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| <b>MDA RDT&amp;E BUDGET ITEM JUSTIFICATION (R-2 Exhibit)</b> | DATE<br><b>February 2002</b> |
|--|------------------------------|

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|--|---|-------------------------------|
| <b>BUDGET ACTIVITY</b><br><b>3 - Advanced Technology Development</b> | <b>PE NUMBER AND TITLE</b><br><b>0603174C Space Based Laser</b> | <b>PROJECT</b><br><b>1360</b> |
|--|---|-------------------------------|

| COST (In Thousands)          | FY2001 Actual | FY 2002 Estimate | FY 2003 Estimate | FY 2004 Estimate | FY 2005 Estimate | FY 2006 Estimate | FY2007 Estimate | Cost to Complete | Total Cost |
|------------------------------|---------------|------------------|------------------|------------------|------------------|------------------|-----------------|------------------|------------|
| 1360 Directed Energy Program | 69595         | 0                | 0                | 0                | 0                | 0                | 0               | 0                |            |

The Ballistic Missile Defense (BMD) Program and resulting FY 2002 President's Budget request has been developed based on revised Secretary of Defense direction to develop capabilities to defend against the missile threat and sustain appropriate deterrence levels. Beginning in FY 2002, funding from this Program Element (PE) is moved to the Ballistic Missile Defense Organization (BMDO) PE 0603883C to facilitate BMD system capability evolution, allow timely responses and reactions to changes in the BMD program, and provide the programmatic agility to mitigate unforeseen consequences.

**A. Mission Description and Budget Item Justification**

**Introduction:**

- This program element (0603174C, formerly part of PE 0603173C), the Space Based Laser (SBL) project, project number 1360, and the companion Air Force (AF) program element (0603876F) fund technology development efforts for the boost phase intercept concept that can provide national missile defense and operate in all theaters, regardless of size, geometry, or weather conditions.
- FY 2001 will be the first year under the new PE 0603174C. FY 2000 funding for the SBL project from BMDO PE 0603173C and from AF PE 0603876F are identified in Section C.
- A constellation of 20 to 40 SBL platforms would provide overlapping continuous, global coverage against missile threats. An SBL system could defend against missiles without putting the lives of US military personnel at risk. With its long range and speed-of-light engagement capability, it accomplishes boost phase intercept at the earliest possible moment, offering the highest probability that intercepted missile fragments (possibly containing active chemical/biological or nuclear materials) will fall within the attackers territory, not on defended assets. Each SBL platform would be provided with an initial fuel load and on-orbit refueling capability.
- The SBL project was structured to address the key critical technical issues:
  1. Can a chemical laser be built powerful enough to destroy a missile at militarily useful ranges? (Alpha program)
  2. Can mirrors and optics be built large enough and easily enough? (Large Advanced Mirror Program (LAMP) and Large Optical Segment (LOS))
  3. Can the high power beam be controlled adequately? (Large Optics Demonstration Experiment, (LODE))
  4. Can the high power components of a Space Based Laser be integrated on the ground and operated as a system? (Alpha LAMP Integration (ALI))
  5. Can missile targets be acquired and tracked from space and can a laser be pointed and fired accurately enough? (Acquisition, Tracking, Pointing, and Fire Control (ATP/FC))
  6. Can these key components be integrated into a functional unit suitable for space flight and remote operation? (Space Based Laser integrated ground demonstration known as the Integrated Test Unit (ITU))
  7. Can the fully integrated system operate adequately on-orbit? (SBL Integrated Flight Experiment (IFX)).

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| <p><b>Progress To Date:</b></p> <ul style="list-style-type: none"> <li>• The Project demonstrated the answers to questions 1 through 4 (and partially 5) and has built devices to perform the respective functions. <ol style="list-style-type: none"> <li>1. The Alpha program high-energy chemical laser achieved weapons-class power in 1991.</li> <li>2. LAMP and LOS demonstrated the ability to build optics of the required dimensions with the successful fabrication of a 4-meter segmented mirror in 1989 and a key segment of an 11 meter mirror in 1993.</li> <li>3. The Large Optics Demonstration Experiment (LODE) demonstrated the ability to control the projected (or outgoing) beam in low power laser experiments in 1987.</li> <li>4. The Alpha LAMP Integration (ALI) experiment demonstrated integrated open loop and closed loop fast steering mirror (FSM) and deformable mirror (DM) system operation in 1997.</li> <li>5. The basic technologies of acquiring and tracking missiles and pointing a high power laser beam from ground and space were demonstrated by a number of programs. The necessary ATP/FC technologies (sensors, optics, processors, etc.) were demonstrated at or near performance levels required for the SBL system. Stable low power laser beam pointing from a space platform was demonstrated at the precision level required for an operational SBL in 1991 during the flight of the Relay Mirror Experiment (RME).</li> </ol> </li> <li>• The high power components of an SBL payload were integrated at the Capistrano Test Site (CTS) and successfully achieved project objectives, thereby validating the SBL beam generation and control concepts. The ALI experiment successfully achieved all of its objectives: <ol style="list-style-type: none"> <li>6. The integration of the Alpha high power laser with a LODE-derived beam control system and a beam expanded using the LAMP 4 meter mirror</li> <li>7. The use of uncooled optics in a high power beam train; and 3) the high power operation of the integrated hardware (LAMP with Holographic Optical Elements (HOEs), Outgoing Wavefront Sensor (OWS) behind the secondary mirror, and FSM and DM control optics). On 20 Feb 1997, the first integrated high power test of SBL technologies was successfully conducted at CTS. The second high power test was completed on 16 Jul 1997, with the OWS controlling the steering of the high power beam through the 4-meter LAMP mirror. The third, and final, high power test of the ALI experiment was completed on 22 October 1997, with the OWS controlling the steering and wavefront error of the high power beam through the 4 meter LAMP mirror. The water-cooled deformable mirror was replaced by an uncooled deformable mirror, and it performed successfully during a high power test on 9 June 1998.</li> </ol> </li> <li>• By previous guidance in PBD 224C (28 Dec 1998) the BMDO and United States Air Force SBL project is pursuing an integrated ground demonstration. It is known as the ITU. Additional guidance was provided by the Under Secretary of Defense for Acquisition, Technology and Logistics (USD (AT&amp;L)) memorandum to BMDO Director dated 25 Feb 1999) to structure a project plan leading to an SBL IFX in FY 2012/2013. Furthermore, the SBL project has been designated as a Pre-Major Defense Acquisition Program (MDAP) by the Under Secretary of Defense for Acquisition and Technology. A contract was awarded 8 February 1999 conveying total system authority (TSA) on a Joint Venture (JV) Team comprised of Lockheed Martin, TRW, and Boeing. Under TSA the government specifies broad objectives, and the JV is responsible for the content of the SBL IFX, including the ITU.</li> <li>• Stennis Space Center was selected as the site for the Performance Test Facility in January 2001.</li> <li>• Testing of a linear array of hypersonic low temperature (HYLTE) gain generator nozzles with the potential for more efficient laser operation was successful. Testing continues, and fabrication techniques for a cylindrical gain generator are being demonstrated. Phase conjugation is being explored for application to an advanced, possibly upgraded, operational system.</li> </ul> <p><b>Current Status:</b></p> |                   |                           |
| Project 1360   | Page 2 of 4 Pages | Exhibit R-2 (PE 0603174C) |

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- In FY 1999-2000, a space high energy laser (HEL) affordability and architecture study (A&AS) was conducted to determine if technically- or mission-derived constraints have changed sufficiently such that the SBL concept is no longer the most cost effective solution as determined by similar studies in the past.

**FY 2001 Accomplishments:**

- 56917 SBL Integrated Flight Experiment – Conduct IFX System Requirements Review (SRR); Continued fabrication, risk reduction, and design validation efforts for the laser, beam control system, beam expander, and ATP/FC.
- 5923 Mission Definition and Requirements Analysis – Continued operational system concept definition and alternate technology roadmap development; Updated the operational system baseline minimum technical data set; Continued operations concept and objectives development with AF Space Command; Continued lethality and system effectiveness assessments.
- 6755 Government IFX Support-provided programmatic support. Interface with IFX contractors, AF Space Command, and other participants in the SBL program.

Total 69595

**FY 2002 Planned Program:**

Beginning in FY 2002, funding from this Program Element is moved to the Missile Defense Agency (MDA) Program Element 0603883C – see corresponding R-documents for FY 2002 Planned Program.

| <b><u>B. Program Change Summary</u></b>         | <u>FY 2001</u> | <u>FY 2002</u> | <u>FY 2003</u> |
|---|----------------|----------------|----------------|
| Previous President's Budget (FY 2002, PB)       | 74537          |                |                |
| Appropriated Value                              | 74537          |                |                |
| Adjustments to Appropriated Value               |                |                |                |
| a. Congressional General Reductions             | -825           |                |                |
| b. SBIR / STTR                                  | -1624          |                |                |
| c. Internal Realignment                         | -2493          |                |                |
| Adjustments to Budget Years Since FY 2002 PB    |                |                |                |
| Current Budget Submit (FY 2003 Budge Estimates) | 69595          |                |                |

Change Summary Explanation:

BMDO funded its half of the joint AF / BMDO SBL Project from PE 0603174C "Space Based Laser" during FY 2001. BMDO transferred all SBL Project funding from PE 0603174C to BMDO PE 0603883C "Boost Defense Segment" beginning in FY 2002.

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**3 - Advanced Technology Development**

PE NUMBER AND TITLE  
**0603174C Space Based Laser**

PROJECT  
**1360**

**C. Other Program Funding Summary (\$ in Thousands)**

|                                   | <u>FY2001</u> | <u>FY2002</u> | <u>FY2003</u> | <u>FY2004</u> | <u>FY2005</u> | <u>FY2006</u> | <u>FY2007</u> | <u>Cost to Complete</u> | <u>Total Cost</u> |
|-----------------------------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|-------------------------|-------------------|
| Space Based Laser, AF PE 0603876F | 67414         |               |               |               |               |               |               |                         |                   |