## CHAPTER 2

# SPACE WEAPONS IN THE 2005 US DEFENCE BUDGET REQUEST

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## INTRODUCTION

What are the prospects for space weaponization? The question is particularly important as the world approaches what promises to be a bruising 2005 Non-Proliferation Treaty (NPT) Review Conference. The Conference on Disarmament (CD) remains deadlocked while the United States reviews its support for the fissile material cut-off treaty. Although the 2000 NPT Review Conference identified 13 practical steps to demonstrate good faith in the commitment to pursue disarmament, the declared nuclear powers are unlikely to make progress on these steps before the 2005 NPT Review Conference. Preventing the weaponization of outer space is not explicitly one of these 13 steps. The vision of expanded military activities in outer space articulated by the current Bush Administration, however, draws heavily on the outline of the *Nuclear Posture Review* and as a result has complicated efforts to build consensus for a work plan in the CD.[1]

The US *Nuclear Posture Review* called for modernizing US strategic forces by adding anti-ballistic missile (ABM) systems and conventional long-range strike systems, both of which might include space-based elements. The US Department of Defense typically does not use the term "space weapon" to describe these systems—instead, the US Department of Defense divides military space operations into four mission areas as follows:

- space control operations provide freedom of action in space for friendly forces while, when directed, denying it to an adversary, and include protection of US and US allied space systems and negation of adversary space systems;



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- space force enhancement operations multiply joint force effectiveness by enhancing battle space awareness and providing warfighter support;
- space support operations consist of operations that launch, deploy, augment, maintain, sustain, replenish, de-orbit and recover space forces, including the command and control network configuration for space operations; and
- space force application would consist of attacks against terrestrial-based targets carried out by military weapons systems operating in or through space—the force application mission area includes ABM systems and force projection.[2]

Of these four mission areas, some of the space control missions and space force projection missions are what most observers think of as "space weapons". The publication of several US military documents outlining these capabilities, including the 1998 Air Force Space Command *Long Range Plan* and the US Air Force's biennial *Strategic Master Plan*, have resulted in considerable criticism of the United States, particularly from China and the Russian Federation. Concern over US military activities in outer space has contributed to the deadlock in the CD and might complicate the NPT Review Conference.

Much of the concern centres on suspicion of the motives of the United States. But the actual intentions of the Bush Administration are not clear—the White House ordered a review of the 1996 National Space Policy, but the results regarding national security matters have not been made public. Officially, the Clinton-era National Space Policy and US Department of Defense 1999 National Space Policy continue to define US government statements regarding military activities in outer space, with the single exception of ABM systems.[3] These policies are reflected in the doctrinal statements and transformation plans outlined by the US Joint Chiefs of Staff, service headquarters and combatant commands.[4]

The final report of the Commission to Assess US National Security Space Management and Organization, chaired by Donald Rumsfeld until his nomination as Secretary of Defense, provides some evidence about the general outlook of the Bush Administration toward space. The commission, empanelled by a Republican Party-controlled Congress, called for "power projection in, through and from space". The commission also recommended that the US government "vigorously pursue the capabilities called for in the National Space Policy to ensure that the President will have

the option to deploy weapons in space to deter threats to and, if necessary, defend against attacks on US interests".[5]

One commission member, General Ronald Fogelman (US Air Force, retired), drew a sharp distinction between arms control and the approach of the commission: "We, as a Commission, believe very strongly that one of the biggest threats to future space capability might be the unintended consequences of well-intentioned people signing up to certain treaties and restrictions today that in and of themselves seem to be very innocent … and as you go down the road, they could end up tying our hands in ways that would very much limit our ability to continue to be dominant".

Broad policy documents, from the National Space Policy to the Air Force Transformation Flight Plan, do not, however, indicate which programmes will survive the thicket of political, technological and budgetary hurdles. For example, the Air Force Space Command published an analysis that "depicts what resources would be required to acquire all of the *capabilities* for which the Air Force Space Command is responsible in the timeframes desired by the warfighter" against an estimate of available resources—that is, total obligation authority (TOA).[6] "Air Force Space Command TOA is inadequate," the Air Force Space Command concluded and the requirements "un-executable".[7]

Documents such as the *Strategic Master Plan* and *Transformation Flight Plan* are, in fact, largely "wish lists" designed for the budgeting process. The requirements set by such documents are typically optimistic and subject to alteration, particularly by the US Congress. Identifying the programmes that are likely to reach operational testing and deployment requires a careful examination of the documents produced to support the President's annual budget request and the authorization and appropriations bills passed by Congress.

Of the many force projection and space control programmes, which ones are the most likely to be tested and deployed in the next few years? Based on an analysis of fiscal year 2004 and 2005 budget requests, the two most important programmes—for opponents of space weaponization—are space-based ABM systems and micro-satellites capable of autonomous proximity operations.[8]

## FORCE PROJECTION AND SPACE-BASED ABM SYSTEMS

Pentagon plans for space-based force projection are largely space-based ABM programmes. The Pentagon does have active research programmes to develop hypersonic vehicles and space-based kinetic energy weapons called hypervelocity rod bundles. Hypersonic vehicle concepts, however, are currently being designed to *transit* space—although there are long-term plans for space operations and space manoeuvre vehicles that would allow on-orbit basing of hypervelocity rod bundles and the Common Aero Vehicle, a hypersonic glide vehicle.

In the short-term, space-based force projection platforms are likely to appear in the form of space-based ABM interceptors to enhance the ABM system, which will stand-up in Alaska by the end of 2005. In December 2002, President Bush indicated that the United States would continue the "development and testing of space-based defenses, specifically space-based kinetic energy (hit to kill) interceptors and advanced target tracking satellites".[9]

The fiscal year 2004 budget request anticipated a major effort to research these technologies, including the creation of a space-based ABM test bed starting in 2008. After substantial Congressional resistance during the authorization and appropriations processes, the fiscal year 2005 budget request has substantially fewer funds dedicated to space-based missile defences, although several programmes remain.

The principle programme that supports space-based interceptors is the Ballistic Missile Defense (BMD) System Interceptor programme—a boost-phase kinetic energy interceptor that is intended to be based on land, at sea and in space. In fiscal year 2004, Congress reduced the line item for BMD System Interceptors by US$ 182.0 million and ordered the Missile Defense Agency (MDA) to focus on land- and sea-basing modes, rather than space. Consequently, the MDA has shifted most of the funding for the space-based component of the BMD System Interceptor programme into the land and sea components.[10] However, the fiscal year 2005 budget request contains some funding for two space-based boost-phase related activities.

- US$ 68.0 million was budgeted for the Near Field Infra Red Experiment (NFIRE) satellite, funded as Experimentation & Test in Block 2010. NFIRE, scheduled to launch during early 2006, is a risk

reduction effort for the space-based interceptor. The satellite will collect data on the characteristics of missile plumes and hardbodies outside the atmosphere, as well space and Earth horizon backgrounds. The MDA will conduct two missile "fly-bys" to allow NFIRE "a close-up view of a burning intercontinental ballistic missile (ICBM) at conditions that are truly real world". During the second test, NFIRE will simulate an engagement by launching "a kill vehicle for a fly-by of a burning missile".[11] The MDA is not attempting to hit the ballistic missile and the kill vehicle lacks an axial stage that would allow it to conduct engagements in real world conditions.

The NFIRE was originally scheduled for launch in June 2004; however, Congress cut the BMD System Interceptors and ordered the MDA to focus its efforts on ground-based interceptor programmes. MDA reprogrammed about US$ 37.5 of the US$ 82 million identified for NFIRE and slipped the launch date to early 2006.

- US$ 10.6 million was budgeted 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 and lifejacket weight. This is substantially less than the US$ 119.5 million that the MDA originally intended to request for fiscal year 2005.

The MDA also conducts a substantial amount of research that could support future space-based efforts in the Ballistic Missile Defense Technology programme, which funds the development of new component technologies and innovative concepts that can be integrated into future block improvements of the BMD system. All of the 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 programme) and the High Altitude Airship.

- Sensing Systems Technologies is a US$ 72.1 million effort that includes an unspecified amount for a micro-satellite programme to investigate "small satellite concepts, payloads and applications for future BMD technology demonstrations and test assets". In 2003, the MDA awarded California-based SpaceDev a US$ 800,000 contract "to design three formation-flying microsatellites" as an alternative to the

Space-based Tracking and Surveillance System designed to track missiles in boost-phase.[12]

- Engagement Systems Technologies is a US$ 85.4 million effort that includes an unspecified amount for the Multiple (formerly Miniature) Kill Vehicle (MKV) programme. The MDA hopes to use as many as 12 Multiple Kill Vehicles on a single ground-based interceptor to provide multiple intercept opportunities in the mid-course of a ballistic missile's flight. The MDA is reportedly exploring other basing modes, including sea-based.[13]

Remaining work on the Space-Based Laser Programme, which was cancelled in 2002, and has been shifted to the Advanced Technology Development Project. Although the MDA is soliciting proposals from the laser and electro-optics industry that could revive the Space-Based Laser Programme, the MDA appears to be focused on using lasers to improve tracking, weapon guidance and imaging. The MDA is decommissioning the Lockheed Martin facility in California where integrated ground tests of the high-power laser and optical subsystems were conducted.

## SPACE CONTROL AND AUTONOMOUS PROXIMITY OPERATIONS

In the short-term, the Pentagon is focusing on reversible measures to control space, including a pair of ground-based systems to temporarily interfere with communications and reconnaissance satellites. The Counter Satellite Communications System is a mobile system "intended to disrupt satellite-based communications used by an enemy for military (command, control and communications)", while the Counter Surveillance Reconnaissance System, currently in the initial design-phase, will impair reconnaissance satellites with "reversible, non-damaging effects". The Counter Satellite Communications System was expected to reach initial operating capability by 2004, while the Counter Surveillance Reconnaissance System is expected to reach initial operating capability by 2007.

The Pentagon has a range of destructive anti-satellite programmes in various states of completion, including the mothballed programme, which programme officers believe they could demonstrate on orbit for about US$ 60 million, as well as an air launched anti-satellite missile.[14] The arms

control community should monitor the development of these systems, but—for the time being—they are not serious threats to weaponization, unless the Bush Administration decides to conduct a Kinetic Energy Anti-Satellite test for purely political purposes.

The most serious prospect for the weaponization of space is from progressively smaller satellites capable of autonomous proximity operations—orbital manoeuvres that would allow satellites to inspect other satellites, diagnose malfunctions and provide on-orbit servicing. Such satellites could also provide sophisticated surveillance in space and would make excellent anti-satellite weapons.

In fact, the Defense Technology Area Plan in 2000 called for "the development of microsatellite vehicles with significant capability" including the ability to "conduct missions such as diagnostic inspection of malfunctioning satellites through autonomous guidance, rendezvous and even docking techniques".[15] The National Aeronautics and Space Administration (NASA), the Defense Advanced Research Projects Agency (DARPA) and the Air Force are planning future demonstration missions (see Table 1).

- NASA's Demonstration of Autonomous Rendezvous Technology (DART) is an advanced flight demonstrator that was scheduled for launch in 2004. Once in orbit, the DART satellite would rendezvous with a US Department of Defense communications satellite and perform several autonomous rendezvous and close proximity operations, such as moving toward and away from the satellite using navigation data provided by an advanced video guidance sensor and other on-board sensors.[16] Orbital's contract for DART is valued at US$ 47 million.[17]
- The Air Force's Experimental Spacecraft System (XSS) is a series of Air Force Research Laboratory satellites designed to demonstrate imaging applications of proximity operations. The most recent satellite, the XSS-10, was launched in 2003.[18] That satellite manoeuvred to within 35m of an expended Delta II rocket body, transmitting digital images, and conducted a number of other on-orbit manoeuvres for 24 hours before completing its mission; the next satellite in the series, the XSS-11, was scheduled for launch in 2004. Unlike the XSS-10, the XSS-11 will remain in orbit for a year and conduct close-proximity operations to multiple targets of opportunity.[19] The US Air Force requested

US$ 18.6 million in fiscal year 2005 for the XSS micro-satellites. Lockheed's contract for the XSS-11 is valued at US$ 21 million.[20]

- DARPA's Orbital Express will demonstrate the feasibility of using automated spacecraft to refuel, upgrade and extend the life of on-orbit spacecraft.[21] 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.[22] DARPA has allocated US$ 56.6 million in fiscal year 2005 on its Orbital Express programme. Boeing's contract for ASTRO and NEXTSat are valued at US$ 113 million.

**Table 1:** Upcoming autonomous proximity demonstrations

| Satellite | | Agency | Firm | Launch | Kg |
|---|---|---|---|---|---|
| DART | Demonstration of Autonomous Rendezvous Technology | NASA | Orbital | October 2004 | 48 |
| XSS-11 | Experimental Spacecraft System-11 | US Air Force | Lockheed | November 2004 | 100 |
| ASTRO | Autonomous Space Transport Robotic Operations | DARPA | Boeing | March 2006 | 700 |

*Sources*: See endnotes 16–26.

There might be other research into autonomous proximity operations at the classified level. At least one Air Force classified small satellite or micro-satellite is scheduled to launch on a Minotaur launch vehicle in 2005; however, its function is unknown.[23]

Although none of these satellites is a dedicated anti-satellite, each has that capability. As the director of the Air Force XSS programme told *Space News*, "You can't closely inspect a vehicle—say, one with an on-orbit malfunction—without getting 'close' and approaching from the right angle. To refuel, obviously you'd have to get more than close, and 'dock' with the vehicle."[24]

The three programmes are already contributing to an innocuous "anti-satellite" mission of sorts: NASA is planning to launch an autonomous "space tug" in 2006, using technology from DART, XSS and ASTRO to de-orbit the Hubble Space Telescope. "We actually think that having three programs that are funded right now to look at aspects of this issue are really going to be a great help", noted one NASA official.[25] The same might be said by Air Force officials, one of whom told *Space News* that the "XSS-11 can be used as an ASAT weapon".[26] In fact, the "single strongest recommendation" of the Air Force's 1999 Microsatellite Technology and Requirements Study was "the deployment, as rapidly as possible, of XSS-10-based satellites to intercept, image and, if needed, take action against a target satellite" based on technology from the Army's Kinetic Energy Anti-Satellite programme. The XSS-11 is a pathfinder for the national "microsat payload imager," outlined in the Air Force Space Command Strategic Master Plan, and the "flexible orbit counterspace microsat" to "neutralize [an] adversary's use of space".[27]

Given growing suspicion about motives of other space-faring states, an unannounced proximity operation might lead to a serious incident in space. One recent operation involving a relatively innocuous micro-satellite test demonstrates the level of mistrust and confusion inherent in unregulated micro-satellite programmes.

In 2000, Surrey Satellite Technology Ltd., a British company affiliated with the University of Surrey, launched two satellites: the first, TsinghuaSat-1, was built by Surrey Satellite Technology Ltd. and a group of scientists at Tsinghua (Qinghua) University in Beijing; it contained a multi-spectral camera with 40m resolution, which Surrey Satellite Technology Ltd. hoped to use as a demonstration of the possible applications of a constellation of remote sensing micro-satellites for natural disaster monitoring and mitigation.[28] The second satellite, SNAP-1, built by Surrey Satellite Technology Ltd. alone, was designed to conduct a proximity operations near TsignhuaSat-1. SNAP-1 successfully manoeuvred to within 9m of the Chinese satellite, transmitting a digital image.[29]

Despite the innocuous mission and relatively limited capabilities of TsinghuaSat-1, the US Department of Defense identified it as evidence that China is developing "parasitic microsatellites" for use as anti-satellite weapons.[30] In addition to concern that the Chinese were developing micro-satellites, the US Department of Defense might also have been

concerned about Chinese affiliation with a project involving proximity manoeuvres; the launch of a Chinese micro-satellite with the capability of SNAP-1, let alone the XSS-11 or DART, would generate intense concern in many parts of the United States. If the Chinese were to conduct a proximity manoeuvre near a US satellite, the reaction would be apoplectic.

Without a legal regime to establish ground-rules for inspections and other proximity operations, serious incidents are possible. In July 1993, the US Navy stopped and inspected a Chinese ship, the *Yinhe*, which the Central Intelligence Agency claimed was carrying chemical weapons precursors to Iran. The inspection found no such weapons, but the incident was, briefly, a serious issue in the China–United States relationship. Is a *Yinhe*-type incident possible in outer space? Already, some proponents of micro-satellites are proposing that the United States develop a micro-satellite "space guard" force, analogous to the Coast Guard, to patrol low-Earth and geostationary orbit.[31] Although proponents point to the stabilizing effect of the US Navy in combating piracy, there is a plausible case to be made that such efforts might stimulate other states to pursue micro-satellites and other anti-satellite capabilities since a space guard force could just as easily be used to deny other states the ability to operate in outer space.

## CONCLUSION

Regulating space-based ABM interceptors and micro-satellite proximity operations will be difficult. The Bush Administration, in abandoning the ABM treaty, clearly stated that it desires the freedom of action to develop an open-ended missile defence architecture that will eventually include space-based elements. Micro-satellites are inherently dual-use, greatly complicating any anticipated restrictions. At the same time, many members of Congress, including many moderate Republicans, are uncomfortable about space-based ABM and anti-satellite capabilities. It was, in fact, a Republican Congress that substantially reduced funding for space-based interceptors. Perhaps one solution is to focus on operational restrictions to prevent provocative manoeuvres in orbit or military activities that create debris. Michael Krepon has suggested an "Incidents in Space" agreement modelled on the 1972 Incidents at Sea Agreement.[32] Others have suggested similar "rules of the road" agreements for space operations.

An incidents in space agreement, or a set of rules of the road, might be more politically palatable to the United States than an agreement designed explicitly to constrain US military capabilities. Recently, the US Congress approved a pilot programme to sell US satellite tracking data to foreign and commercial entities, "consistent with the best interests of national security". An agreement about rules of the road would, in my view, provide a more comprehensive definition of US national interests—a definition that encompasses the common interest of all countries in preserving the orbital environment and promoting international cooperation in preserving the interest of all states in the use of outer space for peaceful purposes.

## Notes

1 The US Department of Defense's *Nuclear Posture Review* is classified, but leaked sections are available from GlobalSecurity at <www.globalsecurity.org/wmd/library/policy/dod/npr.htm>.

2 These definitions are drawn from US Joint Chiefs of Staff, 2002, *Joint Doctrine for Space Operations,* Publication 3–14 (August), chapter IV, pp. 1–10.

3 US National Science and Technology Council, 1996, *Fact Sheet: National Space Policy*, NSTC–8 (September); US Secretary of Defense, 1999, *Space Policy*, Department of Defense Directive 3100.10 (July).

4 Including the US National Science and Technology Council, 1996, ibid.; US Secretary of Defense, 1999, ibid.; US Department of Defense, 2001, *Quadrennial Defense Review* (September); US Joint Chiefs of Staff, 2002, op. cit.; US Air Force, 2001, *Space Operations,* Doctrine Document 2–2 (November); US Air Force, 2003, *The U.S. Air Force Transformation Flight Plan* (November); and US Air Force Space Command, 2003, *Strategic Master Plan FY06 and Beyond* (October).

5 *Final Report of the Commission to Assess United States National Security Space Management and Organization*, January 2001, p. xii, at <www.space.gov/docs/fullreport.pdf>.

6 TOA is the value of programmes regardless of financing; for example, TOA could include funds appropriated by Congress, proceeds from the sale of items or money available from prior years; budget authority is the value of the annual new authority to incur obligations. A helpful glossary is located from the *Moneyspeak-to-English Dictionary,*

American Forces Press Service, at <www.defenselink.mil/news/Feb1999/n02031999_9902034.html>.

7 US Air Force Space Command, 2003, op. cit., p. 13.

8 The analysis of the fiscal year 2004 budget request can be found in Jeffrey Lewis, 2003, *Lift-Off for Space Weapons? Implications of the Department of Defense's 2004 Budget Request for Space Weaponization* (July), at <www.cissm.umd.edu/documents/spaceweapons.pdf>. An update for fiscal year 2005, prepared by Theresa Hitchens, Jessy Cowan and Victoria Samson is available from the Center for Defense Information web site at <www.cdi.org>.

9 US Department of Defense, *Missile Defense Operations Announcement*, 17 December 2002. See also, Office of the Press Secretary, The White House, *National Policy on Ballistic Missile Defense Fact Sheet*, 20 May 2003.

10 Missile Defense Agency, *Fiscal Year 2005 Budget Estimates*, Press Release, 18 February 2004, p. 7.

11 Missile Defense Agency, *Exhibit R-2 (PE 0603886C),* p. 5. An R2, or detailed programme summary, is a budget document that contains basic information about funding levels and work activities.

12 *SpaceDev Reports Financial Results for the Third Quarter of 2003*, SpaceDev Press Release, 11 November 2003; *SpaceDev Explores Microsats for Missile Defense Agency,* SpaceDev Press Release, 24 July 2003.

13 Robert Wall, 2004, Future Ballistic Missile Interceptors May Carry Dozens of Small Kill Vehicles, *Aviation Week & Space Technology,* vol. 160, no. 4 (26 January), p. 50; Marc Selinger, 2004, Shotgun Defense: Lockheed Martin Tapped to Develop Miniature Kill Vehicle, *Aerospace Daily,* vol. 209, no. 3 (8 January), p. 1.

14 Kerry Gildea, 2002, Possible Funding Boost In FY '04 Budget Could Lead To KE-ASAT Flight Test*, Defense Daily,* vol. 216, no. 52 (17 December).

15 US Department of Defense, 2000, *Defense Technology Area Plan*, chapter VIII, p. 14.

16 Marshall Space Flight Center, 2003, *DART Demonstrator to Test Future Autonomous Rendezvous Technologies in Orbit*, National Aeronautics and Space Administration, FS-2003-08-87 (September).

17 *Orbital Awarded $53 Million in Contracts Related to NASA's Space Launch Initiative*, Press Release, 24 May 2001.

18 Jim Banke, 2003, Air Force XSS-10 Micro-Satellite Mission a Success, *Space News*, 30 January.

[19] Elaine M. Grossman and Keith J. Costa, 2003, Small, Experimental Satellite May Offer More Than Meets The Eye, *Inside The Pentagon*, 4 December.

[20] *Lockheed Martin Selected to Build and Fly Microsatellite,* Press Release, 21 August 2001.

[21] Gerry Gottselig, *Orbital Express Advanced Technology Demonstration,* prepared for the Core Technologies for Space Systems Conference, Colorado Springs, November 2002.

[22] *Boeing Team Selected to Build Orbital Express Advanced Technology Demonstration System,* Press Release, 15 March 2002.

[23] *Orbital Receives $11 Million Order For Minotaur Space Launch Vehicle From The U.S. Air Force,* Press Release, 2 October 2003.

[24] Grossman and Costa, op. cit.

[25] Brian Berger, 2003, NASA Proposes $300 Million Tug To Deorbit Hubble, *Space News*, 24 November.

[26] Grossman and Costa, op. cit.

[27] US Air Force Space Command, 2000, *Strategic Master Plan FY02 and Beyond*, 9 February.

[28] You Zheng and M. Sweeting, 2000, *Initial Mission Status Analysis of 3-axis Stable Tsinghua-1 Microsatellite,* 14th Annual AIAA/Utah State University Conference on Small Satellites; Xiong Jianping et al., 2002, *On Board Computer Subsystem Design for the Tsinghua Nanosatellite,* 20th Institute of Aeronautics and Astronautics International Communication Satellite Systems Conference, May.

[29] See the Survey Satellite Technology Ltd. web site for more information on SNAP-1 at <zenit.sstl.co.uk/index.php?loc=47>.

[30] US Department of Defense, 2003, *Annual Report on the Military Power of the People's Republic of China*, 28 July, p. 36.

[31] Matt Bille et al., 1999, *A Microsatellite Space Guard Force,* 13th Annual American Institute of Aeronautics and Astronautics/Utah State University Small Satellite Conference.

[32] Michael Krepon with Christopher Clary, 2003, *Space Assurance or Space Dominance*, Henry L. Stimson Center, pp. 114–23.