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IS IT TOO LATE TO STOP THE WEAPONIZATION OF SPACE?

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ABSTRACT

There is little doubt that the US is the world's leader when it comes to military space activity. The question is not about the militarization of space; clearly the US has been using space to enhance military operations for decades. The real question concerning space development remains: is it inevitable that space will be weaponized? Many people fear that if the US or China deploys space weapons, it will force other nations to follow suit, and in turn, cause the development and deployment of weapons in outer space and potentially start another arms race, this time in space. There are several technical challenges in trying to deploy weapons in space and the international pressures against any nation trying to do so would be great. There are also many influences and experts in the US space community advising top level government officials to weaponize space for protective purposes. Due to the difficulty with deploying such weapons and their great cost, there may still be time to prevent the weaponization of space but the likelihood of space remaining free from weapons is very uncertain. Given the interests of national and international security, the US has the opportunity to take a leadership role and establish a new space policy to protect their own space assets while keeping their military advantage in space and preserving space for peaceful uses.

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> "The goal of developing space weaponry is to allow the United States to deliver an attack very quickly, with short time lines between planning and delivery, any place on the face of the earth."
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> General James Cartwright, US Strategic Commander[1]

> How will the rest of the world take to being dominated from above? One doesn't have to be particularly unfriendly to the United States to feel uncomfortable. More naturally hostile or suspicious countries could well feel they have been given no choice but to develop their own anti-satellite weapons in an attempt to blind United States satellites, even though the United States will far outspend them, the effort would become an ever receding goal. … It will not only make enemies where none exist, it will drive its NATO allies into a state of antipathy towards America.
>
> Jonathan Power, Transnational Foundation for Peace[2]

INTRODUCTION

These two quotes show the opposite sides of the space weaponization debate. In April 2004, General Cartwright, Commander, United States (US) Strategic Command, made these comments to the Senate Armed Services Nuclear Forces Subcommittee.[3] While this shows just one senior official example, it does highlight the prevalent thinking within the military space profession in the US and with many top President Bush officials. In addition to this comment by General Cartwright, there are hundreds of documented cases where senior Air Force officials were quoted in support of space force application and the possibility of weaponizing of space.

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[1] Tim Weiner, "Air Force Seeks Bush's Approval for Space Weapons Programs," *The New York Times,* 18 May 2005.

[2] Anup Shah, "Militarization and Weaponization of Outer Space," http://www.globalissues.org/Geopolitics/ArmsControl/Space.asp; Internet; accessed 16 January 2008.

[3] Tim Weiner, "Air Force Seeks Bush's Approval for Space Weapons Programs," *The New York Times,* 18 May 2005.

There is little doubt that the US is the world's leader when it comes to military space activity. The question is not about the militarization of space; clearly the US has been using space to enhance military operations for decades. The real question concerning space development remains: is it inevitable that space will be weaponized? This distinction between militarization and weaponization will be clarified in a future chapter. With all the advances in technology, is it probable that outer space will become the battlefield of the future? Are space weapons the next logical step in space development? These questions are being debated internationally as fears grow over US pursuit for further space dominance and possibly deploying space weapons.

This paper will define the difference between space weaponization and space militarization and examine US space assets that are used in support of military operations. These space assets include: communication, navigation, surveillance and reconnaissance, weather, and early warning satellites. It will provide both sides of the argument on whether these assets need to be protected, and if so, how? We will dissect the current US space policy to include President Bush's National Space Policy, Air Force Space Command's Vision 2020, US Space Commands doctrine, and the Donald Rumsfeld-led Space Commission Report from 2000. We will also take a look at international treaties and agreements including the Outer Space Treaty of 1967, the Nuclear Weapons Test Ban Treaty, Convention on International Liability for Damage Caused by Space Objects, the Convention on Registration of Objects Launched into

Outer Space, and the United Nations (UN) Prevention of Arms in Outer Space (PAROS), an ad hoc committee formed under the UN Conference on Disarmament.[4]

This paper will look at both sides of the debate on a potential 'Arms Race in Space' and conclude with some ideas for alternative approaches to weaponization and/or offensive or defensive protection of current space assets, the technical challenges associated with deploying weapons in space, and make a recommendation for a new international outer space policy filling the loopholes in existing space treaties.

Is it too late to stop the forward movement towards space weaponization? Many people fear that if the US or China deploys space weapons, it will force other nations to follow suit, and in turn, cause the development and deployment of weapons in outer space and potentially start another arms race, this time in space. As stated earlier, the US is the world's dominating space force and due to this, they may have the most to lose from such an arms race. There are several technical challenges in trying to deploy weapons in space and international pressures against any nation trying to do so. Due to this, there is still time to prevent the weaponization of space but the likelihood of space remaining free from weapons is very uncertain. Given the interests of national and international security, the US should take a leadership role and establish a new space policy to protect their own space assets and keep their military advantage in space while preserving space for peaceful purposes very much like current international treaties call for today.

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[4] United Nations, "Office for Outer Space Affairs," www.unoosa.org/ooas/SOregister/regist.htm; Internet; accessed 17 February 2008.

BACKGROUND AND TERMONOLOGY

Space Defined

What is space? The Joint Chiefs of Staff Joint Publication 3-14 defines space as "a medium, like the land, sea, and air within which military activities shall be conducted to achieve national security objectives."[5] There have been many different definitions for space. NASA awards astronaut wings for flights fifty miles above the Earth. Twenty-eight miles is the altitude where air-breathing engines no longer operate. For this paper, space will be defined as the lowest perigee for an object to orbit the Earth, or approximately one hundred kilometers above the Earth's surface.[6] This is the altitude where aerodynamic controls become ineffective.[7]

Before defining what is or is not space militarization and weaponization, it is important to note that the international community still cannot agree on whether or not militarization should be considered 'peaceful uses of space'. The Conference on Disarmament (CD) argued in 2001 at a United Nations General Assembly that "the prevention of an arms race in outer space would avert grave danger for international peace and security."[8] It was also argued in the same forum that "the exploration and use of space … shall remain be for peaceful purposes and shall be carried out for the benefit

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[5] United States, Joint Chiefs of Staff, *Joint Doctrine for Space Operations: Joint Publication 3-14* (Washington, DC: U.S. Government Printing Office, 2002), GL-5.

[6] John J. Klein, *Space Warfare: Strategy, Principles and Policy* (New York: Routledge Publishing, 2006), 6.

[7] *Ibid*., 6.

[8] Anup Shah, "Militarization and Weaponization of Outer Space," http://www.globalissues.org/Geopolitics/ArmsControl/Space.asp; Internet; accessed 16 January 2008.

and in the interest of all countries, irrespective of their degree of economic or scientific development."[9] This is where things become somewhat confusing. As stated earlier, space has been used for military purposes for decades and in 2001 the united Nations through the CD gave examples of peaceful purposes as, weather monitoring, search and rescue, natural disaster detection, mitigating space debris, monitoring the Earth's environment, and assisting research in science and health. While most nations agree to the UN's examples of peaceful use of space, nowhere in their description was military use to achieve military objectives stated. This may be the single biggest distinction between the two sides of the space weapons debate.

Space Militarization

While there is argument as to what defines 'peaceful purposes' of space, most nations agree that space is already militarized. What is more critical to understand is the differentiation between space militarization verses space weaponization. The widely accepted definition of space militarization is "the use of assets based in space to enhance the military effectiveness of conventional forces or the use of space assets for military purposes."[10] Many authors like John Klein, who wrote *Space Warfare*, argue that the space militarization race started in World War II when the Germans launched the V-2

[9] Anup Shah, "Militarization and Weaponization of Outer Space," http://www.globalissues.org/Geopolitics/ArmsControl/Space.asp; Internet; accessed 16 January 2008.

[10] Matthew Mowthorpe, *The Militarization and Weaponization of Space* (Maryland: Rowman and Littlefield Publishing, 2004), 3.

rockets tipped with munitions toward England.[11] While this is accepted by many as the official start of military use of space, this paper will focus on the space militarization that started out of a rivalry between the US and the Soviet Union in the mid-1950s.

In the 1950s, the US' primary objective for space was to develop satellite reconnaissance to spy on the then closed Soviet Union.[12] The secondary objective was to create an international policy that would make the use of satellites, for peaceful purposes, able to legally over fly other nations to enforce international treaties.[13] The US' final objective was to ensure the use of space would remain free for scientific and other peaceful purposes.

Even though the US was actively negotiating with other countries the permission to fly over their countries with satellites, they were also concurrently working on an intelligence satellite reconnaissance program when the Soviet Union launched a satellite called Sputnik I in 1957. The Soviet launch of Sputnik I shaped the US space policy through the 1960s and through lobbying of the US, international outer space control was to be guided by the United Nations.[14]

Many technological advancements have been made since the 1960s with over fifty nations currently using or planning to use space-based assets to enhance their

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[11] John J. Klein, *Space Warfare: Strategy, Principles and Policy* (New York: Routledge Publishing, 2006), 41.

[12] Matthew Mowthorpe, *The Militarization and Weaponization of Space* (Maryland: Rowman and Littlefield Publishing, 2004), 13.

[13] *Ibid.*, 13.

[14] *Ibid.*, 14-15.

military operations. The militarization of space is internationally accepted as acceptable but space weaponization is not.

Space Weaponization

Now that we have a better understanding of what space militarization is, how it is defined, and roughly when it started, the question that needs answering is how is militarization different from weaponization? There is no one perfect definition for space weaponization. A quick Internet search for "space weaponization" will provide hundreds of thousands of articles and/or definitions. Most of these are somewhat flawed or biased toward the objective of the article and influenced by the author's ideals. A definition in one article, written in a United Nations paper on disarmament, Canada wrote the definition of space weapons as follows: "Canada accepts the military use of space. Our focus is on the non-weaponization of outer space, by 'weapon' we mean any device or component of a system designed to inflict physical harm through disposition of mass and/or energy on another object."[15] Much like the Canadian definition, for the purposes of this paper, a space weapon will be defined as any device or system placed in earth's orbit with the intent of directly engaging or destroying a target either kinetically or with energy.[16]

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[15] Federation of American Scientists, "Canada – Proposal Concerning CD Action in Outer Space," United Nations Conference on Disarmament, UN Document CD/1569, (February 1999). http://www.fas.org/nuke/control/paros/docs/index.html; Internet; accessed 4 February 2008.

[16] Lieutenant Colonel D.P. Christy, "US Policy on Space Weapons" (Pennsylvania: US Army War College Paper, 2006), 2-3.

This paper will focus on the application of weapons in and through space, as well as ground launched weapons intended to attack space-based assets. Richard Garwin, former chair of the US Arms Control and Non-proliferation Advisory Board and member of the Rumsfeld-led commission to assess the Ballistic Missile Threat to the US, pointed out in a 2001 study that the US proposed 'that a fleet of hundreds or thousands of homing kill vehicles be orbited for boost-phased defense against launched Inter-continental Ballistic Missiles (ICBM).'[17] Although the US Ballistic Missile Defense system may include future 'kill vehicles' in space, it will not be included in this research because at this time no such weapons are planned or exist. In 2002 the US withdrew from the Anti-Ballistic Missile Treaty of 1972 and is actively pursuing a ballistic missile system.

By accepting the modified Canadian definition of space weaponization, it is clear and accepted internationally that space is already militarized. Since this is the case, the CD's examples of peaceful purposes do not seem to be relevant given that today, over fifty countries take advantage of military operations in space utilizing satellite technology.

TYPES OF SPACE WEAPONS

As mentioned earlier, this paper will focus on the application of weapons in and through space, and ground launched weapons intended to attack space based assets.

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[17] Richard L. Garwin, "Space Weapons or Space Arms Control?" *The American Philosophical Society* 145, no. 3 (September 2001): 257.

This research will concentrate its attention on directed energy weapons (DEWs) and kinetic energy weapons (KEWs). DEWs get their energy in the form of high-speed beams and KEWs get their energy from their momentum in the form of speed.[18]

DEWs

Directed energy space weapons can be lasers, high-powered microwaves, and particle beams.[19] One system being developed by the US is called Evolutionary Air and Space Global Laser Engagement (EAGLE). This system is designed to extend the operational range of ground and airborne lasers by using space-based relay mirrors to direct different laser powers anywhere in the world.[20] Ground-based lasers can penetrate the atmosphere and directly hit satellites in low earth orbit. Another system is Space-Based Radio Frequency Energy System; this is a series of satellites containing high-power transmitters capable of disrupting or destroying a wide variety of electronics and command and control systems. This type of weapon would typically be used as an ASAT weapon.[21]

In 1996 the Air Force 2025 strategy looked at the future of warfare and listed as one of its top priorities a space-based high-energy laser. Essentially a ground laser would

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[18] Bhupendra Jasani, *Space Weapons and International Security* (New York: Oxford Press, 1987), 14.

[19] Leonard David, "E-Weapons: Directed Energy Warfare In The 21st Century," *Space.com*, (January 2006). [journal on-line]; available from http://www.space.com/businesstechnology/060111_e-weapons.html; Internet; accessed 16 February 2008.

[20] *Ibid*.

[21] *Ibid*.

bounce energy of a constellation of space mirrors capable of striking space, sea, and air targets anywhere in the world within minutes.[22] Ground based lasers have been tested against space assets but to date; there are no space-based DEWs on orbit. The artist rendition below show what a space-based DEW satellite may look like shooting a missile in its boost phase.

In 1997, the US Army used a Mid-Infrared Advanced Chemical Laser (MIRACL) to hit a satellite to test the laser's capability and test the satellite's vulnerability.[23] The US has been secret about the results of the test but experts like Dornheim believes the test has led to enhanced capability and development of a greater ground-based ASAT

[22] Wade Huntly, "US Space Weaponization Planning And Implications For Canada," *Commentary: a Publication of the Royal Canadian Military Institute* (October 2005), 2.

[23] Michael Dornheim, "Laser Engages Satellite, With Questionable Results," *Aviation Week and Space Technology,* October 1997.

capability. While these space and ground based directed energy weapons are and have been developed and tested, they are still very new technology.

KEWs

On 19 October, 1959 the US launched a nuclear ASAT missile from a B-47 bomber aircraft.[24] While it did not hit the intended satellite, the electromagnetic pulse effects were so devastating that the US pushed for a ban on nuclear detonations in space which eventually lead to the Treaty Banning Nuclear Weapon Tests in the Atmosphere, in Outer Space, and Under Water in 1963.[25] In a 2002 article, Richard Garwin wrote, "there is no current ASAT threat. In fact, operational ASATs are vestiges of the Cold War era."[26] Given that China launched an ASAT missile at one of their failed weather satellites in orbit in 2007 his comments now seem wrong and the perceived ASAT threat looks like it may be real. China, the US, and Russia all have ground-to-space ASAT programs and the ability to strike satellites in their orbits.

Another type of KEW is micro or parasitic satellites. These are small, lightweight, cheap systems designed for a variety of missions.[27] The counterspace operations mission applies to this research. In this capacity, a microsatellite can be flown

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[24] John Pike, "Anti-satellite Weapons," *FAS Public Interest Report* 36, no.9 (November 1983).

[25] United States, Department of State, *Treaty Banning Nuclear Weapon Tests in the Atmosphere, in Outer Space and Under Water* (Washington, DC: U.S. Government Printing Office, 1963).

[26] Charles V. Pena, and Edward L. Hudgins, "Should the United States Weaponize Space? Military and commercial implications," *Policy Analysis* 427, (March 2002): 7.

[27] Ibid., 8.

alongside a target until it is commanded to disrupt, disable, or destroy its target.[28] Due to their relatively small size, these types of satellites are very difficult to detect.

In June of 2000, the United Kingdom's University of Surrey, a leader in microsatellites, launched a satellite called SNAP. This microsatellite was able to image other orbiting satellites and, by using GPS signals; maneuver to within a docking orbit of a Chinese satellite. This joint UK and China docking orbit tested this potential space weapon capability. The University of Surrey has cooperated with China, Russia, India, and Pakistan on microsatellite technology.[29]

Similar to microsatellites, space mines are small satellites designed to fly near an enemy satellite and explode or deliver an attack when commanded. While no space mines are on-orbit today, in 2003 the US maneuvered a microsatellite to within 115 feet of an upperstage rocket in space and took pictures. According to Garwin, "at this distance a shotgun shell could have destroyed a satellite."[30] This clearly shows that the space mine concept is capable of becoming a weapon in the future.

Long-rod penetrators or "Rods from God" are a concept of long telephone-pole sized tungsten or titanium rods dropped from low-earth orbit on a ground target. These rods would be capable of speeds of Mach 10 plus (7,000 miles per hour) and destroy deep buried bunkers. These conventional payloads would hit the ground with the power of a

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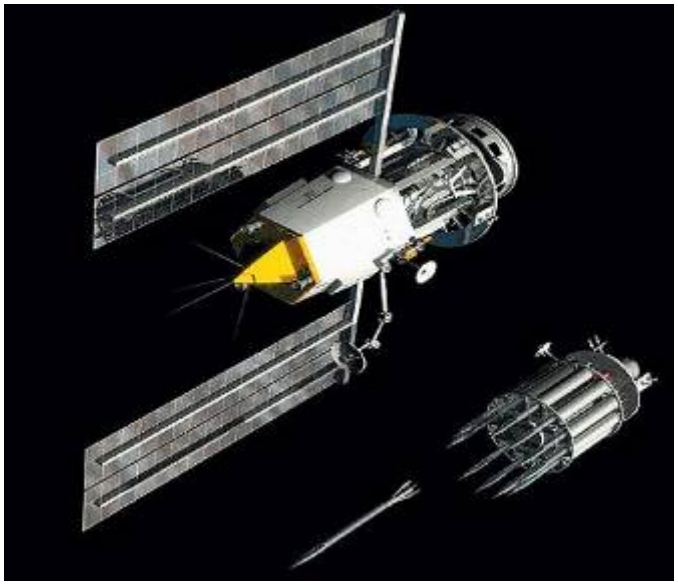
[28] *Ibid*., 8.

[29] Surrey Satellite Technology Press Release, "Surrey Satellite Technology's SNAP-1 Nano satellite Snaps Satellites in Orbit," http://www.spaceref.com/news/viewsr.html; Internet accessed; 22 Feb 2008.

[30] Richard L. Garwin, "Space weapons: Not Yet," *Federation of American Scientists* (May 2003) [journal on-line]; available from http://www.fas.org/rlg/030522-space.pdf; Internet; accessed 16 February 2008).

nuclear weapon.[31] While this system is a concept, many experts believe they are in the advanced design stage of development. Below is an artist rendition of what the "Rods from God" may look like.[32]



PROTECTION OF SPACE ASSETTS THROUGH WEAPONIZATION

Satellite Programs

Space assets and their capabilities are an integral part of everyday life for Americans.[33] "While transparent, space is embedded in homes, businesses, schools, and hospitals. Space is key for energy, transportation, telecommunications, entertainment,

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[31] Eric Adams, "Rods from God: Space Launched Darts that Strike Like Meteors," *Popular Science* (June 2004).

[32] Eric Adams, "Rods from God: Space Launched Darts that Strike Like Meteors," *Popular Science* (June 2004).

[33] Marc Berkowitz, "Protecting America's Freedom of Action in Space," *High Frontier the Journal for Space & Missile Professionals* 3, no.2 (March 2007): 13-14.

the environment, education, agriculture and emergency services central to our daily lives."[34] Space assets also provide for the American 'way of war' with global command and control, communications, intelligence, surveillance and reconnaissance. They also provide support to all phases of military operations from planning to execution.[35] This section will define these space assets, their roles, and analyze their capabilities. It will also provide a point, counter-point argument on whether these assets need to be protected, and if so, how?

Space was defined earlier as approximately 100 kilometers above the Earth. For military satellites, outer space functionally extends out to approximately 35,800 kilometers. Each satellite, based on its mission, has an orbit in which it operates. The basic rule of thumb is the closer a satellite is to Earth the narrower its field of view will be and conversely the further away it is the greater its field of view is.[36] Another way to define these orbits is to divide space into regions, low-earth (out to 2,000 km), medium-earth (out to 20,200 km), and high-earth (out to 35,800 km).[37] Examples of US military satellites working in these regions are: reconnaissance satellites (low-earth); Global Positioning System (GPS) Satellites (medium-earth), and communications satellites like Defense Satellite Communications System (DSCS III) (high-earth). Now that space operating areas are understood, we will look at these systems.

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[34] Marc Berkowitz, "Protecting America's Freedom of Action in Space," *High Frontier the Journal for Space & Missile Professionals* 3, no.2 (March 2007): 13-14.

[35] *Ibid*., 14.

[36] John J. Klein, *Space Warfare: Strategy, Principles and Policy* (New York: Routledge Publishing, 2006), 8.

[37] Charles V. Pena, and Edward L. Hudgins, "Should the United States Weaponize Space? Military and commercial implications," *Policy Analysis* 427, (March 2002): 3.

Command, control, and communications (C3) satellites are critical to military operations and represent the largest use of space for the US military.[38] These satellites provide the global, secure, protected, jam-proof communications for air, sea, and land military forces.[39] The US Department of Defense, through the Air Force, operates and controls numerous communications satellite programs including, but not limited to: DSCS III, Ultra-High Frequency Follow-On (UFO), and Military Strategic and Tactical Relay (MILSTAR).[40] All of the satellites described here operate in the geosynchronous or high-earth orbit. A geosynchronous orbit is where a satellite can operate and 'park' above a stationary point on the Earth. This orbit has a period identical to one full rotation of the Earth.[41] The US has the next generation of communication satellites in design and in production.

The Air Force also controls the Global Positioning Satellite (GPS) constellation of twenty-four operating satellites from Schriever Air Force Base in Colorado Springs, Colorado. GPS is a position, velocity, and timing system able to provide accurate positioning to an unlimited number of users[42] in all weather, day or night, anywhere in the world.[43] The GPS system is made up of three operational parts, the satellites, multiple ground stations, and the GPS users receivers. The GPS satellite system is

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[39] United States, "[Air Force Space Command] Fact Sheet," www.losangeles.af.mil/library/factsheets.asp; Internet; accessed 17 February 2008.

[40] Charles V. Pena, and Edward L. Hudgins, "Should the United States Weaponize Space? Military and commercial implications," *Policy Analysis* 427, (March 2002): 3.

[41] John J. Klein, *Space Warfare: Strategy, Principles and Policy* (New York: Routledge Publishing, 2006), 8.

[42] United States, "AFSPC Fact Sheet," www.schriever.af.mil/library/factsheets.asp; Internet; accessed 17 February 2008.

[43] United States, "Global Positioning System: Serving the World," www.gps.gov; Internet; accessed 11 February 2008.

especially critical to the military as it provides data which aids military platforms and systems in navigation, precision weapons delivery, air-to-air refueling and combat search and rescue operations.[44] The civil uses of this system include: banking, mobile phone communications, control of power grids, farming, surveying, geology and is used by millions of civilians around the world.[45] These satellites operate in the medium-earth orbit.

Surveillance and reconnaissance satellites can be divided into three categories – photographic, radar, and electronic. Surveillance and reconnaissance satellites can offer global access, large amounts of intelligence data, in near real-time. Radar satellites can provide imagery day or night in all weather conditions while optical reconnaissance satellites can produce high resolution imagery but are under the influence of weather limitations.[46]

Optical reconnaissance satellites generally operate in low-earth orbits, while electronic satellites can operate over the full spectrum on operational orbits depending on their intended mission or objective. The US, through the 2006 National Space Policy, presents the following unclassified facts about its surveillance and reconnaissance satellites. "The US Government conducts satellite photoreconnaissance that includes near real-time capability of overhead signals intelligence, overhead measurement, and

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[44] Great Britain, "AP 3000 Aerospace Doctrine: Information Exploitation Ch 4," 2.4.8.

[45] United States, "Global Positioning System: Serving the World," www.gps.gov; Internet; accessed 11 February 2008.

[46] Great Britain, "AP 3000 Aerospace Doctrine: Information Exploitation Ch 4," 2.4.9.

signature collection."[47] Uses for photo-reconnaissance are to monitor compliance with arms control agreements, collecting mapping and charting data in support of defense activities, collecting scientific and environmental data, and collecting data on man-made and natural disasters.[48] They also provide critical data to military planners before and during the conduct of military operations.

Early Warning satellites were first launched in the mid-1960s. Missile Warning satellites were developed in the late 1950s after the Russian launch of Sputnik I, the US realized that an Inter-continental Ballistic Missile (ICBM) launched from Russia would only take thirty minutes to hit the US. Even though the US had radars positioned in Norway, Great Britain, and Greenland this would only give them fifteen minutes notice as they would be detected half-way through their flight.[49] Defense Support Program (DSP) was designed and deployed to give the North American Air Defense (NORAD) advance notice of a missile launch or a nuclear detonation. These satellites operated in high-earth orbits and use infrared detectors to sense the heat against the earth's background.[50]

Weather and environmental satellites are a great example of a dual-use space asset. Weather data is critical to military planners and also important for civilian public

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[47] United States, Office of the President of the United States, *US National Space Policy 2006* (Washington, DC: U.S. Government Printing Office, 2006), 10.

[48] Ibid., 10.

[49] US Centennial of Flight Commission, *Missile Early Warning Satellites*, http://www.centenialofflight.gov/essay/SPACEFLIGHT/warning/SP37.htm; Internet; accessed 10 February 2008.

[50] Federation of American Scientists, "Defense Support Program," www.FAS.org/ssp/military/program/nssrm/initiatives/dspnds.htm; Internet; accessed 17 January 2008.

safety. Also, scientific research is done using data from Department of Defense and National Oceanic and Atmospheric Administration satellite programs.[51] These satellites are in various orbits depending on their specific mission. Now that the satellites on orbit are understood, it is important to see what the US is saying about protecting these assets.

2001 US Space Commission Report

In January 2001, a team of 'who's who' within the space industry and the US Government submitted a report to assess the US national security of space management and organization. This team was led by Donald Rumsfeld and included members like, General (retired) Estes III, Fogleman, Horner, and Moorman, and Admiral (retired) Jeremiah. To appreciate these distinguished members contributions and experience in the space field, each will be briefly introduced.

General Howell M. Estes III retired in 1998 as the commander in chief, North American Aerospace Defense Command (NORAD), and the United States Space Command (USSPACECOM), and commander Air Force Space Command (AFSPC). General Ronald R. Fogleman retired in 1997 as the Air Force Chief of Staff. General Charles A. Horner retired in 1994 as the commander in chief, North American Aerospace Defense Command (NORAD), and the United States Space Command (USSPACECOM), and commander Air Force Space Command (AFSPC). General Thomas Moorman retired in 1997 as the Air Force Vice Chief of Staff and was key in the

[51] Charles V. Pena, and Edward L. Hudgins, "Should the United States Weaponize Space? Military and commercial implications," *Policy Analysis* 427, (March 2002): 3.

development of the Air Force Space Command.[52] Admiral David E. Jeremiah retired in 1994 as the Vice Chairman to the Joints Chiefs of Staff under General Colin Powell.

The Commission's assignment was to assess the direction, management, and organization of the US space activities in support of national security. The members listed above were appointed by the chairmen of the House and Senate Armed Services Committees and by the Secretary of Defence in consultation with the Director of Central Intelligence.[53] After a six-month study of the current state of the US space capability and policy, the commission concluded that the security of the United States and its allies depended on their ability to freely operate in space and called for the protection of this ability.[54] While this is not a complete list, the commission made the following recommendations to the US government:

1. Promote the peaceful use of space,
2. Use the nation's space assets to support domestic, economic, diplomatic and national security objectives,
3. Develop and deploy the means to deter and defend against hostile acts directed at US space assets and against the use of space for hostile acts against any US interests,
4. A quick revision of the national space policy,
5. Invest in technologies to permit the US Government to field systems one generation ahead of what is available commercially to meet unique national security requirements,

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[52] United States, Air Force Link, Biographies http://www.af.mil/bios/; Internet; accessed 10 February 2008.

[53] United States, Air Force Air University, *Report of the Commission to Assess United States National Security Space Management and Organization* http://www.space.au.af.mil/space_commission/; Internet; accessed 8 February 2008, vii.

[54] *Ibid*., vii.

6. Due to the US dominance in space, be cautious of foreign nations and non-state entities who are seeking space-related activities,

7. If the US is to avoid a "Space Pearl Harbour" it needs to take seriously the possibility of an attack on its space systems.[55]

The commission also noted that, history shows that every medium—air, land and Sea has seen conflict and the reality is that space will be the same. "Given this virtual certainty, the US must develop the means both to deter and to defend against hostile acts in and from space."[56] It goes on to describe space as not just a place to acquire information but a medium to conduct operations to, from, in, and through. The US must be able to defend its space assets against hostilities and minimize the hostile use of space against them.

The consistent theme of the Space Commission report is that the US is more dependent on space assets than any other nation, and therefore needs to protect that freedom of action in space. The figure below shows a great example of what a future space battlefield may look like.

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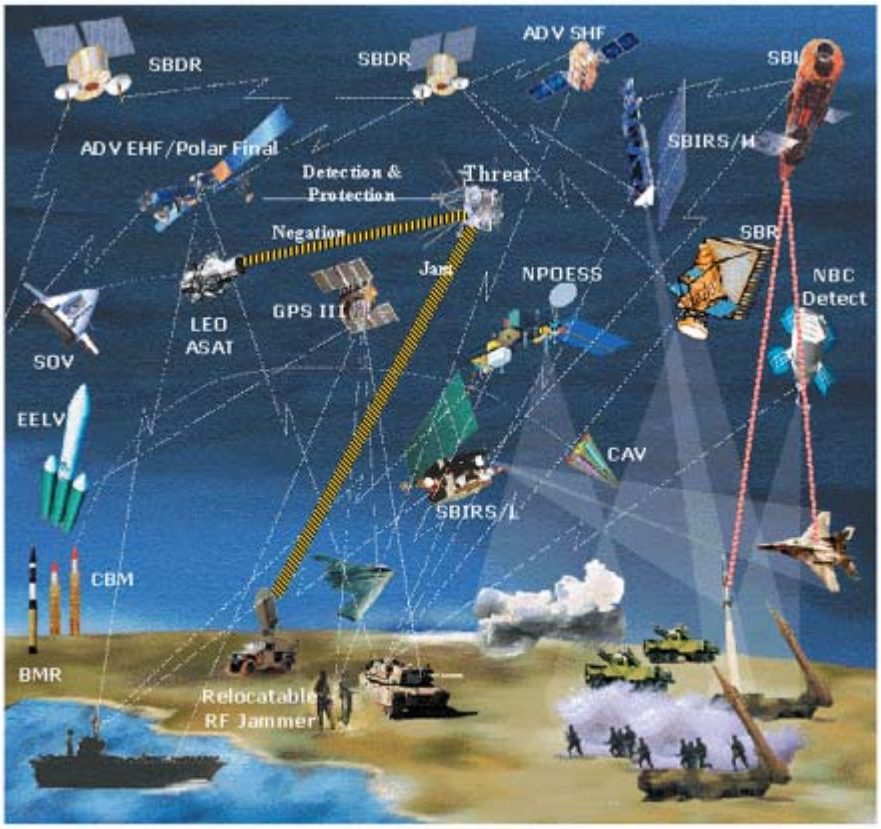
[55] United States, Air Force Air University, *Report of the Commission to Assess United States National Security Space Management and Organization* http://www.space.au.af.mil/space_commission/; Internet; accessed 8 February 2008,vii-ix.

[56] *Ibid*., x.



Source: Headquarters Air Force Space Command
Figure 8: Space systems will transform the conduct of future military operations

Argument For Space Weapons

The 2006 National Space Policy states: "The United States will view purposeful interference with its space systems as an infringement on its rights … and will dissuade or deter others from either impeding those rights or developing capabilities intended to do so."[57] It insists that the US will take appropriate self-defense measures to protect against such an attack that violates its rights of freedom in space.

[57] United States, Office of the President of the United States, *US National Space Policy 2006* (Washington, DC: U.S. Government Printing Office, 2006), 10.

Many space weapons advocates support a defensive strategy for the current on-orbit space assets. They point to a number of international space incidents in the last few years. In 2002, Iraq jammed navigation satellites, Libya and Iran interfered with communications satellite signals in 2005, China used a ground-based laser to laze a US intelligence satellite in 2006, and China's successfully tested an anti-satellite missile in 2007.[58] The argument is that due to incidents like these, the US needs to continue to pursue space defensive and offensive space systems to protect their satellites and their dominance in space and avoid the next Pearl Harbor.

There are numerous advantages to using space-based weapons. They are always in position to strike, offer a tier of defense, command and control, warning, and intercept if necessary. They offer the commander theatre defense and engagement capability while military forces build-up is in progress. These systems in space could offer protection for forward based forces and reduce the requirement for surface-based interceptors.[59]

One of the biggest advocates for the defense of satellites on orbit came from the US Space Commission. It posits that technologies are getting easier and more readily available by potential hostile entities and that the US needs to protect their on orbit assets from such hostilities. "The loss of a space system that supports military operations or collects intelligence would dramatically affect the way US forces could fight."[60] It goes

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[58] Marc Berkowitz, "Protecting America's Freedom of Action in Space," *High Frontier the Journal for Space & Missile Professionals* 3, no.2 (March 2007): 13.

[59] Matthew Mowthorpe, *The Militarization and Weaponization of Space* (Maryland: Rowman and Littlefield Publishing, 2004), 26.

[60] United States, Air Force Air University, *Report of the Commission to Assess United States National Security Space Management and Organization* http://www.space.au.af.mil/space_commission/; Internet; accessed 8 February 2008, 32.

on to say that providing passive and active protection measures like microsatellites, hardened electronics, and autonomous operations will improve the survivability of satellites on orbit.[61]

The commissioners wrote in this report that while they appreciated the sensitivities associated with talking about space weapons, the US should "vigorously pursue" that capability to ensure the President has the option to deploy weapons in space to deter threats and more importantly, if necessary, defend against an attack.[62] When it comes to power projection from space the commission recommended that the US should have the capability to project power in, from, and through space, so they would have a greater deterrent and in a conflict, an "extraordinary military advantage."[63]

Five years after the commission report was submitted; the President authorized a new National Space Policy, which will be discussed later. An important note to this topic is that after its release, questions were being asked as to whether the US was seeking space weapons. In a June 2005 press briefing, the White House spokesman, Scott McClellan said "we believe in peaceful exploration of space and there are treaties in

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[61] United States, Air Force Air University, *Report of the Commission to Assess United States National Security Space Management and Organization* http://www.space.au.af.mil/space_commission/; Internet; accessed 8 February 2008, 32.

[62] *Ibid*., 17.

[63] *Ibid*., 33.

place, we will continue to abide by those treaties."[64] He added that the US "was not looking to weaponize space as some reports had previously suggested."[65]

General Estes III, the former commander of Air Force Space Command suggested that space weapons will defend friendly satellite programs, attack an enemy's satellites, and shoot down long-range ballistic missiles. The basis of his argument is that regardless of what the US does, other nations will develop and deploy space weapons over time. Due to the growing dependence the US has over space systems, it cannot allow another nation to cripple the advantage these systems deliver.[66]

Peter Brookes, Senior Fellow, National Security Affairs and Chung Ju-Yung Fellow for Policy Studies suggests that opponents of space weapons have insisted that a space arms race would result from the new US National Space Policy and that China, Russia, Japan and even the European Union will surely be provoked into following the US'.[67] He also asks the question, if the US leaves space open, what's to stop others from seizing it? He suggests that opponents to space weapons say that another UN arms control treaty is needed.[68] Finally, he points to the decades of arms control talks against ballistic missile defense, suggesting that it would destabilize relations between the US,

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[64] Leonard David, "E-Weapons: Directed Energy Warfare In The 21st Century," *Space.com*, (January 2006). [journal on-line]; available from http://www.space.com/businesstechnology/060111_e-weapons.html; Internet; accessed 16 February 2008.

[65] *Ibid*.

[66] General Howell Estes III, Speech to the Air Force Space Symposium, log Angeles, 18 October 1996.

[67] Peter Brookes, "Militarizing Space," The Heritage Foundation on-line; available from http://heritage.org/press/commentary/ed060705a.cmf; Internet; accessed 15 April 2008.

[68] *Ibid*.

China, and Russia and start the largest arms race ever.[69] The Bush administration deployed missile defense and it has not caused an arms race nor has it made relations with China and Russia worse that it was before.

Another advocate for the weaponization of space was Peter B. Teets the former undersecretary of the Air Force and Director of the National Reconnaissance Office. In 2004, Mr. Teets suggested that the "US does not have full space dominance and space supremacy and should reach for that goal as space is the ultimate high ground."[70] The former Secretary of Defense Donald Rumsfeld said the ultimate goal was not simply to fight wars but to prevent them. To coerce and influence potential adversaries from developing space weapons by deterring them with the ability to defend space assets.[71] He suggested that hardening space systems and building capabilities to defend them could dissuade adversaries from deploying weapons against them. Because we are so dependent on space for our everyday life, the space lines of communication need to be protected in the 21st century just as a sea line of communication needed to be protected today.[72] John Carter McKnight argues that these space lines of communication need to be defended vigorously and effectively.

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[69] Peter Brookes, "Militarizing Space," The Heritage Foundation on-line; available from http://heritage.org/press/commentary/ed060705a.cmf; Internet; accessed 15 April 2008.

[70] Master Sergeant Scott Elliot, "Teets, America Must Reach for Space Dominance," Air Force Link, (September 2004) http://www.af.mil/news/story.asp?storyID=123008652; Internet; accessed 16 February 2008.

[71] *Ibid*.

[72] John C. McKnight, "Let's Weaponize Space," *Space Daily*, (January 2003). Journal on-line; available from http://www.spacedaily.com/news/oped-03d.html; Internet; accessed 10 December 2007.

Finally, General Lance Lord, former Air Force Space Command commander said "we must prepare to face the future threats today. My top priority is space superiority. We would not dream of conducting air operations without air superiority. We are not trying to dominate, but we must protect and project our interests in the space medium."[73]

Argument Against Protection

This section will focus on the argument against space weapons for either defensive or offensive purposes. One such outspoken opponent is Theresa Hitchens, the Director for the Center for Defense Information in Washington DC. At a meeting in Washington in May, 2006, Hitchens spoke about the new US space policy. She said President Bush's new policy is much more military focused than that of President Clinton's policy. She describes the term "freedom of action in space" as a code phrase for "freedom to attack as well as freedom from attack."[74] Hitchens does a good job of connecting the dots between the commission report, the President's space policy and the Department of Defense's doctrine to highlight what looks like a movement within the government to deploy weapons in space. When asked about how the White House answers to the space weaponization questions, Hitchens said, "The reason for the coyness is obvious; the White House knows the idea of space weapons is publicly controversial. Therefore, they will seek to defuse this controversy by emphasizing the defensive needs

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[73] John C. McKnight, "Let's Weaponize Space," *Space Daily*, (January 2003). Journal on-line; available from http://www.spacedaily.com/news/oped-03d.html; Internet; accessed 10 December 2007.

[74] Leonard David, "E-Weapons: Directed Energy Warfare In The 21st Century," *Space.com*, (January 2006). [journal on-line]; available from http://www.space.com/businesstechnology/060111_e-weapons.html; Internet; accessed 15 February 2008.

and approach."[75] In a 2004 report by the Federation of American Scientists (FAS) to consider the deployment of weapons for defensive purposes, they concluded that "space weapons are not preferred or even desired to address threats."[76]

Joan Johnson-Freese, chair of the Naval War College's National Security Decision Making Department, points out that any effort of the US to deny other nations from seeking space technologies will only increase their determination to do so. She said the "US is traveling down a road to space dominance in a car without a steering wheel, and with no consideration of the terrain beyond immediate sight. This is happening in the areas of space control and space force application."[77]

When assessing the two schools of thought about weapons for defense of space assets and whether space weapons are inevitable, it is hard to ignore the comments in the Space Commission report. When considering if space will eventually become weaponized, the comments in the report certainly make a compelling argument that the US is leaning that way if not already there.

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[75] Leonard David, "E-Weapons: Directed Energy Warfare In The 21st Century," *Space.com*, (January 2006). [journal on-line]; available from http://www.space.com/businesstechnology/060111_e-weapons.html; Internet; accessed 15 February 2008.

[76] Joan Johnson-Freese, *Space as a Strategic Asset* (New York: Columbia University Press, 2007), 136.

[77] *Ibid*., 105.

CURRENT TREATIES AND AGREEMENTS

Outer Space Treaty of 1967

The official Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, Including the Moon and other Celestial Bodies was signed in 1967 and entered into force on October 10, 1967.[78] The treaty has four major provisions: all nations shall have free access to space but maintain liability for damage they may cause through space operations; space will be used for peaceful purposes; there will be no weapons of mass destruction placed in orbit around the Earth or on the Moon; In addition, all space objects must be registered with the United Nations.[79] This treaty was ratified at the height of the Cold War to give some international governance to the use of outer space. With the military competition between the Soviet Union and the US over space this was a way to ensure space would be used for peaceful purposes. When this treaty was signed in 1967 only seven countries had satellites in space, today that number is forty-seven.[80] Over forty years later, the Outer Space Treaty is still recognized as the international treaty governing space.

In 1967 the focus of the Outer Space Treaty was on weapons of mass destruction. Article IV under this treaty states, "States Parties to the Treaty undertake not to place in orbit around the Earth any objects carrying nuclear weapons or any other kinds of

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[78] United States, Department of State, Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, Including the Moon and Other Celestial Bodies (Washington, DC: U.S. Government Printing Office, 1967).

[79] *Ibid*.

[80] Jessica West, "Back to the Future: The Outer Space Treaty Turns 40," *The Space Review*, (October 2007) [Journal on-line]; available from http://www.thespacereview.com/articles/982.html; Internet; accessed 16 December 2007.

weapons of mass destruction."[81] Article III states that activities in the exploration of outer space shall be in accordance with international law, "including the non-use of force Charter of the United Nations."[82] Article 51 of the United Nations provides for the "inherent right of self-defence if an armed attack has occurred."[83] When Article 51 is applied to the Outer Space Treaty, advocates for space weapons point to this inherent right to self-defence as their reason for deploying defensive weapons in outer space.

Opposition to the self-defence argument point to the serious loophole in the Outer Space Treaty itself. The treaty does not cover conventional weapons, just weapons of mass destruction. This opens the door for parties to interpret the treaty to suit their interests. The CD has been attempting to get international consensus on a new treaty or policy to cover this loophole.

The Partial Nuclear Test Ban Treaty

The Partial Test Ban Treaty of 1963 was aimed at prohibiting nuclear weapons tests in the atmosphere, in outer space, and under water.[84] Negotiations for this treaty between the US, UK, Canada, France, the former Soviet Union and many other nations

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[81] United States, Department of State, Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, Including the Moon and Other Celestial Bodies (Washington, DC: U.S. Government Printing Office, 1967).

[82] *Ibid*.

[83] United Nations, "Charter of The United Nations: Chapter IV," www.un.org/aboutun/charter/chapter7.htm; Internet; accessed 17 February 2008.

[84] United States, Department of State, Treaty Banning Nuclear Weapon Tests in the Atmosphere, in Outer Space and Under Water (Washington, DC: U.S. Government Printing Office, 1963).

took nearly eight years to achieve.[85] The problem with the negotiations was with the technical challenges of verification and the deep-seated differences between the nation's approaches to arms control. Another obstacle in the negotiations was the poor relationship between the East and West.[86] Negotiations began in 1955 and were finally adopted in 1963.

In 1996 the Comprehensive Nuclear Test ban treaty was opened for signature in New York. This treaty expanded the test ban to all environments and signed in 2006 by seventy-one states including five of the eight nuclear states. Today 178 states have signed the treaty but only 144 have ratified it. To date the US has not ratified the treaty and proponents for US ratification argue that if they ratify, it would create an international norm that would pressure other nuclear countries to sign the treaty. In 1999 President Clinton said,

> "I am very disappointed that the US Senate voted not to ratify the Comprehensive Nuclear Test Ban Treaty. This agreement is critical to protecting the American people from the dangers of nuclear war. It is, well worth fighting for. And I assure you, the fight is far from over."[87]

Despite the warning from President Clinton, this fight was never fought again nor voted on in the US Senate. To date, this treaty has not been ratified by the US.

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[85] United States, Department of State, Treaty Banning Nuclear Weapon Tests in the Atmosphere, in Outer Space and Under Water (Washington, DC: U.S. Government Printing Office, 1963).

[86] *Ibid*.

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Convention on International Liability for Damage Caused by Space Objects

This convention was signed in 1972 to elaborate on Article VII of the Outer Space Treaty of 1967. This convention states that "a launching state shall be absolutely liable to pay compensation for damages caused by its space objects on the surface of the earth or to aircraft and liable for damage as a result of its faults in space."[88] As of 2007, eighty-four states have signed and twenty-four have ratified.[89]

The Convention on Registration of Objects Launched into Outer Space

This convention, signed in 1974, requires nations to register and inform the United Nations with information on their launches. In accordance with General Assembly resolution 1721 B, the registration of objects launched into outer space will be maintained by the Secretariat of the UN.[90] The Registration Convention states that launching states provide "as soon as possible" the following information on the launched object: name of launching State, appropriate registration number, date and territory of launch, orbital parameters, and general function of the space object.[91]

While the Outer Space Treaty is the main international treaty affecting the weaponization of space, it is also important to understand the other international laws and

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[88] United Nations, "Office for Outer Space Affairs" www.unoosa.org/ooas/SpaceLaw/liability.htm; Internet; accessed 17 February 2008.

[89] *Ibid*.

[90] United Nations, "Office for Outer Space Affairs" www.unoosa.org/ooas/SORegister/regist.htm; Internet; accessed 17 February 2008.

[91] *Ibid.*

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treaties that may shape this debate. That the US has not ratified the Comprehensive Nuclear Test Ban Treaty may show their reluctance to work cooperatively through international channels regarding space issues. The Liability Convention is relevant to this argument because if a state deploys weapons and uses those weapons from space to hit terrestrial targets, are there liabilities under this treaty? Furthermore, the Registration Convention is relevant to space weapons as these weapons would need to be registered with the United Nations with their purpose. The loophole in this convention and many of the others is there is the lack of enforcement and oversight. Nothing forces launching states to give the real application of the space object being launched and these states rarely register in a timely matter.

CURRENT US SPACE POLICY

President Bush's National Space Policy 2006

On August 31, 2006, President George Bush authorized a new US National Space Policy replacing the 1996 version. In it, the US describes how its space activities have "improved life in the United States and throughout the world, enhancing security, protecting lives and the environment, speeding information flow, and serving as an engine for economic growth."[92] It also describes how a country that utilizes space will

[92] United States, Office of the President of the United States, *US National Space Policy 2006* (Washington, DC: U.S. Government Printing Office, 2006), 1.

"enjoy added prosperity and security"[93] and will have a huge advantage over countries that do not.

This National Space Policy is a direct action, taken by the President, out of the space commission report and is broken down into principles and goals. It also states that US space programs will remain a top priority for the US Government. The guiding principles are as follows:

1. The US is committed to the exploration and use of outer space by all nations for peaceful purposes.
2. The US rejects any claims to sovereignty by any nation over outer space or celestial bodies.
3. The US will seek to cooperate with other nations in the peaceful use of outer space and to extend those benefits space, space exploration, and protection throughout the world.
4. The US considers those space systems to have the rite of passage through and operations in space without interference.
5. The US considers space capabilities extremely vital to its national interests. The US will dissuade or deter others from impeding its right of freedom in space and will take actions necessary to protect its space capabilities; respond to interference; and deny, if necessary, adversaries the use of space capabilities that are hostile against US national interests.[94]

This policy specifically calls for the Secretary of Defense to maintain capabilities to execute space support, force enhancement, space control, and force application missions. While all four of these missions will be described in the next section, the focus

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[93] United States, Office of the President of the United States, *US National Space Policy 2006* (Washington, DC: U.S. Government Printing Office, 2006), 1.

[94] *Ibid*., 1-2.

will be on force application as this is more relevant to this research. It also calls for the "plans and options to ensure freedom of action in space, and, if directed, deny such freedom of action to adversaries."[95] These words in the new policy certainly look like the US is positioning itself to plan, design, and/or deploy space weapons, even if for defensive purposes until the time when they are needed for offensive operations.

Finally, the space policy calls for "the US to take the lead internationally, to encourage foreign nations and international organizations to adopt principles and practices aimed at debris mitigation."[96] This is especially critical in low earth orbits where the manned space missions are being conducted on the US space shuttle and the International Space Station.

Now let's take a closer look at the wording in this policy and see where it differs from previous space policies. In general, this policy is no different than past space policies, it talks to the peaceful use of space, access to space for all nations and organizations, and international cooperation. However, a closer examination on this new policy reveals a few key critical differences; the first is declaring space capabilities being "vital to National Interests."[97] It then goes on to say that the US will oppose regimes that intend to prohibit or limit US space access or use.[98] The final and maybe most

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[95] United States, Office of the President of the United States, *US National Space Policy 2006* (Washington, DC: U.S. Government Printing Office, 2006), 4.

[96] Ibid., 9.

[97] Dr. Dana J. Johnson, "National Space Policy: Opportunities and Challenges in Shaping the International Space Regime," *High Frontier the Journal for Space & Missile Professionals* 3, no.2 (March 2007): 50.

[98] Ibid., 51.

compelling to this research is the statement that any "proposed arms control agreements or restrictions must not impair the rights of the US to conduct research, development, testing, and operations in space for US national interests."[99] Reading between the lines, this new policy may be saying that the US intends to fulfill its obligations to the Outer Space Treaty but sees no need for new international arms control in space agreements. As you will see in a future section, the Outer Space Treaty of 1967 has serious holes in it when it comes to space weapons and their possible use. So, if the US intends on pursuing space weapons for defensive or offensive means, these are the types of words one might expect to see.

US and Air Force Space Commands

The official national security space missions of the United States are space support, force enhancement, space control, and force application.[100] The US Space Command's (USSPACECOM) vision statement is, "dominating the space dimension of military operations to protect US interests and investment. Integrating Space Forces into warfighting capabilities across the full spectrum of conflict."[101] Their Vision 2020 introduces four operational concepts, control of space, global engagement, full force

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[99] United States, Office of the President of the United States, *US National Space Policy 2006* (Washington, DC: U.S. Government Printing Office, 2006), 2.

[100] United States, Joint Chiefs of Staff, *Joint Doctrine for Space Operations: Joint Publication 3-14* (Washington, DC: U.S. Government Printing Office, 2002), GL-2.

[101] United States, Department of Defense, *AFSPC Vision* (Washington, DC: U.S. Government Printing Office, 2006), 2.1.3.

integration, and global partnerships.[102] Space control ensures uninterrupted access to space for the US and its allies and freedom of operations within space while denying others the use of this medium if required. Global engagement is surveillance of earth, worldwide missile defense and the ability to apply force from space. Full force integration attempts to join space-derived information and information derived from land, sea, and air. Finally, global partnership will augment space capabilities by accessing civil, commercial, and international space capabilities.[103]

The Air Force Space Command's (AFSPC) vision statement is different than the USSPACECOM's. AFSPC's vision is, "a globally integrated aerospace force providing continuous deterrence and prompt engagement for America and its allies…through control and exploitation of space and information."[104] The big distinction between the two is AFSPC's comments on "prompt engagement" through "control and exploitation" of space. By looking at AFSPC's mission areas it may seem as if the US Air Force plans to develop and deploy weapons in space. Their mission areas are: space force enhancement, counterspace (or space control), space force application, space support, and mission support.[105] Although we will briefly discuss each of these mission areas, the

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[102] United States, Department of Defense, *AFSPC Vision* (Washington, DC: U.S. Government Printing Office, 2006), 2.1.3.

[103] *Ibid*., 2.1.3.

[104] United States, Department of Defense, *AFSPC Vision* (Washington, DC: U.S. Government Printing Office, 2006), Figure 2-1.

[105] United States, Air Force Space Command, *Air Force Space Command, Strategic Master Plan FY04 and Beyond* (Colorado Springs, Colorado: Peterson AFB, 2004), Figure 1-1.

emphasis will be on space control and space force application as they are the two that may apply to space weaponization.

Finally, and more important to the space weaponization debate are, space force application and space control. Space force application is defined as "missions carried out by weapons systems operating from or through space for holding terrestrial targets (land, air, and sea) at risk in support of military operations."[106] These would be weapons like space-based lasers and Rods from God. Currently there are no operational space systems deployed that provides space force application as described above.

Space control focuses on capabilities to attain and maintain space superiority. This is done by allowing and supporting allies' freedom of movement in space and denying adversaries the same freedom. In conflict, space control is used to prevent the space forces of an opponent from influencing the outcome of terrestrial or space operations. These systems would include attack mirosatellites and space mines. Like space force application, there are no systems deployed for space control operations. Richard Garwin describes the US space control technology as a program that will include protection, prevention, negation, and surveillance space activities. He says their goal "conjures up the vision of anti-satellite weapons (ASAT) that could destroy other satellites at will."[107]

While space force application and space control seems to go against what is defined as peaceful use of space, as stated above, there are no systems currently on orbit

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[106] United States, Air Force Space Command, *Air Force Space Command, Strategic Master Plan FY04 and Beyond* (Colorado Springs, Colorado: Peterson AFB, 2004), 13.

[107] Richard L. Garwin, "Space Weapons or Space Arms Control?" *The American Philosophical Society* 145, no. 3 (September 2001): 248.

in support of the two. These two mission areas are in the Joint Vision 2020 but not in current US doctrine and whether the US moves forward to realize these missions remains to be seen.

The Space Commission Report made specific recommendations about the US' space asset vulnerabilities to President Bush and within five years, he authorized a new US National Space Policy. The Department of Defense, AFSPC, and USSPACECOM's answered with new doctrine to meet the challenges laid out in the President's policy. Analyzing the National Space Policy principles it may look like space will continue to be used for military and peaceful purposes and free from space weapons, but when combined with the Department of Defense's space control and space force application missions, it looks like the door may be left open. The statement, "The US will dissuade or deter others from impeding its right of freedom in space and will take actions necessary to protect its space capabilities; respond to interference; and deny, if necessary, adversaries the use of space capabilities that are hostile against US national interests"[108] appears to carefully leave the door wide open to the possibility of deploying defensive space weapons in the future. What the US does next will largely depend on the actions of their allies and actions from their potential opponents.

INTERNATIONAL RELATIONS

> To counter U.S. advantages in space, other states and international organizations have sought agreements that would restrict the use of space. For example, nearly

[108] United States, Office of the President of the United States, *US National Space Policy 2006* (Washington, DC: U.S. Government Printing Office, 2006), 2.

> every year, the U.N. General Assembly passes a resolution calling for prevention of "an arms race in outer space" by prohibiting all space weapons. Russia and China have proposed to prohibit the use of space for national missile defense. The U.S. should seek to preserve the space weapons regime established by the Outer Space Treaty, particularly the traditional interpretation of the Treaty's "peaceful purposes" language to mean that both self-defense and non-aggressive military use of space are allowed.[109]

"The Space weapons under US development could be used not only to attack missiles in flight, but also to attack military and civilian satellites and targets anywhere on earth."[110] These two quotes give an example of how far apart the thinking about space weaponization is in the international community, especially between China, Russia, and the United States. One such international body concerned about space weaponization as mentioned earlier is the United Nations Conference on Disarmament when addressing the Prevention of an Arms Race in Outer Space (PAROS).

Conference on Disarmament

In 1981 the Conference on Disarmament began a draft treaty to ban all weapons in space. There was steady progress on this draft until 1995 when the disagreements between China and the US prevented consensus.[111] Since 1995 there has been much debate on space weaponization but the Conference on Disarmament has agreed not to

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[109] United States, Air Force Air University, *Report of the Commission to Assess United States National Security Space Management and Organization,* http://www.space.au.af.mil/space_commission/; Internet; accessed 8 February 2008, 37.

[110] Hui Zhang, "Act now to Stop a Space Arms Race," *Financial Times* (London: June 10, 2005): 13.

[111] Sarah Estabrooks, "Options for Preventing the Weaponization of Space," *Peace Magazine* 19, no. 3 (July-September 2003): 10.

convene this ad hoc committee on PAROS.[112] Over the years there have been numerous proposals presented and supported by several states but no agreements have been made on a new treaty for the role of outer space. One example of this is the 2001 Russian proposal for a moratorium on the development of space weapons and the 2004 Chinese 'working papers' on PAROS.

The most recent address of space weaponization to the Conference on Disarmament was on 12 February 2008 by Russian's Foreign Minister Sergey Lavrov. He proposed a new draft treaty preventing space weapons and China's Ambassador Li Baodong addressed the Conference on Disarmament with a statement from the Chinese Foreign Minister showing similar support for a new space weapons treaty.[113]

The draft treaty acknowledged that space was key to future development, and that it needed to be kept free for exploration and peaceful purposes. It focuses on keeping outer space free from all weapons and states that an arms race in space would hurt the international community. This new draft treaty describes space and what a space weapon is (very much like this paper did earlier) and focuses on the following key articles:

Article II demands that nations will not place in orbit around the earth any objects carrying any kind of weapon and not place any weapons on celestial bodies. They will not threat or use force against space objects nor assist or encourage others participating in activities prohibited by the Treaty. Article IV states that this treaty cannot be interpreted

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[112] Lloyd Axworthy, "Prevention of an Arms Race in Outer Space," http://www.disarmament.un.org/DDApublications/op6art9.pdf; Internet; accessed 3 February 2008, 108.

[113] Conference on Disarmament 2008, "Reaching Critical Will," http://www.reachingcriticalwill.org/political/cd/speaches08.html; Internet; accessed 12 February 2008.

to impede the rights of others to explore and use outer space for peaceful purposes under international law including the Charter of the UN and the Outer Space Treaty of 1967. Article V states that nations cannot impede the right for self-defense in accordance with Article 51 of the Charter of the UN. Article VI discusses the need for verification and compliance with the treaty. It states that to facilitate assurance of compliance and promote confidence-building in space activities, nations shall practice on a voluntary basis, unless agreed otherwise, agreed confidence-building measures. To measure the verification and compliance with the treaty, there may need to be additional protocols. Article XI gives nations the right to withdraw from the treaty if it decides that the treaty has jeopardized the interests of its country.[114]

Over the years there had been many disagreements with the proposed UN treaties and discussions. This new draft treaty is no different; the same questions that have been asked for years not only need to be asked but need to be agreed to. Questions like: what effects will the current militarization of space have on this new treaty? Most nations accept the peaceful purposes of outer space to include military satellites, however, the use of military satellites to wage war on Earth is not resolved in this treaty. Dual use satellites which are used for commercial and military purposes are not discussed either in this draft treaty. Would any space object that could be manoeuvred to crash into another satellite be considered a space weapon? The technology for autonomous rendezvous satellites is being developed to fix other satellites in orbit. These satellites will be able to manoeuvre into position of another satellite and possibly disable or destroy it. This draft

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[114] Conference on Disarmament 2008, "Reaching Critical Will," http://www.reachingcriticalwill.org/political/cd/speaches08.html; Internet; accessed 12 February 2008.

treaty does not address the development or testing of space weapons, only their use. Therefore, would a China ASAT missile test in 2007 or a US ASAT launch of a modified SM-3 missile in 2008 be considered a violation of the treaty given that both ASAT launches were against their own satellites and not intended to wage war? If nations are allowed to develop and test space weapons it will defeat the stated purpose of the treaty.

While these are all legitimate questions that have been asked every time a new proposed treaty is offered, negotiating them will add detail and close the loopholes in the Outer Space Treaty of 1967. Unfortunately this new draft treaty is much like the draft treaties of the past. In 2005, 160 countries voted in favour of adopting the PAROS GA resolution 60/54 but the US was the lone vote against it with only Israel abstaining. The US voted against the resolution explaining that the current system governing outer space use is sufficient, since there is no arms race in space. Later in 2005, Russia introduced a new resolution "Measures to Promote Transparency and Confidence Building in Outer Space." This resolution was similar in voting with broad support from the international community but again, the US voted against the draft.

The US has also had reservation with the lack of verification to any of these treaties. Verification of a treaty, should not be separated from other aspects of the treaty and should be addressed during the negotiations. The indication that verification “may” be covered by an additional protocol suggests the possibility of no or limited verification measures. A US delegate to the UN General Assembly insisted that the danger is not some theoretical arms race but denial of peaceful access to and use of outer space. He said because any satellite could be capable of maneuvering to and destroying another satellite by colliding with it, space does not lend itself to the old-school thought of arms

control. He finished his speech with there is no arms race in space and there is no prospect of an arms race in space. Thus there is no arms problem for the international community to address.[115] This seems to be in direct conflict with the wording in the Rumsfeld commission report warning of a "Space Pearl Harbour".

Ashley Tellis, a senior associate with the Carnegie Endowment for International Peace, specializing in international security, defense, and Asian strategic issues, analyzed the new China and Russia constructed draft treaty and concluded that the it would "neither effectively prohibit their deployment, nor conclusively annul the threat of force against space objects."[116] He said it would only produce the illusion of security and do nothing to eliminate the threat capabilities of many countries, especially China.[117] He also contends that the treaty addressed weapons in space (where there are none) and not land and sea-based weapons used to attack space assets. Tellis argues that the 2008 China/Russia proposed treaty was drafted for three political and strategic reasons:

> First, they genuinely fear an imminent American deployment of space weapons—perhaps in connection with missile defense— and want a treaty to impede that deployment...Second, a space security treaty allows Russia and China to engage in some eye-catching histrionics. It enables them to dominate international public diplomacy and paint the US as the irresponsible driver of a new arms race... Third, the Russian-Chinese draft treaty remains a splendid way for Beijing to draw international attention away from its own growing counterspace program—even as it enables Russia to assuage its own discomfort with China's space-denial capabilities.

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[115] Christopher Moraff, "Star Wars, Under the Bush Administration's Space Policy, the Sky's the Limit," *The American Prospect*, (January 2007). [journal on-line]; available from http://www.prospect.org/cs/articles?articleid=12363; Internet; accessed 11 March 2008.

[116] Ashley J. Tellis, "Don't Panic about Space Weapons," *The Wall Street Journal* 22 February 2008, A15.

[117] *Ibid*., A15.

Tellis concludes that the Bush administration is correct to reject this draft treaty, and encourages any new presidential administration to do the same.[118]

Jeff Kueter, president of the George C. Marshall Institute identified the biggest problem with this treaty is that it is not verifiable nor enforceable[119] and is not in the US' national interest to sign. He insists that the Chinese and Russian treaty is nothing more than a cover for their "self-serving attempts to constrain the US, while doing nothing to restrict their own clandestine ASAT programs."[120]

US – China Relations

There has been a deadlock between the US and China regarding the negotiations of a new space treaty for years. Ambassador Javits, the US representative on the UN Conference on Disarmament said the US will not support 'any mandate that attempts to bias the work of the future ad hoc committee toward a particular goal or outcome."[121] In 2002 China changed its position on negotiating a mandate for the ad hoc committee on PAROS and instead proposed to negotiate an international legal instrument (CD/1682).[122]

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[118] Ashley J. Tellis, "Don't Panic about Space Weapons," *The Wall Street Journal* 22 February 2008, A15.

[119] Jeff Keuter, "Flaws on Proposed Space Treaty," http://marshall.org/article.php?id=578; Internet; accessed 18 March 2008.

[120] *Ibid*.

[121] Rebecca Johnson, "United Nations First Committee and the Conference on Disarmament," *The Acronym Institute for Disarmament Diplomacy* (October 20, 2004).

[122] *Ibid*.

The US did not agree with China's approach and a consensus could not be reached. In August, 2003 Chinese Ambassador Hu Xiaodi stated to the Conference on Disarmament,

> In order for the Conference on Disarmament to restart its substantive work and taking into consideration the concerns of relevant sides, China would like to demonstrate flexibility once again. China accepts the mandate of the PAROS Ad Hoc committee as proposed and tabled on June 26 and is prepared to join the consensus on the program of work (CD/1693, with the new wording as amended on June 26). It is our hope that other relevant sides respond positively to China's constructive attitude, so that the Conference on Disarmament could start substantive work as early as possible.[123]

Despite the compromise by the Chinese, there was no response from the US and the stalemate continued. In an attempt to negotiate again, the Conference on Disarmament President proposed (CD1757) dropping the clause related to negotiating an international legal instrument but the Chinese said it will not support the proposal due to the "weakened language" and the previous concessions they had already made. This stalemate and tension between China and the US continues today and the US has stopped negotiating.

In 2004 the Chinese Ambassador Hu Xiaodi addressed the UN Conference on Disarmament and said that the peaceful purposes of space are important for the whole world and would benefit all countries.[124] He went on to say that space was being considered the next high frontier with military value being attached and that if we did not act now, space would become the next medium of warfare after land, sea, and air.[125]

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[123] Ambassador Hu Xiaodi, Speech to the Conference on Disarmament, August 7, 2003.

[124] Rebecca Johnson, "United Nations First Committee and the Conference on Disarmament," *The Acronym Institute for Disarmament Diplomacy* (October 20, 2004).

[125] *Ibid*.

China has argued that an arms race in space would damage international relations, peace and security and that testing weapons in low-earth orbit would add to an already serious problem with debris in space.

Even though China is proposing peace in space and advocating no weapons there, in 2001, the Chinese newspaper, Sing Tao reported that China was secretly developing a parasitic satellite program and had completed ground testing and was putting the finishing touches on a plan to test the satellites in space.[126] This system is designed to attach to an enemy's satellite and during a conflict destroy the satellite. Given that the Chinese have been working with Surrey University in Great Britain, the leading microsatellite researcher, it is presumed by the US that the Chinese already have this technology and potentially plan to deploy this capability in space which may point to an arms race in space already existing.

In addition to the microsatellite technology, on January 11, 2007 China launched an ASAT missile at one of their aging weather satellites 537 miles above the Earth. The result was a debris field in space with as many as 35,000 pieces.[127] When it comes to China's ASAT test, 85 percent of these 'satellite killing' pieces of debris will still be in orbit 100 years from now.[128] This ASAT test was China's third attempt to successfully shoot down one of their satellites in orbit. Their previous two efforts failed. The US

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[126] Association of Former Intelligence Officers, "Rumsfeld space Power Commission Report," Weekly Intelligence Notes February 2001, http://www.afio.com/sections/wins/2001/2001-05.html; Internet; accessed 11 March 2008.

[127] Carl Hoffman, "Battlefield Space," *Popular Mechanics* 184, no. 7 (July 2007): 76.

[128] *Ibid*., 76.

Defense Satellite Program (DSP) satellite identified all three attempts with their infrared sensors.[129]

The United States understands that current and future adversaries know of their military dependence on space assets, and it would be naïve to assume that the space domain will not be challenged.[130] The US needs to be able to defend itself from such attacks as stated above. As already mentioned, in 2006 China used ground-based lasers to blind US reconnaissance satellites and now have launched an ASAT missile. In early 2008 US agents arrested a former Boeing Space employee for selling secrets to China on US space satellite programs and Lockheed and Northrup Grumman have been targets of Chinese cyber attacks for the past few years.[131] The US suspended all cooperation with China after their ASAT test.

The US also points to comments from a senior Chinese military officer, Colonel Yao Yunzhu when he said "after the test the Chinese national security community considered the weaponization of space inevitable."[132] The growing mistrust between China and the US is becoming greater. On one hand China pushes for international cooperation and a new space treaty preventing space weapons and on the other they laze

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[129] Carl Hoffman, "Battlefield Space," *Popular Mechanics* 184, no. 7 (July 2007): 76.

[130] Robert Kehler, "General Urges Protection of Space Assets against ASATs," *Space & Missile Defence Report* 8, no.44 (November 2007).

[131] Brian Wingfield, "A New Space Race," *Forbes.co,* (Feb 2008) [journal on-line]; available from http://www.forbes.com/2008/02/21/china-aerospace-satellites-biz-beltway-cx_bw_0221china.html; Internet; accessed 22 February 2008.

[132] Edith Lederer, "Chinese Colonel Sees Arms Race in Space," *Associated Press*, (Jan 27, 2007) http://www.wmdinsights.com/i13/I13_EA1_SP_PRC_ASAT.htm; Internet; accessed 22 February 2008.

a US satellite and launch an ASAT missile in space. The US views China as hypocritical and unable to fairly negotiate peace treaties.

Why did China provoke this international concern by launching an ASAT missile in space? Even though the Chinese announced that the test was not aimed at another country or at sending any message, some believe that the test was a statement to the US in response to their National Space Policy given that this test happened three months after it was released.

Recall that the policy basically says it has the right to restrict the use of space to only its allies. Jeffery Lewis, an arms control expert at the New America Foundation believes that most of the world is appalled at the tone of the Bush policy.[133] "One British newspaper columnist said it made space the 51st state."[134] Many experts think the Chinese test was an attempt to force the issue on PAROS and show the US the potential consequences of refusing to negotiate on a new treaty. If this is the case, "it was a mistake" says Michael O'Hanolon, a senior fellow in security studies at the Brookings Institution in Washington D.C.[135] "All this test did was fuel America hard-liners who want to restrict American technological cooperation with China."[136]

In 1997 the US House of representatives investigated companies and their assistance to the Chinese space programs. This report was known as the Cox report. It identified that China was interested and developing ASAT technology. It warned of a

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[133] Carl Hoffman, "Battlefield Space," *Popular Mechanics* 184, no. 7 (July 2007): 76.

[134] *Ibid*., 76.

[135] *Ibid*., 76.

[136] *Ibid*., 76.

joint Russia and China ground based laser and modifying missiles to become space kinetic kill weapons.[137] As of the writing of this paper both of these ASAT technologies have been successfully tested even while China has been publicly calling for anti-space weapons treaties.

Most experts expect the tension between the US and China to escalate and last for years to come. According to John Logsdon, the director of the Space Policy Institute at George Washington University in Washington D.C., the idea of a cooperation and/or a space treaty between the US and China is doubtful.[138] Elliot Pulham from the Space Foundation said nobody was surprised that China could launch an ASAT, they were surprised that they would actually do it.[139]

US – Russia Relations

While the US and China relationship is volatile at best, the relationship between the US and Russia is not quite as bad. US and Russia have been working together sharing space technologies. Russia assisted with the International Space Station while the US Space Shuttle was grounded after the Columbia Shuttle explosion. The US also uses a Russian rocket engine on its Atlas IV rocket.

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[137] United States, "Cox Report," www.whitehouse.gov/coxreport/cont.html; Internet; accessed 7 March 2008.

[138] Brian Wingfield, "A New Space Race," *Forbes.co,* (Feb 2008) [journal on-line]; available from http://www.forbes.com/2008/02/21/china-aerospace-satellites-biz-beltway-cx_bw_0221china.html; Internet; accessed 22 February 2008.

[139] Kevin Whitelaw, "China Aims High; Beijing's Blast Sets Off a Debate About How to Protect U.S. Satellites," *U.S. News & World Report* 143, no. 21 (December 2007): 42.

During the Cold War, the US and Russia essentially considered satellites as non-targets for military action. Both nations had proven ASAT capability but understood that the ability to survey each other from space outweighed the benefit of limiting the other's space capability. Russia maintains a full spectrum of military satellite technology. Much like the US, Russia has the same type complement of space capability including Glonass, a navigation system of satellites like GPS. Russia's space program has seen massive budget cuts in the last decade to the point where none of their functioning satellite programs are fully operational.[140]

While there are areas where the US and Russia cooperation are evident, Russia is a strong supporter in the UN for a weapons ban in space. In this area there is as much distrust on both sides and lack of cooperation, similar to China. As mentioned earlier, they have co-authored proposals to the Conference on Disarmament calling for a new treaty to supplement the Outer Space Treaty and in 2001 Jane's Space Directory listed Russia's ASAT program as inactive.[141] In 2001, Russian general Anatoliy Perminov warned the international community about the US policy on space. He insisted that US space doctrine was written to reserved the right to employ forces for military operations in outer space which could force an arms race in space.

In 2007, Russia's Chief of Space Forces General Vladimir Popovkin warned of retaliation if other nations deployed weapons in space.[142] This warning was not targeted

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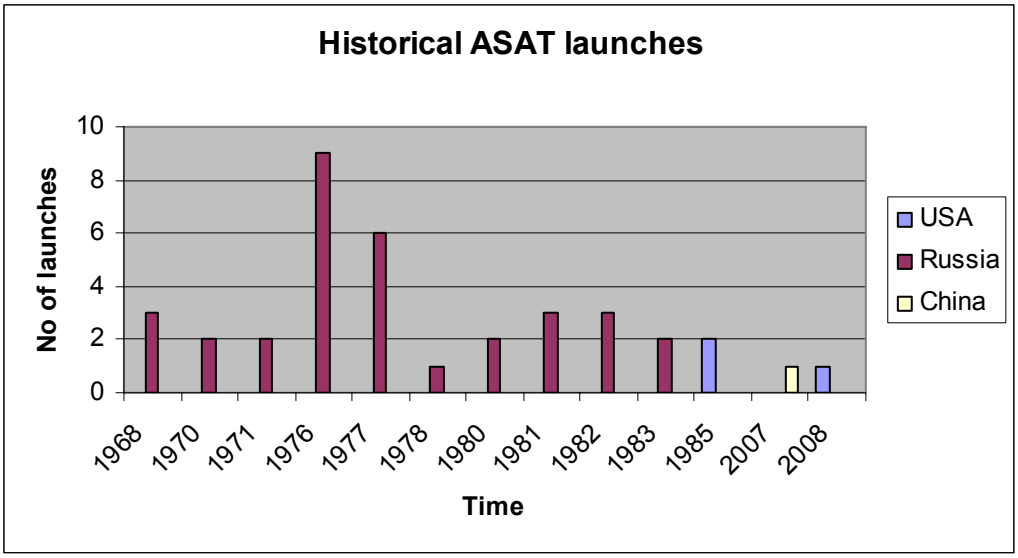
[140] Theresa Hitchens, "Developments in Military Space," New York: Carnegie Corporation Research Paper, 2003, 10.

[141] *Ibid*., 11.

[142] International Herald Tribune, "Russia Issues Warning on Space-Based Weapons," http://www.iht.com/articles/2007/09/27/asia/russia.php; Internet; accessed 7 March 2008.

at any specific country but most believe it was directed at the US. He insisted that Russia does not want to wage a war in space, nor do they seek space dominance, but they will not allow any other nation to dominate space. He said "if any country deploys weapons in space then the laws of warfare are such that retaliatory weapons are certain to appear."[143] Popovkin and Russian President Putin supported the 2006 Chinese ASAT test saying it was a reaction to US plans for space-based weapons. The chart below gives a historical perspective of the ASAT launches that have been conducted by the US, USSR, and China. This clearly shows the imbalance of ASAT launches conducted by Russia over the years.[144]



[143] International Herald Tribune, "Russia Issues Warning on Space-Based Weapons," http://www.iht.com/articles/2007/09/27/asia/russia.php; Internet; accessed 7 March 2008..

[144] JPL, Mission and Spacecraft Library, "Launch History," http://www.milnet.com/pentagon/spacecom/satdat/asat-lainches.htm; Internet; accessed 14 April 2008.

The Next Arms Race?

Is the world on the verge of an arms race in space, or are we already there? Given the wording in the new US Space Policy, it may seem as though the US plans to develop and deploy defensive space-based kinetic interceptors but this is just speculation. The US

Hitchens pointed out that the current US space systems are not threatened. She said that for an adversary to threaten the US in space, it would need both the technology and the intent to use weapons and that there was little evidence that there are any countries that possess the technology to threaten US space operations.[149] Three months after Hitchens said these words, China shot down one of their aging satellites in low-earth orbit with an ASAT missile. This clearly shows their capability to deliver such a weapon and potentially threaten space.

Everett Dolman, the Associate Professor of Comparative Military Studies at the School of advanced Air and Space Studies at Maxwell Air Force Base believes that the time is now for the US to weaponize space because there really is no fear of an arms race. There are no real competitors capable of challenging the US in space right now and the longer the US waits, the more opportunity exists for such a competitor to emerge.[150] He insists that in ten or twenty years the US will be confronting an active space power and believes that if the world wants an arms race in space, do nothing now.[151] Bruce McDonald, one of President Clinton's science advisors points out that if we are on the brink of an arms race in space, China is clearly leading the way. The US needs to find a

[149] Anup Shah, "Militarization and Weaponization of Outer Space," http://www.globalissues.org/Geopolitics/ArmsControl/Space.asp; Internet; accessed 16 January 2008.

[150] Leonard David, "Weapons in Space: Dawn of a New Era," *Space.com*, (January 2006). [journal on-line]; available from http://www.space.com/businesstechnology/060111_e-weapons.html; Internet; accessed 16 February 2008.

[151] *Ibid*.

middle ground between doing nothing and not responding to China's ASAT launch and responding in a way that provokes such a full-scaled arms race.[152]

Arms control advocates have argued that deploying space weapons would certainly lead to the escalation of an arms race. John Klein argues that this is just not true. He suggests that an escalation is possible; history has shown that the development and use of new weapon systems can also have a stabilizing effect.[153] He points to the stabilization effect Mutually Assured Destruction had between the US and Russia during the Cold War.[154]

To show the opposing opinion on the potential space arms race you need to look no further than a 2006 paper written by the Union of Concerned Scientists which challenged that the US had the most to lose from such an arms race in space. In this paper, they contend that by deploying space weapons, even if done so for defensive purposes, is short-sighted and would ultimately lead to other countries developing and deploying effective ASAT weapons which would actually increase the vulnerability of US space systems.[155] By developing space weapons, the US would undermine relations and increase tensions worse than they are now which could further reduce cooperation.

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[152] Kevin Whitelaw, "China Aims High; Beijing's Blast Sets Off a Debate About How to Protect U.S. Satellites," *U.S. News & World Report* 143, no. 21 (December 2007): 42.

[153] John J. Klein, *Space Warfare: Strategy, Principles and Policy* (New York: Routledge Publishing, 2006), 144-145.

[154] *Ibid*., 145.

[155] Union of Concerned Scientists, "Keeping Space in Check," http://www.ucsusa.org/assets/documents/global_security/Grego-Physics-World-Oct07.pdf; Internet; accessed 10 March 2008.

Valery Loshchinin, the Russian Ambassador to the UN office in Geneva, said that the placement of weapons in space would undoubtedly provoke a new arms race, this time in space.

The countries most capable of producing and deploying space-based weapons have also been the strongest advocates for banning these weapons. Russia and China have been the most vocal on the international stage, through the UN, to try and prevent the deployment of weapons in space but the US has consistently refused any of their recommendations.

ALTERNATIVE APPROACH TO WEAPONS FOR PROTECTION

There are alternative approaches a nation can take instead of using weapons for defense of space systems. How much would these defensive space systems cost compared to the satellites they would protect in the first place? Adding redundancy into the current fleet of space systems would make them less vulnerable to attack. There are a number of programs and experiments currently being looked at by the US that would reduce the need for defensive weapons in space to protect their on-orbit satellites.

The US Air Force is running an experiment called Operationally Responsive Space. This exercise tests the feasibility of developing and deploying smaller satellites with less capability than existing ones.[156] The idea is that instead of developing massive

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[156] Kevin Whitelaw, "China Aims High; Beijing's Blast Sets Off a Debate About How to Protect U.S. Satellites," *U.S. News & World Report* 143, no. 21 (December 2007): 42.

space systems including the ground-based infrastructure needed to support their missions, there would be compatible space and ground systems that are less capable but more numerous and much less expensive. This would increase the fleet of satellites and make it much harder and more expensive for an adversary to attack.

There are a growing number of commercial companies providing satellite imagery, communications, and other space-based products and the US is developing relations and priorities with these companies to serve as a back-up to their military satellite products. This is a much cheaper approach to ensure the space-based data the US military requires is available instead of developing and deploying space weapons to defend their existing systems.

There are also a number of actions a nation can take to protect their future satellites. These satellite systems can be quickly maneuvered on-orbit. During their development, these systems can be hardened with special materials and filters can be developed and placed over sensitive sensors to protect from lasers. Cheap decoys can be launched with existing satellites to spread the assets and possibly provide needed redundancy. In addition to space assets, airborne assets can replace and potentially provide critical back-up to space-based systems. Aircraft flying with sophisticated sensors that have similar capability as satellite systems, can also dissuade adversaries from attacking the space asset due the perceived redundant capability.

TECHNICAL CHALLENGES TO WEAPONIZATION

Besides the international pressures any nation will face with regards to deployment of space weapons, the technical challenges in doing so may be even greater. Some of the advanced weapons talked about like lasers, tungsten rods, parasitic satellites, and space mines are easier to develop on paper and laboratories than in the field. The cost of launching these potentially heavy objects into outer space and then defend them in orbit may be astronomical.[157] The US currently does not have sufficient space lift capability from its fleet of boosters. The Evolved Expendable Launch Vehicle (EELV) heavy configuration cannot lift the heaviest of the space weapons proposed. The cost of launching such weapons like "Rods from God" would outweigh the benefit from having such a weapon.

When largest cost when considering deploying weapons in space like tungsten rods is getting the weapons in their orbits. Currently the US has the EELV, Delta IV in a heavy configuration to launch its largest payloads. The average cost of a Delta IV rocket in this configuration is approximately 255 million US dollars.[158] This heavy-lift vehicle has the capacity to put 56,800 pounds into a low-earth orbit.[159] When considering a space weapon like Rods from God would require multiple heavy bundles of tungsten rods in each satellite and multiple satellites to be able to deliver the lethal blow anywhere in

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[157] Michael Krepon and Christopher Clary, "Is the Weaponization of Space Inevitable?" http://www.stimson.org/wos/pdf/space2.pdf; Internet; accessed 11 March 2008.

[158] Encyclopaedia Astronautica, "Delta IV Heavy" http://www.astronautix.com/lvs/delheavy.htm; Internet; accessed 14 April 2008.

[159] *Ibid*.

the world, the of such an enterprise would be in the billions. Below is a picture of the Delta IV rocket on the launch pad at Cape Canaveral Air station, Florida.

The technical challenges with directed-energy weapons in space are achieving the right power level to inflict the desired destructive level. To increase the level of destruction, the satellite component sizes need to be rather large compared to other on-orbit satellite components.[160] The amount of power required from space to inflict the type of damage required from a space weapon is great. Consider that in a factory, a high-powered laser producing thousands of watts of power can destroy a relatively large sized target. This laser uses optics approximately .1 meter in size. Now deploy this high-power laser in outer space and the requirement for power goes up to millions of watts of power and optics approximately 10 meters in size just to achieve the same destructive

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[160] Preston, Robert, D. Johnson, S. Edwards, M. Miller and C. Shipbaugh, *Space Weapons Earth Wars* (California: RAND Corporation, 2002), 25.

power because of the greater distances of being space-based.[161] These systems would need to be large and expensive to achieve their desired effect. To effectively direct energy to the ground within a respectable time, there would need to be a constellation of numerous satellites with the same capability.

Technical challenges with kinetic-energy weapons in space are that they would need to be large enough to survive re-entry through the Earth's atmosphere. These types of weapons would require active cooling to reduce the heat build-up of re-entry and because of their high-speeds; any aerodynamic behavior would cause unpredicted misses.[162] Because these weapons would fall and not fly, the rods would need to remain symmetrical to avoid misses on the ground.

Also, the number of each type of satellite that would need to be in the constellation would be significant. To have the short notice strike capability, anywhere in the world the US Government calls for in their doctrine and Vision 2020, there would need to many of each satellite to ensure short revisit times around the earth.

RECOMMENDATION

Given the technical challenges as well as the international and domestic scrutiny the US faces with the deployment of space weapons, I believe the best option is for the US to engage with China and Russia on the PAROS issue. The US should draft a

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[161] Preston, Robert, D. Johnson, S. Edwards, M. Miller and C. Shipbaugh, *Space Weapons Earth Wars* (California: RAND Corporation, 2002), 25.

[162] *Ibid*., 41.

proposed treaty expanding on, and filling the gaps in the Outer Space Treaty of 1967. This agreement should identify what space weapons are, and what they are not, and what would be acceptable under this new draft treaty. The wording needs to be clear enough for all to understand so it cannot be manipulated and above all else, it needs to protect all US interests in space. Given that the US has already tested Ballistic Missile Defense capabilities, it should not be included in this new treaty. Other issues like fissile material need not be lumped into this proposal as this only leads to arguments and broken negotiations. The focus of this treaty needs to be space weapons alone and not a other proposals bundled into creating further restrictions in unrelated areas.

Johnson-Freese suggests that due to the difficulty with defining what would be legal and what would not; the first step could be to prohibit actively commanded space-based systems like hyperactive rod bundles and space-based lasers.[163] She insists that because America has the strongest military and space program, it has the most to lose from space weaponization. She suggests that the US has taken an image hit in the international community with regard to its world leadership role, and it is in the US' best interest to negotiate and remind other countries of America's strong leadership capabilities and develop a new space treaty.[164]

The bottom line, when it comes to a new proposed treaty, the US needs to ensure that its national interests are still protected and China and Russia need to know the US is not seeking an arms race in space. Finally, and probably the hardest, there would need to

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[163] Joan Johnson-Freese, *Space as a Strategic Asset* (New York: Columbia University Press, 2007), 247.

[164] *Ibid*., 248.

be some agreed to approach for verification and enforcement of the treaty by all signed parties.

The problem with a recommendation like this, is that it has been made before. The Rumsfeld-led Commission warned the president against "buying into" the PAROS debate and suggests the US does not need a new outer space treaty because the OST of 1967 is sufficient. Several technological advisors to both President Bush and Clinton, warned against negotiating a new space treaty as well. And finally, senior Air Force officials also advise against such actions asserting the current treaties are sufficient.

CONCLUSION

There is little argument that the military use of space is required today. Most accept that space has already been militarized and the US is leading the world when it comes to using and militarizing outer space. The international debate is whether space should be weaponized, and if so, how? This paper defined space weaponization as any system placed in earth's orbit with the intent of directly engaging or destroying a target either kinetically or with directed-energy.

There were two types of weapons discussed, kinetic and directed-energy weapons. The directed-energy weapons discussed were lasers either deployed in outer space or fired from the ground and then reflected off space mirrors to attack targets on the ground, in the air, on the sea, or in space. Kinetic-energy weapons include ASAT missiles, microsatellites capable of destroying or disrupting satellites on-orbit, and space mines that are used to destroy satellites.

The US currently has communication, navigation, surveillance, reconnaissance, early warning, weather, and environmental satellites supporting everything from the military to environmental monitoring. There has been much international debate in deciding whether to defend these space assets, and if so, how? The US released a Space Commission Report in 2001 calling for the active protection of these satellite systems. It was chaired by Donald Rumsfeld and included the "who's who" of the space industry and the military on the commission. Their recommendations to the President of the US were to maintain the peaceful use of space, develop the capability to deter and defend against an adversarial attack in space, immediately revise the national space policy, and because the US is so dependent on space, protect it from the next "Pearl Harbor." This commission report led to the President of the US signing a new National Space Policy in 2006 calling for a number of changes from the previous decade's policy. The two most notable changes to policy were the addition of space control and space force application.

Although the commission report called for increased international negotiations and maintaining space for peaceful purposes, the space control and space force application additions were a very strong message and have led many to believe that the US is in the process of developing if not already deploying space weapons.

The argument for the protection of on-orbit space systems points to the numerous attacks on US satellites since 2000 and the recent China ASAT missile launch. The basis of the argument for protection of satellites is that the US finds itself most vulnerable due to their dependence on these space systems and regardless of what the US does, nations will develop and deploy weapons in space over time as space becomes the next medium of warfare. Supporters for the protection of US satellites include present and former

commanders of Space Command, the former undersecretary of the Air Force, the former Secretary of Defence and the current President of the US.

The countries and organizations that argue against the deployment of space weapons point to the fact that the new US space policy is much more military focused than previous policies. These anti-weapon advocates insist that the US is planning to deploy weapons in outer space regardless of the amount of international outcry that would occur from such actions. These supporters include the Federation of American Scientists and the Center for Defence Information just to name a couple.

While there are currently signed international treaties preventing weapons in space, they only call for the banning of weapons of mass destruction and include many loopholes allowing nations to interpret the treaty to meet their interests and pursue weapons development. There has been international pressure and draft treaties developed to fill the holes in the Outer Space Treaty and even amending the current policy, but to date, no agreements have been made. The United Nations Conference on Disarmament started discussions called PAROS to develop a treaty and China along with Russia have attempted on several occasions to co-chair a draft treaty to fill these loopholes but the US has not agreed to the honesty of the negotiations on the part of China and Russia and the restrictive wording in the draft.

Relations between China, Russia and the US have been stressed on the space weapons debate and although China and Russia have tried to negotiate with the US, the mistrust between the them has lead to stalemates and broken talks. The US points to the 2007 Chinese ASAT launch, the arrest of US spies working in the space industry selling

space systems information to China in 2008, and top Chinese officials publicly announcing programs within their government to develop space weapons. US officials point out that these incidents all happened while China is half-heartedly attempting to reach international agreements on the ban of such weapons. China states that they are pursuing these weapons due to the lack of US cooperation in negotiating the new draft treaty on PAROS proposed by the Conference on Disarmament. Russia has publicly warned the US that any attempt to deploy weapons in space would definitely lead to an arms race in space.

Many believe the arms race is already started and the US and China are leading the way in this race. Both countries point the finger at each other with caution and accuse the other of hypocrisy. There are people and organizations in the US that feel as though now is the time to weaponize space because they feel there really is no threat of retaliation. There are others that argue that this will only escalate the arms race debate and cause space to become the battlefield of the future.

There are alternative approaches to space weapons to protect satellites. This includes hardening of spacecraft, using redundant systems, developing highly maneuverable satellites, covering sensors with special filters, deploying small in-expensive decoy satellites, and utilizing air-borne replacements and back-up systems. All of these approaches are considered much less expensive and less technically challenging than developing and/or deploying space weapons for protection.

Finally, when looking at the Space Commission Report, Air Force Space Command doctrine, US Space Command Vision 2020, and the 2006 US National Space

Policy, it is hard to ignore the strong words and direction they contain. Given what the National Space Policy states regarding space control and space force application and the comments about dissuading and deterring others from impeding the United State's right of freedom in space, along with the US tying national interests to space capabilities, its hard to imagine a future without space weapons.

Is it too late to stop the weaponization of outer space? When looking at the very recent Chinese and US ASAT missile tests, the current state of relations between the US, China, and Russia, and the stalled and insincere negotiations by all parties to develop a new outer space treaty, this author thinks so.

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