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Exhibit R-2a, RDT&E Project Justification							Date: February 2003	
Appropriation/Budget Activity RDT&E, Defense Wide/BA 1				Project Name and Number * High Energy Laser Initiative PE 601108D8Z				
Cost (\$ in millions)	FY 2002	FY 2003	FY 2004	FY 2005	FY 2006	FY 2007	FY 2008	FY 2009
Total Program Element (PE) Cost	11.785	11.666	0	0	0	0	0	0
High Energy Laser Initiative/P108	11.785	11.666	0	0	0	0	0	0

A. Mission Description and Budget Item Justification:

(U) BRIEF DESCRIPTION OF ELEMENT

*** Beginning in FY 2004, High Energy Laser Initiative program management and execution responsibilities will be transferred to the Air Force under PE-0601108F and will result in a more appropriate policy-level role for OSD.**

(U) This program element funds basic research aimed at developing fundamental scientific knowledge to support future DOD high-energy-laser (HEL) systems. HEL weapons systems have many potential advantages, including speed-of-light time-to-target, high precision, nearly unlimited magazine depth, low cost per kill, and reduced logistics requirements because of no need for stocks of munitions or warheads. As a result, HELs have the potential to perform a wide variety of military missions, including some that are impossible, or nearly so, for conventional weapons. These include interception of ballistic missiles in boost phase, defeat of high-speed, maneuvering anti-ship and anti-aircraft missiles, and the ultra-precision negation of targets in urban environments with no collateral damage. Research conducted under this program element develops the technology necessary to enable these and other HEL missions.

(U) This program element is part of an overall DOD initiative in HEL science and technology being conducted by the HEL Joint Technology Office (JTO). The goals of this HEL JTO funded research are to provide the technology to make HEL systems more effective and also to make them lighter, smaller, cheaper, and more easily supportable on the battlefield. In general, efforts funded under this program element are chosen for their potential to have major impact on multiple HEL systems and on multiple Service missions. As a result of this focus and of close coordination with the military departments and defense agencies, this program element complements other DOD HEL programs that are directed at more specific Service and agency needs.

(U) A broad range of technology is addressed in key areas such as chemical lasers, solid-state lasers, beam control, optics, propagation, and free-electron lasers. Research is conducted principally by universities, but also by Government laboratories and industry. The program element funds theoretical, computational, and experimental investigations. In many cases, these three types of investigations are combined under a single effort, thereby creating synergistic effects between various scientific approaches, and greatly enhancing the potential for making important breakthroughs in HEL-related technologies. DOD intends to translate the knowledge developed under this program element into proof-of-concept solutions to broadly defined HEL-related military problems as part of further laboratory experiments and field-testing.

B. Accomplishments/Planned Program

(U) The majority of funds from this program element were used to support university-led multidisciplinary basic research in areas applicable to DOD's HEL program. Each research topic is being investigated by one or more teams of researchers representing different academic disciplines. The projects are closely monitored by the military departments and defense agencies for breakthrough advances that can be rapidly transitioned to DOD HEL applied-research and advanced-technology-development programs. Using a competitive process designed to select only the highest payoff proposals, DOD selected projects to fund in accordance with the six topic areas listed in the FY 2002 multidisciplinary research solicitation:

	FY 2002	FY 2003	FY 2004	FY 2005
Solid State Lasers	2.361	2.215	0	0

(U) Solid-State Lasers

(U) **FY 2002 Accomplishments:** Fundamental research in solid-state lasers. This research focuses on the development of scientific knowledge needed for revolutionary advances in fieldable high-brightness and high-power diode-pumped solid-state lasers. Over the long term, solid state lasers, because they run on electricity, promise to greatly simplify logistics requirements. Achieving this promise, however, requires that cost, power, and efficiency barriers be breached. To enable these developments, research areas of interest include laser materials with large fluorescence lifetime and cross-section and the ability to operate at high temperatures, athermal laser gain media, modular and scalable architectures for laser power scaling, means of increasing efficiency to in excess of 20%, operation in harsh environments, and corrections for thermally induced distortions in gain media.

(U) **FY 2003 Plans:** Pursuant to the nature of the university-led multidisciplinary research initiative (MRI) program, all of the new start efforts that were funded through this program element during FY 2002 will be receiving funding for the continuation of the technical efforts during FY 2003 through FY 2005. The MRI projects are part of the Congressionally directed effort to develop a DOD wide comprehensive, prioritized investment plan for HEL science and technology. There are no significant changes to the investment plan that would result in the termination of any of the competitively selected FY 2002 projects. The projects will continue to be closely monitored by the military departments and defense agencies for breakthrough advances that can be rapidly transitioned to DOD HEL applied-research and advanced-technology-development programs.

	FY2002	FY 2003	FY 2004	FY 2005
Beam Control	1.744	1.905	0	0

(U) Beam Control

(U) **FY 2002 Accomplishments:** Fundamental research in high power, lightweight optics. This research focuses on technology development that addresses advanced technological elements and concepts relevant to the development of lightweight optics for HEL systems. This research will be aimed at greatly reducing weight while simultaneously improving performance and reducing cost, issues of importance to all potential military HEL systems, particularly space-based systems. Areas of interest include basic materials and fabrication techniques, large optics lightweight structure and deployment concepts, HEL optical coatings, multipurpose materials (e.g., wavefront correction combined with aperture adjustment), and control mechanisms.

(U) **FY 2003 Plans:** Pursuant to the nature of the university-led multidisciplinary research initiative (MRI) program, all of the new start efforts that were funded through this program element during FY 2002 will be receiving funding for the continuation of the technical efforts during FY 2003. The MRI projects are part of the Congressionally directed effort to develop a DOD wide comprehensive, prioritized investment plan for HEL science and technology. There are no significant changes to the investment plan that would result in the termination of any of the competitively selected FY 2002 projects. The projects will continue

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	FY 2002	FY 2003	FY 2004	FY 2005
Atmospheric Characterization	3.496	3.450	0	0

(U) Atmospheric Characterization

(U) FY 2002 Accomplishments: This research focuses on the scientific concerns associated with atmospheric beam control, to include characterization efforts in aerial, battlefield, and maritime-like environments. These efforts could lead to substantial increases in the lethality of HEL systems without the need for ever-higher power levels. Areas of interest include improved theoretical and computer-based analysis of propagation effects, advanced wavefront sensing and reconstruction (especially in the presence of thermal blooming), the effects of extended reference sources used for wavefront correction, and new concepts for effective wavefront sensing and correction, especially under high-scintillation conditions.

(U) FY 2003 Plans: Pursuant to the nature of the university-led multidisciplinary research initiative (MRI) program, all of the new start efforts that were funded through this program element during FY 2002 will be receiving funding for the continuation of the technical efforts during FY 2003. The MRI projects are part of the Congressionally directed effort to develop a DOD wide comprehensive, prioritized investment plan for HEL science and technology. There are no significant changes to the investment plan that would result in the termination of any of the competitively selected FY 2002 projects. The projects will continue to be closely monitored by the military departments and defense agencies for breakthrough advances that can be rapidly transitioned to DOD HEL applied-research and advanced-technology-development programs.

	FY2002	FY 2003	FY 2004	FY 2005
Chemical Lasers	1.229	1.184	0	0

(U) Chemical Lasers

(U) FY 2002 Accomplishments: Fundamental research in chemical lasers. This research focuses on improving the understanding of the processes necessary for the realization of truly closed cycle, lightweight, high-power, continuously operating chemical lasers. A completely closed cycle chemical-laser HEL weapon would require only electrical power and not expensive, heavy exhaust systems or chemical supplies, thereby capitalizing on the high efficiencies inherent in the chemical-laser process, while enhancing supportability. Areas of interest include studies of chemical processes and reactions for a closed-cycle chemical-laser system, new sources of the high-energy chemical species needed to produce the lasing event, and novel recovery systems for regeneration of the laser fuels.

(U) FY 2003 Plans: Pursuant to the nature of the university-led multidisciplinary research initiative (MRI) program, all of the new start efforts that were funded through this program element during FY 2002 will be receiving funding for the continuation of the technical efforts during FY 2003. The MRI projects are part of the Congressionally directed effort to develop a DOD wide comprehensive, prioritized investment plan for HEL science and technology. There are no significant changes to the investment plan that would result in the termination of any of the competitively selected FY 2002 projects. The projects will continue to be closely monitored by the military departments and defense agencies for breakthrough advances that can be rapidly transitioned to DOD HEL applied-research and advanced-technology-development programs.

	FY 2002	FY 2003	FY 2004	FY 2005
Free Electron Lasers	1.835	1.700	0	0

(U) Free Electron Lasers

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(U) **FY 2002 Accomplishments:** Fundamental research in high-average-power ultra-short-pulse free-electron lasers (FELs). This research will advance the average power obtainable by ultra-short-pulse FELs significantly over the current state-of-the-art, while increasing efficiency and lethality and decreasing relative size and cost, thus enhancing opportunities for eventual weaponization of FELs for military applications. Areas of interest include high-current devices and control methods, higher damage threshold resonator optics, advanced optical cavity designs for high power and compact spaces, design methods for scaling FELs to reach multi-megawatt class average power levels.

(U) **FY 2003 Plans:** Pursuant to the nature of the university-led multidisciplinary research initiative (MRI) program, all of the new start efforts that were funded through this program element during FY 2002 will be receiving funding for the continuation of the technical efforts during FY 2003. The MRI projects are part of the Congressionally directed effort to develop a DOD wide comprehensive, prioritized investment plan for HEL science and technology. There are no significant changes to the investment plan that would result in the termination of any of the competitively selected FY 2002 projects. The projects will continue to be closely monitored by the military departments and defense agencies for breakthrough advances that can be rapidly transitioned to DOD HEL applied-research and advanced-technology-development programs.

	FY 2002	FY 2003	FY 2004	FY 2005
Modeling and Simulation	1.120	1.212	0	0

(U) **Modeling and Simulation**

(U) **FY 2002 Accomplishments:** The objectives of the effort are: (1) to develop a tri-service research team to integrate DoD fundamental research in end-to-end HEL modeling; and (2) to develop a government-owned, DoD-accepted global interface, which integrates existing and future HEL models. The initial focus achieves a balance between (1) on-going, high-fidelity technical analyses, (2) engineering trade studies, which allow analyses of a wide range of systems, not simply a deep analysis of any one selected system, and (3) analyses of HEL systems' military utility against a broad range of missions.

(U) **FY 2003 Plans:** Pursuant to the nature of the university-led multidisciplinary research initiative (MRI) program, all of the new start efforts that were funded through this program element during FY 2002 will be receiving funding for the continuation of the technical efforts during FY 2003. The MRI projects are part of the Congressionally directed effort to develop a DOD wide comprehensive, prioritized investment plan for HEL science and technology. There are no significant changes to the investment plan that would result in the termination of any of the competitively selected FY 2002 projects. The projects will continue to be closely monitored by the military departments and defense agencies for breakthrough advances that can be rapidly transitioned to DOD HEL applied-research and advanced-technology-development programs.

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C. Other Program Funding Summary.

D. Acquisition Strategy.

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