conduct RDT&E to improve military aircraft survivability, develop and standardize aircraft survivability modeling and simulation (M&S), facilitate information exchange on aircraft survivability and support aircraft survivability education for the DoD and U.S. aircraft community. Each chartering command provides a senior aircraft survivability expert for the JASP Principal Members Steering Group (PMSG), which guides the program and approves projects for funding. The JASP assesses and reports on combat damage incidents through the Joint Combat Assessment Team (JCAT), is the Executive Agent for the Joint Live Fire Aircraft Systems Program managed by the Live Fire Test office of DOT&E.

The Joint Logistics Commanders' Joint Technical Coordinating Group for Munitions Effectiveness (JTCG/ME) was chartered more than 40 years ago to serve as DoD's focal point for munitions effectiveness information. This has taken the form of widely used Joint Munitions Effectiveness Manuals (JMEMs) which address all major non-nuclear U.S. weapons. JTCG/ME authenticates weapons effectiveness data for use in training, systems acquisition, weapon procurement, and combat modeling and simulation. JMEMs are used by the Armed Forces of the U.S., NATO, and other allies to plan operational missions, support training and tactics development, and support force-level analyses. JTCG/ME also develops and standardizes methodologies for evaluation of munitions effectiveness and maintains databases for target vulnerability, munitions lethality, and weapon system accuracy. The JMEM requirements and development processes continues to be driven by operational lessons

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learned (Enduring Freedom, Iraqi Freedom, Odyssey Dawn and Inherent Resolve) and the needs of Combatant Commands (CCMDs), Services, Military Targeting Committee, and Operational Users Working Groups (OUWG) input for specific weapon-target pairings and methodologies.

This program element also includes funds to obtain Federally Funded Research and Development Center (FFRDC) expertise in performing analyses in support of described Live Fire Test and Evaluation tasks, as well as travel funds to carry out the LFT&E, JASP and JTCG/ME programs.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
Title: Live Fire Test and Evaluation	58.950	64.332	69.172

FY 2019 Plans:

JLF Programs and LFT&E Initiatives

The FY 2019 JLF budget will support at least 28 projects (tentatively 9 new starts and 19 projects continuing from previous FYs). JLF projects have been focused to either (1) build a more lethal force, (2) strengthen alliances and attract new partners, or (3) reform the department for greater performance and affordability.

Build a More Lethal Force

In FY 2019, JLF will continue to investigate means to advance the survivability therefore lethality of our systems in expected theater of operations. As an example, JLF will assess the vulnerability of aircraft to fuel tank fires due to ullage ignition in order to explore methods to reduce aircraft losses while maintaining mission effectiveness. JLF will investigate the penetration of long yawed rods in order to support munition development such as the AIM-9X, ensuring the desired lethal effects are achieved when these weapons are employed. JLF will also improve test instrumentation to allow more accurate assessment of imposed forces and crew casualties during mine or improvised explosive device attacks. JLF will be performing assessments of flammable materiel commonly found in current Naval vessels during operations to better model and prevent fire initiation, as well as promote better design to contain the spread of fire and improve fire suppression techniques.

Strengthen Alliances and Attract New Partners

JLF is leveraging existing M&S tools and expanding their capabilities to expand evaluation of active protection systems that may be installed on a variety of U.S. platforms to defend against a variety of threats. This work will be performed particularly in conjunction with efforts of partner nations such as Israel. Furthermore, JLF will conduct a variety of underwater explosion tests and analyses of effects upon ship hulls. These tests will be using hardware from a decommissioned Canadian ship and test execution conducted in cooperation with both Canadian and European Union partners.

Reform the Department for Greater Performance and Affordability

In FY 2019, the JLF program is sponsoring work by the Massachusetts Institute of Technology and Air Force Institution of Technology to assess the merits of test program methodologies utilized across industry, academia, and government, with the goal of leveraging the merits of these communities toward evaluating lethality/survivability. JLF will produce frameworks to allow the

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
DoD to better tailor Live Fire test rigor for a variety of program timelines, including a sensitivity analysis to determine what general qualities are most important to test before rapidly fielding hardware or software. In addition, JLF will better quantify the point of diminishing returns for major program of record Live Fire test programs in order to maximize return on investment. Finally, JLF efforts will allow the DoD to better model the combined effects of multiple complex systems in a multi-model threat environment (for example, combined air and ground threats combined with electronic attack and cyber attack), enhancing performance in battle as well as focusing DoD investment in new hardware technologies. JASP In FY 2019 the JASP will continue work on at least 23 multi-year RDT&E projects and initiate 11 new projects approved by the JASP Principal Members Steering Group and OSD/DOT&E. The JASP will develop measures to defeat Near-Peer Adversary Threat (N-PAT) radio-frequency and infrared guided threats coupled with quantifiable improvements in digital and hardware in the loop modeling and simulation capability and credibility. Improve aircraft force protection by increasing threat and flight environmental situational awareness, hostile fire identification, and degraded visual environment flight capabilities; advancing system hardening against ballistic and high energy laser threats; and improving aircraft crashworthiness. Improve aircraft survivability to fire by increasing the speed and efficiency of fire detection and suppression systems and the accuracy and confidence in prediction of threat initiated fires onboard aircraft. The Joint Combat Assessment Team (JCAT) will continue to support the Air Force, Army, Marine Corps and Navy by assessing combat damage incidents, training operators on threat effects and combat damage assessment, and reporting their findings to combatant commanders and the DoD science and technology and acquisition communities. The JASP will continue supporting aircraft survivability education and information exchange through internet sites (restricted access and classified), by publishing the Aircraft Survivability Journal, developing educational materials and conducting training for the DoD and their contractors. The JASP will initiate, continue and complete other projects as approved by the JASP Principal Members Steering Group and OSD/DOT&E. Joint Technical Coordinating Group for Munitions Effectiveness In FY 2019, JTCG/ME will continue to develop, enhance, and standardize methodologies for evaluating munitions effectiveness. This includes target vulnerability characterization, munitions lethality, weapon system accuracy, and specific weapon-target pairings driven primarily from current operational lessons learned, Joint Staff Data Calls, and CCMDs' needs. JTCG/ME will deploy and continue to enhance future versions of its major JTCG/ME Joint Munitions Effectiveness Manual (JMEM) products, the JMEM Weaponeering System (JWS), Joint Antiair Combat Effectiveness (J-ACE), Digital Precision Strike Suite (DPSS) Collateral Damage Estimation (DCiDE) tool, and the Digital Imagery Exploitation Engine (DIEE). JTCG/ME will continue to progress and develop non-kinetic JMEM capability with Joint-Non-Kinetic Effects (J-NKE) Tool, as well as support specialized solutions to address operational needs to include direct analytical support to operations, Probability of kill (Pk) Lookup Tools, Collateral Damage Estimation (CDE) analysis and tables, and munitions weaponeering guides. Since JTCG/ME products			

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
are User focused and requirements driven, JTCG/ME will continue to maintain and strengthen relationships with the Warfighter, operational users, and coalition partners to establish requirements for current and future products. Efforts will include forums, training, foreign military sales, and day-to-day operational support. The objective is to provide efficient and effective support to meet CCMD current and future needs for agility and greater lethality in a more dynamic combined operational environment. In FY 2019, JTCG/ME plans to: -Sustain/support fielded JWS v2.3, with efforts including multiple training and user forums for the fielded product. -Finish and field JWS v2.3.1. which is an update to integrate a new display viewer compatible with evolving image formats (non-segmented imagery), to synchronize with the DIEE v2.1 viewer. -Develop JWS v2.4, which will provide enhanced data, Fast Integrated Structural Tool (FIST), and connectivity capabilities, while maximizing the final JWS v2.x product line. Specific highlights include interim enhanced database capabilities with updated data sets to include up to 13 new calculated targets and 70 refreshed targets. The enhanced database capabilities will allow for accelerated, out of production cycle weapons and target data updates, tailored product versions for releasability, and more effective, focused testing. Capabilities include Hard Target Void Sensing Fuze and trajectory model updates, as well as FIST v2.4 with several expanded methodologies for structural target response variables. These capabilities will enable more options to the weaponeer and improve the underlying phenomenology representation in JWS. -Continue development on the next JWS series, known as JWS v3.x. The JWS v3.x line leverages Endgame Framework (EF) as the underlying software architecture that will maximize modularity, flexibility of design, and reuse of standard capabilities across the community for greater performance and affordability. FY 2019 efforts and deliverables will include updated Capability Needs Statement response documentation, JWS v3.0 EF Implementation Plan, JMEM Effects Library (JEL) Capabilities Roadmap and Smart book, DIEE v2.x to Application Program Interface (API) Implementation Plan, enhanced JWS Product Management Structure, and continuing to coordinate with stakeholders. These efforts form the foundation of JWS v3.0 fielding in 2020. -Support current use and future development requirements by hosting and supporting JWS training sessions, Operational Users Working groups (OUWG), and User help desk support via the JMEM Product Information Access System (JPIAS) and JWS newsletter. Specifically, JTCG/ME will support approximately 30 JWS training sessions with about 500 students. The training sessions allow users to optimize use of JWS capabilities, while providing JTCG/ME with critical input on Warfighter use for future development. OUWGs are critical venues for receiving direct User feedback and development of future requirements from the operational community in regard to needed software enhancements and capabilities in support of air-to-surface and surface-to-surface weaponeering. In addition, direct forward support to Combatant Commanders/Task Forces will be provided to enable target materiel development, weaponeering, and CDE solution development. JTCG/ME will continue to chair OUWGs, with participation from USCENTCOM, USAFRICOM, USSTRATCOM, USPACOM, USSOCOM, the Services, the Defense Intelligence Agency (DIA), the Defense Threat Reduction Agency (DTRA), the Fires Center of Excellence, Service School Houses, the Marine Aviation Weapons/Tactics Squadron, Operations Support Squadrons, Intelligence Squadrons, and numerous other operational units.			

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
-Facilitate coalition interoperability and information exchange forums. JTCG/ME will deliver JWS version releases and standalone Pk Lookup tools to key coalition partners in support of current operations under Foreign Military Sales agreements. These deliveries increase efficiency by leveraging ongoing Department efforts and supporting the Department's intent to complement U.S. interest and capabilities by providing weaponeering and targeting capability to Coalition partners, as well as improve the effectiveness of U.S. fires and targeting personnel working in combined environments. JTCG/ME will also hold information exchange forums via information exchange agreements (IEAs) with the United Kingdom and Republic of Korea. These exchanges facilitate collaboration on methodologies and efforts of mutual interest in the area of weapons effectiveness/collateral damage estimation. -Develop and enhance processes to supply target vulnerability data to operational and acquisition communities. The JTCG/ME conducts detailed vulnerability analysis to produce tri-service approved target vulnerability information (i.e., Target Geometric Model (TGM) development, Failure Analysis Logic Tree (FALT), Failure Mode, Effects, and Criticality Analysis (FMECA), etc). These data are used to feed the approved vulnerability models to generate the target data used on JMEMs. In addition, acquisition programs leverage JTCG/ME target vulnerability data to conduct detailed analysis of their new capabilities against threat targets. The leveraging of this information saves programs valuable time and resources, and ensures the acquisition community is using consistent and valid threat representation. -Support urgent operational needs for target vulnerability data with rapid response surrogation and development of Pk Lookup data for high priority weapons and targets. These specialized products directly assist CCMDs to meet the operational requirements of a dynamic environment as formal products are developed. -Continue to collect, approve, and supply weapons characteristics data and standards for the tri-service community to include soon to be fielded systems. These weapons are: Small Diameter Bomb (SDB) II; Small Guide Munition (SGM) GBU-69; Focused Lethality Munition (FLM) GBU-39; Joint Air-to-Ground Missile (JAGM); Joint Multiple Effects Warhead System (JMEWS); Advanced Anti-Radiation Guided Missile (AARGM); and High speed Anti-Radiation Missile (HARM). -Enhance weapons characterization processes and communication through the JTCG/ME Test Assistance Group (TAG). The TAG provides a forum that fuses science and art of weapon testing with subject matter experts from all the services and test ranges to review, adopt technologies and methods that reduce expense, time, anomalies, and expanded data collection. JTCG/ME archives and publishes these weapon characterization standards in updates to the JTCG/ME Weapon Test Procedures Manual (TPM) used by weapon test ranges. The TAG also facilitates partnerships and leveraging. These technologies and partnerships have the potential to reduce the number of weapon test articles required and remove labor-intensive activities from weapon testing. -Update and execute strategic roadmaps for underlying vulnerability and lethality models used as standards by the tri-service community to better support JWS 3.x development and Live Fire Testing and Evaluation (LFT&E). These roadmaps align JTCG/ME funded and related tasks by other services and programs to facilitate leveraging. In addition, the roadmaps provide a tool for future investment planning to support modeling and simulation validation and resolution of capability gaps. A key roadmap component included several interconnected model sensitivity studies. The goal of these studies is to understand the range of			

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
potential model outputs, including stochastic variations in penetration and other processes, so that differences between test data and predictive models can be better understood. This will be used to guide live fire testing requirements for validation of the models for a program office's specific operational envelope. These studies will also provide data to support several model reaccreditations. -Develop and accredit Collateral Effects Radii (CER) Reference Tables in accordance with the Chairman of the Joint Chiefs of Staff Instruction (CJCSI) 3160.01C, "No-Strike and the Collateral Damage Estimation (CDE) Methodology" for air-to-surface and surface-to-surface weapons, which are the basic data that support the CDE methodology. The JTCG/ME CER tables and CDE methodology are used in every planned kinetic strike in all Areas of Responsibility Operation (AORs) to meet Commanders' intent and to minimize civilian casualties. As such, it is critical to the Warfighters' ability to meet urgent operational needs. JTCG/ ME implements the CER and CDE methodology within the DCiDE tool. DCiDE is an accredited and automated CDE tool that expedites and simplifies the CDE process. DCiDE enables JTCG/ME to continuously support the CJCSI 3160.01 series, DCiDE was the only automated CDE tool authorized for use in the USCENTCOM and USAFRICOM AORs. -Maintain and support DIEE v2.1, DIEE is an enterprise targeting solution that provides both seamless planning and linkage to various mission planning systems and tools in operational units. It is a "Government off the shelf" (GOTS) product for advanced target development that integrates Target Coordinate Mensuration (TCM), Collateral Damage Estimation (CDE), Weaponeering, and data basing functions. DIEE was selected as the preferred operational solution of a 2018 Air Force Advanced Target Development (ATD) Software Fly-off based on 135 hours of hands-on time and 451 scored line items. The Chairman of the Joint Chiefs of Staff issued guidance stating that,"The Services, Combatant Commands, and Combat Support Agencies will upload and use DIEE v2.1 for automated CDE to comply with the updated methodology and reporting requirement." DIEE v2.1 includes user requested enhancements, more advanced JWS interface for weaponeering capability, CJCSI 3160.01C compliant CER Reference Tables and DCiDE for CDE capability, and updated Common Geopositioning Services (CGS) for Precision Point Mensuration (PPM) capability. -Continue to develop future DIEE versions that will include CGS updates, 3-D viewer capability, direct Collateral Effects Library (CEL) interfacing, route tool user requested enhancements, battle damage assessment graphic production, and initial android tablet capabilities, while maintaining Warfighter support and future requirements through training and User forums. -Leverage CEL and other high fidelity techniques to deliver analysis packages for collateral damage mitigation, post-forensic, and force protect analyses packages to operational Users for high value targets in current operations (i.e., Operations Inherent Resolve, Operation Resolute Support, and Operation Freedom Sentinel). These efforts directly assist Combatant Commands to meet commander's intent and minimize collateral damage. -Continue the Enhanced Weaponeering and Collateral Damage Estimation (CDE) Program, a multi-year test program focused on enhancing and validating JTCG/ME CDE tools. This program will support improvements in weaponeering methodology to minimize risk to mission and risk to forces while not increasing risk of collateral damage by providing foundational data for the development of higher fidelity predictive tools. Specific efforts will generate buried ordnance characterization data based upon usage statistics from CCMD Expenditure reports, and AOR specific building debris data to enhance and validate current			

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
weaponeering/collateral damage estimation methodologies required by Strike Approval Authorities to make their strike decision calls. FY 2019 efforts leverage seven FY 2018 testing events and multiple collaboration forums. FY 2019 tests will include four buried ordnance tests to evaluate the effects of burial and weapon class on warhead performance, crater ejecta, and collateral damage, and five building debris characterization tests. -Initiate the “Battle Damage Assessment (BDA) of Deliberate and Dynamic Strikes“analysis to directly support the solution offered by the Munition Strategic Portfolio Review to address the current state of the Department's munitions stockpile. The effort is a multi-year task to analyze ongoing strikes required to update JWS to: (1) ensure effective and efficient munition expenditure rates and (2) mitigate the stockpile stress. The analysis approach will include: (1) establishing an analytical cell to provide a detailed and usable Department-level combat assessment of past, current, and future strikes/weapons employments, (2) establishing an archival database that captures the pre- and post-strike assessments of these engagements, in a format that will be called upon by the JWS to select strike packages with optimal and efficient munition expenditures, and (3) guiding tactics improvement for evolving environments and methodology development to improve weaponeering tools. Overall impact of effort will result in increased operational agility for the Combatant Commands in terms of weapons employment, as well as directly link current JMEM predictions to operational battlefield performance. -Sustain/support fielded J-ACE v5.3. Efforts will include multiple training and user forums for the fielded product. These forums are pivotal for J-ACE developers to understand requirements and align development with other external debrief and analytical capabilities that use J-ACE as the underlying analytical engine to underpin results. Many users leverage J-ACE’s API to link debrief and analysis tools at training and test ranges across the Joint community. The forums allows J-ACE external application developers to receive any updates and interact with J-ACE developer to refine requirements and plans. -Leverage a parallel J-ACE development strategy that will continue to develop J-ACE v5.x line to provide high priority data and capabilities to the User community, while developing J-ACE v6.x product line. -Finish and field J-ACE v5.3.1. J-ACE is used as a stand-alone product or through an application interface. Many users leverage J-ACE’s API to link debrief and analysis tools at training and test ranges across the joint community. J-ACE v5.3.1 is a software update release to provide a high priority requirement by the API user community for J-ACE v5.3 64-bit capability. -Finish J-ACE v5.4 development. J-ACE v5.4 will include updated Plug-and-Play weapons and aircraft data, updated countermeasures, and a new cross platform BROWSE module, which contains descriptive information for each player (weapon, aircraft). In addition, J-ACE v5.4 will include a new Endgame Manager (EM) module that simulates terminal effects of the weapon lethality and target vulnerability. The faster EM has improved speed of new fuze model and refined graphic display data generation, and includes more weapon lethality-target vulnerability data sets. -Continue J-ACE v6.x development. The J-ACE v6.0 will fully migrate Hybrid Interactive Visualization Engine (HIVE) framework capability as the underlying software architecture that will maximize modularity, provide flexibility for faster software development/ modification, and reuse of standard capabilities across the aircraft survivability community. J-ACE v6.0 will include a new User Interface with state-of-art graphical displays including Virtual Reality (VR). J-ACE v6.0 will address improved target detection capability leveraging National Air and Space Intelligence Center (NASIC) Radio Frequency (RF) models. J-ACE v6.x includes			

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
an initial Suppression of Enemy Air Defense/Destruction of Enemy Air Defense (SEAD/DEAD) Capability (Air-to-Surf Weapons Trajectory and Arrival). J-ACE v6.x will address longer development requirements to include rotary wing aircraft capability, expanded SEAD/DEAD capability, and increased electronic warfare and counter-measure capabilities. -Continue to develop J-NKE as the single source for operational Warfighters, analysts, targeteers, and planners to analyze offensive cyber capabilities and directed energy effectiveness. FY 2019 efforts will build upon FY 2018 initial program efforts. -Development of cyber effects estimation capabilities with a focus on refining the standardization of data required to address weapon characterization, target vulnerability, Operational Environment, and Uncertainty Metrics to support the development of the Cyber Operation Lethality and Effectiveness (COLE) tool. Continue to mature Cyber JMEM capabilities with continued execution of multiyear plan. Cyber FY 2019 capability development/deliverables include: (1) Development of Data Producer App (1.0) to support creation of J-NKE standard/compliant data, (2) COLE v0.1 with initial Operational Environment Model creation, weapon-target probabilistic attack (Probability of effect (Pe) calculation for individual targets/nodes w/minimal target characteristic uncertainties and initial probabilistic matching providing weapon/target pairing recommendations for select capabilities/uncertainties, (3) Draft Uncertainty Metric Model (UM2) standards document, (4) Draft Cyber Collateral Damage Estimation (CDE) methodology, (5) Revised Weapon, Target, OEM & Cyber Effectiveness Table (CET) standards (based on relevant feedback). Other FY 2019 efforts include maintaining User community interaction, as well as maturing linkages to USCYBERCOM and other key stakeholders, to ensure Combatant Command and Service Warfighter requirements and needs are articulated and understood. Continue Operational User Working Group meetings along with various face-to-face unit level meetings. FY 2019 efforts are the building blocks for maturing capabilities and fielding of Cyber JMEMs. -Continue to coordinate with a FY 2018/2019 Joint Test Project to leverage, enhance, and develop directed energy effects estimation and standardization tools. The FY 2018/2019 Joint Test Project, Joint Laser Systems Effectiveness (JLaSE), was approved as a conduit for warfighters to solve joint laser operational issues and provide a non-material solution to the warfighter. Efforts will take advantage of work completed by the Directed Energy Joint Transition Office (DE JTO) and various planned Use Cases (Surface-to-Air, Surface-to-Surface, Air-to-Surface) throughout the two year cycle. Focus will be on Service near term capabilities (~10 capabilities) that take advantage of the high-energy laser (HEL) weapons low cost per shot, deep magazine, precision engagement, and scalable effects. -Continue to mature DE effectiveness capabilities with execution of multiyear plan. FY 2019 efforts will build upon FY 2018 outcomes, while continuing the work and leveraging of the FY 2018/2019 Joint Test Project, JLaSE. Leveraging and cooperation between JTCG/ME and JLaSE will facilitate lessons learned, data standards, methodology standards, and working relations imperative in the fruition of a DE effectiveness, weaponeering, and CDE solution for the Warfighter. FY 2019 outcomes will include initial prototype and methodologies for DE effectiveness and collateral damage estimation. The eventual results of the multi-year tasking will provide Joint Fire Support Planners and Targeteers the Tactics, Techniques, and Procedures for Weaponeering and Collateral Damage Estimation, to adequately plan for and execute Directed Energy Laser Weapons in the joint battlespace.			

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
-The JLaSE effort will conclude in FY 2019. JTCG/ME is pursuing future out-year funding to continue the development of the DE effectiveness, weaponeering, and CDE solution for the Warfighter, based on the successful JLaSE and JTCG/ME partnership in FY 2018 and FY 2019.			
FY 2020 Plans: Live Fire Test and Evaluation (LFT&E) of Major Department of Defense (DoD) Acquisition Programs The FY 2020 budget will enable the LFT&E Deputate to: (1) assess the adequacy of programs' test and evaluation plans and generate new test and evaluation policies, as needed; (2) review and analyze the test data to support an independent evaluation of the survivability/lethality of the systems in support of the development of OSD Live Fire Test and Evaluation reports to Congress; and (3) review major acquisition plans, reports, and requirement documents to inform system design and capability development. JLF Programs and LFT&E Initiatives The FY 2020 budget will support the planning and execution of tests of fielded systems not previously tested under the Live Fire Programs to support DOT&E and operator needs. New threats, missions, tactics, techniques and procedures (TTPs), and combat environments will create the need for these tests and an assessment of performance. JLF projects will be defined, planned, and executed to provide survivability and lethality data on currently fielded U.S. systems; improve modeling and simulation tools; develop vulnerability data libraries for emerging threats; and initiate responses to quick reaction requests from theater. Efforts will concentrate on ultimately delivering a more lethal force, developed in tandem with our alliances and other partner nations as appropriate. In addition, JLF will continue to pursue ways to reform test and evaluation practices to provide greater performance while maximizing both affordability and speed in support of rapid acquisition initiatives. JASP In FY 2020 the JASP will continue work on at least 19 multi-year RDT&E projects and initiate about 8 new projects approved by the JASP Principal Members Steering Group and OSD/DOT&E. The JASP will develop measures to defeat Near-Peer Adversary Threat (N-PAT) radio-frequency and infrared guided threats coupled with quantifiable improvements in digital and hardware in the loop modeling and simulation capability and credibility. Improve aircraft force protection by increasing threat and flight environmental situational awareness, hostile fire identification, and degraded visual environment flight capabilities; advancing system hardening against ballistic and high energy laser threats; and improving aircraft crashworthiness. Improve aircraft survivability to fire by increasing the speed and efficiency of fire detection and suppression systems and the accuracy and confidence in prediction of threat initiated fires onboard aircraft. The JCAT will continue to support the Air Force, Army, Marine Corps and Navy by assessing combat damage incidents, training operators on threat effects and combat damage assessment, and reporting their findings to combatant commanders and the DoD science and technology and acquisition communities. The JASP will continue supporting aircraft survivability education and			

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
information exchange through internet sites (restricted access and classified), by publishing the Aircraft Survivability Journal, developing educational materials and conducting training for the DoD and their contractors. The JASP will initiate, continue and complete other projects as approved by the JASP Principal Members Steering Group and OSD/DOT&E. Joint Technical Coordinating Group for Munitions Effectiveness In FY 2020, JTCG/ME will continue to develop, enhance, and standardize methodologies for evaluating munitions effectiveness. This includes target vulnerability characterization, munitions lethality, weapon system accuracy, and specific weapon-target pairings driven primarily from current operational lessons learned, Joint Staff Data Calls, and CCMDs' needs. JTCG/ME will deploy and continue to enhance future versions of its major JTCG/ME JMEM products, the JWS, J-ACE, DCiDE tool, and the DIEE. JTCG/ME will continue to progress and develop non-kinetic JMEM capability, as well as support specialized solutions to address operational needs to include direct analytical support to operations, Pk Lookup Tools, CDE analysis and tables, and munitions weaponeering guides. Since JTCG/ME products are User focused and requirements driven, JTCG/ME will continue to maintain and strengthen relationships with the Warfighter, operational users, and coalition partners to establish requirements for current and future products. Efforts will include forums, training, foreign military sales, and day-to-day operational support. The objective is to provide efficient and effective support to meet CCMD current and future needs for agility and greater lethality in a more dynamic combined operational environment. In FY 2020, JTCG/ME plans to: -Field and sustain JWS v2.4. Efforts will include multiple training and user forums for the fielded product. JWS v2.4 will be the final version of the JWS 2.x product line with the development and fielding of JWS 3.x. JWS v2.4 will include interim enhanced database capabilities with updated data sets, as well as ability to accelerate out of production cycle weapons and target data integration and tailor for releasability, thereby supporting force lethality and coalition partner capabilities. Capabilities will enable more options to the weaponeer and improve the underlying phenomenology representation to include FIST v2.4 with several expanded methodologies for structural target response variables. -Finish development of JWS v3.0. JWS v3.0 will be the first version of the JWS v3.x product line, which will have EF as the underlying software architecture. EF will maximize modularity, flexibility of design, and reuse of standard capabilities across the community for greater performance and affordability. JWS v3.0 will focus on fielding of JEL v1.0 capabilities using EF, with a focus on infrastructure and personnel target capability, to include implementation of a DIEE API. JWS v3.0 will also set the foundation of inclusion of CER Tables, collateral damage mitigation capability, and ground mobile targets in JWS v3.1. -Facilitate coalition interoperability and information exchange forums. JTCG/ME will continue to deliver JWS version releases and standalone Pk Lookup tools to key coalition partners in support of current operations under Foreign Military Sales (FMS)			

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
agreements, as well as migrate to new processes via the JWS v3.x EF concept. These FMS deliveries complement U.S. interest and capabilities by providing weaponeering and targeting capability to Coalition partners. JTCG/ME will also continue to hold information exchange forums via multiple IEAs. These exchanges facilitate collaboration on methodologies and efforts of mutual interest in the area of weapons effectiveness/collateral damage estimation. -Develop and enhance processes to supply target vulnerability data, weapons characterization data, weapons effectiveness methodology to operational and acquisition communities. The JTCG/ME develops and improves data and methodology used as tri-service standards. A focus of FY 2020 efforts is to migrate to data and methodology utilized through the JEL v1.0. JTCG/ME will continue to support and host technical working groups in targets, weapons, and methodology, as forums to share knowledge and build partnerships for greater leveraging, performance, and affordability. The CCMD Target Execution Group (CTEG) and Weapons Characterization Working Groups (WCWGs) are great examples of successful technical working groups. CTEG approves vulnerability models to generate the target data used on JMEMs. In addition, acquisition programs leverage the target vulnerability data to conduct detailed analysis of their new capabilities against threat targets. This leveraging saves programs valuable time and resources, and ensures the acquisition community is using consistent and valid threat representation. WCWGs collect and approve weapons lethality and delivery accuracy data and methodology for the tri-service community, as well as uses the TAG to review and build partnerships for viable weapons testing and simulation technologies. These technologies and partnerships have the potential to reduce the number of weapon test articles required and remove labor-intensive activities from weapon testing. -Update and execute strategic roadmaps for underlying vulnerability and lethality models used as standards by the tri-service community to better support JWS 3.x development and LFT&E. These roadmaps align JTCG/ME funded and related tasks by other services and programs to facilitate leveraging. In addition, the roadmaps provide a tool for future investment planning to support modeling and simulation validation and resolution of capability gaps. -Develop and accredit CER Reference Tables in accordance with the latest CJCSI 3160.01, “No-Strike and the CDE Methodology” for air-to-surface and surface-to-surface weapons, which are the basic data that support the CDE methodology implemented in DCiDE and DIEE. -Maintain and support fielded DIEE v2.x versions. DIEE is an enterprise targeting solution that provides both seamless planning and linkage to various mission planning systems and tools in operational units. It is a GOTS product for advanced target development that integrates TCM, CDE, Weaponeering, and data basing functions. -Develop and field future DIEE versions that will include CGS updates, 3-D viewer capability, direct CEL interfacing, route tool user requested enhancements, battle damage assessment graphic production, and initial android tablet capabilities, while maintaining Warfighter support and future requirements through training and User forums. -Support and deliver analysis packages for collateral damage mitigation, post-forensic, and force protect analyses packages to operational Users for high value targets in current operations. These efforts directly assist Combatant Commands to meet commander’s intent and minimize collateral damage.			

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
- Continue the Enhanced Weaponeering and CDE Program, a multi-year test program focused on enhancing and validating JTCG/ME CDE tools. This program will support improvements in weaponeering methodology to minimize risk to mission and risk to forces, while not increasing risk of collateral damage by providing foundational data for the development of higher fidelity predictive tools. Specific efforts will generate buried ordnance characterization data based upon usage statistics from CCMD Expenditure reports, and AOR specific building debris data to enhance and validate current weaponeering/collateral damage estimation methodologies required by Strike Approval Authorities for strike decisions. FY 2020 efforts will leverage nine FY 2019 testing events and multiple collaboration forums. FY 2020 efforts will include approximately four buried ordnance and five building debris characterization tests, as well as analyzing and transitioning data and findings from previous tests to weaponeering and CDE tools. -Continue to execute multi-year plan for the “BDA of Deliberate and Dynamic Strikes“ analysis task to directly support the solution offered by the Munition Strategic Portfolio Review to address the current state of the Department's munitions stockpile. The effort will analyze ongoing strikes required to update JWS to: (1) ensure effective and efficient munition expenditure rates and (2) mitigate the stockpile stress. The analysis approach will include: (1) establishing an analytical cell to provide a detailed and usable Department-level combat assessment of past, current, and future strikes/weapons employments, (2) establishing an archival database that captures the pre- and post-strike assessments of these engagements, in a format that will be called upon by the JWS to select strike packages with optimal and efficient munition expenditures, and (3) guiding tactics improvement for evolving environments and methodology development to improve weaponeering tools. Overall impact of multi-year efforts will result in increased operational agility for the Combatant Commands in terms of weapons employment, as well as link current JMEM predictions to operational battlefield performance. -Sustain/support fielded versions of J-ACE, which includes multiple training and user forums for the fielded product. These forums are pivotal for J-ACE developers to understand requirements and align development with other external debrief and analytical capabilities that use J-ACE as the underlying analytical engine to underpin results. -Field J-ACE v5.4, which will include updated Plug-and-Play weapons and aircraft data, updated countermeasures, and a new cross platform BROWSE module, which contains descriptive information for each player (weapon, aircraft). In addition, J-ACE v5.4 will include a new EM module that simulates terminal effects of the weapon lethality and target vulnerability. The much faster EM has improved speed of new fuze model and refined graphic display data generation; and includes more weapon lethality-target vulnerability data sets. -Finish J-ACE v6.0, which is the first of the J-ACE v6.x product line. J-ACE v6.x will use HIVE framework capability as the underlying software architecture that will maximize modularity, provide flexibility for faster software development/modification, and reuse of standard capabilities across the aircraft survivability community. J-ACE v6.0 will include a new modern look-and-feel User Interface with state-of-art graphical displays including Virtual Reality. J-ACE v6.0 will address improved target detection capability leveraging NASIC RF models. J-ACE v6.x includes an initial SEAD/DEAD Air-to-Surf Weapons Trajectory and Arrival). Further J-ACE v6.x versions will address longer development requirements to include rotary wing aircraft capability, expanded SEAD/DEAD capability, and increased electronic warfare and counter-measure capabilities.			

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
-Continue to develop J-NKE as the single source for operational Warfighters, analysts, targeteers, and planners to analyze offensive cyber capabilities and directed energy effectiveness. FY 2020 efforts will build upon FY 2019 program efforts. -Develop/enhance cyber effects estimation capabilities in the COLE Tool. Planned FY 2020 capability development/deliverables include: (1) Completion of COLE v1.0 that will include OEM ingestion/generation, avenues of approach through adversary cyberspace modeling, calculate capability estimates and Pe based on desired damage criteria, advanced uncertainty modeling (Monte Carlo, etc.), and initial capability to interface/integrate with other JTCG/ME toolsets, (2) Finalized initial Uncertainty Metric Model (UM2) standards document, and (3) Finalized initial Cyber CDE methodology. Along with development efforts, JTCG/ME will continue to maintain User community and other key stakeholders' interaction to ensure Combatant Command and Service Warfighter requirements and needs are articulated and understood, as well as Continue Operational User Working Group meetings along with various face-to-face unit level meetings. -The Joint Test Project, JLaSE, will conclude in FY 2019. JLaSE is a conduit for warfighters to solve joint laser operational issues and provide a non-material solution to the warfighter. Two year efforts will leverage DE JTO and various planned Use Cases (Surface-to-Air, Surface-to-Surface, Air-to-Surface) focusing Service near term capabilities (~10 capabilities) in HEL weapons. JTCG/ME is pursuing out-year funding to continue and finish the development of the DE effectiveness, weaponeering, and CDE solution for the Warfighter, based on the successful JLaSE and JTCG/ME partnership in FY 2018 and FY 2019. ***FY 2019 to FY 2020 Increase/Decrease Statement:*** The increase from FY 2019 to FY 2020 of $4.840 Million is consistent with increases due to Joint Munitions Effectiveness Manuals for Directed Energy and Electromagnetic Spectrum Fires, inflation, and planned program decreases in enhanced weaponeering and Joint Laser Systems Effectiveness (JLaSE) projects.			
Accomplishments/Planned Programs Subtotals	58.950	64.332	69.172

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

E. Performance Metrics

(U) Performance Measure: Percentage of required live fire test planning documents, assessments, munition effectiveness manuals, and reports applicable to acquisition programs on the OSD Test and Evaluation Oversight List and other special interest programs/legacy systems that are completed and delivered to the appropriate decision makers on time. Percentage of required products, such as test planning documents, munitions effectiveness manuals, tactic-techniques and reports that are developed and delivered to program managers and customers on time.