Exhibit R-2, RDT&E Budget Item Justification: PB 2022 Operational Test and Evaluation, Defense	Date: May 2021
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 2020	FY 2021	FY 2022 Base	FY 2022 OCO	FY 2022 Total	FY 2023	FY 2024	FY 2025	FY 2026	Cost To Complete	Total Cost
Total Program Element	64.332	69.172	70.933	68.549	-	68.549	-	-	-	-	-	-
000311: *LFT&E*	64.332	69.172	70.933	68.549	-	68.549	-	-	-	-	-	-

A. Mission Description and Budget Item Justification

This Program Element consists of three programs: Live Fire Test and Evaluation (LFT&E), 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 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 U.S. Navy Naval Air Systems Command, U.S. Army Aviation and Missile Command, and U.S. Air Force 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 2020	FY 2021	FY 2022 Base	FY 2022 OCO	FY 2022 Total
Previous President's Budget	69.172	70.933	70.297	-	70.297
Current President's Budget	69.172	70.933	68.549	-	68.549
Total Adjustments	0.000	0.000	-1.748	-	-1.748
• Congressional General Reductions	-	-			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	-	-			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-	-			
• SBIR/STTR Transfer	-	-			
• Inflation/Travel adjustment	-	-	-1.748	-	-1.748

Exhibit R-2A, RDT&E Project Justification: PB 2022 Operational Test and Evaluation, Defense											Date: May 2021	
Appropriation/Budget Activity 0460 / 6					R-1 Program Element (Number/Name) PE 0605131OTE / *Live Fire Test and Evaluation (LFT&E)*				Project (Number/Name) 000311 / *LFT&E*			
COST ($ in Millions)	**Prior Years**	**FY 2020**	**FY 2021**	**FY 2022 Base**	**FY 2022 OCO**	**FY 2022 Total**	**FY 2023**	**FY 2024**	**FY 2025**	**FY 2026**	**Cost To Complete**	**Total Cost**
000311: *LFT&E*	64.332	69.172	70.933	68.549	-	68.549	-	-	-	-	-	-
Quantity of RDT&E Articles	-	-	-	-	-	-	-	-	-	-		

A. Mission Description and Budget Item Justification

This Program Element consists of three programs: Live Fire Test and Evaluation (LFT&E), 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 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 U.S. Navy Naval Air Systems Command, U.S. Army Aviation and Missile Command, and U.S. Air Force 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. Accomplishments/Planned Programs ($ in Millions)	FY 2020	FY 2021	FY 2022
Title: Live Fire Test and Evaluation	69.172	70.933	68.549
FY 2021 Plans: Live Fire Test and Evaluation (LFT&E) of Major Department of Defense (DoD) Acquisition Programs The Fiscal Year (FY) 2021 budget enables the LFT&E Deputate to assess the adequacy of LFT&E strategies/plans and generate new LFT&E policies to support systems' acquisitions and rapid fielding. The FY 2021 budget ensures an adequate execution of the agreed upon LFT&E plans and subsequently ability to conduct independent analysis of survivability and lethality test and Modelling and Simulation (M&S) data in support of the development of Office of the Secretary of Defense (OSD) LFT&E reports to Congress. Joint Live Fire (JLF) Programs and LFT&E Initiatives The FY 2021 JLF budget supports at least 18 projects (tentatively 10 new efforts and 8 projects continuing from previous FYs). Project's objectives directly support National Defense Strategy (NDS) objectives to include building a more lethal force, new partnerships, or DoD business reforms. Build a More Lethal Force In FY 2021, JLF continues to increase the accuracy and capability of critical modeling and simulation tools to support test and evaluation efficiency and ensure credibility of DoD assessments and weaponeering tools.			

Exhibit R-2A, RDT&E Project Justification: PB 2022 Operational Test and Evaluation, Defense		Date: May 2021
Appropriation/Budget Activity 0460 / 6	**R-1 Program Element (Number/Name)** PE 0605131OTE / *Live Fire Test and Evaluation (LFT&E)*	**Project (Number/Name)** 000311 / *LFT&E*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2020	FY 2021	FY 2022
- For example one effort updates the weaponeering methods needed to estimate Multiphase Blast Explosive (MBX) effects used in low-collateral-damage munitions such as BLU-129/B to combine very low collateral damage with increased (nearfield) lethality on a target. - Another effort consolidates ongoing efforts to expedite the development and fielding of credible tools needed to evaluate ship vulnerabilities to kinetic threat engagements while also enabling operational users to accurately/timely plan strike missions against adversary surface ships. JLF efforts also continue to leverage new technologies and test methods to improve Survivability/Lethality/Vulnerability evaluation efficiency and credibility. -For example, one effort aligns the DoD, Department of Energy, and industry experts to improve pedigree of weapons data, provide uncertainty quantification for M&S validation, demonstrate operational and warfighter support for credible weapon effects, and enhance LFT&E acquisition life-cycle by accelerating weapon development timelines and reducing cost. -JLF is addressing test and evaluation shortfalls needed to adequately evaluate emerging hypersonic weapons by enabling optical characterization of fragment dispersion in flight tests. Reform the Department for greater performance and affordability to accelerate DOT&E initiatives and priorities, enabling policy and procedure improvements while also directly supporting the warfighter requirements. In coordination with established service activities JLF is developing a framework capable of consolidating available and future LFT&E data in support of a range of data mining and data analytics intended to more effectively inform requirements, performance evaluations and development of evaluation/test tools. JLF is focusing on application of scientific methods to standardize efficient validation, verification, and accreditation processes for LFT&E/Joint Munition Effectiveness Manuals (JMEM) M&S tools to accurately outline M&S capabilities, limitations, uncertainty quantification, and statistical confidence in predicted outcomes. JLF is also continuing to lead innovation in LFT&E methods to increase LFT&E efficiency and support rapid fielding. - JLF continues to enhance an M&S capability that will enable efficient evaluation of active protection systems integrated with ground combat vehicles - JLF is developing and optimizing machine learning and M&S tools to improve the ability to identify, quantify and project DoD system vulnerabilities to cyber effects.			

Exhibit R-2A, RDT&E Project Justification: PB 2022 Operational Test and Evaluation, Defense		Date: May 2021
Appropriation/Budget Activity 0460 / 6	**R-1 Program Element (Number/Name)** PE 0605131OTE / *Live Fire Test and Evaluation (LFT&E)*	**Project (Number/Name)** 000311 / *LFT&E*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2020	FY 2021	FY 2022
Joint Aircraft Survivability Program (JASP) In FY 2021 the JASP is continuing work on 26 multi-year RDT&E projects and initiating 19 new projects approved by the JASP Principal Members Steering Group and OSD/DOT&E. The JASP is supporting the NDS objective to 'Build a More Lethal Force' by developing measures to defeat near-peer adversary radio frequency (RF) 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 advancing system hardening against rocket-propelled grenade, small-arms, and high-energy laser threats and increasing threat and flight environmental situational awareness. Reform the DoD for Greater Performance and Affordability by funding the development of more efficient M&S tools and threat models to enable more effective aircraft survivability capability development, test and evaluation against kinetic and non-kinetic threats. The Joint Combat Assessment Team (JCAT) is continuing 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 is continuing to support 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 is initiating, continuing, and completing other projects as approved by the JASP Principal Members Steering Group and OSD/DOT&E. Joint Technical Coordinating Group for Munitions Effectiveness (JTCG/ME) In FY 2021, JTCG/ME efforts are assisting the DOT&E, OSD in supporting the NDS lines of effort of enabling greater force lethality, strengthening partner capabilities, and optimal use of resources through efficiency. JTCG/ME is: -Developing, enhancing, and standardizing data/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 Combatant Commands' (CCMDs) needs. -Fielding and continuing to enhance future versions of its kinetic JTCG/ME Joint Munitions Effectiveness Manual (JMEM) products to include the JMEM Weaponeering System (JWS), Joint Antiair Combat Effectiveness (J-ACE) / Joint Anti-Air Model (JAAM), Digital Precision Strike Suite (DPSS) Collateral Damage Estimation (DCiDE) tool, Risk Estimation Distances (REDs) and the Digital Imagery Exploitation Engine (DIEE).			

Exhibit R-2A, RDT&E Project Justification: PB 2022 Operational Test and Evaluation, Defense		Date: May 2021
Appropriation/Budget Activity 0460 / 6	**R-1 Program Element (Number/Name)** PE 0605131OTE / *Live Fire Test and Evaluation (LFT&E)*	**Project (Number/Name)** 000311 / *LFT&E*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2020	FY 2021	FY 2022
-Developing and fielding non-kinetic JMEMs capability to include Cyber Operations Lethality and Effectiveness (COLE) and Joint Laser Weaponeering Software (JLaWS) products, as well as High Power Microwave (HPM) and Electromagnetic Spectrum (EMS) Fires data/tool sets. -Supporting specialized solutions to address operational needs to include direct analytical support to operations, Probability of kill (Pk) Lookup Tools, Quick Weaponeering Tool (QWT), RED, Collateral Damage Estimation (CDE) analysis and tables, and air-to-surface and surface-to-surface weaponeering guides. -Continuing to execute a multi-year test program to enhance weaponeering/collateral damage estimation in complex environments. -Improving the utilization of Battle Damage Assessment (BDA) data to more effectively and efficiently estimate munition expenditure rates and mitigate stockpile stress, while improving CCMDs' force effects. -Continuing to maintain and strengthen relationships with the Warfighter, operational users, and coalition partners to establish requirements for current and future products, through forums, training, foreign military sales, and reachback operational support. The objective is to provide support to meet CCMD current and future needs for agility and greater lethality in a more dynamic combined operational environment. -Increasing efficiency by leveraging ongoing Department efforts and support the Department's intent to complement U.S. interest and capabilities by providing weaponeering, targeting, and collateral damage estimation (prevent civilian casualties) capability to Coalition partners through foreign military sales. -Continuing to build and implement the next JTCG/ME JMEM product lines on a foundation of effects libraries using software frameworks enabling quicker development, flexibility, leveraging, and tailoring. -Investigating and implementing the use of machine learning and data analytics to improve quality of existing solutions, decrease computation time of applications, and answer questions previously not possible. Specifically in FY 2021, JTCG/ME is:			

Exhibit R-2A, RDT&E Project Justification: PB 2022 Operational Test and Evaluation, Defense		Date: May 2021
Appropriation/Budget Activity 0460 / 6	**R-1 Program Element (Number/Name)** PE 0605131OTE / *Live Fire Test and Evaluation (LFT&E)*	**Project (Number/Name)** 000311 / *LFT&E*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2020	FY 2021	FY 2022
-Fielding and sustaining JWS v2.4 and JWS v2.4.x (as needed), which provide enhanced data, Fast Integrated Structural Tool (FIST), and connectivity capabilities, while maximizing the final JWS v2.x product line as the future weaponeering product line is developed/completed. Specific highlights include interim enhanced database capabilities with updated data sets to include CCMD's high priority calculated, refreshed, and surrogated targets. The enhanced database capabilities allow accelerated, out of production cycle weapons and target data updates, tailored product versions for releasability, and more effective, focused testing. New 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 enable more options to the weaponeer and improve the underlying phenomenology representation in JWS. - Developing and delivering JWS v3.0 Technical Preview (TP) 4 through 7, which provide scene-based weaponeering and targeting solutions by implementing an agile software delivery process. FY 2021 focus is to develop a JWS v3.0 Minimal Viable Product (MVP) to include weaponeering capabilities for Buildings, Bunkers, Precision Munition Planning Tool (PMPT), Penetration and Cratering (PC) Effects, Personnel, Maritime/Ships, and Probability of Kill Look-up Tool (PKLuT). -Delivering Joint Effects Library (JEL) v1.0 (Spiral 1 - Personnel and Structure Targets) capabilities to complete JWS v3.0 MVP and DIEE v3.0 initial interfaces. JEL Spiral 1 capabilities include new/updated trajectory modeling, new weapon/targets database designs/data and user interfaces, enhanced structural target response and prediction, personnel vulnerability methods, Application Program Interface (API) to DIEE, JEL processes, JEL model Smart Book, and EF training to solidify institutional EF development knowledge. -Facilitating coalition interoperability and information exchange forums. JTCG/ME is continuing to deliver JWS version releases (Australia, Canada, United Kingdom, and Republic of Korea (ROK)) and standalone Pk Lookup tools to multiple key coalition partners in support of current operations under FMS agreements, as well as migrate to new processes via the JEL/JWS v3.x concept. These FMS deliveries complement U.S. interest and capabilities by providing weaponeering and targeting capability to Coalition partners. -Continuing to hold information exchange forums via International Exchange Annex (IEA) 1858 (United Kingdom) and IEA 0585 (ROK). These exchanges facilitate collaboration on methodologies and efforts of mutual interest in the area of weapons effectiveness/collateral damage estimation. -Developing and enhancing 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 2021 efforts is to continue to migrate data and methodology utilized through the Joint Analysis Repository and Visual Interface System (JARVIS) and the Joint Effects Library (JEL).			

Exhibit R-2A, RDT&E Project Justification: PB 2022 Operational Test and Evaluation, Defense		Date: May 2021
Appropriation/Budget Activity 0460 / 6	**R-1 Program Element (Number/Name)** PE 0605131OTE / *Live Fire Test and Evaluation (LFT&E)*	**Project (Number/Name)** 000311 / *LFT&E*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2020	FY 2021	FY 2022
JTCG/ME continues 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. Leveraging existing technologies and partnerships have the potential to reduce the number of weapon test articles required and remove labor-intensive activities from weapon testing. -Updating and executing strategic roadmaps for underlying vulnerability / lethality models used as standards by the tri-service community to better support JMEMs 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 / simulation validation and resolution of capability gaps. -Developing and accrediting CER Reference Tables in accordance with the latest Joint Chiefs of Staff Instruction (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. -Maintaining and supporting fielded DIEE v2.3 and v2.3.1 versions. DIEE is an Office of the Under Secretary of Defense for Intelligence (OUSDI) enterprise targeting solution that provides both seamless planning, 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), CDE, Weaponeering, and data basing functions. - Continuing to develop future DIEE versions (v2.x/v3.x) with JWS 3.x linkage through the development of API. Focused FY 2021 efforts continue to maintain/improve connectivity to community tools, implement interface with JEL emerging capabilities, transition battle damage assessment workflow and data capabilities from BDA analytical efforts, and maintain awareness of policy changes to applicable CJCSIs. -Supporting and delivering reach-back analysis packages for collateral damage mitigation, post-forensic, and force protection 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. - Continuing the Enhanced Weaponeering and CDE Program, a multi-year test program focused on enhancing and validating JTCG/ME CDE tools. This program supports 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 generate buried ordnance characterization data based upon usage statistics from CCMD Expenditure reports, and area of responsibility specific building debris data to enhance and validate current weaponeering/ collateral damage estimation methodologies required by Strike Approval Authorities. FY 2021 efforts are leveraging six FY 2020			

Exhibit R-2A, RDT&E Project Justification: PB 2022 Operational Test and Evaluation, Defense		Date: May 2021
Appropriation/Budget Activity 0460 / 6	**R-1 Program Element (Number/Name)** PE 0605131OTE / *Live Fire Test and Evaluation (LFT&E)*	**Project (Number/Name)** 000311 / *LFT&E*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2020	FY 2021	FY 2022
testing events and multiple collaboration forums. FY 2021 efforts include approximately four buried ordnance and four building debris characterization tests, as well as analyzing and transitioning data and findings from previous tests to weaponeering and CDE tools. -Continuing to implement the BDA of Deliberate and Dynamic Strikes analysis. The effort is a multi-year task to analyze ongoing strikes required to update JMEM capabilities. The overall objective and intent is to ensure effective and efficient munition expenditure rates and mitigate the stockpile stress, while improving CCMDs' force effects. In essence, improve the warfighter's ability to get the right weapon on the right target, achieve the desired effect, and minimize collateral damage while optimizing scarce resources. FY 2021 efforts include: continued extraction of new strike data events, further refine strike analysis methodologies to increase cloud-based automation, further development of new analysis tools obtain end user feedback on new tools / User interfaces, integrate BDA analysis tools with existing JTCG/ME weaponeering applications, and shape BDA reporting standards. -Sustaining/supporting 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. -Fielding final J-ACE v5.x product capabilities, which includes updated weapons and aircraft data in JAAM, new cross platform BROWSE module, which contains descriptive information for each player (weapon, aircraft). In addition, J-ACE v5.4 includes a new 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. Other capabilities include Time-Space-Position Information (TSPI) file updates and filtering/error identification, aircraft maneuver updates, new input/output control options for a "war room summary sheet, and initial Air-to-Surface Weapon (ASW) fly out model. -Integration of Air Combat Effects Library (ACEL) v1.0 capabilities in J-ACE v6.0/6.x. FY 2021 efforts include finishing the review/approval of threshold capabilities, and continued integration and generation of standalone J-ACE application. ACEL v1.0/J-ACE v6.0 threshold capabilities include transitioned v5.x capabilities, unmanned aerial system features, enhanced weapon engagement zone methodology, new graphical displays, refined terrain masking options, and auto-generated test reports for each product player. Other efforts include finishing the development and starting the review/integration of J-ACE v6.0 objective capabilities into ACEL 1.x and J-ACE v6.0 respectfully. These capabilities include enhanced air-to-air missile modeling capability, more ASW fly outs, updated/new surface-to-air models, updated Enhanced Surface-to-Air Missile Simulation (ESAMS) capability with more counter measures, and target detection capability leveraging National Air and Space Intelligence Center (NASIC) RF models/data. Begin to integrate longer lead development items into ACEL v1.x for future J-ACE v6.x product to include infrared detection/track, red surface-to-air gun modeling in EM, rotary wing aero performance modeling, and enhanced chaff modeling.			

Exhibit R-2A, RDT&E Project Justification: PB 2022 Operational Test and Evaluation, Defense		Date: May 2021
Appropriation/Budget Activity 0460 / 6	**R-1 Program Element (Number/Name)** PE 0605131OTE / *Live Fire Test and Evaluation (LFT&E)*	**Project (Number/Name)** 000311 / *LFT&E*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2020	FY 2021	FY 2022
- Continuing Cyber JMEM development capabilities with continued execution of multiyear plan to develop the COLE tool. FY 2021 efforts focus on completion of CD 3, 4, 5, and 6 that includes automated fusion of multi-domain estimates, correlation of foundational data to support Operational Environment Model (OEM) generation, preliminary artificial intelligence-based decision support system, OEM analysis and attack planning support, refined integration with other JTCG/ME toolsets, and quantitative comparisons. Similar to other JMEMs, User feedback is critical. FY 2021 includes multiple Operational Users Working Groups (OUWGs) to review development with operators and preparation for fielding products in future FYs. -Continuing to mature Directed Energy (DE) JMEM capabilities to include High Energy Laser (HEL) and HPM weapons. FY 2021 DE HEL efforts includes continuing HEL lethality testing/target vulnerability analysis/data modeling for verification and validation (V&V) on service specific target sets, field testing, continuing target vulnerability characterization and modeling to provide inputs to JLaWS tool, and conducting the accreditation of HEL JLaWS tool and collateral risk estimation Probabilistic Risk Assessment (PRA) tool. FY 2021 DE HPM JMEM development efforts include continuing HPM lethality testing/target vulnerability analysis/data collection for V&V on service-specific target sets, field-testing, target vulnerability characterization and modeling to provide inputs to JMEM models, finalizing HPM tool development, and completing the HPM PRA Tool. -Continuing to develop/mature EMS Fires JMEM program and capabilities. FY 2021 efforts build upon outputs of FY 2020 efforts (mission analysis assessment to define model, data, BDA and EW conversion) and include execution of developed long-term strategy. FY 2021 includes efforts along JMEM development lines of effort to include: 1) Users interaction/requirements management, 2) Target vulnerability/threat characterization collection, standardization, and Tri-Service approval, 3) EMS Fire weapon characterization collection, standardization, and Tri-Service approval, 4) Effects Methodology development, standardization, and Tri-Service approval, 5) JMEM development management, integration, data management, Verification, Validation, and Accreditation (VV&A), and external interface, and 6) Lab/field testing to support data/ methodology gaps and VV&A. ***FY 2022 Plans:*** Live Fire Test and Evaluation (LFT&E) of Major Department of Defense (DoD) Acquisition Programs The FY 2022 budget will enable the LFT&E Deputate to assess the adequacy of LFT&E strategies/plans and generate new LFT&E policies to support systems' acquisitions and rapid fielding. The FY 2022 budget will ensure an adequate execution of the agreed upon LFT&E plans and subsequently ability to conduct independent analysis of survivability and lethality test and M&S data in support of the development of OSD Live Fire Test and Evaluation reports to Congress. JLF Programs and LFT&E Initiatives			

Exhibit R-2A, RDT&E Project Justification: PB 2022 Operational Test and Evaluation, Defense		Date: May 2021
Appropriation/Budget Activity 0460 / 6	**R-1 Program Element (Number/Name)** PE 0605131OTE / *Live Fire Test and Evaluation (LFT&E)*	**Project (Number/Name)** 000311 / *LFT&E*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2020	FY 2021	FY 2022
The FY 2022 budget will support a more lethal force by increasing the accuracy and capability of critical M&S tools to support T&E efficiency and ensure credibility of DoD assessments and weaponeering tools. The FY 2022 program will continuously focus on multi-year initiatives such as VV&A standardization, warhead characterization, blast, and hypersonics. JLF efforts will also resolve survivability and lethality related system design challenges of currently fielded U.S. systems. Finally, JLF will continue to lead innovation in LFT&E methods to increase LFT&E efficiency and support rapid fielding. JASP In FY 2022 the JASP will continue work on at least 32 multi-year RDT&E projects and initiate new projects approved by the JASP Principal Members Steering Group and OSD/DOT&E. The JASP will support the NDS objective to 'Build a More Lethal Force' by developing measures to defeat near-peer adversary RF and infrared guided threats coupled with quantifiable improvements in digital and hardware-in-the-loop M&S capability and credibility. Improve aircraft force protection by advancing system hardening against rocket-propelled grenade, small-arms, and high-energy laser threats and increasing threat and flight environmental situational awareness. Reform the DoD for Greater Performance and Affordability by funding the development of more efficient M&S tools and threat models to enable more effective aircraft survivability capability development, test and evaluation against kinetic and non-kinetic threats. 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. Joint Technical Coordinating Group for Munitions Effectiveness JTCG/ME will: -Develop, enhance, and standardize data/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.			

Exhibit R-2A, RDT&E Project Justification: PB 2022 Operational Test and Evaluation, Defense		Date: May 2021
Appropriation/Budget Activity 0460 / 6	**R-1 Program Element (Number/Name)** PE 0605131OTE / *Live Fire Test and Evaluation (LFT&E)*	**Project (Number/Name)** 000311 / *LFT&E*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2020	FY 2021	FY 2022
-Field and continue to enhance future versions of its major JTCG/ME Joint Munitions Effectiveness Manual (JMEM) products, the JWS, J-ACE, DIEE, COLE, and JLaWS. - Develop non-kinetic JMEMs capability to include High Power Microwave (HPM) and EMS Fires data/tool sets. -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. -Continue to execute a multi-year test program to enhance weaponeering/collateral damage estimation in contested environments. -Develop BDA analysis tool to determine more effectively and efficiently estimate munition expenditure rates and mitigate stockpile stress, while improving CCMDs' force effects. -Continue to maintain and strengthen relationships with the Warfighter, operational users, and coalition partners to establish requirements for current and future products, through 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. -Increase efficiency by leveraging ongoing Department efforts and support the Department's intent to complement U.S. interest and capabilities by providing weaponeering, targeting, and collateral damage estimation (prevent civilian casualties) capability to Coalition partners through foreign military sales. - Continue to build and implement the next JTCG/ME JMEM product lines on a foundation of effects libraries using software frameworks enabling quicker development, flexibility, leveraging, and tailoring. - Implement the use of machine learning and data analytics to improve quality of existing solutions, decrease computation time of applications, and answer question previously not possible. Specifically in FY 2022, JTCG/ME plans to: -Develop and field JWS v3.0, which use the Model-View-View Model (MVVM) software architecture in scene based environment. The new JWS v3.0 design allows a DIEE API or any other APIs to call directly into the calculations engine to support Advanced Target Development (ATD)/Weaponeerng functions at Combatant Command (CCMD) level. -Deliver JEL v2.0 (Spiral 2) capabilities to develop/complete JWS v3.1 and DIEE v3.0 interfaces. JEL Spiral 2 capabilities include new/updated trajectory modeling, new weapon/targets database designs/data and user interfaces, enhanced structural target response and prediction, personnel and ground mobile vulnerability methods, Application Program Interface (API) to DIEE, and JEL model Smart Book. FY 2022 efforts will include continued development of Spiral 2 capabilities, which include collateral effects radii tables, enhanced collateral damage mitigation, new ground mobile target capability and data, and new maritime operational weaponeering tool, new infrastructure targets (tunnels and bridges). -Support requirements collection by hosting JMEM training sessions, Operational Users Working Groups (OUWG), and User help desk via the JPIAS. JTCG/ME will support approximately 30 training sessions anticipating about 500 students annually.			

Exhibit R-2A, RDT&E Project Justification: PB 2022 Operational Test and Evaluation, Defense		Date: May 2021
Appropriation/Budget Activity 0460 / 6	**R-1 Program Element (Number/Name)** PE 0605131OTE / *Live Fire Test and Evaluation (LFT&E)*	**Project (Number/Name)** 000311 / *LFT&E*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2020	FY 2021	FY 2022
These training sessions allow users to optimize use of JMEM capabilities, while providing JTCG/ME with critical input for future development. 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 collect User requirements and product use cases, to process and codify in capability needs statements used for planning and JMEM product development. Additionally, FY22 will deliver the new JTCG/ME requirement management tool that will: track requirements lifecycle through development and completion; provide context to leadership, analysts and developers without breaking flow: and align Requirements activities with current DEVSECOPS guidance. -Facilitate coalition interoperability and information exchange forums. JTCG/ME will continue to deliver JWS version releases (ROK JWS v1.3, JWS v2.4.1 for ACGU) and standalone Pk Lookup tools to multiple key coalition partners in support of current operations under FMS agreements, as well as migrate to new processes via the JEL/JWS v3.x concept. These FMS deliveries complement U.S. interest and capabilities by providing weaponeering and targeting capability to Coalition partners. - Continue to hold information exchange forums under IEA agreements (US-UK IEA 1858 and US-ROK IEA 0585). These exchanges facilitate collaboration on methodologies and efforts of mutual interest in the area of weapons effectiveness/collateral damage estimation for both kinetic and non-kinetic weapons. -Develop and fully exercise the JARVIS and JEL 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 2022 efforts is to continue to migrate data and methodology utilized through the JARVIS and the JEL. -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. Leveraging existing 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 / lethality models used as standards by the tri-service community to better support JMEMs 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 / simulation validation and resolution of capability gaps. -Develop and accredit Collateral Effects Radii (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 v2.4 and v3.0 versions. Continue to evolve DIEE as an enterprise targeting solution that provides both seamless planning, linkage to various mission planning systems and tools in operational units. - Continue to develop future DIEE version v3.x with JWS 3.x linkage through the development of API. Focused FY 2022 efforts will continue to maintain/improve connectivity to community tools, implement interface with JEL, Integrated Munitions Effects Assessment (IMEA), and Collateral Effects Library (CEL) emerging capabilities. In addition, establish connectivity with Android,			

Exhibit R-2A, RDT&E Project Justification: PB 2022 Operational Test and Evaluation, Defense		Date: May 2021
Appropriation/Budget Activity 0460 / 6	**R-1 Program Element (Number/Name)** PE 0605131OTE / *Live Fire Test and Evaluation (LFT&E)*	**Project (Number/Name)** 000311 / *LFT&E*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2020	FY 2021	FY 2022
Link-16, Variable Message Format (VMF) in support of Dynamic Operations, transition battle damage assessment workflow and data capabilities from BDA analytical efforts, and maintain awareness of policy changes to applicable CJCSIs. -Continue to support and deliver reachback analysis packages for collateral damage mitigation, post-forensic, and force protection 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. - 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 and CDE 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 area of responsibility specific building debris data to enhance and validate current weaponeering/ collateral damage estimation methodologies required by Strike Approval Authorities. FY 2022 efforts will leverage eight FY 2021 testing events and multiple collaboration forums. FY 2022 efforts will include approximately four buried ordnance and three building debris characterization tests, as well as analyzing and transitioning data and findings from previous tests to weaponeering and CDE tools. -Continue to implement the BDA of Deliberate and Dynamic Strikes analysis. The effort is a multi-year task to analyze ongoing strikes required to update JMEM capabilities. The overall objective and intent is to ensure effective and efficient munition expenditure rates and mitigate the stockpile stress, while improving CCMDs' force effects. In essence, improve the warfighter's ability to get the right weapon on the right target, achieve the desired effect, and minimize collateral damage while optimizing scarce resources. FY 2022 efforts include: continued extraction of new strike data events, further refine strike analysis methodologies to increase automation, further development of new analysis tools obtain end user feedback on new tools / User interfaces, integrate BDA analysis tools with existing JTCG/ME weaponeering applications, and shape BDA reporting standards. -Sustain/support fielded versions of J-ACE v5.x, 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. -Continue integration of ACEL v1.0 capabilities in J-ACE v6.0, which includes Survivability and Lethality of Aircraft in Tactical Environments (SLATE) capabilities for Rotary Wing and Low Altitude Combat Weapons. - Continue Cyber JMEM development capabilities with continued execution of multiyear plan to develop / enhance the COLE tool. FY 2022 efforts will focus on completion of CD 8, 9, and 10 that will include automated fusion of multi-domain estimates, correlation of foundational data to support OEM generation, preliminary artificial intelligence-based decision support system, OEM analysis and attack planning support, refined integration with other JTCG/ME toolsets, and quantitative comparisons. Similar to other JMEMs, User feedback is critical. -Develop and field JLaWS tool v2.0 including JTCG/ME Endgame Framework integration and HPM Weapon Systems (HPMWS) beta version include continuing HPM lethality testing/target vulnerability analysis/data collection for V&V on service-specific target sets, field-testing, target vulnerability characterization and modeling to provide inputs to JMEM models.			

Exhibit R-2A, RDT&E Project Justification: PB 2022 Operational Test and Evaluation, Defense		Date: May 2021
Appropriation/Budget Activity 0460 / 6	**R-1 Program Element (Number/Name)** PE 0605131OTE / *Live Fire Test and Evaluation (LFT&E)*	**Project (Number/Name)** 000311 / *LFT&E*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2020	FY 2021	FY 2022
-Continue to develop/mature EMS Fires JMEM program and capabilities. FY 2022 efforts will enhance Electronic Attack Effectiveness capability including standardization of data and methods (e.g., approved effectiveness library/services) for EA (Offensive Jamming) Effectiveness for use by the Joint force within Operational tools and develop capability to determine Weaponeering effects due to The Global Positioning System (GPS) Denial. ***FY 2021 to FY 2022 Increase/Decrease Statement:*** The decrease from FY 2021 to FY 2022 is due to inflation adjustments and travel reductions.			
Accomplishments/Planned Programs Subtotals	69.172	70.933	68.549

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A