The Weaponization of Space

Introduction

The United States relies on space more than any other nation. American life is informed and connected by a vast network of hundreds of satellites silently in orbit overhead. Assured access to space is necessary to maintain our national security. The 1998 loss of a single asset, a malfunctioning Galaxy IV satellite, had consequences ranging from the loss of the pager services to shutdown of financial networks [1]. An increasingly urgent science policy dilemma for the 21st century is how best to protect these assets without instigating a space arms race. A clear, deliberate, and informed path remains to be charted through these unknown waters.

Policy History

The history of American space policy is deeply rooted in the events of the Cold War. After WWII, the rapid advancement of military and space technologies was deemed crucial to countering the Soviet threat. The 1950's saw the introduction of thermonuclear weapons and the long-range ballistic missiles to carry them. In 1957, with the launch of Sputnik, America was terrorized with the notion that the Communists had the power to place almost anything just a few hundred miles above. National security seemed to demand we retake the high ground of the new space frontier.

The space race was on; both countries aggressively developed a wide range of space access technologies. Surprisingly, an enormous amount of restraint was exercised during this time. Despite stresses such as the Powers U-2 incident, the Cuban Missile Crisis, and the deployment of stealthy ballistic missile submarines, both the United States and the Soviet Union refrained from placing weapons in orbit; Cold War armaments were deliberately kept terrestrial. Though both space programs were fully militarized, an early emphasis on manned missions and space reconnaissance avoided issues related to weaponization.

Perhaps the first major milestone in space policy was the Limited Test Ban Treaty of 1963 [2]. For years the Soviets had been pushing for a global ban on above-ground nuclear testing. Before this time, a number of detonations were conducted at the edge of space. In 1962, during the Starfish Prime test high over the Pacific [3], the US conducted its largest space detonation. The 1.4 megaton blast produced an electromagnetic pulse (EMP), a powerful phenomenon not previously observed, which damaged electronics on Hawaii over 1300 km away! The radiation became trapped in earth's magnetic field and fried several satellites in low orbit. Suddenly the US fully realized the risk of nuclear weapons in space and signed the test ban treaty.

The next major step was the Outer Space Treaty of 1967 [4]. This was a broad treaty which set important guidelines for the utilization of space and conduct of orbital operations. Space and other celestial bodies were deemed to be neutral territory for the

exploration of any nation. The moon was not to be utilized for military purposes, and space was to be kept free of all weapons of mass destruction, excluding the transit of intercontinental ballistic missiles. It claimed that “the exploration and use of outer space shall be carried out for the benefit and in the interests of all countries and shall be the province of mankind”. Though not explicitly prohibiting conventional weapons in space, it clearly discouraged their use in spirit. This vital agreement has served as the cornerstone for all subsequent international space policy initiatives.

Nuclear weapons policy was also formative for another historic space policy document: the 1972 Antiballistic Missile Treaty (ABM) [5]. The ABM treaty prevented the US and Soviet Union from deploying a national missile defense system. The ability of one nation to counter a large-scale nuclear strike was seen as destabilizing to mutually assured destruction. The relevant provision was the prohibition of antimissile systems in space. During the Regan years, the US chose to develop such defenses through the Strategic Defense Initiative (or Star Wars program). The US agreed to remain partner to the ABM treaty so long as it was interpreted so as to allow the development and testing of such countermeasures, just not their actually deployment. The Star Wars program waned over the 1990’s, eventually being scaled back to provide a limited national missile defense. President George W. Bush pledged to actually make missile defense operational, and withdrew from the ABM treaty in 2002. Due to strong ties to President Putin, Russian protest was limited.

Current US Policy

Our nation's current disposition toward the weaponization of space is somewhat nebulous. The military, the current administration, the congress, foreign governments, and the academic community all play major roles in shaping space policy. The most important fact to note is that no nation has placed any kind of weapon in space. On the other hand, nations have conducted extensive research into various types of space weapons. The US has now fully deployed land and sea-based components of missile defense, but a space component remains undecided. Overall it seems the Bush administration and Air Force are interested in having space weapons, but most are years away from production and it's not clear whether Congress will support them. Still, the tide is turning towards increasing militarization; we are at a critical turning point and the issue must be publicly explored and debated before permanent decisions are made.

National space doctrine is primarily codified as amalgamation of a number of low-level reports and internal documents. Such reports clearly illustrate the changing political climate and controversy surrounding the issue.

Arguably the most influential study on current space policy was the Rumsfeld Report [6]. In 1999 Congress formed the Commission to Assess US National Security Space Management and Organization led by Donald Rumsfeld. The commission reported two years later that the nation was at risk of a "space Pearl Harbor." It accused the Air Force of not aggressively defending space and recommending that it be reorganized to address these vulnerabilities. In addition to advocating a system for national missile defense, the report also suggested that the US "have an option to deploy weapons in space to deter

threats to and, if necessary, defend against attacks on US interests." The subsequent appointment of Rumsfeld to Secretary of Defense (he also served in this position for President Ford) ensured that implementing many of these recommendations has become a priority for the Bush administration.

In August 2004 there was a small scandal when the Air Force leaked its Counterspace Operations report [7]. The preliminary report on space doctrine says that it is the Air Force's responsibility to not only defend American space assets, but to also be able to deny space to any adversary. It explicitly stated that this included attacking commercial satellites or those of neutral countries if used by the adversary. The Air Force went as far as to threaten a neutral country's ground facilities and space infrastructure. Some see this as assertive posturing to encourage funding and intimidate rivals, but clearly the weaponization of space is a major pillar of Air Force planning.

There have been a number of prominent external policy recommendations, ranging from the NATO report on Weapons in Space and Global Security [8] to the Federation of American Scientists (FAS) 2004 report on Threat to US Space Assets [9]. Some such reports by pacifist advocacy groups or partisan think tanks do not present realistic policy recommendations for the administration, others represent well-researched studies meriting lengthy consideration. Most recommend that we not be the first nation to introduce weapons into space and that we internationalize the issue. All sides agree this is an important issue and that the US must proceed cautiously.

Space and Anti-satellite (ASAT) Weapons

It is instructive to discuss the general types of weapons being developed. The primary classification is between terrestrial ASAT weapons deployed from earth and actual space weapons placed in orbit. Terrestrial weapons can be subdivided into interceptors and energy weapons. Space weapons can be divided into interceptors, energy weapons, and mircosatellites. An important challenge for policy makers is to determine whether arms restrictions on space weapons will also include prohibitions on these terrestrial ASAT weapons.

Terrestrial interceptors have been produced in a variety of forms. They may be launched from land, sea, or air. They operate much like the national missile defense system. A rocket accelerates a kill vehicle into space, where it maneuvers to intercept a target. Due to the enormous velocities involved, destruction is achieved by the kinetic energy of the collision rather than explosives. In addition to the complexities of hitting an object traveling 25,000 km/hr, interceptors have the drawback of producing a great deal of orbital debris. This isn't a serious problem for low orbits, since debris will return to earth fairly quickly. In high geosynchronous orbits where satellites are closely parked, debris will persist longer and can damage other unintended satellites. A major exchange could make such orbits too polluted to still be usable. Currently, both the US and Russia have tested several terrestrial ASAT interceptors, but none of them are operationally deployed.

Terrestrial energy weapons include lasers and jammers. Lasers are used to either temporarily blind the sensitive optics of a satellite or permanently disable it. It was

common during the Cold War to covertly laze one another's reconnaissance satellites. Laser development has had limited successes. Currently they require massive power facilities and only a few in the world (in the US, Russia, and possibly China) are powerful enough to pose a threat. Satellites in high orbits are even safer from damage.

Jammers are typically radio-frequency weapons designed to interfere with the communications between a satellite and its tracking station. This electronic jamming does not physically damage the satellite, but merely drowns out its signal. Several nations have jamming capabilities, as the technology is fairly cheap and nondestructive. In October 2004, the US announced the completion of Counter Communications jamming system [10]. Recently the Iranian embassy in Havana was caught jamming radio and TV transmissions to Iran from the US [11]. Most US military satellites are hardened against such interference.

Space-based interceptors are similar to terrestrial interceptors: they deploy a kill vehicle to collide with a target. Since these kill vehicles begin in orbit, they do not require a massive rocket to attain the speed needed for interception. The Air Force is increasing interested in designing interceptors to hit targets on earth. Uranium or tungsten "rods of God" would be fired upon targets below the satellite, using their orbital kinetic energy to attack with much more destructive power than a Tomahawk missile. Within just a few minutes, a constellation of these satellites could unleash a devastating attack nearly anywhere in the world and assure US dominance in a military conflict. We are the only

nation with the resources to deploy such a system, but the technology is still unproven and years away.

Space-based energy weapons operate the same as their terrestrial counterparts. In the near term, satellites do not sufficient power to incorporate these weapons.

Mircosatellites [9] are the most realistic near-term threat. They consist of miniature satellites which can stealthily approach and interfere with the operation of a target. They may attach themselves and disorient the satellite, collide for destructive effect, jam, or take pictures and eavesdrop on enemy communications. Those designed for purely hostile interceptions are often referred to as space mines. Their small size and ability to remain dormant for long periods mean that the host may not realize they're being attacked. It would be difficult to discern whether the satellite had malfunctioned or had been attacked by an unknown aggressor. The US, Russia, and China are all suspected of having done research on microsatellites. The Air Force is anxious to fully to exploit this capability but Congressional funding of such programs have been sporadic. The Chinese and Russian programs are not believed to be as advanced.

Risk of Weaponization

Many of the reasons against the weaponization of space are obvious and parallel lessons learned from the nuclear arms race during the Cold War. It could be a diplomatic disaster and cost our international relationships a great deal of capital. An escalation in space may ignite an arms race that would be exceedingly expensive and may leave us with a

narrower military advantage than we have now. Not even the Pentagon is sure that it would represent a wise financial investment in an era of increasingly limited budgets.

Deploying such weapons can also make their use more likely. The idea is that if the enemy attacks, you want to destroy all enemy satellites before they can respond. Thus these systems are put on hair triggers. The risk of this aggressive posture was illustrated in 1979 and 1980: major mistakes in our early warning system accidentally started preparations for a massive nuclear strike against the Soviets [12].

Perhaps the best reason to ban weapons in space is that we have the most to lose. The US has the majority of operational military, science, and telecommunications satellites. We rely on space for everything for TV to GPS navigation, cell phones to financial transactions. A serious degradation in these hard-to-replace assets would threaten our ability to conduct business or perform military operations.

Need for Weaponization

The US has never strongly supported an international weapons ban, despite support from NATO, Russia, and China. Distaste for international treaties aside, there are a number of valid arguments in favor of unilateral weapons deployment by the US.

Currently, the US dominates space. All nations except Russia lack the strategic benefits provided by GPS, high resolution imagery, and high capacity telecommunications. The conflicts during the past twenty years have shown how precision munitions, network

centric communication, and unprecedented situational awareness have given the US an insurmountable advantage. Quality of information now allows a numerically inferior force to dominate the modern battlefield. Given enough time, our potential adversaries will develop similar capabilities in space. If we ban the use of space weapons, we are voluntarily allowing our enemies to leverage these powerful technologies against us. Space is the new high ground for our forces. Denying the enemy the use of space is necessary to ensuring the safety of our troops. If they are being tracked by satellites and targeted with precision munitions, why should these satellites not be disabled as readily as an enemy radar or command post?

Weaponizing space is also frowned upon internationally because most countries realize that they are simply not able to compete in this arena. An unrestricted space buildup, despite the terribly high cost, is likely to result in US supremacy. Thus any space arms control will restrict US capabilities far more severely than any other nation. Enacting such limitations allows other nations to weaken US military power at little cost to themselves.

The Air Force seeks to aggressively control space for yet another reason. They subscribe to the idea of deterrence by dominance. The idea is that once the US gets far enough ahead, rather than starting an arms race, our competitors will not bother to waste resources trying to compete. This isn't as absurd as it might sound. There have been a number of military sectors in which other nations have "given up and gone home." The US Navy surface fleet is vastly more powerful than any other, and no nation is spending

the tens of billions of dollars necessary to close the gap. Instead they may compete politically or economically, or turn to other technologies like cruise missiles and diesel-electric submarines. The Air Force believes that if the US can pull ahead in space, we will remain unrivaled in orbit and on the ground for the foreseeable future.

Reducing the Risks

Balancing these competing concerns will require more time, more debate, and better information on the consequences. In the meantime there are a number of prudent measures which should be taken to further reduce the threat to our space assets.

In order to mitigate the impact of a critical satellite failing, we should have launchers and spare satellites available on short notice. Because the military increasingly uses civilian imaging and communications satellites, these systems should also be hardened to military standards.

We must also gather more intelligence. We need to further study the consequences of space conflict, from orbital debris to international relations. More intelligence must be gathered on the covert research being conducted by rival nations. We need better situational awareness in space so we can unambiguously identify an attack and determine the aggressor.

The United States must improve transparency. The administration needs to clarify our national space policy, and work with the international community to establish guidelines

for peacetime space operations. There needs to be vigorous public debate, open to input from within and outside the government, so that all opinions are expressed.

Many groups, including the FAS [9], would also suggest that the US continue low level research into various space weapons, but with a prohibition on testing actual prototypes. This serves as hedge against cheating by other nations, as well as maintaining an important technology base.

Conclusion

This issue, like other complex science policy issues, has no simple solution and will require compromise on all sides. The US must work to mitigate today's threats while ensuring safety and security tomorrow. The scientific community has the tools and resources to make very significant contributions to this debate. Only with quality information can our government make well-informed decisions.

References

(1) - http://www.armscontrol.org/act/2004_11/Krepon.asp, Weapons in Heavens, Michael Krepon

(2) - http://www.fas.org/nuke/control/ltbt/text/ltbt2.htm, Limited Test Ban Treaty

(3) - http://en.wikipedia.org/wiki/Operation_Dominic, Operation Dominic I and II, Wikipedia

(4) - http://www.astronautix.com/articles/outreaty.htm, Outer Space Treaty

(5) - http://www.fas.org/nuke/control/abmt/, ABM Treaty

(6) - http://www.fas.org/irp/congress/1998_cr/s980731-rumsfeld.htm, Rumsfeld Commission Report to the Senate

(7) - http://www.dtic.mil/doctrine/jel/service_pubs/afdd2_2_1.pdf, Counterspace Operations, USAF

(8) - http://www.globalsecurity.org/space/library/report/2003/030417-67.htm, Weapons in Space and Global Security, NATO Parliamentary Assembly

(9) - http://www.fas.org/main/content.jsp?formAction=297&contentId=311, Threats to US Space Assets, Federation of American Scientists

(10) - http://www.rense.com/general59/jam.htm, US Deploys Space Satellite Jamming System, Reuters

(11) - http://www.cnn.com/2003/WORLD/americas/07/19/cuba.jamming/, Cuba Denies Jamming US Broadcasts to Iran, CNN

(12) - http://www.pbs.org/wgbh/nova/missileers/falsealarms.html, False Alarms on the Nuclear Front, Geoffrey Forden of NOVA