Space Weapon Related Programs
in the FY 2005 Budget Request

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Introduction and Budget Overview

The annual budget process, in which the president submits a request to Congress for authorization and appropriation, provides an opportunity to shape the investment decisions that determine the shape of the U.S. military. Congress will choose not to fund some elements of the president's request, and may add funding for others that were not originally included (as the Senate did for many years with the Kinetic Energy ASAT program). Only rarely are entire programs eliminated after years of development. Such cancellations, which involve the voiding of authorized contracts, are usually done by the Executive Branch, while Congress typically acts by imposing dramatic spending cuts.

All of the defense money spent on procurement and research, development, testing & evaluation (as opposed to spending for operations & maintenance or military construction) is divided into several hundred "program elements" or "PE's." Each "program element," in turn, may include funding for a number of "projects." For example, the Counterspace Technologies program element holds funding for at least three different projects that will produce two distinct military systems to temporarily disable satellites and a third that will detect attacks on U.S. satellites (see the Counterspace Technologies factsheet below).

Program elements often have vague or misleading names and may contain seemingly unrelated projects. Moreover, some projects change program elements from one year to the next. The Missile Defense Agency, in particular, has a very obscure budgeting process in part because Congress has exempted MDA from normal oversight requirements. However, the Bush Administration and the Missile Defense Agency have explicitly included plans for a space-based layer, as well as ground- and sea-based elements, in the proposed missile defense network. This entire network will use a common set of sensors and command and control nodes. Providing support for the sensors, as Canada may find an attractive option, would support all elements of the ballistic missile defense (BMD) system, including, if it exists, a space-based layer.

In addition to the often obtuse budget terminology, many space technologies are inherently dual-use. Many technologies currently being developed for non-weapons purposes could, if successfully fielded, be combined to create space weapons. A notable example of this is laser technology: there are over 100 programs in the U.S. Department of Defense involving lasers and some 48 programs involving directed energy, but only two involving space 'unique' directed energy technology, and only certain sub-elements of these explicitly exploring force application technologies. Yet, technology such as lightweight optics, relay mirrors and precision tracking techniques could all be used for space-based weapon applications.

Therefore, it is clear that the United States is funding R&D that could, and in some cases *intends* to, provide capabilities in the next decade or so, to fight war "in, from and through" space – as is the stated objective of the U.S. Air Force.[1] Our goals are to identify the program elements or projects that are related to space-based missile defense systems, anti-satellite weapons or space-based strike weapons; to assess how close these research programs are to becoming full-fledged weapons systems; and to make recommendations about which programs should be prohibited in the authorization bill or denied funding in the appropriations bill.

The president's budget also includes six-year funding projections, called the Future Years Defense Program (FYDP). The FYDP projections are a rare indicator of the intention of the White House and the Office of the Secretary of Defense. For example, the president's commitment to the "development and testing of space-based defenses" outlined in the National

[1] See, for example, "Air Force Space Command Strategic Master Plan FY06 and Beyond," October 2003; or "Air Force Transformation Flight Plan," November 2003.

Policy on Ballistic Missile Defense is made very clear by the large six year funding increases he proposed for the Ballistic Missile Defense Interceptors PE, which includes funding for a space-based missile defense test range.

Although many of the programs in the current budget request are long-term or dual-use in nature, it is crucial that we act on this issue now rather than later. Spending on these programs generates momentum which becomes more difficult to stop with time. Slowly ramping up the funding for programs with developing technologies of concern has the potential to desensitize policy makers and the public to the implications of their development. Moreover, this 'spiral development' process, endorsed by the Pentagon, calls for programs to be fielded as test-beds. For example, the ground-based missile defense interceptors being placed in Alaska, which are now being installed as an 'operational system,' were promoted with reassurances by officials that the system was only going to be a test-bed. The space-based interceptor test bed now envisioned for 2012 may also later be deemed "operational" once political opposition has been mitigated by claims that the deployment is intended for test purposes only. It is these considerations and more that motivate the following factsheets on selected programs within the U.S. Department of Defense budget request for Fiscal Year 2005 (FY 05).

A note about the information contained in these factsheets:

Each year the budget request is released in two stages. First, the program elements and the amount they are requesting for that year are released. Following this (sometimes up to several months later) more detailed descriptions are released which include a further breakdown of the names, descriptions, and funding request for the projects within each program element. The budget request for FY 05 can be found on the *DefenseLink* website at www.defenselink.mil/comptroller/defbudget/fy2005/index.html. The descriptive summaries, when they are released, are also posted on the *DefenseLink* website at www.defenselink.mil/comptroller/defbudget/fy2005/budget_justification/index.html under RDT&E on the left hand side. At this time (March 11, 2004), the descriptive summaries for FY 05 for the Air Force, which hosts several of the programs in question, have not been released. However, descriptive summaries for the Missile Defense Agency (MDA) and Defense Advanced Research Project Agency (DARPA) requests, both of which are independent defense agencies, have been released. These factsheets have used the most up–to-date material available. **For Air Force programs, although the amount requested is from the FY 05 request, the descriptions of the programs and projects used are from the FY 04 materia**l. A searchable database of these descriptive summaries for FY 04 and previous years is available on-line at www.dtic.mil/descriptivesum/.

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Air Force Laser Technology Programs (PE 0603500F and PE 0602500F)

Based on the descriptive summaries from the FY 04 budget request, the Air Force may be conducting anti-satellite laser research in programs such as Multi-Disciplinary Advanced Development Space Technology, and Multi-Disciplinary Space Technology. Further, there are a host of other laser technology development and testing programs that are pursuing technologies which, although not explicitly for this purpose, if applied to space-based lasers or space-based laser components, would likely enable those capabilities in a way not possible otherwise.

Program Element Name	Program Element Number	Agency	FY 04 Request	FY 04 Appropriated	FY 05 Projected Request	FY 05 Actual Request
Multi-Disciplinary Space Technology	0602500 F	USAF	$90.5M	$101.4M	$91.2M	$84.6M
Note: Contained $0.6M in 2003 and $2.1M in 2004 explicitly for anti-satellite research in the Laser & Imaging Space Technology sub-element.)						
Multi-Disciplinary Adv Dev Space Tech	0603500 F	USAF	$62.6M	$62.1 M	$54.151M	$51.1M
Note: Contained $8.2M in 2003 and $5.3M in 2004 explicitly for anti-satellite research in the Advanced Optics and Laser Space Technology sub-element.)						

Multi-Disciplinary Space Technology (PE 0602500F):
Laser Imaging and Space Technology (Project 5023)

The *Laser Imaging and Space Technology* sub-element contained $0.6 million in 2003 and $2.1 million in 2004 to "[a]ssess the vulnerability of satellites to the effects of high energy laser weapons." Another $3.0 million from this program in FY 04 included research to "[d]evelop technologies for lightweight primary mirrors applicable to bifocal relay mirrors," used for receiving and re-targeting laser beams in space. A *National Defense Magazine* article highlighting research into this technology quoted R. Earl Good, director of the Directed Energy Directorate of the Air Force Research Laboratory, as saying this was "breakthrough work towards our goal of instantaneous global power with global reach."[2] The article noted that if fielded, the Bifocal Relay Mirror Spacecraft project would orbit a constellation of 27 of the twin-mirror satellites at a 715 km altitude sometime in the next decade.[3] This appears to be the only PE funding research into space unique technologies for bifocal relay mirrors, although PE 0602605F Directed Energy Technology was also funding a small scale "bifocal relay testbed" in 2004 as part of a $1.1 million sub-sub-element in the *Lasers and Imaging Technology (Project 4866)* sub-element. While the technology has several possible applications, it does appear that there is interest in applying it for force application purposes.

Program Element Name	Program Element Number	Project (sub-element) Name	Project Number	FY 04 Request	FY 05 Projected Request*
Multi-Disciplinary Space Technology	0602500F	Laser Imaging and Space technology	5023	$5.1M	$5.1M
Note: Laser and imaging space technologies develops concepts for advanced, very long-range optical systems and assesses the vulnerability of satellites to the effects of high-energy laser weapon systems. *Note that this is the *projected* request from the FY 04 budget, and that the *actual* request for FY 05 will not be available until the Descriptive Summaries for this fiscal year are released.					

[2] "Navy, Air Force to Develop Twin-Mirror Laser-Retargeting Satellite Technology" John Stanton, National Defense Magazine, August, 2002. http://www.nationaldefensemagazine.org/article.cfm?Id=874
[3] ibid.

Multi-Disciplinary Advanced Development Space Technology (PE 0603500F):
Advanced Optics and Laser Space Technology (Project 5031)

Money in the *Advanced Optics and Laser Space Technology (Project 5031)* sub-element is used to develop, refine, and demonstrate, supporting technologies needed for laser propagation through space. It appears that this project is focused on space-based components supporting primarily ground-based laser systems. Included in this are technologies to refine and extend laser propagation, such as adaptive optics (to overcome atmospheric turbulence), beam control and stabilization, and optical coatings (generally to enhance reflectivity) and relay mirrors "to advance global strike" capabilities. A relay mirror could be used to relay the energy towards a space- or an earth-based object. The descriptive summaries note that "relay mirrors can greatly extend the range of high power laser weapons…"

This sub-element contained $8.2 million in FY 03 and $5.3 million in FY 04 explicitly for research on anti-satellite applications. "[T]esting of full aperture point-ahead atmospheric compensation system for low-power laser projection to satellites on weapons-class beam director (3.5-meter telescope)" is specified. This sounds like the testing of a system to compensate for atmospheric distortion of a "weapons-class" ground based laser, at low power. Although high power (that is, lots of energy over little time) would be required for destructive effects, low power could possibly be used to test the same beam frequency and its propagation through the atmosphere, while not actually applying a destructive force.

Program Element Name	Program Element Number	Project (sub-element) Name	Project Number	FY 04 Request	FY 05 Projected Request*
Multi-Disciplinary Advanced Development Space Technology	0603500F	Advanced Optics and Laser Space Technology	5031	$19.6M	$23.8M
Note: Advanced optics and laser space technology demonstrates and assesses space unique advanced optics and high energy laser weapon systems capabilities. *Note that this is the *projected* request from the FY 04 budget, and that the *actual* request for FY 05 will not be available until the Descriptive Summaries for this fiscal year are released.					

PEs Funding Non-Space-Unique Laser Technologies
A 3.67m telescope, of the same approximate size as that needed to test the atmospheric compensation system mentioned above, is part of the Maui Space Surveillance System (MSSS) (PE 0603444F), which had a $4.5 million request in FY 04 for "technical support to research, development, and operational users and visiting experimenters using the MSSS assets." Any funding from this PE would have been on top of the $19.6 million already going into the Advanced Optics and Laser Space Technology project. Notably, the MSSS PE (which has only one sub-element) requested $6.3 million for FY 04, but according to the FY 05 request the program actually received $51.6 million. Of the four sub-sub-elements within this PE, it is not clear which one this extra money was assigned to. The request for FY 05 is back down to $6.3 million.

PE 0603605F Advanced Weapons Technology has had space-applicable laser technologies under its wing consistently for several years. Specifically, "[t]his program provides for the development and demonstration of advanced directed energy and optical concepts that are not space unique." The FY 04 requested amount was only $27 million, but the FY 05 budget request indicates that this PE actually received $61.2 million in FY 04. The FY 05 request for this PE is $31.1 million.

Notice: Laser weapon technologies are scattered throughout many programs and sub-elements, and many space applicable technologies are being pursued in non-space-unique PEs. The diversity of existing programs suggests both that a) no one technology or system concept has

successfully matured to the point that it would justify narrowing the research focus and channeling funds towards it, but b) that the Air Force remains committed to investigating the full range of possible applications for these technologies. That is, while a system may not be deployed anytime soon, money is certainly going into these programs.

DoD DIRECTED ENERGY PROGRAMS (Cost in U.S. $ millions, FY 04*)									
Program Element Name	**Program Element Number**	**FY 02**	**FY 03**	**FY 04**	**FY 05**	**FY 06**	**FY 07**	**FY 08**	**FY 09**
High Energy Laser Research Initiatives *High Energy Laser Research Init.*	**0601108F** 5097	0.0	0.0	12.1	12.4	12.5	12.7	12.9	13.1
Multi-Disciplinary Space Tec.[1] *Laser & Imaging Space Tec.*[2]	**0602500F** 5023	0	1.2	5.1	5.1	5.4	5.4	5.4	4.7
High Energy Laser Research *High Energy Laser Research*	**0602890F** 5096	0.0	0.0	41.9	45.5	48.4	51.8	52.2	53.0
Directed Energy Technology *Lasers & Imaging Tec.* *Adv. Weapons & Survivability Tec.*	**0602605F** 4866 4867	18.8 14.7	21.8 15.8	20.6 14.7	20.9 15.4	23.9 15.7	27.2 18.0	26.5 17.3	26.3 17.3
Multi-Disciplinary Adv Dev Space Tec[1] *Adv. Optics & Laser Space Te.c*[2]	**0603500F** 5031	0	14.6	19.6	23.8	26.5	31.4	33.9	35.8
Advanced Weapons Technology *Advanced Optics Tec.* *High Power Solid State Laser Tec.* *High Power Microwave Tec.* *High Energy Laser Tec.*	**0603605F** 3150 3151 3152 3647	0 5.0 7.5 26.7	21.5 8.6 12.7 8.3	23.8 14.2 8.4 4.4	0 15.1 11.5 3.6	0 15.6 11.6 2.0	0 15.9 13.7 2.1	0 16.2 11.9 2.2	0 16.4 12.1 2.2
High Energy Laser Adv. Tec. Program *High Energy Laser Adv. Tec.*	**0603924F** 5095	0	0	10.9	8.6	6.2	3.8	3.9	4.0
DoD High Energy Laser Test Facility *DOD HELSTF*	**0605605A** E97	22.4	16.7	17.8	18.0	18.2	18.6	19.0	19.5
TOTAL		**95.1**	**121.2**	**193.5**	**179.8**	**186**	**200.6**	**210.2**	**204.2**

1. Other programs in this PE omitted.
2. Space Unique Directed Energy Programs

Summary of all DoD Directed Energy Programs in the FY 04 request, including the two developing space-unique technologies.[4]

*The programs in this table were contained in the listed PE's in the FY 04 budget request, and are therefore likely to be in the same PE's in the FY 05 budget request.

[4] Jeffrey Lewis, "Liftoff for Space Weapons? Implications of the U.S. Department of Defense's 2004 Budget Request for Space Weaponization," July 21, 2003, p.19.

Space Control Technology (PE 0603438F)

The Air Force's Space Control Technology PE supports "research, demonstration, component development and prototyping" as well as modeling, simulations, and exercises of Space Control technologies. In FY 05, U.S.A.F. is requesting $15.0 million, a half-million dollar increase over last year's money.

Program Element Name	Program Element Number	Agency	FY 04 Requested	FY 04 Appropriated	FY 05 Projected Request	FY05 Actual Request
Space Control Technology	0603438F	USAF	$14.7M	$14.5M	$15.8M	$15.0M
Note: Has contained funding in previous years for the Kinetic Energy Anti-Satellite (KEASAT) program.						

The Kinetic Energy Anti-Satellite program is funded from the Space Control Technology program element (PE 0603438F),[5] after being transferred from the Army when Defense Secretary Donald Rumsfeld designated the Air Force the "Executive Agent" for space. Although the administration has not requested funds for the Kinetic Energy Anti-Satellite program in years, the Senate has added funding for the program in six of the past nine years. In FY 04, the Senate Armed Services Committee authorized $4 million for this program.

This program supports Offensive and Defensive counterspace, as well as Space Situational Awareness, under the sub-element *Technology Insertion Planning and Analysis (Project 2611)*. These are all crucial elements of the Air Force's vision for becoming a "full spectrum space combat command."[6] Offensive counterspace capabilities are described as activities to "disrupt, deny, degrade, or destroy space systems, or the information they provide." While the descriptive summary specifies that these efforts are currently limited to technologies which have "temporary, localized and reversible effects," the mission area is defined in the "Air Force Space Command Strategic Master Plan for FY 06 and Beyond" to include in the future the "capability to create irreversible effects (degrade, destroy) against adversary space capabilities." The document goes on to note that while "this sub-mission area is currently the least urgent capability AFSPC can provide … we are proactively preparing for the future when it will become closer in importance (to Defensive Counterspace)."[7]

Emphasis in this sub-element, which requested $9.4 million in FY 04 and was expected to request the same in FY 05, is on a host of technologies likely to support advanced capabilities in the Space Control Arena, such as sensors, vulnerability assessments, communication, navigation, and surveillance techniques, including relevant counterspace technologies. $5.3 million in FY 04 included the investigation of "key technology areas such as … kinetic energy impacts" which, curiously enough, appears under *defensive* counterspace.

Also included in this PE is the *Space Range (project A007)* sub-element. The Space Range is a "virtual" test range that the Air Force intends to base at Nellis Air Force Base in Nevada in order to conduct "exercises, training, and tactics development for Space Control systems." The Space Range requested $5.3 million in FY 04.

The key challenge with this PE is that while it is not explicitly developing technologies for force application in or from space, the existing doctrine emphasizes these mission areas as key enablers for such a capability, partly justifying their pursuit *due* to these enabling characteristics. The

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[5] Jeffrey Lewis, "Liftoff for Space Weapons? Implications of the U.S. Department of Defense's 2004 Budget Request for Space Weaponization," July 21, 2003, p.12.
[6] Air Force Space Command Strategic Master Plan, FY06 and Beyond, October 2003.
[7] ibid, p. 23

fuzzy line between force enhancement and force application is blurred even further by the grouping of technologies within programs which straddle this line. Further, it lessens the public's ability to be well informed as to when that line is both defined and crossed.

PE 0603438F SPACE CONTROL TECHNOLOGY* (Cost in U.S. $ Millions)								
	FY 02	FY 03	FY 04	FY 05	FY 06	FY 07	FY 08	FY 09
Technology Insertion Planning and Analysis	29.0	13.6	9.4	9.4	9.5	12.6	15.7	20.6
Space Range	0	0	5.3	6.4	4.7	10.5	14.8	19.6
TOTAL	**29.0**	**13.6**	**14.7**	**15.8**	**14.2**	**23.0**	**30.6**	**40.3**

USAF RDT&E Descriptive Summaries

*This table, from the FY 04 budget request, shows the *appropriated* amounts from FY 02 and FY 03, the amount *requested* in FY 04, and the FY 04 Fiscal Years Defense Plan (projected requests for future years).

Counterspace Technology Program (0604421F)

The majority of Air Force space control systems other than those in Space Control Technology are funded out of Counterspace Technology, which comprises three ground-based counterspace systems with "reversible effects." One of these, the Counter Satellite Communications System (CSCS), a ground-based, mobile system "intended to disrupt satellite-based communications used by an enemy for military C3," is expected to reach initial operating capability (IOC) in 2004.

Program Element Name	Program Element Number	Agency	FY04 Request	FY04 Appropriated	FY05 Projected Request	FY05 Actual Request
Counterspace Technology	0604421F	USAF	$82.6 M	$81.6 M	$85.9 M	$75.9 M
Note: Contains funding for three ground-based counterspace systems with "reversible effects," one of which is expected to reach IOC in 2004.						

The Counterspace Technology (PE 0604421F) takes the technologies pursued under Space Control Technology (PE 0603438F) to the next level. The PE funds three systems: The Counter Satellite Communications System (CSCS), Counter Surveillance Reconnaissance System (CSRS), and the Rapid Attack Identification Detection and Reporting System (RAIDRS). Until 2003, these programs were funded out of Space Control Technology as demonstration and validation efforts. The shift in budget categories indicates that the programs have moved into the engineering and manufacturing development stage.

The CSCS is a ground-based, mobile system "intended to disrupt satellite-based communications used by an enemy for military C3." The Counter Surveillance Reconnaissance System (CSRS), currently in the initial design phase, is also ground-based and designed to impair reconnaissance satellites with "reversible, nondamaging effects." These two systems, which are offensive counterspace systems, are expected to reach initial operating capability in 2004 and 2007, respectively. The Rapid Attack, Identification, Detection, and Reporting System (RAIDRS) is a defensive counterspace system designed to aid the detection, reporting, identification, location, and classification of attacks against valuable space assets. RAIDRS is planned to achieve initial operational capability in FY 08.

As this PE represents the next step after the Space Control Technology PE in the fielding of space control capabilities, it also represents the same challenges — namely, that while it is not explicitly developing technologies for force application in or from space, the existing doctrine emphasizes these mission areas as key enablers for such a capability, partly justifying their pursuit *due* to these enabling characteristics.

PE 0604421F COUNTERSPACE SYSTEMS* (Cost in U.S. $ Millions)								
	FY 02	FY 03	FY 04	FY 05	FY 06	FY 07	FY 08	FY 09
Counter Satellite Communications System	0.0	9.1	9.6	6.3	6.4	6.5	6.7	6.8
Counter Surveillance Reconnaissance System	0.0	23.5	66.4	53.4	5.0	14.2	9.8	3.7
Other Procurement, Air Force	0.0	0.0	0.0	9.9	47.5	38.1	31.2	35.3
Rapid Identification Detection and Reporting System	0.0	6.9	6.6	16.4	16.5	12.1	12.4	66.5
Other Procurement, Air Force	0.0	0.0	0.0	0.0	0.0	25.7	26.9	23.6
TOTAL	**0.0**	**39.5**	**82.6**	**85.9**	**75.4**	**96.7**	**87.0**	**136.0**

USAF RDT&E Descriptive Summaries

*This table, from the FY 04 budget request, shows the *appropriated* amounts from FY 02 and FY 03, the amount *requested* in FY 04, and the FY 04 Fiscal Years Defense Plan (projected requests for future years).

Ballistic Missile Defense Technology (PE 0603175C)

Ballistic Missile Defense Technology is an MDA program that funds the development of new component technologies and innovative concepts that can be integrated into future Block improvements of the BMD system.

(Then Year U.S. $Millions)	FY 03	FY 04	FY 05	FY 06	FY 07	FY 08	FY 09
0502 Advanced Technology Development	0.0	198.4	200.0	195.0	241.2	280.3	299.0
0503 Laser/LADAR Technology	0.0	22.3	0.0	0.0	0.0	0.0	0.0
0602 Program-Wide Support	0.0	4.6	4.4	4.4	5.1	6.0	6.7
Total PE Cost	151.2*	225.3	204.3	199.5	246.3	286.3	305.4
Includes $148.4M from 6010 Advanced Technology Development (Discontinued) and $2.9M from 0690 Program-Wide Support (Discontinued). FY 05 MDA Exhibit R-2 (PE 0603175C) 1.							

All research efforts have been consolidated under a single project, 0502 Advanced Technology Development, which contains efforts such as Sensing Systems Technologies, Engagements Systems Technologies (including the Multiple Kill Vehicle program) and the High Altitude Airship.

- Sensing Systems Technologies is a $72.1 million effort that includes a micro-satellite program to investigate "small satellite concepts, payloads, and applications for future BMDS technology demonstrations and test assets." In 2003, MDA awarded California-based SpaceDev an $800,000 contract "to design three formation-flying microsatellites" as an alternative to the Space-based Tracking and Surveillance System (STSS) designed to track missiles in boost phase.[8]

- Engagement Systems Technologies is an $85.4 million effort that includes an unspecified amount for the Multiple (formerly Miniature) Kill Vehicle (MKV) program. MDA hopes to use as many as 12 MKVs on a single ground-based interceptor to provide multiple intercept opportunities in the mid-course of a ballistic missile's flight. MDA is reportedly exploring other basing modes, including sea-based.[9]

Remaining work on the Space-Based Laser (SBL) program, which was canceled in 2002, has been shifted into the Advanced Technology Development Project. Although MDA is soliciting proposals from the laser and electro-optics industry that could revive the SBL, MDA laser efforts appear focused on improving tracking, weapon guidance, and imaging. MDA is decommissioning the Lockheed Martin facility in California where integrated ground tests of the high-power laser and optical subsystems were conducted.

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[8] "SpaceDev Reports Financial Results for the Third Quarter of 2003," Press Release (Nov. 11, 2003) and "SpaceDev Explores Microsats for Missile Defense Agency," Press Release (July 24, 2000). Available at: http://www.spacedev.com/

[9] Robert Wall, "Future ballistic missile interceptors may carry dozens of small kill vehicles," *Aviation Week & Space Technology* 160:4 (Jan. 26, 2004) 50 and Marc Selinger, "Shotgun Defense: Lockheed Martin tapped to develop Miniature Kill Vehicle," *Aerospace Daily* 209: 3 (Jan. 8, 2004) 1.

Advanced Aerospace Systems (PE 0603285E)

Advanced Aerospace Systems is a Defense Advanced Research Projects Agency (DARPA) program that houses several projects to enhance the ability to detect and characterize potential attacks, ready access to space, the ability to neutralize man-made space environments, and a flexible infrastructure for maintaining the capabilities of on-orbit assets.

(Then year U.S. $ millions)	FY 03	FY 04	FY 05	FY 06	FY 07	FY 08	FY 09
Space Program and Technology (ASP-02)	111.6	201.6	249.2	233.6	261.8	296.9	327.0
Department of Defense Fiscal Year (FY) 2005 Budget Estimates, Research, Development, Test and Evaluation, Defense-Wide, Volume 1 — Defense Advanced Research Projects Agency, Unclassified, (February 2004) 229.							

DARPA "is working on technologies that will prevent our adversaries from using space to harm the United States or its allies" under the category of Space Mission Denial, but does not identify projects conducting this work.[10] At least three projects in Advanced Aerospace Systems support space control and space force projection mission areas:

- $25 million for Project Force Application and Launch from CONUS (FALCON), formerly Hypersoar. FALCON is a DARPA program to support the Common Aero Vehicle (CAV) hypersonic glide vehicle by (1) developing a Small Launch Vehicle (SLV) to place CAV at the required altitude and velocity in the near-term, and (2) developing a reusable, hypersonic cruise vehicle (HCV) capable of delivering several CAVs at intercontinental distances in less than two hours.[11] See also Common Aero Vehicle, PE 0604856F.

- $56.6 million for Orbital Express, which will demonstrate the feasibility of using automated spacecraft to refuel, upgrade, and extend the life of on-orbit spacecraft.[12] Boeing is building two satellites — the Autonomous Space Transport Robotic Operations satellite (ASTRO) and a surrogate next generation serviceable satellite (NEXTSat) — for an on-orbit demonstration of autonomous satellite servicing set for launch in March 2006.[13]

- $4.6 million for the Microsatellite Demonstration Science and Technology Experiment Program (MiDSTEP). MiDSTEP expands the former Space Assembly and Manufacture program to demonstrate advanced lightweight microsatellite technologies. MiDSTEP may become the DARPA testbed for future microsatellite applications.

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[10] Defense Advanced Research Projects Agency, *Fact File: A Compendium of DARPA Programs* (August 2003) 12-13.
[11] Defense Advanced Research Projects Agency, *FALCON: Force Application and Launch from CONUS Technology Demonstration,* PHASE I SOLICITATION 03-XX (June 17, 2003) 7.
[12] Gerry Gottselig, "Orbital Express Advanced Technology Demonstration," Presentation to 2002 Core Technologies for Space Systems Conference, Colorado Springs, Colorado, Nov. 19-21, 2002.
[13] "Boeing Team Selected to Build Orbital Express Advanced Technology Demonstration System," Press Release, March 15, 2002.

Ballistic Missile Defense System Interceptor (PE 0603886C)

BMDS Interceptor is an MDA program to develop a mobile boost/ascent-phase, kinetic energy interceptor that can be based on land, at sea and in space.

(Then year U.S. $ Millions)	FY 03	FY 04	FY 05	FY 06	FY 07	FY 08	FY 09
0013	0.0	112.2	451.4	971.3	1275.1	1215.1	670.2
R113	0.0	0.0	47.5	130.9	421.6	947.0	1739.1
0602 Program Support	0.0	5.5	12.4	16.4	20.7	34.5	40.0
TOTAL PE COST	0.0	117.7	511.3	1118.6	1717.5	2196.5	2449.3
FY 05 MDA Exhibit R-2 (PE 0603886C) 1.							

In FY 04, Congress reduced the line item for BMDS Interceptors by $182.0 million and ordered MDA to focus on land- and sea-basing modes. Consequently, MDA has shifted most of the funding for the space-based component of BMDS Interceptor program into the land and sea component.[14] The FY 05 budget request does contain some funding for two space-based, boost-phase related activities.

- $68.0 million for the Near Field Infra Red Experiment (NFIRE) satellite, funded as "Experimentation & Test" in Block 2010. NFIRE, scheduled to launch during the early 2006, will collect data on the characteristics of missile plumes and hardbodies outside the atmosphere, as well space and Earth horizon backgrounds. MDA will conduct two missile "fly-bys" to allow NFIRE "a close-up view of a burning ICBM at conditions that are truly real world."[15] During the second test, NFIRE will simulate an engagement by launching "a kill vehicle for a fly-by of a burning missile."[16] NIFRE is a risk reduction effort for the BMDS Interceptor.

- $10.5 million in Block 2012 for Space-Based Interceptor Test Bed activities. The funding is intended to initiate technology development and testing of advanced, lightweight space-based interceptor components including development of a liquid axial stage and reductions in kill vehicle (KV) and lifejacket weight. This is substantially less than the $ 119.5 million that MDA originally intended to request for FY 05.

Space-Based Test Bed Schedule

Develop Liquid Axial Stage	1Q/05 - 4Q/07
Develop First Space Based Experiment	1Q/08 - 4Q/09
Initiate KV and Lifejacket Weight Reduction	3Q/05 - 2Q/07
Modeling and Simulation	1Q/05 - 4Q/09
Space Basing Decision	2Q/08

[14] Missile Defense Agency, Fiscal Year (FY) 2005 Budget Estimates, Press Release (Feb.18, 2004) 7.
[15] Marc Selinger, "Satellite experiment planned for boost-phase missile defense," *Aerospace Daily* 205:11 (Jan.16, 2003) 3.
[16] MDA Exhibit R-2 (PE 0603886C) 5.