RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)									DATE June 2001	
APPROPRIATION/BUDGET ACTIVITY RDT&E, Defense Wide/BA 1							R-1 ITEM NOMENCLATURE High Energy Laser Initiative **PE 0601108D8Z**			
COST *(In Millions)*	FY2000	FY2001	FY2002						Cost to Complete	Total Cost
Total Program Element (PE) Cost	0.000	0.000	11.877						Continuing	Continuing
High Energy Laser/P108	0.000	0.000	11.877						Continuing	Continuing

(U) A. Mission Description and Budget Item Justification

(U) BRIEF DESCRIPTION OF ELEMENT

(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 recently formed 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.

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(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.

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High Energy Laser /P108	0.000	0.000	11.877						Continuing	Continuing

(U) Project Number and Title: P108 High Energy Laser

(U) PROGRAM ACCOMPLISHMENTS AND PLANS

(U) FY 2001 Accomplishments:

(U) None; this program element is a new initiative as of FY 2002.

(U) FY 2002 Plans:

(U) Funds will be used to support university-led multidisciplinary basic research in areas applicable to DOD's HEL program. Each research topic will be investigated by one or more teams of researchers representing different academic disciplines. The projects will 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. Using a competitive process designed to select only the highest payoff proposals, DOD intends to fund six topic areas:

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- (U) Fundamental research in solid-state lasers. This research will seek to develop the 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) Fundamental research in affordable HEL fiber-laser modules. This research will examine the scientific concerns involved in developing and producing low-cost, manufacturable modules in the 100 Watt to kilowatt range and in developing methods to combine modules to achieve the weapons power levels. The focus on affordability could lead to drastic reductions in acquisition cost for future HEL systems. Areas of interest include laser materials and devices, nonlinear optical phenomena at high power levels, reliable and low-cost design techniques, and integrated optics and beam/pulse forming.
- (U) Fundamental research in modeling, design, and simulation of beam-control systems for military HEL applications. This research will examine 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) Fundamental research in high power, lightweight optics. This research will attempt to establish a multidisciplinary program 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.

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- (U) Fundamental research in chemical lasers. This research will focus on improved 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) 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) Funds from this program element will also support research on specific HEL-related problems for which fundamental scientific research promises to offer innovative and revolutionary solutions, and which are amenable to solution by a small team from a single academic discipline. The areas of interest include, but are not limited to: beam-control theory, propagation analysis and measurement, chemical-laser mixing and diagnostics, solid-state-laser materials and design concepts, modeling and simulation of HELs, and education and training of HEL scientists and engineers for public and private-sector service.

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(U) B. Program Change Summary	**FY 2000**	**FY 2001**	**FY 2002**						**Total Cost**
Previous President's Budget Submit	0.000	0.000	0.000						
Appropriated Value	0.000	0.000	0.000						Continuing
Adjustments to Appropriated Value									
a. Congressionally Directed Undistributed Reduction	0.000	0.000	0.000						
b. Rescission/Below-threshold Reprogramming, Inflation Adjustment	0.000	0.000	0.000						
c. Other	0.000	0.000	11.877						
Current President's Budget	0.000	0.000	11.877						Continuing

Change Summary Explanation

(U) **Funding**: PE 0601108D8Z is a new PE established for FY 2000-2007 to better balance research in new revolutionary laser technology with large demonstration programs.

(U) **Schedule**:

(U) **Technical**:

(U) C. OTHER PROGRAM FUNDING SUMMARY COST:

(U) D. ACQUISITION STRATEGY:

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(U) E. SCHEDULE PROFILE: