Exhibit R-2, RDT&E Budget Item Justification: FY 2018 Air Force											Date: May 2017	
Appropriation/Budget Activity 3600: *Research, Development, Test & Evaluation, Air Force* / BA 2: *Applied Research*					R-1 Program Element (Number/Name) PE 0602890F / *High Energy Laser Research*							
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	-	39.155	42.300	43.049	0.000	43.049	43.685	44.553	45.443	46.352	Continuing	Continuing
625096: *High Energy Laser Research*	-	39.155	42.300	43.049	0.000	43.049	43.685	44.553	45.443	46.352	Continuing	Continuing

A. Mission Description and Budget Item Justification

This program funds Department of Defense (DoD) high energy laser (HEL) applied research through the Joint Directed Energy Transition Office (JDETO). This program is part of an overall DoD HEL Science and Technology (S&T) program. HEL weapon systems have many potential advantages including speed-of-light delivery, precision target engagement, significant magazine depth, low-cost per kill, and reduced logistics requirements. HELs have the potential to perform a wide variety of military missions including defeat of high-speed, maneuvering anti-ship and anti-aircraft missiles and the ultra-precision negation of targets in urban environments with minimal collateral damage. Efforts funded under this program are generally chosen for their potential to have an impact on multiple HEL systems and multiple Service missions while complementing Service/Agency programs that are directed at specific Service needs. A broad range of technologies are addressed in key areas such as laser sources, laser beam control, modeling and simulation, and laser lethality mechanisms. This program also supports the Senior Official as required. Efforts in this program have been coordinated through the DoD S&T Executive Committee process to harmonize efforts and eliminate duplication.

This program is in Budget Activity 2, Applied Research because this budget activity includes studies, investigations, and non-system specific technology efforts directed toward general military needs with a view toward developing and evaluating the feasibility and practicality of proposed solutions and determining their parameters.

B. Program Change Summary ($ in Millions)	FY 2016	FY 2017	FY 2018 Base	FY 2018 OCO	FY 2018 Total
Previous President's Budget	41.855	42.300	43.049	0.000	43.049
Current President's Budget	39.155	42.300	43.049	0.000	43.049
Total Adjustments	-2.700	0.000	0.000	0.000	0.000
• Congressional General Reductions	0.000	0.000			
• Congressional Directed Reductions	0.000	0.000			
• Congressional Rescissions	0.000	0.000			
• Congressional Adds	0.000	0.000			
• Congressional Directed Transfers	0.000	0.000			
• Reprogrammings	-1.261	0.000			
• SBIR/STTR Transfer	-1.439	0.000			
• Other Adjustments	0.000	0.000	0.000	0.000	0.000

Change Summary Explanation

Decrease in FY 2016 reflects reprogramming to support Research and Development Projects, 10 U.S.C. Section 2358.

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C. Accomplishments/Planned Programs ($ in Millions)	FY 2016	FY 2017	FY 2018
Title: Robust Electric Laser Initiative	1.540	0.000	-
Description: Advance solid-state laser development via the Robust Electric Laser Initiative (RELI). ***FY 2016 Accomplishments:*** Completed a joint high power electric laser product improvement program, as part of the RELI effort. Monitored technical progress of the four efforts and other sources. Monitored performance of the lasers as integrated onto relevant military platforms. Completed analysis of trade space to understand performance, fielding, robustness and integration issues for future platforms. Completed government-sponsored measurements to validate performance. ***FY 2017 Plans:*** In FY2016, the RELI effort completes.			
Title: Solid State Laser Technologies	7.900	7.650	7.650
Description: Mature technologies that will provide system level performance commensurate with fieldable laser devices. ***FY 2016 Accomplishments:*** Completed a joint high-power electric laser product improvement program as part of the RELI effort. Monitored technical progress of the four efforts and other sources. Monitored performance of the lasers as integrated onto relevant military platforms. Completed analysis of trade space to understand performance, fielding, robustness and integration issues for future platforms. Completed government-sponsored measurements to validate performance. ***FY 2017 Plans:*** Continue to develop high reliability, lower cost, efficient and high temperature diode pump sources. Scale alternate laser wavelengths to additional militarily relevant power levels. Investigate high power fiber technologies. Continue risk reduction in solid state lasers for their inclusion in future laser systems. Monitor performance of the RELI lasers as integrated onto relevant military platforms. Conduct analysis of trade space to understand performance, fielding, robustness and integration issues for future platforms. ***FY 2018 Plans:*** Continue to develop high reliability, lower cost, efficient and high temperature diode pump sources. Scale alternate laser wavelengths to additional militarily relevant uses and power levels. Investigate high power fiber technologies. Continue risk reduction in solid state lasers for their inclusion in future laser systems. Conduct analysis of trade space to understand performance, fielding, robustness and integration issues for future platforms.			
Title: Advanced High Energy Laser Technologies	5.300	6.210	6.210

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C. Accomplishments/Planned Programs ($ in Millions)	FY 2016	FY 2017	FY 2018
Description: Investigate new technologies that have revolutionary potential HEL applications. ***FY 2016 Accomplishments:*** Explored novel laser technologies to improve efficiency and decrease mass/volume for future laser weapon systems. Evaluated additional materials for high energy laser applications. Continued to improve understanding of short pulse laser technology to include material interaction and propagation. Continued to scale electrically pumped alkali lasers to kilowatt (KW)-class power levels. Continued efforts to characterize and understand the physics of HEL propagation in adverse weather conditions such as fog, rain, smoke and dust. Continued development of the Avoidance and Air Space Deconfliction system and continued early-phase testing on HEL test range(s). Conducted a Service and Agency call for FY17. ***FY 2017 Plans:*** Explore novel laser technologies to improve efficiency and decrease mass/volume for future laser weapon systems. Evaluate additional materials for high energy laser applications. Continue to improve understanding of short pulse laser technology to include material interaction and propagation. Continue to scale electrically pumped alkali lasers to higher KW-class power levels. Continue efforts to characterize and understand the physics of HEL propagation in adverse weather conditions. Conduct verification and validation for airspace de-confliction (AD), integrate AD with predictive avoidance tools to support an integrated demonstration. Establish a technical transition partner for program of record status designation. ***FY 2018 Plans:*** Explore novel laser technologies to improve efficiency and decrease mass/volume for future laser weapon systems. Evaluate additional materials for high energy laser applications. Continue to improve understanding of short pulse laser technology to include material interaction and propagation. Continue to scale electrically pumped alkali lasers to higher KW-class power levels. Continue efforts to characterize and understand the physics of HEL propagation in adverse weather conditions such as fog, rain, smoke and dust. Continue testing of the Avoidance and Air Space De-confliction system on HEL test range(s).			
Title: Laser Beam Control Technologies ***Description:*** Develop technology to support high performance beam control systems and integrated demonstrations. ***FY 2016 Accomplishments:*** Continued development of beam control technologies for laser weapon use on multiple platforms (aircraft, ground vehicles and shipboard systems) in stressing environments. Continued development of a predictive avoidance fire control system for use on multiple platforms. Enhanced execution of a program for kill assessment technologies. Continued joint investigations of beam control hardware and technologies to improve throughput efficiency through the beam director, decrease component weight, and	18.055	21.080	21.080

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C. Accomplishments/Planned Programs ($ in Millions)	FY 2016	FY 2017	FY 2018
improve tracking and compensation through the atmosphere. Conducted a Service and Agency call for FY17. ***FY 2017 Plans:*** Continue development of beam control technologies for laser weapon use on multiple platforms (aircraft, ground vehicles and shipboard systems) in stressing environments. Continue development of a predictive avoidance fire control system for use on multiple platforms. Continue execution of a program for kill assessment technologies. Continue joint beam control efforts to develop hardware and technologies to improve throughput efficiency through the beam director, decrease component weight, and improve tracking and compensation through the atmosphere. Select additional programs for Service specific applications. ***FY 2018 Plans:*** Continue development of beam control technologies for laser weapon use on multiple platforms (aircraft, ground vehicles and shipboard systems) in stressing environments. Continue development of a predictive avoidance fire control system for use on multiple platforms. Continue execution of a program for kill assessment technologies. Continue joint beam control efforts to develop hardware and technologies to improve throughput efficiency through the beam director, decrease component weight, and improve tracking and compensation through the atmosphere. Select additional programs for Service specific applications.			
Title: Lethality Research ***Description:*** Conduct laser vulnerability experiments on materials, components, and targets. Develop a lethality database, and integrate into a systems-level architecture plan and lethality models. ***FY 2016 Accomplishments:*** Integrated lethality data into campaign-level HEL system level models. Conducted laser vulnerability experiments on materials, components, and targets. Continued development of an unmanned air vehicle vulnerability module for integration into the modeling and simulation toolkit. Continued development of a suite of directed energy weapon (DEW) tools to be used in a database from which the warfighter can assess target vulnerabilities and mission utility for a given DEW platform and engagement. ***FY 2017 Plans:*** Continue to integrate recent lethality data into campaign-level HEL system models. Conduct laser vulnerability experiments on additional materials, components, and targets. Continue the development of a suite of DEW tools to be used in a database from which the warfighter can assess target vulnerabilities and mission utility for a given DEW platform and engagement. ***FY 2018 Plans:*** Continue to integrate recent lethality data into campaign-level HEL system models. Conduct laser vulnerability experiments on materials, components, and targets. Continue development of a suite of DEW tools to be used in a database from which the	3.220	3.720	4.095

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C. Accomplishments/Planned Programs ($ in Millions)	FY 2016	FY 2017	FY 2018
warfighter can assess target vulnerabilities and mission utility for given DEW platform and engagement using standard Joint Munitions Effectiveness Standards criteria.			
Title: High Energy Laser Modeling	3.140	3.640	4.014
Description: Maintain and evaluate high-fidelity engineering models for HEL system scenario evaluation and incorporation into the HEL toolkit. Provide for HEL system modeling for mission-level war gaming activities. ***FY 2016 Accomplishments:*** Provided maintenance, verification, validation, and accreditation for updated system level HEL models, continued validation and verification of HEL models. Conducted mission-level HEL engagement scenarios and wargame HEL concepts. Created a Model Based Systems Engineering (MBSE) framework that provides criteria for design, test, and investment of a full system represented by an end-to-end model. Validated databases plus models provide accurate performance envelopes for advanced beam control tasks. Output is end-to-end model incorporating upgraded components and demonstration of new engagement capability. Continued analysis of scenario conditions to understand relative gains in hardware developments. ***FY 2017 Plans:*** Provide continued maintenance, verification, validation, and accreditation for updated system level HEL models. Conduct additional mission-level HEL engagement scenarios and wargame HEL concepts. Continue to update atmospheric data into theater models to support performance characterization tables. Support risk assessment for the unintentional illumination of air and space objects by tactical laser weapons. ***FY 2018 Plans:*** Provide continued maintenance, verification, validation, and accreditation for updated system level HEL models. Collaborate with Service sponsored field test planning to correlate model predictions to measured data for surface, maritime and aerospace environments. Continue to update atmospheric data into theater models to support performance characterization tables. Conduct verification and validation planning to support advanced beam control objectives.			
Accomplishments/Planned Programs Subtotals	39.155	42.300	43.049

D. Other Program Funding Summary ($ in Millions)

N/A

Remarks

E. Acquisition Strategy

N/A

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F. Performance Metrics

Please refer to the Performance Base Budget Overview Book for information on how Air Force resources are applied and how those resources are contributing to Air Force performance goals and most importantly, how they contribute to our mission.