Exhibit R-2, RDT&E Budget Item Justification: PB 2019 Air Force											Date: February 2018	

Appropriation/Budget Activity
3600: *Research, Development, Test & Evaluation, Air Force I* BA 2: *Applied Research*

R-1 Program Element (Number/Name)
PE 0602890F *I High Energy Laser Research*

COST ($ in Millions)	Prior Years	FY 2017	FY 2018	FY 2019 Base	FY 2019 OCO	FY 2019 Total	FY 2020	FY 2021	FY 2022	FY 2023	Cost To Complete	Total Cost
Total Program Element	-	39.545	43.049	43.359	0.000	43.359	44.221	45.103	46.019	46.948	Continuing	Continuing
625096: *High Energy Laser Research*	-	39.545	43.049	43.359	0.000	43.359	44.221	45.103	46.019	46.948	Continuing	Continuing

A. Mission Description and Budget Item Justification

This program funds Department of Defense high energy laser applied research through the Joint Directed Energy Transition Office. This program is part of an overall Department of Defense high energy laser Science and Technology program. High energy laser 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. High energy lasers have the potential to perform a wide variety of military missions including high value asset and base protection, precision strike and platform self-protection vs. a wide variety of missile, rocket, artillery, mortar and air platforms. Efforts funded under this program are generally chosen for their potential to have an impact on multiple high energy laser 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 supports the Senior Official as required. Efforts in this program have been coordinated through the Department of Defense Science and Technology Executive Committee process to harmonize efforts and eliminate duplication.

This program element may include necessary civilian pay expenses required to manage, execute, and deliver science & technology capabilities. The use of program funds in this PE would be in addition to the civilian pay expenses budgeted in program elements 0601102F, 0602102F, 0602201F, 0602202F, 0602203F, 0602204F, 0602601F, 0602602F, 0602605F, 0602788F, 1206601F, and 0602298F.

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.

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B. Program Change Summary ($ in Millions)	FY 2017	FY 2018	FY 2019 Base	FY 2019 OCO	FY 2019 Total
Previous President's Budget	42.300	43.049	43.685	0.000	43.685
Current President's Budget	39.545	43.049	43.359	0.000	43.359
Total Adjustments	-2.755	0.000	-0.326	0.000	-0.326
• 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	-1.269	0.000			
• SBIR/STTR Transfer	-1.486	0.000			
• Other Adjustments	0.000	0.000	-0.326	0.000	-0.326

Change Summary Explanation

Decrease in FY 2017 reflects reprogramming to support Research and Development Projects, 10 U.S.C. Section 2358.

C. Accomplishments/Planned Programs ($ in Millions)	FY 2017	FY 2018	FY 2019
Title: Solid State Laser Technologies	7.650	7.650	9.185
Description: Mature technologies that will provide system level performance commensurate with fieldable laser devices. *FY 2018 Plans:* 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. Reduce technical risk in solid state lasers for inclusion in future laser weapon systems. Conduct trade space analysis to understand performance, fielding, robustness and integration issues for military platforms. *FY 2019 Plans:* Continue to develop high reliability, lower cost, efficient and high temperature diode pump sources. Continue to scale alternate laser wavelengths to additional militarily relevant uses and power levels. Investigate high power fiber technologies. Continue to reduce technical risk in solid state lasers for inclusion in future laser weapon systems. Continue trade space analysis to understand performance, fielding, robustness and integration issues for military platforms. *FY 2018 to FY 2019 Increase/Decrease Statement:* FY 2019 increased compared to FY 2018 by $1.535 million. Justification for this increase is increased emphasis in solid state laser technologies.			
Title: Advanced High Energy Laser Technologies	6.210	6.210	6.100

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C. Accomplishments/Planned Programs ($ in Millions)	FY 2017	FY 2018	FY 2019
Description: Investigate new technologies that have revolutionary potential for high energy lasers. *FY 2018 Plans:* Explore advanced concepts for laser technologies that will improve efficiency and decrease mass and volume for future laser weapon systems. Evaluate materials for high energy laser applications. Improve understanding of short-pulse laser technologies to include material interaction and propagation. Scale electrically-pumped alkali vapor lasers to higher kilowatt class power levels. Characterize and understand the physics of high energy laser atmospheric propagation in adverse environmental conditions such as fog, rain, smoke and dust. Evaluate and test Avoidance and Air Space De-confliction systems on high energy laser test ranges. Collaborate with the international laser development community. Validate predictive models through analysis of atmospheric propagation data and measurements. *FY 2019 Plans:* Continue to explore advanced concepts for laser technologies that will improve efficiency and decrease mass and volume for future laser weapon systems. Continue to evaluate materials for high energy laser applications. Continue to improve understanding of short-pulse laser technologies to include material interaction and propagation. Continue to scale electrically-pumped alkali vapor lasers to higher kilowatt class power levels. Continue to characterize and understand the physics of high energy laser atmospheric propagation in adverse environmental conditions such as fog, rain, smoke and dust. Continue to evaluate and test Avoidance and Air Space De-confliction systems on high energy laser test ranges. Continue to collaborate with the international laser development community. Validate predictive models through analysis of atmospheric propagation data and measurements. *FY 2018 to FY 2019 Increase/Decrease Statement:* FY 2019 decrease compared to FY 2018 by $0.110 million. Justification for this decrease is described in plans above.			
Title: Laser Beam Control Technologies *Description:* Develop technology to support high performance beam control systems and integrated demonstrations. *FY 2018 Plans:* Develop beam control technologies for laser weapon use on multiple platforms (aircraft, ground vehicles and shipboard systems) in stressing environments. Develop predictive avoidance fire control systems for use on multiple platforms. Develop kill assessment technologies. Develop hardware and technologies to improve throughput efficiency through the beam director, decrease component weight, and improve tracking and compensation through the atmosphere for joint beam control. Select additional programs for service-specific applications. *FY 2019 Plans:*	18.325	21.080	22.174

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C. Accomplishments/Planned Programs ($ in Millions)	**FY 2017**	**FY 2018**	**FY 2019**
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 to FY 2019 Increase/Decrease Statement:*** FY 2019 increase compared to FY 2018 by $1.094 million. Justification for this increase is increased emphasis laser bean control technologies.			
Title: High Energy Laser 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 2018 Plans:*** Integrate lethality data into campaign-level high energy laser system models. Conduct laser vulnerability experiments on materials, components, and targets. Develop a suite of directed energy weapon tools to be used in a database from which the warfighter can assess target vulnerabilities and mission utility for given directed energy weapon platform and engagement. Develop warfighter tools employing service and agencies metrics and criteria such as the Joint Munitions Effectiveness Standards. ***FY 2019 Plans:*** Continue to integrate lethality data into campaign-level high energy laser system models. Continue to conduct laser vulnerability experiments on materials, components, and targets. Continue to develop a suite of directed energy weapon tools to be used in a database from which the warfighter can assess target vulnerabilities and mission utility for given directed energy weapon platform and engagement. Continue to develop warfighter tools employing service and agencies metrics and criteria such as the Joint Munitions Effectiveness Standards. ***FY 2018 to FY 2019 Increase/Decrease Statement:*** FY 2019 decreased compared to FY 2018 by $0.595 million. Justification for this decrease is described in plans above.	3.720	4.095	3.500
Title: High Energy Laser Modeling ***Description:*** Maintain and evaluate high-fidelity engineering models for high energy laser system scenario evaluation and incorporation into the high energy laser toolkit. Provide atmospheric propagation and high energy laser system modeling for mission-level war-gaming activities.	3.640	4.014	2.400

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C. Accomplishments/Planned Programs ($ in Millions)	FY 2017	FY 2018	FY 2019
FY 2018 Plans: Provide maintenance, verification, validation, and accreditation for updated system level atmospheric propagation and high energy laser models. Collaborate with service-sponsored field-test planning to correlate model predictions with measured data for surface, maritime and aerospace environments. Incorporate atmospheric data into theater models to support performance characterization tables. Conduct verification and validation planning to support advanced beam control objectives, diagnostics and warfighter tools. *FY 2019 Plans:* Continue to provide maintenance, verification, validation, and accreditation for updated system level atmospheric propagation and high energy laser models. Continue to collaborate with service-sponsored field-test planning to correlate model predictions with measured data for surface, maritime and aerospace environments. Continue to incorporate atmospheric data into theater models to support performance characterization tables. Continue to conduct verification and validation planning to support advanced beam control objectives, diagnostics and warfighter tools. *FY 2018 to FY 2019 Increase/Decrease Statement:* FY 2019 decreased compared to FY 2018 by $1.614 million. Justification for this decrease is decreased emphasis in high energy laser modeling.			
Accomplishments/Planned Programs Subtotals	39.545	43.049	43.359

D. Other Program Funding Summary ($ in Millions)
 N/A
Remarks

E. Acquisition Strategy
 N/A

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.