Exhibit R-2, RDT&E Budget Item Justification: FY 2018 Operational Test and Evaluation, Defense	Date: May 2017
Appropriation/Budget Activity 0460: *Operational Test and Evaluation, Defense I* BA 6: *RDT&E Management Support*	**R-1 Program Element (Number/Name)** PE 0605131OTE *I Live Fire Test and Evaluation (LFT&E)*

COST ($ in Millions)	Prior Years	FY 2016	FY 2017	FY 2018 Base	FY 2018 OCO	FY 2018 Total	FY 2019	FY 2020	FY 2021	FY 2022	Cost To Complete	Total Cost
Total Program Element	47.776	46.882	48.316	59.500	-	59.500	56.962	56.390	59.362	57.370	Continuing	Continuing
0605131OTE: *LFT&E*	47.776	46.882	48.316	59.500	-	59.500	56.962	56.390	59.362	57.370	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 begun 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 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, Services, Military Targeting Committee, and Operational Users Working Groups 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. Program Change Summary ($ in Millions)	FY 2016	FY 2017	FY 2018 Base	FY 2018 OCO	FY 2018 Total
Previous President's Budget	46.882	48.316	48.966	-	48.966
Current President's Budget	46.882	48.316	59.500	-	59.500
Total Adjustments	0.000	0.000	10.534	-	10.534
• Congressional General Reductions	-	-			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	-	-			
• Congressional Directed Transfers	-	-			
• Reprogrammings	0.000	-			
• SBIR/STTR Transfer	-	-			
• Program increases for Enhanced Collateral Damage Methodology	-	-	4.534	-	4.534
• Program increases for Enhanced Laser Weaponeering Methodologies and Joint Munition Effectiveness Manual (JMEM) Development	-	-	6.000	-	6.000

Change Summary Explanation

$4.534 million is to fund collateral damage estimation methodology improvements for buried ordinance characterization and Area of Responsibility (AoR) specific building debris.

$6.000 million is to fund generation of preliminary data and analysis of selected Directed Energy Laser Weapons Systems (DWS) characteristics, to include their delivery accuracy, reliability, and damage effects on the targets of interest. Costs will include required component laboratory and field tests as well as advances to relevant modeling and simulation to set a more sustainable protocol for DEW JMEM database development and to have an ability to assess a wider spectrum of weapon-target pairings. It will also establish and guide the selection of DWS target pairing procedures based on potential engagement scenarios, collateral damage estimation, and other considerations.

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COST ($ in Millions)	Prior Years	FY 2016	FY 2017	FY 2018 Base	FY 2018 OCO	FY 2018 Total	FY 2019	FY 2020	FY 2021	FY 2022	Cost To Complete	Total Cost
0605131OTE: *LFT&E*	47.776	46.882	48.316	59.500	-	59.500	56.962	56.390	59.362	57.370	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 2016	FY 2017	FY 2018
Title: Live Fire Test and Evaluation	46.882	48.316	59.500
FY 2016 Accomplishments: Live Fire Test and Evaluation Major Test and Evaluation Programs The FY 2016 budget supported Live Fire Test and Evaluation deputate's assessment of Test and Evaluation Master Plans, Test Plans, System Acquisition Reports, Defense Acquisition Executive Summary reports, and the development of Live Fire Test and Evaluation reports for those programs designated for OSD oversight. The DOT&E oversight list contains 132 programs on live fire oversight; it is maintained continuously and published annually. JLF Programs and LFT&E Initiatives In FY16, JLF funded 27 projects and delivered 21 reports. Focus areas for JLF included projects that either 1) characterized new survivability issues; 2) characterized new lethality issues; 3) improved accuracy and fidelity of weapon data; 4) improved test methods; or 5) improved modeling and simulation methods. JLF Air projects evaluated a range of contemporary vulnerability issues. Projects investigated the ballistic vulnerability of (1) rotorcraft with auxiliary fuel tanks inside the cabin; and (2) C-12 fuel subsystem ullage reactions. Another project evaluated the effectiveness of the CV-22 Wing Fire Protection System during various modes of fuel transfer. In addition, the effectiveness of ultra-high-molecular-weight polyethylene armor installed in CV-22 cabins (due to emerging threats encountered on the battlefield) was addressed by one project. Other projects improved modeling and simulation tools by collecting aircraft system-level damage effects data for medium-class missile warheads against fixed-wing aircraft, as well as a project to determine the vulnerability to yawed armor-piercing and armor-piercing incendiary projectiles. Finally, JLF Air projects assessed vulnerability to foreign threats such as the OG-7V fragmentation grenade as well as MANPADS. JLF Ground projects pursued a variety of lethality and survivability research objectives. One project characterized the complete fragmentation description data for an MK84 bomb. Other efforts quantified collateral damage effects from Hellfire and MK82 warheads, developed better methods to characterize blast debris for collateral damage assessments, and measured the effect of bomb burial on collateral damage. Other projects modeled the behind-armor debris of ground vehicle kinetic energy penetrators			

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2016	FY 2017	FY 2018
as well as anti-tank mines, and an underbody blast vulnerability assessment of the JLTV was conducted. JLF Ground projects sought to develop materials to better evaluate body armor as well as evaluate various materials used in combat eye protection. JLF Ground conducted modeling to determine a more lethal mix of 30 mm ammunition combinations. Finally, JLF Ground pursued efforts to enhance test & evaluation methodology such as improved methods of collecting arena test data. JLF Sea projects provided various vulnerability results. One JLF Sea project conducted deep depth underwater explosion testing against a model surrogate to improve submarine vulnerability assessments. Another project collected test data of underwater explosion bubble jetting in order to improve modeling and simulation tools. Finally, another project developed ballistic mannequins that provide for real-time assessment of rapid incapacitation. JLF continued to support the development of a ground vehicle survivability educational program, including a 3-day short course and the development of formal course notes and a textbook. Joint Aircraft Survivability Program (JASP) In FY 2016 the JASP continued work on 37 multi-year RDT&E projects and initiated 18 new projects approved by the JASP Principal Members Steering Group and OSD/DOT&E. In the area of susceptibility reduction, the JASP addressed improving the effectiveness and reducing the space, weight and power required for directed energy infrared countermeasures, electronic countermeasures technology and techniques, integrated aircraft survivability equipment, and aircrew situational awareness. In the area of vulnerability reduction, the JASP continued to address requirements for lighter and more effective vulnerability reduction technology (e.g., armor, fuel containment, fire suppression, and aircrew and passenger protection). In aircraft survivability Modeling and Simulation (M&S), the JASP continued to improve survivability M&S credibility, address operator requirements for survivability data, integrate DIA threat missile models into threat engagement codes, improve the assessment of aircrew and passenger injuries, and address M&S requirements identified by the joint aircraft survivability community. The JASP completed 27 reports documenting efforts accomplished in FY 2016. The JCAT continued 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 continued 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. Joint Technical Coordinating Group for Munitions Effectiveness			

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2016	FY 2017	FY 2018
JTCG/ME continued to field critical JMEM products to enable on-going Combatant Command (CCMD) operational Weaponeering and collateral damage estimates, along with support to the Anti-air effectiveness community (operational, training, testing, and analysis). In FY16, JTCG/ME continued to develop and standardize methodologies for evaluating munitions effectiveness, including 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 Combatant Commands' needs. JTCG/ME deployed and continued enhancement of future versions of its two major JTCG/ME Joint Munitions Effectiveness Manual (JMEM) products, the JMEM Weaponeering System (JWS) and Joint Antiair Combat Effectiveness (J-ACE). The JTCG/ME also continued coordination and development of a non-kinetic JMEM capability, to include a prototype Cyber JMEM. Beyond traditional JMEM products, JTCG/ME developed and supplied specialized weaponeering data and solutions for Warfighter requirements. This includes the Digital Precision Strike Suite (DPSS) Collateral Damage Estimation (DCiDE) tool and Digital Imagery Exploitation Engine (DIEE), as well as standalone resources such as the Probability of kill (Pk) Lookup Tools, Collateral Damage Estimation (CDE) tables, and munitions weaponeering guides. JWS is the DoD wide source for air-to-surface (AS) and surface-to-surface (SS) weaponeering, munitions, and target information used daily in the U.S. Central Command (USCENTCOM), U.S. Special Operations Command (USSOCOM), and U.S. Africa Command (USAFRICOM) in the deliberate planning process directly supporting Joint Publication 3-60 "Joint Targeting". JWS enables Combatant Commands to efficiently prosecute their target sets. JWS incorporates accredited methodologies, certified munition characteristics, delivery accuracy, target vulnerability data, and numerous user aids to support the operational use of JWS to predict weapons effectiveness for fielded weapons and delivery systems. The JTCG/ME deployed JWS v2.2 in FY16. JWS v2.2 included a total of 220 methodology, functionality, weapons/warheads/fuzes, and target updates. JWS v2.2 included initial connectivity with the Digital Precision Strike Suite (DPSS) Collateral Damage Estimation (DCiDE) Tool, as well as updates to the Fast Integrated Structural Tool (FIST) (containing building types and a quasi-static blast capability) and other high priority User requirement updates. The connectivity with DCiDE improves both speed and throughput of data. This capability enabled the Combatant Commands to have operational targeting, weaponeering, and collateral damage estimation capability in direct support of operations, mission planning, and training. Additionally, Warfighters were able to put ordnance on target and as such, directly affected combat effectiveness in current operations. JTCG/ME continued to facilitate coalition interoperability in FY16, and is currently completing several JWS version releases to key coalition partners in support of current operations under Foreign Military Sales (FMS) agreements. These efforts will enable the United Kingdom, Canada, Australia, Republic of Korea, and other coalition partners to plan operational weaponeering and			

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2016	FY 2017	FY 2018
collateral damage estimates, support training and tactics development, and support force-level analyses. This capability is critical to the effectiveness of U.S. targeting and fires personnel working in combined environments. JTCG/ME finalized integration, performed operational testing, and progressed to final systems verification for JWS v2.3 in FY16, with Risk Mitigation Framework testing and release scheduled for FY17. JWS v2.3 will include enhanced data sets and capabilities with focus on connectivity to other targeting and mission planning capabilities for improved estimates and more seamless planning. Specifically, JWS v2.3 will include new/updated data sets, new Imagery Interface to implement aimpoint development leveraging the Tasked Target Text Data (T3D) data format implemented by currently fielded mission planning systems. JWS software and T3D imagery interface modifications to support integration of Electronic Light Table (ELT) viewers. There will also be a Modernized Integrated Database (MIDB) and Joint Targeting Toolbox (JTT) interface with additional capabilities to support connectivity. These developments will enable the integration of Weaponeering, Precision Point Mensuration (PPM) and Collateral Damage Estimation (CDE) via Digital Imagery Exploitation Engine (DIEE). JWS v2.3 will also add the updated Gunship Delivery Accuracy Program (GDAP), Rotary Wing Delivery Accuracy Program (RWDAP), and Fast Integrated Structural Tool (FIST) v2.0. JTCG/ME continued to deliver data and methodology for integration and development of JWS v2.4 in FY16. Enhanced capabilities for data and connectivity will continue for JWS v2.4 during FY17. JTCG/ME began to plan and refine a future JWS architecture strategy to enable interactive scene base weaponeering, maximize re-use and interoperability of capabilities, increase speed of modeling and simulation, support future hardware/software compatibility, and support allied releasability. A key to this strategy is a JWS v3.x prototyping effort initiated in FY16, which will continue in FY17. The JTCG/ME released Digital Precision Strike Suite (DPSS) Collateral Damage Estimation (DCiDE) tool version v1.2.3 in FY16 to support the Chairman of the Joint Chiefs of Staff Instruction (CJCSI) 3160.01B – “No-Strike and the Collateral Damage Estimation (CDE) Methodology”. The DCiDE tool is critical to the Warfighters’ ability to meet Urgent Operational Needs for an accredited automated CDE tool that both expedites and simplifies the CDE process. DCiDE is the only automated CDE tool authorized for use in the USCENTCOM and USAFRICOM Areas of Operation (AORs). The JTCG/ME CDE tables are used in every planned kinetic strike in all AORs to meet Commanders intent and to minimize civilian casualties. JTCG/ME updated the accredited Collateral Effect Radii (CER) Reference Tables for selected AS/SS weapons, which are the basic data that supports the CDE methodology. Changes included additions for airburst munitions, nomenclature changes, and additional updates for newly fielded/updated systems (e.g., Hellfire family). JTCG/ME also developed and accredited the Collateral Effects Library (CEL) Tool in support of advanced CDE mitigation techniques. DOT&E received positive feedback on the use of the CER values as a critical enabler in support of munitions employment against high value targets (HVTs).			

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2016	FY 2017	FY 2018
JTCG/ME is finalizing the Digital Imagery Exploitation Engine (DIEE) v2.0 with DPSS. DIEE will provide both seamless planning and direct linkages between JWS and mission planning systems in operational units. DIEE will combine applications that will allow targeteers and operational planners to develop more rapid strike plans, due to seamless connectivity of weaponeering, collateral damage estimation, and precision point mensuration results to mission planning systems for target execution. This new concept will integrate capabilities of an Electronic Light Table (ELT), Precision Point Mensuration tool (Common Geopositioning Services - CGS), and CDE tool (DCiDE), as well as other targeting applications in what we are calling an Integrated Display Viewer (IDV). Although DIEE is in final development, with expected fielding by beginning of FY17, several Combatant Commands have already committed to using DIEE as their primary tool for full-integrated targeteering capability. J-ACE provides authoritative air-to-air (AA) and surface-to-air (SA) weapons effectiveness information, and serves as the primary tool used by the Air Force and Navy to underpin air combat tactics, techniques, and procedures development. J-ACE is the umbrella program that includes both the Joint Anti-air Model (JAAM) and Endgame Manager (EM), which provides a full kill chain (end-to-end) capability. Other Users include National Test and Training Ranges for AA/SA shot validation and various members of the analytical community for air combat studies and planning. U.S. Strategic Command (USSTRATCOM) leverages J-ACE capabilities to support of route planning for the execution of strike packages. JAAM supports operational squadrons mission de-brief tools such as Personal Computer Debriefing System (PCDS) and several others. In FY16, JTCG/ME performed operational testing and progressed to final systems verification reviews for J-ACE v5.3, with expected Risk Mitigation Framework testing and fielding in FY17. J-ACE v5.3 will extend and update data sets for missile and aircraft target aero-performance, anti-air missile lethality, and air target vulnerability. New capabilities include the Hybrid Integration and Visualization Engine (HIVE) computer architecture interface and BLUEMAX6 (six degree of freedom aero performance) model for increased aircraft aero performance modeling with Hands-On-Stick-and-Throttle (HOTAS) and display capability allowing for actual flight control of the air craft, as well as increased counter-measure capabilities leveraging Enhanced Surface-to-Air Missile Simulation (ESAMS). J-ACE v5.3 will also include the effect of weapon system reliability on the probability of a successful engagement. The fielding of J-ACE v5.3 will allow greater aero performance options and the ability to estimate counter-measure effectiveness. A key enhancement of J-ACE v5.3 is the continued evolution of the J-ACE architecture to maximize re-use, interoperability of capabilities, support future hardware/software compatibility, and optimize integration and validation testing. JTCG/ME continued to develop, deliver, and integrate data and methodology for J-ACE v5.4, which will provide enhanced data, methodology, and descriptive material to support new weapons in the JAAM and EM. The fielding of J-ACE v5.4 in FY18 will allow for greater connectivity for outbrief capabilities by units, target detection estimation, counter Air Defense prediction capability, and enhanced architecture allowing future version growth and compatibility. J-ACE will enhance Personal Computer Debriefing System (PCDS) capability, and further evaluate enhancement of aircraft maneuverability modeling with HIVE/BLUEMAX6. In			

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2016	FY 2017	FY 2018
addition, JAAM will include capability to evaluate two sided Suppression of Enemy Air Defense (SEAD) and Destruction of Enemy Air Defense (DEAD); improved target detection capability leveraging National Air and Space Intelligence Center (NASIC) Infrared (IR) and Radio Frequency (RF) models; and multiple ESAMS capability. The J-ACE architecture continues to be enhanced to maximize re-use, interoperability of capabilities, support future hardware/software compatibility, and optimize integration and validation testing. JTCG/ME performed requirements analysis and planning for J-ACE v5.5. J-ACE v5.5 will include rotary wing aircraft capability and further expansion of electronic warfare and counter-measure capabilities. User input through working groups and training sessions are feeding requirements generation and planning to ensure alignment with User community. In FY16, JTCG/ME continued the development of non-kinetic weaponeering tools and methodologies. Joint Non-Kinetic Effectiveness is intended to be the single source for operational Warfighters, analysts, targeteers, and planners to analyze offensive cyber capabilities, electronic attack weapons, and directed energy effectiveness. In conjunction with DOT&E and the Air Force's 363rd Intelligence, Surveillance, and Reconnaissance Group, the JTCG/ME continued development of a JMEM process for cyberspace operations, electronic attack, and directed energy. FY16 efforts centered on developing the foundational elements for JMEM production, including weapons characteristics, target vulnerability, and effects estimation tools (e.g., U.S. Cyber Command's Cyber Capabilities Registry, Electronic Warfare/Cyber Critical Elements/ Weaponeering Guides, and Directed Energy Effectiveness Lookup Tables). These efforts culminated in an initial Cyber JMEM prototype to stimulate user interaction, feedback, and maturation, while setting the foundation for a full J-NKE capability suite, to include other non-kinetic effects (e.g., directed energy). JTCG/ME will continue to refine these initial efforts in FY17, with further expanded efforts in FY18. Since JTCG/ME products are User focused and requirements driven, there is considerable effort that goes into working with Users to establish Warfighter requirements for on-going efforts and future JTCG/ME products. The Operational Users Working Group (OUWG) is a critical venue for receiving direct User feedback and development of future requirements from the operational community in regards to needed software enhancements and capabilities to support AS, SS, AA, and non-kinetic engagements. JTCG/ME continued to chair OUWGs, while representatives from USCENTCOM, USAFRICOM, USSTRATCOM, U.S. Pacific Command (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 routinely participate.			

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2016	FY 2017	FY 2018
JTCG/ME provided User training on its products. For JWS in FY16, JTCG/ME supported 23 JWS sessions at 19 CONUS/ OCONUS locations and approximately 340 students. For DCiDE, JTCG/ME supported numerous training classes to support units in USCENTCOM (e.g., Combined Task Forces, J-34 FIRES, and J2 Targeting Elements), USPACOM, and coalition partners (e.g., Australia). With new versions of JWS, DCiDE, DIEE, and J-ACE expected in FY17, there will be additional growth in training support. JTCG/ME provides help desk and training packages via the JMEM Product Information Access System (JPIAS), as well as product newsletters. FY16 support included addressing over 400 User support requests and developing training aids, such as the JWS Training Tidbits and Sample Weaponeering Problems. At times User requirements call for specialized solutions, such as weapons fielded between product releases and need for urgent target vulnerability surrogations to support current operations. JWS is the calculation engine used to develop Quick Weaponeering Guides/Probability of Kill Lookup Tool software to address some of these requirements. FY16 examples include updates for the AGM-114, AGM-176, GBU-49/BLU-129, GBU-49/BLU-126, GBU-12/BLU-129. JTCG/ME also leveraged the Collateral Effects Library to deliver 40 collateral damage mitigation analysis packages to operational Users for HVTs. There were seven rapid request target vulnerability surrogation packages (31 target-weapon pairings - filled based on Urgent Operational Needs), and a specialized AN/SEQ-3(XN-1) Solid State Laser-Quick Reaction Capability Laser Weapon System (SSL-QRC LAWS) Weaponeering Guide authored.			
FY 2017 Plans: Live Fire Test and Evaluation Major Test and Evaluation Programs The FY 2017 budget will support the Live Fire Test and Evaluation deputate's assessment of Test and Evaluation Master Plans, Test Plans, System Acquisition Reports, Defense Acquisition Executive Summary reports, and the development of Live Fire Test and Evaluation reports for those programs designated for OSD oversight. JLF Programs and LFT&E Initiatives The FY 2017 JLF budget will support at least 20 projects (tentatively 12 new starts and 8 projects continuing from previous FYs). Focus areas for JLF include projects that either: 1) characterize new survivability issues; 2) characterize new lethality issues; 3) improve accuracy and fidelity of weapon data; 4) improve test methods; 5) improve modeling and simulation methods; or 6) develop vulnerability data libraries for emerging non-kinetic threats.			

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2016	FY 2017	FY 2018
JLF Air projects will continue to evaluate technologies and techniques to decrease vulnerabilities to all currently tested aircraft, against operationally relevant threats. Previously initiated projects that will be continued include developing a model for the OG-7V fragmentation grenade, quantifying the penetration of armor piercing incendiary munitions, evaluating the effectiveness of CV-22 Wing Fire Protection Systems, and evaluating the vulnerability of engines to MANPADS. New efforts will be initiated to (1) determine the root cause of CH-53 and CH-47 self-sealing bladder performance issues; (2) measure flammability traits of AH-64E Fire Detection Expansion Systems; and (3) develop a 12.7 x 108 mm Heat (High) Explosive Incendiary threat model prediction. JLF Ground projects will continue to optimize the mix of 30 mm ammunition, determine the fragment spray pattern and velocity for the MK84 warhead, and determine/mitigate collateral damage effects. Several new efforts will be initiated to develop better test methodologies: (1) develop instrumented inert warheads to mimic rocket-propelled grenade and anti-tank guided munitions; (2) develop better underbody blast threat and blast box analysis; and (3) develop improved instrumentation to assess local accelerative loading due to blast effects within armored vehicles. One effort will improve modeling and simulation of buried underbody blast effects. Finally, one effort will analyze statistical quantification of probability estimates of small caliber munitions in order to minimize the number of Live Fire tests required. JLF Sea projects include improving the modeling of simulation of equipment failure due to thermal effects, developing modeling tools for structural damage due to underwater explosions and their resulting bubble loading, and improving vulnerability hydrocodes by generating underwater explosion data that mimics multiple bubble pulsations. Live Fire initiatives will also include continued support of the execution and further development of a ground vehicle survivability course. JASP In FY 2017 the JASP will continue work on at least 28 multi-year RDT&E projects and initiate 12 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			

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2016	FY 2017	FY 2018
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 FY17, JTCG/ME will continue to develop and standardize methodologies for evaluating munitions effectiveness, including 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 two major JTCG/ME Joint Munitions JMEM products, the JWS and J-ACE. The JTCG/ME will continue to coordinate and develop a non-kinetic JMEM capability, leveraging its FY16 Cyber JMEM prototyping efforts. Additionally, JTCG/ME will field and coordinate new capabilities, such as the DIEE and DCiDE Collateral Damage Estimation. Beyond traditional JMEM products, JTCG/ME will continue to support specialized weaponeering data and solutions for Warfighter urgent requirements and support Users. This includes standalone resources such as the Pk Lookup Tools, CDE tables, and munitions weaponeering guides. The objective is to provide efficient and effective support to meet CCMD current and future needs for agility in a dynamic operational environment. The JTCG/ME will field JWS v2.3 in FY17. JWS v2.3 will include enhanced data sets and capabilities with focus on connectivity to other targeting and mission planning capabilities for improved estimates and more seamless planning inherent in the concept of operational agility. When fielded, this capability will continue to enable CCMDs to have operational targeting, weaponeering, and collateral damage estimation capability in direct support of operations, mission planning, and training. JTCG/ME will continue to facilitate coalition interoperability in FY17. It will supply several JWS version releases to key coalition partners in support of current operations under FMS agreements. FY17 efforts will enable the United Kingdom, Canada, Australia, Republic of Korea, and other coalition partners to plan operational weaponeering and collateral damage estimates, support training and tactics development, and support force-level analyses. This capability is critical to the effectiveness and synergy of U.S. targeting and fires personnel working in combined partnered environments. JTCG/ME will finalize integration and operational testing of JWS v2.4 in FY17, with expected release in FY18. JWS v2.4 will be the last in the JWS v2.x product line and will include enhanced and updated weapons and target data sets, improved Graphical User Interphases for improved business logic and human system interaction, and improved database designs for speed and updating. JWS v2.4 will also include FIST v2.1 with Integrated Munitions Effects Assessment (IMEA) v11.1, enhanced imagery,			

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2016	FY 2017	FY 2018
and enhanced Response Surface Mapping/ Penetration Launch Acceptability Region capabilities. JWS v2.4 will continue to address and implement CCMD requirements. JTCG/ME will develop JWS v3.x product line open architecture construct. This will enable interactive scene base weaponeering, maximize re-use and interoperability of capabilities, increase speed of modeling and simulation, support future hardware/software compatibility, and support allied releasability. JWS v3.x efforts will include formulation and refinement of the Joint Effects Library (JEL), which will provide the modules for the open architecture. JWS v3.x is the next evolution of agile, scalable capability solutions to meet the needs of the Joint Force in a dynamic operational environment. JTCG/ME will continue to support updates for DCiDE tools in FY17 to support the CJCSI 3160.01B – "No-Strike and the CDE Methodology". JTCG/ME will update and the accredit CER Reference Tables for selected air-to-surface and surface-to-surface weapons, which are the basic data that supports the CDE methodology. Changes will include additional updates for newly fielded/ updated systems, as well as new fragmentation and blast methodologies. JTCG/ME will also enhance and accredit improvements to the CEL Tool in support of advanced CDE mitigation techniques. JTCG/ME will field DIEE v2.0 with DPSS. The first fielded version of DIEE, v2.0, will integrate capabilities of an ELT, Precision Point Mensuration tool, and CDE tool, as well as other targeting applications in what we are calling an IDV. DIEE usage in Combatant Commands as their primary tool for full-integrated targeteering capability will continue to grow. JTCG/ME will develop and integrate DIEE v2.1 in FY17, with expected release in FY18. DIEE v2.1 will include CGS update, CEL interface development, additional imagery formats, and increased Common Operating Picture information on IDV. DIEE enhancements will continue to provide agile capability solutions for the Joint Force Commander in dynamic operational environments. JTCG/ME will field J-ACE v5.3 in FY17. J-ACE v5.3 will extend and update data sets for missile and aircraft target aero-performance, anti-air missile lethality, and air target vulnerability. The fielding of J-ACE v5.3 will allow greater aero performance options and the ability to estimate counter-measure effectiveness. A key enhancement of J-ACE v5.3 is the continued evolution of the J-ACE architecture to maximize re-use, interoperability of capabilities, support future hardware/software compatibility, and optimize integration and validation testing. JTCG/ME will continue to develop and progress to operational testing for J-ACE v5.4. J-ACE v5.4 will provide enhanced data, methodology, and descriptive material to support new weapons in the JAAM and EM. The fielding of J-ACE v5.4 in FY18 will allow for greater outbrief capability and connectivity by units, target detection estimation, counter Air Defense prediction capability, and enhanced architecture allowing future version growth and compatibility. J-ACE will enhance PCDS capability, and further evaluate			

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enhancement of aircraft maneuverability modeling with HIVE/BLUEMAX6. In addition, JAAM will include capability to evaluate two sided SEAD and DEAD; improved target detection capability leveraging NASIC IR and RF models; and multiple ESAMS capability. The J-ACE architecture will continue to be enhanced to maximize re-use, interoperability of capabilities, support future hardware/software compatibility, and optimize integration and validation testing. JTCG/ME will develop data and methodology for J-ACE v5.5. J-ACE v5.5 will include rotary wing aircraft capability and further expansion of electronic warfare and counter-measure capabilities. JTCG/ME will perform requirements analysis and plan for J-ACE v5.6 based on User requirements from working groups and training sessions to ensure alignment with User community. Joint Non-Kinetic Effectiveness JMEMs are intended to be the single source for operational Warfighters, analysts, targeteers, and planners to analyze offensive cyber capabilities and directed energy effectiveness. In FY17, JTCG/ME will continue to develop non-kinetic weaponeering tools and methodologies. JTCG/ME will continued to develop and mature the JMEM process for cyberspace operations and directed energy. FY17 efforts will build from FY16 that developed the foundational elements for JMEM production, including weapons characteristics, target vulnerability, and effects estimation tools. JTCG/ME will interact with the User community based on initial FY16 Cyber JMEM prototype. This will help with maturation process and further strengthen the foundation for a full J-NKE capability suite, to include other non-kinetic effects. JTCG/ME will continue to refine these initial efforts in FY17, with increased efforts in FY18. Since JTCG/ME products are User focused and requirements driven, there is considerable effort that goes into working with Users to establish Warfighter requirements for on-going efforts and future JTCG/ME products. JTCG/ME will chair OUWGs. OUWGs are a critical venue for receiving direct User feedback and development of future requirements from the operational community in regards to needed software enhancements and capabilities to support AS, SS, AA, and non-kinetic engagements. JTCG/ME will also continue User training on its products in FY17. With the fielding of new versions of JWS, DCiDE, DIEE, and J-ACE, there is an expected growth in training support requirements. JTCG/ME will provide help desk and training packages via the JPIAS, as well as product newsletters.			

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2016	FY 2017	FY 2018
JTCG/ME will also support urgent operational needs with specialized solutions, such as weapons fielded between product releases and need for urgent target vulnerability surrogations to support current operations. ***FY 2018 Plans:*** Live Fire Test and Evaluation Major Test and Evaluation Programs The FY 2018 budget will support the Live Fire Test and Evaluation deputate's assessment of Test and Evaluation Master Plans, Test Plans, System Acquisition Reports, Defense Acquisition Executive Summary reports, and the development of Live Fire Test and Evaluation reports for those programs designated for OSD oversight. JLF Programs The FY 2018 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, 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. JASP In FY 2018 the JASP will continue work on at least 27 multi-year RDT&E projects and initiate about 5 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 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.			

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2016	FY 2017	FY 2018
Joint Technical Coordinating Group for Munitions Effectiveness In FY18, JTCG/ME will continue to develop and standardize methodologies for evaluating munitions effectiveness, including 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 two major JTCG/ME JMEM products, the JWS and J-ACE. The JTCG/ME will increase development of a non-kinetic JMEM capability, as well as the DIEE and Collateral Damage Estimation capabilities. Beyond traditional JMEM products, JTCG/ME will continue to support specialized weaponeering data and solutions for Warfighter urgent requirements and support Users. This includes standalone resources such as the Pk Lookup Tools, CDE tables, and munitions weaponeering guides. The objective is to provide efficient and effective support to meet CCMD current and future needs for agility in a dynamic operational environment. JTCG/ME will continue to expand coalition interoperability in FY18 with JWS version releases to key coalition partners in support of current operations under FMS agreements. Past efforts enabled the United Kingdom, Canada, Australia, Republic of Korea, and other coalition partners to plan operational weaponeering and collateral damage estimates, support training and tactics development, and support force-level analyses. This capability is critical to the effectiveness and synergy of U.S. targeting and fires personnel working in combined partnered environments. JTCG/ME will field JWS v2.4 in FY18. JWS v2.4 will include enhanced and updated weapons and target data sets, improved Graphical User Interphases for improved business logic and human system interaction, and improved database designs for speed and updates. When fielded, this capability will continue to enable CCMDs to have operational targeting, weaponeering, and collateral damage estimation capability in direct support of operations, mission planning, and training. JTCG/ME will develop and begin implementing JWS v3.x product line capabilities. JWS v3.x will enable interactive scene base weaponeering, maximize re-use and interoperability of capabilities, increase speed of modeling and simulation, support future hardware/software compatibility, and support allied releasability. JWS v3.x efforts will implement the JEL, which will provide open architecture capabilities. JWS v3.x is the next evolution of agile, scalable capability solutions to meet the needs of the Joint Force in a dynamic operational environment. Beginning in FY18 (based on FY18-22 increases), JTCG/ME will have focused efforts to enhance and validate collateral damage. The enhancement 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			

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2016	FY 2017	FY 2018
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 to make their strike decision calls. JTCG/ME will continue to support updates for DCiDE tools in FY18 to support the CJCSI 3160.01B – "No-Strike and the CDE Methodology". JTCG/ME will update and the accredit CER Reference Tables for selected AS/SS weapons, which are the basic data that supports the CDE methodology. JTCG/ME will field DIEE v2.2. DIEE enhancements will continue to provide agile capability solutions for the Joint Force Commander in dynamic operational environments. JTCG/ME will continue to sustain and monitor DIEE requirements with the User community. JTCG/ME will field J-ACE v5.4 in FY18. J-ACE v5.4 will provide enhanced data, methodology, and descriptive material to support new weapons in the JAAM and EM. JTCG/ME will finalize development and provide operational testing for J-ACE v5.5 in FY18. J-ACE v5.5 will include rotary wing aircraft capability and further expansion of electronic warfare and counter-measure capabilities. JTCG/ME will continue to develop, deliver, and integrate data and methodology for J-ACE v5.6 based on User requirements from working groups and training sessions to ensure alignment with User community. Joint Non-Kinetic Effectiveness JMEMs are intended to be the single source for operational Warfighters, analysts, targeteers, and planners to analyze offensive cyber capabilities and directed energy effectiveness. Beginning in FY18 (based on FY18-22 increases), JTCG/ME will enhance development of non-kinetic weaponeering tools and methodologies. JTCG/ME will continue to develop and mature the JMEM process for cyberspace operations and directed energy. JTCG/ME will expand efforts to review, analyze and synthesize offensive cyber capabilities and target data into standardized Joint Munitions Effectiveness Manuals. Cyber JMEM is a top priority of USCYBERCOMMAND and CCMDs to support their Warfighting Force. FY18 efforts will include increased manpower to further enhance and build upon prototype efforts in FY16 and FY17. These increased efforts and resources will culminate in institutionalized methodology and cyber effectiveness capabilities that will provide warfighters with non-kinetic weaponeering assessments and a common non-kinetic measurement to predict cyber capability outcomes. The publishing of JMEMs, accreditation of non-kinetic capability effectiveness methodologies, facilitation for validation of operational data, and the population of non-kinetic capability databases will help fulfill the Department's Cyber Strategy.			

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2016	FY 2017	FY 2018
Since JTCG/ME products are User focused and requirements driven, there is considerable effort that goes into working with Users to establish Warfighter requirements for on-going efforts and future JTCG/ME products. JTCG/ME will chair OUWGs. OUWGs are a critical venue for receiving direct User feedback and development of future requirements from the operational community in regards to needed software enhancements and capabilities to support AS, SS, AA, and non-kinetic engagements. JTCG/ME will continue User training on its products in FY18, as well as provide help desk and training packages via the JPIAS and newsletters. JTCG/ME will support urgent operational needs with specialized solutions, such as weapons fielded between product releases and need for urgent target vulnerability surrogations to support current operations.			
Accomplishments/Planned Programs Subtotals	46.882	48.316	59.500

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.