Satellite Killers and Space Dominance

Compiled by
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'…the Department of Defence must have the appropriate capabilities to deny when necessary an adversary's use of space systems to support hostile military forces.'
– William S. Cohen, former US Secretary of Defence[1]

Anti-Satellite (ASAT) warfare is an important element in a United States first-strike capability. If, simultaneously with or slightly before launching Trident and other missiles to destroy an opponent's missiles in their silos, the United States could knock out the opponent's communications and early warning satellites, it would delay getting the fire command to the opponent's missiles before they are destroyed. Anti-Satellite warfare would probably be the first move in a United States first strike.

It is actually easier to destroy a satellite in a known and tracked orbit than to instantaneously detect, target and destroy a ballistic missile out of the blue. Furthermore, satellites do not presently have defences such as decoys and other types of spoofing. Since missiles and satellites entered the modern age, schemes to destroy both of them have been closely interwoven. Ballistic missile defence and anti-satellite programmes, ostensibly separated and autonomous, have supplemented and reinforced each other for decades. The National Missile Defence, and possibly the upper tier Tactical Missile Defence, interceptors would be more effective against low-orbit satellites than they would against missiles. That is because the location of satellites is known for any point in time and there are no counter-measures. The airborne laser and the space-based laser would also be much more effective against satellites where they only shoot through the void of space, as opposed to shooting down into the atmosphere at missiles in their boost phase. The atmosphere tends to spread the laser beam (called blooming) so it is diffused and cannot be concentrated on a vital spot. Lasers might

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also be effective against higher satellites in geosynchronous orbit. Likewise, the early warning and X-band radars being developed for ballistic missile defence will have inherent space-tracking capabilities.

Converted inter-continental ballistic missiles or submarine-launched ballistic missiles would make good booster rockets for hit-to-kill vehicles against satellites. The hit-to-kill technology has already been tried against satellites. The main obstacle to anti-satellite development is explained by Major Kurt Stevens of the Air Force Space Command's planning directorate: 'The bottom line is that you've got to develop the public and congressional support that understands that there is a need for an ASAT.'[2] Air Force officials acknowledge that politics, not technology, is the main obstacle to anti-satellite development. Meanwhile United States anti-satellite activities quietly profit from ballistic missile defence developments.

A short history

It wasn't long after the Soviets put Sputnik in orbit that the United States started pursuing anti-satellite technologies. In 1959 a Bold Orion rocket was launched from a B-47 bomber to intercept the Explorer-6 satellite over Cape Canaveral.

Anti-satellite studies were taking place from 1960 to 1962. They included using a microwave (MASER) beam to destroy satellites, blinding satellites with paint to cover their optical window, and deploying a cloud of metal pellets in a satellite's path. Programmes specific to this study were the Satellite Interceptor (SAINT), the Manned Orbital Laboratory (MOL), and the Ballistic Missile Boost Intercept (BAMBI). All three branches of the military got into the act. It should be noted that, since there is no blast effect in space, satellites can only be destroyed if they are hit by a physical object of high-energy radiation.

From May 1963 until January 1966 the Army conducted a project at Kwajalein Atoll called 'Project Mudflap.' At least eight Nike-Zeus anti-ballistic missile interceptors were fired with nuclear warheads. The first ground-launched intercept occurred on 23 May 1963 when an Agena-D spacecraft was hit in orbit. There was believed to be an operational system on Kwajalein Atoll until 1968.

The Navy project was called 'Early Spring.' It used a modified Polaris submarine-launched ballistic missile to scatter metal pellets in a satellite's orbit.

Johnston Island in the Pacific was the scene of the Air Force's 'Project 437 Thor.' At least sixteen 'thrust augmented' Thor rockets were launched with a manoeuvering second stage and nuclear warheads. This system was believed to have been operational until 1975 and could reach satellites up to 800 miles altitude over a radius of 1,700 miles. About this time it was discovered that nuclear explosions in space created an electro-magnetic pulse (EMP) that destroyed our own satellites and other electronics hundreds of miles away.

During the 1980s anti-satellite activities went along parallel with Ronald Reagan's Star Wars charade. In 1981 the Air Force was given the go-ahead for a first generation anti-satellite programme. This air-launched anti-satellite vehicle used a short-range attack missile (SRAM) first stage with a Thiokol Altaire-3

second stage, and had a 900-mile range. It was launched from an F-15 aircraft in a steep climb and pointed at the target. The warhead was a non-nuclear, hit-to-kill vehicle with infrared sensors to see the target and small rocket motors to guide it onto a collision course. The first test on 21 January 1984 did not use a warhead and was only aimed at a point in space. Obviously, it was a success. The second test on 13 November 1984 used the infrared sensors to find the light from a star. It had a cooling line failure. A test of the complete system at an actual target took place on 13 September 1985 against a 345-mile-high Solwind satellite. Two more tests followed in August and September of 1986 against the light from a star – each time a star closer to the horizon.

A total of twelve tests were scheduled with a planned initial operational capability in 1987 for an eventual force of over 100 interceptors. However, when the estimated system cost skyrocketed over tenfold, the Air Force cut the programme back. After technical problems and testing delays compounded the troubles, anti-satellite activities were cancelled by the administration in 1988. Shortly thereafter, Congress banned tests against any object in space unless the Soviets broke their self-imposed moratorium on such tests.[3]

Current anti-satellite interest

There has been no waning in the Pentagon's desire to wage war in space – 'space control,' as it is euphemistically called today. Although anti-satellite activities are not the whole of space warfare, neither are they at the bottom of the list. General Ralph E. Eberhart – commander-in-chief of the North American Aerospace

GLOSSARY

AGIL	*All Gas Iodine Laser.*
ASAT	*Anti-Satellite.*
BAMBI	*Ballistic Missile Boost Intercept.*
BMD	*Ballistic Missile Defence.*
DoD	*Department Of Defence.*
EMP	*Electro-Magnetic Pulse.*
GAO	*General Accounting Office.*
ICBM	*Inter-Continental Ballistic Missile.*
KE-ASAT	*Kinetic Energy ASAT.*
MASER	*Microwave Amplification by Stimulated Emission of Radiation.*
MIRACL	*Mid-InfraRed Advanced Chemical Laser.*
MOL	*Manned Orbital Laboratory.*
NORAD	*North American Aerospace Defence Command.*
SAINT	*Satellite Interceptor.*
SLBM	*Submarine-Launched Ballistic Missile.*
SRAM	*Short-Range Attack Missile.*

Defence Command (NORAD), the United States Space Command, and the Air Force Space Command – said: 'We rely on space for communications, navigation, timing, surveillance, reconnaissance, and weather forecasting.... Not only do we have to use it, we have to be able to defend it and *deny our enemy the use of space if we are at war*.'[4] (Emphasis added) That obviously includes destroying the opponent's satellites.

Numerous recent reports also describe the Pentagon's interest in space warfare and anti-satellite activities. In his 2000 posture statement, Defence Secretary William S. Cohen stated: '...[the Department of Defence] must have the appropriate capabilities to deny when necessary an adversary's use of space systems to support hostile military forces.'[5] A little earlier the Pentagon-commissioned Strategic Studies Group IV similarly stated: 'In order to neutralise – and selectively deny access to – space, the Department of Defence must develop the means to control and destroy space assets (both in space and at ground level), while selectively reconstituting its own capability through multiple sources.'[6]

The Phase II report of the United States Commission on National Security for the 21st Century also addressed the growing importance of space: 'Outer space and cyberspace are the main arteries of the world's evolving information and economic systems.... Through both technical and diplomatic means, the United States needs to guard against the possibility of 'breakout' capabilities in space and cyberspace that would endanger United States survival or critical interests.'[7]

Joint Vision 2020 is the Pentagon's benchmark document for military transformation. In its contribution to that document the United States Space Command stated: 'Indeed, so important are space systems to military operations that it is unrealistic to imagine they will never become targets.... space superiority is emerging as an essential element of battlefield success and future warfare.'[8]

The *Joint Vision 2000* document, itself, was very explicit on the importance of space. The ultimate goal of United States military activities is called Full Spectrum Dominance, which is 'to defeat any adversary and control the situation across the full range of military operations,' which means United States forces must excel 'with access to and freedom to operate in all domains – *space*, sea, land, air, and information.'[9] (Emphasis added.) In its discussion of Precision Engagement, referring to space activities as well as all other operations, the document goes on to say: 'Precision Engagement is the ability of joint forces to locate, surveil, discern, and track objectives or targets; select, organize, and use the correct systems; generate desired effects; assess results; and re-engage with decisive speed and overwhelming operational tempo as required, *throughout the full range of military operations*.'[10] (Emphasis added.)

These official quotes should provide an understanding of how interested the Pentagon is in space warfare and anti-satellite capabilities. Soon there will be another report by a congressionally-mandated Commission to Assess United States National Security Space Management And Organisation which held its

first meeting on 11 July 2000. This commission is mandated by the fiscal year 2000 National Defence Authorisation Act and is an extension of the Rumsfeld Commission – chaired by the new Defence Secretary Donald Rumsfeld and said to be composed of '13 distinguished private citizens.'[11] Those distinguished citizens consist of seven retired generals or admirals, three former Department of Defence officials, one former NASA official, one former House Armed Forces Committee member, and one senator. The word 'citizen' should not be confused with 'civilian.' The public will soon be hearing more platitudes on how important it is to 'defend' space.

Current anti-satellite activity

Anti-satellite development was slated to be cancelled entirely when President Clinton took office in 1993. But a small group of senators have been able to provide a tiny, unrequested amount of budget for ASAT each year. Since 1989 the Army has been quietly overseeing a joint-services Tactical Anti-Satellite Technologies programme featuring a hit-to-kill warhead, called the kinetic energy anti-satellite (KE-ASAT) weapon, similar to that being developed for ballistic missile defence.

1. Hit-To-Kill Warheads.

The kinetic energy anti-satellite programme began in 1989 as a means of leveraging off technologies developed for Star Wars. The 94-pound interceptor uses a visible light optical seeker to find and track the target while small computer-operated rocket motors guide the vehicle onto a collision course. It also has a shroud for the purpose of containing all the debris so as not to create space junk that would jeopardize United States spacecraft. All ground testing is completed for the kinetic energy anti-satellite weapon.

Although the Department of Defence has never requested funds for the kinetic energy anti-satellite weapon since at least 1995, Congress appropriated $30 million in fiscal year 1996 to perform hover tests. $50 million was provided by Congress in fiscal year 1997, and $37.5 million in fiscal year 1998. Boeing North America Inc's Rocketdyne Division (Canoga Park, California) is developing the system under contract to the United States Army. About $235 million had been spent on the kinetic energy anti-satellite weapon up to that point.

The kinetic energy anti-satellite weapon received no funding in fiscal year 1999 and the $7.5 million appropriated for KE-ASAT in fiscal year 2000 has not been released because no agreement has been released on a spending plan for the programme. According to Jack L. Brock Jr., Managing Director of Acquisition and Source Management for the General Accounting Office, 'Status of the KE-ASAT programme is currently in a state of disarray and [its] future remains uncertain.'[12] In 2000 the Department of Defence recommended that the Army complete existing programme contracts, place delivery of flight qualified vehicles in storage, and pursue no further development of the kinetic energy anti-satellite system.[13]

2. High Energy Lasers.

Destroying the function of a hostile satellite is preferable to smashing it to bits because it decreases the amount of space debris that United States satellites must encounter. For that reason, high energy lasers are a preferred anti-satellite weapon because they can blind spy satellites and burn out the electronics in others. High energy lasers may also be the only effective weapon against satellites in very high orbits.

A February 1996 Air Force report entitled *New World Vistas: Air and Space Power for the 21st Century* concluded: 'Control of space will become essential in the next decade ... [and] the United States may be called upon to protect non-military space assets from attack by terrorists or a rogue nation.'[14] The report recommended that the Air Force develop a ground-based high energy laser to destroy satellites. Besides the airborne laser and the space based laser, which are being developed as ballistic missile defence weapons, anti-satellite interests also centre on the Army's mid-infrared advanced chemical laser (MIRACL).

The mid-infrared advanced chemical laser was originally part of the Reagan Administration's Star Wars project but was cancelled by Congress in 1983. But Congress at the same time ordered MIRACL to be set up at the High Energy Laser Test Facility at White Sands Missile Range in New Mexico. There it has been used to support various Department of Defence tests since the late 1980s.

MIRACL is a megawatt-class deuterium-fluoride mid-infrared chemical laser which can hold a continuous beam on a target for up to 70 seconds. On 17 October 1997 – the same week that the White House used the line-item veto to kill the kinetic energy anti-satellite weapon – MIRACL fired two short bursts at an old United States Air Force satellite called MISTI-3. The test was reported to have successfully demonstrated the laser's ability to disable a satellite's spying capability. Senator Tom Harkin of Iowa described this as a test 'both unnecessary and provocative' which could induce other nations to build anti-satellite weapons.[15]

The Air Force also has the High Energy Research and Technology Facility in a remote area of the Monzano Mountains on Kirtland Air Force Base, New Mexico. This facility experiments in other directed energy weapons besides the killer laser. These include high-power microwaves, high-energy advanced pulsed power, and very-high-energy plasmas.

This Air Force laboratory has also come up with an 'all gas' chemical laser called all gas iodine laser (AGIL), which it claims would be ideal for use in space because of its light weight. It mixes nitrogen chloride and iodine gases in a vacuum to create the lasing action. Researchers believe it would take at least until 2003 to develop, demonstrate, and test the all gas iodine laser.

Conclusion

The hit-to-kill intercept tests that have taken place so far in ballistic missile defence programmes are really more representative of anti-satellite tests. The target comes from a known direction and a known speed at a known time.

Likewise, the high energy laser may be more effective against satellites than against missiles. With all the evidence and professional opinion opposed to ballistic missile defence – to say nothing of the political, diplomatic, and arms control nuances – one must wonder if there isn't an ulterior motive for such tenacity to missile defence activities. Ballistic missile defence programmes could well be a front for developing an anti-satellite capability. At the very least, a parallel effort. But, if so, why is anti-satellite development being done so clandestinely? Probably because the uproar of public opinion would be even greater and international dissent even stronger. Or maybe the capability needs secrecy to mask its first-strike connection.

During meetings in Geneva from late January until 18 February 2001, the United Nations Conference on Disarmament proposed that negotiations be commenced to establish new guidelines for banning offensive weapons in space and for limiting development of systems that could destroy spacecraft from earth. The United States blocked this proposal, saying there is no space race and that such a treaty is unnecessary. The United States further contended that the 1967 Open Skies Treaty and the 1972 Anti-Ballistic Missile Treaty are adequate in forbidding weapons of mass destruction in space. The United States has always maintained that its space efforts are purely defensive.

The flip side of the coin from learning how to destroy something is learning how to prevent it from being destroyed. One can pursue defensive technology and once the means of defence are known, the means of overcoming that defence can be developed. The United States Air Force has activated a Space Control Squadron at Peterson Air Force Base in Colorado. Its purpose is to study future concepts of offensive and defensive counter-space weapons. It may have been no accident that the United Nations proposal to establish new guidelines for space immediately followed the Pentagon's January 2001 exercise by the United States Air Force Space Warfare Centre at Shriever Air Force Base in Colorado, a war game which simulated a war in space in 2017.

The true natures of ballistic missile defence and anti-satellite capabilities are masked by the 'defensive' connotations under which they are presented to the public. It is hard to criticise anything that is truly defensive. There are two things wrong with this perception. First, it obviates any other means of settling international disputes which create the threat in the first place. Secondly, government and Pentagon reputation is replete with deception. What is presented to the public is not necessarily what is really taking place. In this case, the announced intentions do not reflect the capability the United States is seeking – a capability revealed by close study of how military development programmes fit together to achieve it. That is an aggressive first-strike capability which is neither defensive nor deterrent.

Whether there is skullduggery afoot or not, the technologies for ballistic missile defence and anti-satellite warfare are essentially one and the same. Both ballistic missile defence and anti-satellite warfare are critical elements of a first-strike capability. When combined with America's precision strategic missiles and

anti-submarine capabilities, all interconnected and integrated through an intricate system of command, control, and communication, the first-strike capability is there. As all these technologies mature, that first-strike capability becomes more real. As the capability becomes more real, the more threatening it is to human values in all their nuances.

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Notes

1 Cohen-2000, p. 97.
2 *Space News*, 26 April 1993, p. 10.
3 For a more complete history of ASAT see Aldridge, *First Strike*, pp. 211-226.
4 *SPACEDAILY*, 10, June 2000.
5 Cohen-2000, p. 97.
6 SSG-IV, p. 17.
7 Seeking A National Strategy, p. 9.
8 *Vision For 2020*.
9 *Joint Vision 2000*, p. 8.
10 *Joint Vision 2000*, p. 28.
11 DoD News Release 13July2000.
12 GAO-01-228R.
13 GAO-01-228R.
14 Cited in *Defence News*, 26 February 1996, p. 4.
15 Cited in *Defence News*, 27 October 1997, p. 14.