The Viability of U.S. Anti-Satellite (ASAT) Policy: Moving Toward Space Control

INTRODUCTION

The United States has the highest reliance on satellites of any country in the world, not only in the national security sector, but the private sector as well. Although it has recognized the importance of protecting satellites as strategic assets since their inception, different times and circumstances have yielded different approaches regarding how and how vigorously this should be accomplished. During the Cold War, whereas hardening military satellites against potential destruction was commonplace, for example, development of specific weapons to target hostile satellites or threats to U.S. satellites was politically eschewed. The United States' desire to protect its satellites was overridden by wanting to avoid what were considered potentially destabilizing efforts, and what seemed as an inevitable arms race in space that would result from those latter efforts. During the Reagan Administration, however, the United States tacitly engaged in a space arms race with the Soviet Union, called the Strategic Defense Initiative (SDI, or Star Wars).

It is the intent of this paper to suggest that the strategic arguments that pervaded in past ASAT debates are now, for the most part, gone, but replaced by another broader, and in some ways more nuanced organizational issue. That issue concerns determination of the relative importance of space weaponry designed toward negating space-based threats—the traditional role of ASATs—within the parameters of U.S. space control capabilities specifically and military planning generally. In that context, it will be argued that although past political impediments to the development of ASATs have dissipated, ASAT development will likely continue conservatively much as it

has in the past, now as a part of a broader spectrum of efforts. In a change from the past, however, organizational politics and fiscal prioritization rather than macro strategic political and public debate now determine such a course.

Because of the increased complexity of the entire space control issue, including protection of our own satellites and negation of those which are a threat to U.S. national security, it is also important to specify what is meant by ASAT in the context of this paper. ASAT here uses the traditional definition, referring to the narrow category of hardware designed to disable, temporarily or permanently, satellites in orbit. Although some would argue that ASAT is an obsolete term because the same goal can often be achieved through a variety of other routes, the existence of programs such as Kinetic Energy Anti-satellite (KE-ASAT), Mid Infrared Advanced Chemical Laser (MIRACL), and others, justifies such a use and an examination.

Previously, because the ASAT debate was a macro political and sometimes public issue, assessing the viability of U.S. ASAT policy required that three interrelated, critical elements be considered: policy, law and programs. Recognizing the difference between policies and programs, and why they might be rationally assumed as linked, manifests a definitional nuance *cum* essential difference rarely acknowledged. A policy is "a high-level overall plan embracing the general goals and acceptable procedures."[1] Paraphrased, it is a statement of intent. A program, on the other hand, in governmental terms is an activity that has been substantively approved (authorization) and an activity for which funds have been made available (appropriation). Theoretically, programs are the vehicles for carrying out policies. In the United States, however, it has been the case that policies and programs sometimes do not match. This has been particularly true in the space field, because space policy so often evolves as a subset of foreign or defense policy.[2] One can argue it is through funded activity that actual governmental priorities can be determined. Aaron Wildavsky states, "budgeting is a process of discovering and enforcing preferences."[3]

Therefore, in considering ASAT policy, it has been necessary to consider both policy and funded programs, because the two did not necessarily match.

U.S. action, or inaction, must also be considered within the context of international treaties to which the United States is a party, as well as relevant domestic laws. Although the ability to dictate policy is theoretically driven by these parameters, it will be argued in this paper that has not actually been the case. Indeed when the legal parameters have become inconvenient toward achieving political goals, the tack has been to simply find a lawyer who can give a more acceptable interpretation to the law than that which had formerly held. These permeable legal interpretations have played a critical role in perpetuating the approach-avoidance ambivalence previously characteristic of U.S. ASAT policy. There has been more-or-less official ASAT policy, and at the same time, though not necessarily related, several ASAT programs at different developmental stages under several policy justifications and various sponsors.

The examination will begin with a look at the past as prologue to the present and future. It is important to understand the depth and assumptions behind past philosophic positions both in support of and against ASATS in order to appreciate how remarkable it is that in a period of about a decade, those positions have been subsumed by organizational politics. The past also provides a beginning for understanding the origins of the attitudes that now shape the organizational politics.

THE EVOLUTION OF ASAT POLICY

Traditionally, an ASAT has been defined as a device that makes a satellite inoperable by negating its payload. There are a number of ways to accomplish that, including "shining" energy on the satellite from a ground or space-based illuminating device; placing co-orbiting "mines" in space adjacent to the satellite one may want to negate; direct ascent; achieving a co-orbit with the satellite and "catching up" to it; and launching a device from a high-altitude aircraft. Why the United States might desire to develop the capability to

pursue such a course of action dates back to strategic thinking in the Post-World War II era.

In the 1940's and 1950's strategic thinking was dominated by the Pearl Harbor syndrome, and the desire to avoid surprise attack in the nuclear age. Multiple avenues were followed in this regard, from space-based reconnaissance in pursuit of the ultimate high-ground to development of capabilities to defend against such threats as the Soviet Fractional Orbital Bombardment System (FOBS), which involved ballistic missile intercept technology symbiotic to ASAT technology. This era of strategic thinking was interrupted by what has been called the Golden Age of Arms Control in the 1960's and 1970's. Mutually Assured Destruction (MAD), a political rather than a military strategy, dominated thinking. In that context, ASATs and other weaponry of its sort were characterized as destabilizing, because of their potential to upset the precarious balance necessary for MAD to be credible. Although classical military strategists continued to argue that anything that impeded the enemy in achieving its goals was inherently an advantage, the arguments fell on deaf ears. It was then also that the arms-race-in-space argument was advanced, further deterring the political will to develop any potentially "destabilizing" military space programs.[4]

Between 1957 and 1968, U.S. efforts in the ASAT field were primarily in response to concerns about Soviet deployment of orbiting nuclear weapons in space. The always prudent Eisenhower Administration envisioned multiple systems to address this anticipated problem: satellite inspection methods from our own satellites (satellite to satellite), an air-launched ASAT, and a ground-launched ASAT, both with nuclear warheads. In the ground-launched category, the U.S. Army proposed converting the Nike Zeus anti-ballistic missile to an ASAT role as early as November 1957. Eisenhower, however, was the first but not the last president to feel compelled to take the conservative route regarding ASATs. It was during his presidency that the question of whether maintaining space for "peaceful" purposes, later key in a

legal debates, meant non-military, non-combatant, defensive, passive, or something else. Subsequently, Eisenhower focused on the Satellite Inspector (SAINT) program. Although the Air Force always intended to convert it to a true anti-satellite program,[5] the Eisenhower policy is reflected in the Purcell Panel's report, which received presidential approval on March 26, 1958.

> Much has been written about space as a future theater of war, raising such suggestions of satellite bombers, military bases on the moon and so on. For the most part, even the more sober proposals do not hold up well on close examination or appear to be achievable at an early date.[6]

A policy of passive-only military use of space prevailed.

The first successful U.S. ASAT test took place in 1963, during the Kennedy Administration. This program, known as Project Mudflap or 505, lasted until 1966. It was a variant of the earlier Army Nike Zeus system. Approval for that program, though highly secret, led to speculation that an operational version of SAINT would also be approved. Initially in the Kennedy Administration the Air Force had a good chance of regaining its ascendancy in space, some of which had been lost to NASA and through inter-service rivalries. Indeed the Air Force geared up for a role in the manned space effort,[7] only to later be ingloriously shot down by Secretary of Defense McNamara.

The Air Force did test and deploy several Thor rockets modified for use as ASATs, between 1964-1970, illustrating that programs persisted even when policy rejected or inhibited an operational use. Air-launched ASAT efforts were a part of programs to develop air-launched ballistic missiles in the 1950's and early 1960's, evidencing the conjoint nature of the technologies. These included the Air Force Bold Orion program, launching rockets from a B-47 bomber, and the Navy Hi-Ho tests using F-4 fighters. Neither resulted in an operational system for technical reasons, subsequently sidestepping the political considerations.

Technology limitations at the time, specifically regarding guidance systems, meant that ASATS could be counted on only to place a warhead within a few miles of their target, which meant that they had to use a nuclear warhead. Tests in the early 1960's demonstrated that the electromagnetic pulse from the explosion carried for a considerable distance. Subsequently, U.S. satellites became vulnerable to as much damage as the intended targets. The military utility of such an indiscriminate weapon was minimal. Additionally, the anticipated threat of orbiting nuclear weapons had never materialized.

In the meantime too, the United States was deeply involved in Viet Nam, further reducing the priority of new space assets generally and ASAT's specifically. Although the Soviets were launching considerably more military satellites at this time than was the United States, U.S. satellite technology was better, and subsequently lasted longer. The Soviets needed to replace their satellites more often, raising their launch rate. By this time, the United States had a clear dominance in space.

During the Nixon years, 1968 specifically, the Soviets tested a co-orbital, non-nuclear warhead ASAT. The results were marginal. How to respond was problematic. Deterrence, threatening to shoot down a Soviet satellite if they shot down a U.S. satellite, was weak in that the U.S. had already become more dependent on satellites than the Soviets because ours worked better. Further, the Soviet tests were so inconclusive that there was no specific technology that the United States could directly respond to. The sanctuary status of space, evident since the Kennedy Administration decision to limit U.S. military space activities to those of a “passive” nature, also continued to prevail. Taken together, the Nixon Administration did not want to overreact and shake the fragile détente being constructed, so U.S. ASAT efforts continued to languish.

The contribution of the abbreviated Ford Administration to the ASAT evolution is an ironic one, evidencing the somewhat schizophrenic nature of

politics. In an incongruous case of role reversal, for a short time it was the White House pushing for expanded military space programs, including ASATs, while DOD and the Air Force held back. The White House position was based primarily on the recognition of ever increasing U.S. dependency on satellites. The DOD position can perhaps be characterized best as ambiguous. The Air Force, however, had lost its taste for space after the defeats with McNamara, and reverted back to its traditional "air" culture almost exclusively.[8] Therefore, when U.S. policy changed in January 1977 with Ford authorizing anti-satellite development, it was from White House impetus. This left making the hard decisions to the Carter Administration, which apparently was part of the intent. "….A number of nasty decisions were made in the final days of the Ford administration in order to influence the agenda for the incoming Carter Administration."[9]

The Carter Administration approach was two-track: 1) start an advanced air-launched ASAT program with 2) the clear intention of being willing to bargain it away in arms negotiations. Indeed negotiations on an ASAT treaty were initiated in 1978 but broke off in 1979 due to the Soviet invasion of Afghanistan. When the U.S. broke off the talks, the Soviet Union used that opportunity to showcase its efforts in ASAT arms control being stymied by the United States. Indeed it presented and publicized draft ASAT treaties in the United Nations in 1981 and 1983.[10]

By this time U.S. efforts were shifting to non-nuclear kinetic kill mechanisms. The Air-Launched Miniature Vehicle (ALMV), launched from an F-15 fighter, was the primary U.S. ASAT effort in the early 1980's. That system carried a heat-seeking Miniature Homing Vehicle (MHV) that could destroy its target by direct impact at high speed. The last Soviet co-orbital ASAT was tested in 1982, prompted by U.S. ASAT testing plans and the SDI program.

The Reagan Administration in the 1980's was both heralded and decried for ushering in what was called the "militarization of space," though in

reality space had been a military domain for longer than it had been a civilian one. The concept of "space control" began to be discussed in earnest, most often with analogies drawn to control of the high seas. The characteristics of space control at that time included 1) protection of U.S. assets 2) full surveillance and 3) negation capabilities, with ASATs thought of at this time as hard-kill negation.

The Reagan Administration initially wanted no part of negotiations with the Soviet "evil empire." ASAT treaty discussion was part of the "defense and space" segment of the tripartite Geneva Nuclear and Space Talks, but with little enthusiasm on the part of the United States.[11] Rather ironically, although the Reagan Administration is particularly credited with advancing space-weapons technology through the Strategic Defense Initiative (SDI), or Star Wars, the policy aspect of ASATs became particularly muddled during that same period, due to assumptions made that were perhaps overstated. For example:

> … subsequent changes in Soviet offensive and defensive capabilities invalidated much of the anti-ballistic missile defense argument. President Reagan is not today hampered by the anti-military industrial complex arguments of the Vietnam era; he has largely been successful in arguing for congressional approval of exotic defense programs. But most important, recent advances in ground-based and space-based component technology have led many people to believe that a defense to the enhanced Soviet threat is not feasible. For the first time, many thought it was feasible to add outer space as a base for providing "depth" to a missile defense system.[12]

The principle "kill" technologies being considered at that time were: pulsed laser, continuous wave laser, continuous particle beam, mass accelerator (hyper-velocity gun), and self-propelled missile. The self-propelled missile and hyper-velocity gun system evolved from earlier ground-based ballistic missile defense proposals. Others, e.g. the x-ray laser, excimer laser, free electron laser, chemical laser, and

neutron particle beam, were considered exotic devices, and hence the Star Wars designation given the SDI program.

Policy arguments aside too, despite vigorous rhetorical and financial support, even the Reagan Administration was unable to deploy an operational ASAT force. Although an operational force of 100 ALMV interceptors was planned at one time, by 1986 the program was so far over-budget (from initial estimates of approximately $500 million to something approaching $5.3 billion completion), cost reduction measures were vigorously sought. Subsequently, the MHV program was scaled back in 1987 by two-thirds. In 1988, the program was eventually cancelled due to technical problems with the homing guidance system and testing delays, both of which had added to the significant cost growth.

The Bush Administration also supported ASAT programs. That administration was indeed criticized for pursuing Open Skies proposals, where satellites serve the essential role of the eyes for verification aspects of arms control agreements, and simultaneously asking for funds to pursue ASAT programs which could jeopardize those assets required for verification.[13]

In assessing the viability of current U.S. ASAT policy it is also essential to recognize how inextricably linked any analysis of that issue is with that of Ballistic Missile Defense (BMD). The similar requirements and methods to detect, track and intercept both missile and satellites make BMD and ASAT research and development almost symbiotic in technical nature and political issue involvement. The symbiotic technical relationship between BMD and ASATs goes back to the conversion of the Nike Zeus missile to an ASAT role in 1957. Therefore, despite occasional forays in that direction, there is no ASAT treaty, but the Anti-Ballistic Missile (ABM) Treaty is the legal document of record that prefaces any discussion of the viability of current U.S. ASAT policy.

Outer Space Treaty (OST) of 1967

The OST has been called both "the Constitution for Outer Space" and the "Magna Carta of Space." Although it does provide a framework for legal considerations, like any framework it is also fraught with ambiguities. The ambiguity that has overshadowed all others since the time of its writing is the difficulty defining "peaceful purposes." There is the U.S. view that it means "non-aggressive." Even within the U.S., however, what is included in aggressive has changed over time, from the "passive systems only" doctrine of Kennedy to the Reagan Administration's eager embrace of active systems. The military view has always, understandably, focused on the more liberal interpretation, occasionally to the exclusion of consideration of others. Another view is that what is not prohibited in Article IV of the OST is permitted, and the Treaty clearly does not prohibit all military activities. On another extreme of the debate is the idea that the Outer Space treaty served to completely demilitarize space. Professor Mark G. Markoff, Professor of International law at University of Fribourg, Switzerland, particularly supports that view.[14] Language interpretations also have been considered. "In Russian, the word for 'military' essentially means warlike rather than pertaining to the armed services of a country; in the United States 'peaceful' is not regarded as the opposite of 'military'—we think of 'peaceful' as 'non-aggressive.'"[15] Some argue that regardless of academic and public pronouncements, what is important is recent practice. If that is the case, then peaceful has indeed been increasingly evolving to mean non-aggressive. Still, the issue cannot simply be dismissed, as some countries and groups of countries have defined "peaceful" as meaning non-military in their legal instruments. That makes it difficult if not sometimes impossible to try embark on a joint endeavor deemed peaceful by U.S. definitions, but not by theirs. Some of these definitionally-restricted countries are now considering modifying their own parameters.

Regarding ASATs and the OST, it has been concluded that "non-nuclear ASAT weaponry is…legal."[16] Bruce Hurwitz concludes that since

ASATs are not weapons of mass-destruction they are legal according to the letter of the OST. Considering the spirit of the law, "the conclusion appears to be that anti-satellite weapons are legal, *de lege late*, but should be illegal, *de lege ferenda*."[17] The type of ASAT system being considered becomes critical. While there is no formal delimitation of outer space, earth orbit is most often considered outer space. Therefore, an orbital (space-based) defense would be subject to international law, where a ground-based system would not.

1972 Anti-Ballistic Missile Treaty (ABM)

The Strategic Arms Limitation Talks that extended from November 1969 to May 1972 resulted in two agreements: the ABM Treaty and an "Interim Agreement Between the United States of America and the Union of Soviet Socialist Republics on Certain Measures With Respect to the Limitation of Strategic Offensive Arms," commonly called SALT I. This bi-lateral ABM treaty provides that space-based laser weapons are illegal for intended use against ballistic missiles. The treaty was singed at the peak of détente in 1972 after vigorous debate. There were five basic arguments that predominated alone and in combination against anti-ballistic missile defense: the system would not work; even if it would work, it was not needed; it would destroy the stability of deterrence; it would create a threat to particular localities it purported to defend; and it was a project ultimately motivated to benefit primarily the military-industrial complex. Taken together, it was felt that an operational ABM system would result in a destabilizing arms-race and as well promoting crisis-instability in general by extricating the owner country of first-strike vulnerability, thereby negating the concept of deterrence.

The question then becomes where does the ABM Treaty leave ASATs from a legal perspective. There is, not surprisingly, more than one answer. Hurwitz believes that "all extraterrestrial autonomous weapons are illegal. However, non-nuclear weapons, which are not autonomous, may be stationed and, in accordance with generally accepted principles of international law, used in earth orbit."[18] A more simplified approach says that

"Antiballistic missiles based on laser or particle beam techniques are not weapons of mass destruction. Since they are meant to be a defense system, they are by definition nonaggressive, and their deployment in earth orbit would therefore not represent a violation of international space law."[19] This view can be nuanced though. "Generally speaking, the ABM Treaty bans a territorial ballistic missile defense system, but permits the development, testing, and deployment of fixed, ground-based radars, interceptor missiles, and interceptor missile launchers under very tight constraints. The development, testing, or deployment of sea-based, air based, space-based, or mobile land-based systems or of components for such systems is prohibited."[20]

The relevant section of the ABM treaty regarding ASATs is that which deals with anticipated advancements in ABM technology. To decrease the pressures of technological change and its unsettling impact on the strategic balance, both parties to SALT agreed to prohibit development, testing, or deployment of sea-based, air-based, or space-based ABM systems and their components, along with mobile land-based ABM systems. Should future technology result in new ABM systems "based on other physical principles" than those employed in systems in existence in 1972, it was agreed that limiting such systems would be discussed, in accordance with the Treaty's provisions for consultation and amendment.

Within that relatively simple premise, however, considerable debate has resulted as to definitional intentions and parameters.

> Article II of the ABM Treaty defines an ABM "system" as "a system to counter strategic ballistic missiles or their elements in flight trajectory, currently consisting of: (a) AMB interceptor missiles…(b) ABM launchers…(c) ABM radars." The treaty does not mention lasers, particle beams, or any of the other 'exotic' technologies being considered under SDI. Because of this, many ABM critics argue that Article II explicitly limits the definition of an ABM system to the particular technologies cited in the article: ABM interceptor missiles, launchers, and radars. A logical conclusion from this line of thinking is that, since they were not then "currently available," the new technologies are not

> the kinds of "ABM systems" that are limited by the treaty; therefore, they may be developed without restraint.
>
> A more reasonable interpretation of Article II is that the United States and the Soviet Union intended to include new "exotic" ABM technologies with the definition of "ABM systems." The use of the phrase "currently consisting of" implies that the drafters contemplated the possibility that future ABM systems could incorporate technologies other than those that were feasible at the time.... As Article III permits only land-based systems to be deployed, Agreed Statement D therefore provides a means by which ABM system "based on other physical principles" might be deployed within the geographical and quantitative confines of Article III. "Exotic" systems that are meant for deployment at the two land-based sites permitted under Article III may be researched, developed and tested, as the treaty does not prohibit these activities for land-based systems. But before they are deployed, specific limitations on the new systems are subject to good faith bilateral consultation. If amendments to the treaty are deemed necessary to accommodate the "exotic" land-based technology, they of course may be proposed and agreed upon by the parties.[21]

Clearly, maneuvering rooms exists for lawyers to make a claim one way or another in support of including or excluding some programs from the scope of the ABM Treaty.

The Reagan Administration unilaterally adopted a broad interpretation of that section, requisite to allow for development, testing and deployment of SDI systems. This bold move both utilized and resulted in some embarrassingly ambiguous and tenuous legal premises, and subsequently created a flurry of controversy domestically and internationally. Then-White House National Security Affairs Advisor, Robert C. McFarlane appeared on the television show "Meet the Press," on October 6, 1985 and provided what was called the Reagan administration's "new interpretation" of the ABM Treaty. Accordingly to McFarlane, Agreed Statement D of the Treaty provided "that research on new physical principles or other physical principles is authorized as is testing and development." He suggested that only

deployment was foreclosed. McFarlane's statements quickly were confirmed as representing the administration's policy. But, Gerard C. Smith, who led the ABM Treaty negotiations, and other previous administration officials who had been involved in arms control negotiations, disagreed. They immediately criticized the "new interpretation," contending that it went beyond the traditional "restrictive" interpretation, which recognized the treaty's implicit approval of research, development, and testing of fixed, land-based systems, by extending these activities to the space-based systems that are envisioned under SDI. Moreover, the "new interpretation" apparently would permit the Agreed Statement to modify express language in Article V, which prohibits the United States and the Soviet Union from developing, testing, or deploying space-based ABM systems. They felt that allowing the Agreed Statement to stand on an equal footing with the treaty article was contrary to accepted principles of treaty interpretation.[22]

But in essence, the thrusts and parries being made were central to a political battle as much or more than a legal one. In follow-up statements such as that made by Assistant Secretary of Defense Richard N. Perle, it became increasingly clear that the administration had a course of action in mind and did not intend to be swayed by legalisms.

> In my judgement there is one correct view of what the treaty provides… After one wages through all of the ambiguities and reads carefully the text of the treaty itself and the negotiating record…with respect to the systems based on "other physical principles"…we have the legal right under the treaty to conduct research and development and testing unlimited by the terms of the treaty.[23]

Clearly, however, the backing of a legal opinion, however tenuous, was desired.

Apparently, Perle and MacFarlane based their positions on a 19-page report on the subject prepared by a former New York assistant district attorney, Philip Kunsberg. Kunsberg concluded that as part of the ABM Treaty negotiations, the United States had sought a tight ban on "exotic" future

AMB systems except for those in a fixed land-base mode. But, he stated, the Soviets had consistently objected. Although that appears to be correct, the record is unclear as to exactly what agreement was then reached. Classification of documents is part of the problem in that regard.[24]

Chief Negotiation Gerard Smith wrote a letter to the editor of the *New York Times* to weigh in with his view of history. "It was not our intention that any type of technology for space-based ABM systems could be developed or tested under the treaty. This has been the official view of the United States government for more than 13 years…. The treaty does permit a small deployment of fixed land-based ABM missile using traditional technology. It also permits development and testing of new technology for such fixed land-based defenses—but not deployment."[25] Law and politics were clearly being kludged in ways intended to support various positions.

Congressional democrats in Congress were, not surprisingly, appalled at the "new interpretation." Paul H. Nitze, special advisor to Reagan on arms control, was sent to reassure a House Foreign Affairs subcommittee that the "new interpretation" would not be applied to SDI. Secretary of State George Schultz was given the lead in assuring allies that SDI was designed as a research program to fall within the narrower definition of the ABM Treaty's provisions. Much to the chagrin of many, however, the "new interpretation" was not repudiated by the Administration. That seemed to leave open the future possibility that could reverse its "policy" which advocated a "restrictive interpretation" of the meaning of Agreed Statement D, in favor of the "broad" new interpretation.

The adage "politics always wins" certainly seemed exemplified in this battle of legal interpretations, evidencing that legal parameters seem permeable at best. Clearly, the Reagan Administration did consider the ABM Treaty to apply to the exotic new technologies associated with SDI. It was not clear, and never tested, how and to what extent the treaty was seen as limiting SDI and similar technologies.

Hurwitz's survey of the U.S. Strategic Defense Initiative (SDI) led him to conclude that the SDI, or rather its development, violated the 1972 ABM Treaty.[26] Others have concluded similarly, suggesting that if the U.S. was to proceed with the development, testing and eventual deployment of a system, (basically, anything beyond research) then Treaty withdrawal would be necessary. Having stated that though, it is also pointed out that the distinction beyond research and development is not clear-cut. Herein lies another ambiguity still overshadowing the entire policy debate. ASATs are not specifically mentioned in the ABM Treaty and therefore are not prohibited *per se*. But, ASAT weapons violate Article IV if they are given ABM capabilities. Since the technologies overlap so much, many elements needed for an ABM system may be tested or even deployed under the guise of ASAT tests.

Similarities and Differences

While the ABM Treaty apparently prohibits the use of directed-energy weapons in the ABM mode, the same technology when used in the development/testing/deployment of ASATs is not prohibited. Some legal analysts suggest that it may sometimes be impossible to distinguish between ABM directed-energy space vehicles and those deployed exclusively for antisatellite purposes. This apparent loophole may be exploited, particularly in the development and testing phases.

Subsequently, in response to SDI and the new interest in ASATs in the United States, which Congress believed opened the door to an arms race for a weapon of questionable effectiveness, ASAT testing was banned in 1985. On August 20, 1985, President Reagan certified, pursuant to the congressional resolution limiting ASAT test funds, that further testing of a U.S. ASAT system was in the national security interest, despite good faith efforts on the part of the United States to negotiate a strict ASAT treaty with

the Soviet Union.[27] In December 1987, the Air Force proposed termination of the current ASAT system as a cost-cutting measure.[28] Congress wisely calculated that the military would continue research in the field, but could only go so far without testing.

In 1996, reversing 7 years of Republican policy, the Clinton Administration informed the Senate that it would return to adherence with the traditional interpretation of the ABM Treaty. The reasons were primarily political.

> The return to the original interpretation gives the White House a concrete policy justification for sharply reducing ABM spending down the road. The move may also help President Clinton repair his sullen relations over the gay issue in the military with Senate Armed Forces Committee chief Sam Nunn, the leading advocate of the original interpretation. In their quest for a space-based ABM defense under SDI, Reagan and Bush pressed unilaterally for a broad interpretation that would have allowed both testing and development of mobile and space-based exotic weapons technology—"exotic" referring to technologies not current in 1972. Nunn, a lawyer, argued that a unilateral, and belated, interpretation raised profound Constitutional questions. He also argued it was illegal to test or develop SDI kinetic kill vehicles under either interpretation.[29]

So while the United States returned to a more conservative interpretation of the ABM treaty, for domestic political reasons, under the Clinton Administration the legal parameters are still ambiguous, but with the ambiguities defined in a less volatile and visible political environment.

Debate continues on whether the AMB Treaty should be revised or dismantled to accommodate U.S. plans for National Missile Defense (NMD) and Theater Missile Defense (TMD), and international politics still play a role in that debate. Dialogue between Russian president Boris Yeltsin and U.S. president Bill Clinton regarding Russian perceptions of the issue is essential, for example, toward avoiding actions that could subsequently yield unintended

political consequences. But, the strategic realities of emerging threats and the inextricably linked technologies between ASATs and BMD compel a reevaluation of the parameters imposed by the ABM.

While the macro debate about the future of the ABM Treaty goes on at one level, however, a perhaps even more important and subtler debate on ASATs as a component of space control has become the more dominant determinant of future directions. Here is where the major change in the ASAT debate has occurred. Whereas in the past, macro-level strategic considerations framed the political debate, now the debate is primarily a domestic resource one based on varying assessments of the appropriateness and need for the technology.

THINGS BEGIN TO CHANGE

In 1989 with the fall of the Berlin Wall, the entire strategic environment began to change dramatically. The Soviet Bear that had challenged the United States for so long became increasingly unable to present a viable challenge because of its own internal difficulties. ASAT proposals in the early 1990's were still debated from Cold War premises though. The arguments which had characterized ASAT debates since the Kennedy Administration still dominated: the "space as a sanctuary" argument, the undermining strategic stability argument, and the arms race argument. All had worked effectively before, so a similar effort seemed again in order. The problem was, the reality of two of the three arguments was quickly disintegrating, much like the Soviet Union against which the arguments were based.

The Gulf War in 1990-91 also changed the equation for consideration of ASATs. Referred to as the first "space war," perhaps the biggest realization of the importance of space in warfighting during that war came to the Air Force. Although the primary owner of space assets, many felt they were (and continue to be) third behind the Army and Navy in utilization. In the Gulf War,

however, the pilots who run the Air Force were confronted with the advantages of utilizing space as a force enhancer. Indeed virtually every element of modern warfare utilizes space capabilities for communications, intelligence, early warning, weather forecasting, and navigation.[30]

Subsequently, military pressure for space control capability grew more intense after the experience of Desert Storm, when the tremendous advantages of space were experienced by the allied coalition. The military's lesson drawn from that conflict has been that the ability to leverage space assets must be preserved by the U.S. and its allies, and denied to adversaries, e.g. space control. Recognition of the wide range of capabilities that would entail, beyond traditional ASAT hardware, came through the same avenue that most doctrine is written, retrospect based on experience.

Post-Cold War and post-Gulf War, the strategic arguments that had dominated the ASAT debate dissipated, except for perhaps the purist position supporting space as a sanctuary. They began being replaced, however, with other concerns. First, the Clinton White House let its opposition to military-space programs be known through both words and actions. Later, debate within the Defense Department generally and the Air Force specifically began on the role of ASATs within the increasingly sophisticated definition of space control, and where space control fit into budget priorities.

When the Clinton Administration came into office, ASAT proponents, including Secretary of the Air Force Sheila Widnall and Air Force General Charles Horner, tried to raise ASATs as a political issue to be addressed.[31] The White House resisted, particularly regarding the Army's Kinetic Energy Anti-satellite (KE-ASAT).[32] The Clinton White House supported the space sanctuary view generally, and did not support “kill” weapons or what it considered “adventurous” military space programs specifically.

Congressional supporters though, like New Hampshire Senator Bob Smith, have backed military space programs and kept some of them alive, despite sometimes-strong opposition from the White House and intra-service ambivalence. Congress, for example, approved $30 million in 1996 funds for KE-ASAT, but Clinton tried to rescind the money. Congress rejected that action June 9, 1996. Indeed KE-ASAT became a budget battle, with pet projects of Clinton's held hostage. The 1997 DoD budget authorization bill contained provisions, called fences, to withhold money from the space control element of the Pentagon's space architecture study and technological studies and analyses for counter-proliferation efforts. Among Clinton's favored programs, they were held hostage pending the release of all of the 1996 and 1997 money for KE-ASAT.[33]

Then with the FY 1998 budget, Clinton wielding his newly acquired power to veto specific programs, and cut $38 million from the KE-ASAT. But Congress kept finding ways to keep the program alive, and in May 1998, KE-ASAT scientist Mark Fisher stated that "If there's money available in 1999 we could conduct a proof-of-principle flight within 18 months. I would need $65 million to do two flight tests."[34] There was money in 1999, but from previous years' funding, and apparently not enough as far as the Pentagon is now concerned. A request for a monetary infusion of $41 million for the FY00 budget was requested to keep the program going. Almost certainly though, political opposition and timelines notwithstanding, KE-ASAT will continue.[35]

Perhaps even closer to deployment than KE-ASAT is the Mid Infrared Advanced Chemical Laser (MIRACL) currently in existence at the White Sands testing range in New Mexico. Originally an SDI anti-missile program, it is now in the process of adapting the laser for use against satellites. In additional to MIRACL, the Pentagon is working on both excimer- and free-

electron lasers as ground-based ASAT systems. These directed energy systems can respond in a much more timely manner than kinetic kill systems.

Internal prioritization given to these programs by the services, initially at least, was often not high. Clues regarding the importance of particular military policies and programs can often be garnered in several ways, including 1) whether or not they appear in the Five Year Development Plan (FYDP) from which services plan and 2) what organization takes the lead as their champion. When funds are unrequested by DOD or individual services, it can generally be assumed that the programs are rogues rather than mainstream priorities.

Programs were often championed by Congress, particularly the Senate as noted prior, rather than in the services themselves. Clementine 2, a program that lived and died between 1996-98, is another exemplary story of the opposition encountered by ASAT missions from inside and outside the Pentagon. It was conceived as a follow-on mission to the highly successful Clementine 1[36] mission that for $5 million mapped the Moon and provided evidence of ice on the surface. Clementine 2 was originally scheduled for launch in 1998. It would have been the first mission specifically intended to study asteroids from an impact mitigation perspective. As pointed out earlier, targeting an asteroid involves many of the same technical issues as targeting a satellite.[37] The space probe was to be built by the Air Force, and at one point was provided $120 million toward achieving its goals,[38] and fit with instrument-packed three-foot-long missiles. Those missiles were to be released into the path of two asteroids selected by NASA: 1986JK, a half-mile wide chunk of rock to be encountered in May 2000; and Toutatis, an asteroid about two miles across, to be intercepted about five months later. The instrumented missiles would first take close-up pictures and make scientific measurements before slamming into their targets. The idea was to provide scientists with information about strength and make-up of the objects,

specifically vital to understanding how to counter a potential Earth-impact, as well as to gain information on targeting space objects generally.

Externally, opposition to Clementine 2 came from multiple quarters. Politicians and scientists both voiced concern about the use of military technology in space, seeing Clementine 2 as a stalking horse to justify military space budgets and BMD research. Lawyers were concerned that it had been specifically designed to meet the stipulations of the Outer Space Treaty of 1967, or circumvent the intent, depending on how you look at it.

Internally, Clementine 2 did not make the FYDP,[39] considered a key indicator of the priority DOD puts on a program. Except for key proponents, the Air Force apparently was not particularly interested for several reasons. First, the Clinton White House had made it very clear that they were not interested in planetary defense, and told DOD to stay away from it. The Air Force has been willing to oblige if the mission did not come with additional funding. At one point elements within the Air Force apparently did attempt to include language in the Space Surveillance Operational Requirements Document (ORD). The Army and Navy opposed it in the Joint Requirements Oversight Council (JROC), eliminating even the surveillance part, as they did not want the Air Force to get a new "mission" which would compete for scarce money. And then there's the giggle factor too. Warriors fight enemies, not rocks. [40]

At one point too, the military control of space, including plans for the protection of satellites, was assigned to the (DoD) Space Architect's office. The difficulties of that office have also been chronicled,[41] especially with regard to persuading the individual services to actually implement the "architectures" it is charged with designing in terms of both doctrine and acquisitions. Although overlapping areas of responsibility can sometimes provide alternative homes, or at least support, for orphaned programs such as Clementine 2, that did not occur in this instance. The Space Architect's Office was neither willing nor able to lend support. Clementine 2 did not survive.[42]

In 1996, President Clinton issued a new National Space Policy. It was intended to reflect a post-Cold War evaluation of the strategic and political environment. It directed that:

> …consistent with treaty obligations, the United States will develop, operate, and maintain space control capabilities to ensure freedom of action in space and, if directed, deny such freedom of action to adversaries.

With respect to the denial aspect of space control, negation activities are permitted under international law for individual and collective self-defense. Hence the path was increasingly being cleared for a broad-spectrum of space control efforts, subject to prioritization within DoD.

Perhaps most importantly, what began to change during the Clinton Administration were the assumptions upon which the entire ASAT debate had persisted before and during the Cold War. Certainly, for example, there were no other countries in a position to engage in an arms race with the United States. Further, it became both clear and articulated that hard kill negation of space assets was often not the only, nor the easiest, nor even the best way to deal with the array of issues potentially confronting the security community in space. The military led the effort to recognize that the space capabilities of other countries, technologies, and the information age had progressed to the extent that defining “space control” had become a far more sophisticated task. Hence, space control slowly and quietly, taking advantage of the diminished "risk of strategic imbalance" argument which resulted from the ending of the Cold War, evolved to include:

1. Surveillance of space,
2. Protection of U.S. space assets,
3. Negation of adversary space systems and services used for purposes hostile to U.S. national security interests: the ability to disrupt, deny, denigrate and destroy space systems, including temporary and reversible measures, and

4. Prevention of adversary exploitation of other's space systems and services used for purposes hostile to U.S. national security.

Clearly, ASAT fits into this definition of space control through negation, as in the past, but its relative role in space control, and perhaps its importance, is diminished.

NEW RATIONALES

The arguments offered by ASAT proponents internally and externally to DOD during the Clinton Administration initially varied little from those of the past. That might be part of the reason they fell on deaf-ears, as they were heard as more of the same old thing offered by the usual suspects. Eventually, however, some new premises were offered, including the need to protect space-based "global utilities." The argument basically says that increased public reliance on private or publicly owned satellites, like the Global Positioning System (GPS) or telecommunication satellites, requires a similarly increased capability to protect them from interruption.[43] This argument has been critiqued as inappropriately drawing an analogy between the need to protect sea-lanes and the need to protect space-based global utilities because there is no similar force-on-force threat in space as there can be on the seas.[44] That position in and of itself, however, then raises the point that the threat need not be terrestrial based, as it could come from near-Earth-objects (NEO), such as meteors, negating the force-on-force requirement.

The NEO argument is refuted by critics, however, with the proposition that the military already has the responsibility for protecting its strategic assets and will do so according to the perceived risk. It was the Air Force, for example, that led observation efforts of the Leonid meteor showers in 1998 and 1999, due to concern over potential damage to space-based assets. If it is private assets that need protection though, private companies do not seem to be demanding such protection.

In the case of private companies driven by profit margins, increasing the cost of their hardware to protect against dangers that they have not so far

encountered simply is not in the business plan. If an incident were to occur, however, that could change. Until the incident with the Hughes Galaxy 4 satellite in 1998 that resulted in pagers all over the United States failing, commercial companies did not see redundancy as a necessity as they had never had such a failure before. Indeed, that all pager signals were run off the same Hughes satellite evidences the perhaps naïve confidence companies had in their ability to provide uninterrupted service. After the Galaxy 4 incident, the way companies did business, at least Hughes, changed. Redundancy and diversity were integrated into operational planning. If a commercial satellite had been damaged or destroyed during the Leonid showers though, leaving thousands or millions of people unable to use their ATM cards, for example, it is not unlikely that a loud cry for protection would have quickly followed.

Crisis-response is the typical public policy operation model in the United States. It is also effective. But in the meantime, for the national security community, there are other, equally compelling reasons to pursue space control at some agreed-upon-as-appropriate pace.

The simple, yet compelling argument for space control capabilities, including ASATs, is that capabilities-based planning, rather than threat-based planning, dictates development of space control, including ASAT, technologies. The May 1997 Quadrennial Defense Review (QDR) implied that it was desired capabilities that would drive the future forces, based on threat, risk, and opportunities assessments. Indeed that premise is suggested in the Secretary's message that set the parameters for the QDR.[45]

> We started with a fresh, unblinking look at the world both today and over the temporal horizon to identify the *threats, risks,* and *opportunities* for U.S. national security. In addition, we recognized that the world continues to change rapidly. We cannot expect to comprehend fully or predict the challenges that might emerge from the world beyond the time lines covered in normal defense planning and budgets. Our strategy accepts such uncertainties and will prepare our armed forces to deal with them.

> From that analysis of the global environment, we developed an overarching *defense strategy* to deal with the world today and tomorrow, identify required military capabilities, and define the programs and policies needed to support them.

The services have been only slowly integrating that approach into their doctrine though. Perhaps because of Army reliance on doctrine more than the other services,[46] one of the first places it has become obvious is in the Army's Opposing Forces Manuals.[47] Within the Air Force, the leap ought to be a rather natural one to make as, accordingly to many scholars, airplane acquisition has been done that way for years, with considerable success.[48] Space doctrine, however, has been and continues to be spartan at best. The argument in favor of capabilities based planning for space control is reflected and supported in the 1999 DOD Space Policy.

In July 1999, DOD released its first new Space Policy since 1987. It reiterates the mission areas of space support, force enhancement, space control, and force application, and the need for capabilities necessary to carry out such. Throughout the document capabilities-based preparation and readiness more-or-less as the threat warrants is stressed, rather than any implication of operational capabilities to be deployed immediately. Hence, again, there is no intent or desire to politically raise an operational ASAT issue.

Within the document, definitions are given that clarify a considerable amount of ambiguity that has clouded space doctrine discussions in the past.[49]

- E2.1.1 Force Application. Combat operations in, through, and from space to influence the course and outcome of conflict. The force application mission area includes: ballistic missile defense and force projection.
- E2.1.1. Force Enhancement. Combat support operations to improve the effectiveness of military forces as well as support other intelligence, civil, and commercial users. The force

enhancement mission area includes: intelligence, surveillance, and reconnaissance; tactical warning and attack assessment; command, control, and communications; position, velocity, time, and navigation; and environmental monitoring.

- E2.1.3. Space Control. Combat and combat support operations to ensure freedom of action in space for the United States and its allies and, when directed, deny an adversary freedom of action in space. The space control mission area includes: surveillance of space, protection of U.S. and friendly space systems; prevention of an adversary's ability to use space systems and services for purposes hostile to U.S. national security interests; negation of space systems and services used for purposes hostile to U.S. national security interests; and directly supporting battle management, command, control, communications and intelligence.

Information contained in the Space Control Technology Plan presented to Congress by the DOD outlines efforts underway and planned in support of space control.

- Regarding Surveillance, the diverse Space Surveillance Network (SSN) provides "space object cataloguing and identification, warning of attacks on satellites, timely notification to U.S. forces of satellite flyover, space treaty monitoring, and scientific and technical intelligence gathering. In addition, the SSN would provide targeting and damage assessment information to support space control operations. The SSN is comprised of the Navy Fence, phased array and mechanical radars, and optical sensors as well as the Space Control Center located in Cheyenne Mountain. The current SSN, however, is aging. Consequently, we are pursuing extensive research and development activities through a variety of Program Elements (PE) in the Departments of the Army, Navy and Air Force."
- Regarding protection, "DOD space systems are designed, developed and operated to assure the survivability and endurance of their space mission capabilities in peace, crisis, and through appropriate levels of conflict

commensurate with national security requirements. The survivability of DOD space systems is enhanced though such protection measures as ground station protection, satellite proliferation, hardening, communication crosslinks, encryption, communications security protection, and threat warning sensors." Many of these protections are designed against the variety of negation techniques that the U.S. also pursues.

- Regarding prevention, it is the newest aspect of space control, necessary and evident due to the proliferation of space systems, private and public. Political, legal, and technical measures are pursued as part of prevention. "Space prevention involves measures to preclude an enemy's use of data or services from U.S. and friendly space systems and services used for purposes hostile to U.S. national security interests. This includes encryption of satellite control and payload data to prevent unauthorized access. In addition, U.S. government monitors the licensing of commercial satellites. Licenses for private remote sensing space system operations, for example, include provisions for encryption devices to prevent unauthorized access as well as to limit data collection and/or distribution during periods when national security may be compromised."
- Regarding negation, "there are a range of potential negation options to deny an adversary use of space systems or services for purposes hostile to U.S. national security interests. These include: physical damage of ground segment; electronic jamming of data; temporary disruption of satellite functions; and physical destruction of the space segment. *The Department's philosophy is that physical destruction of satellites is not the preferred approach.* (emphasis added) It could undercut U.S. commercial interests that depend on global cooperation, such as frequency spectrum allocation, as well as potentially damage other U.S. systems from collateral damage and debris. Moreover, commercial space assets are increasingly being utilized for a wide range of defense

application. Terrestrial-oriented negation measures thus may be more consistent with long-term American interests. Nonetheless, we must retain the option for irreversible denial. Doctrinally, we have characterized these actions as deny, disrupt, degrade and destroy actions with the first two being temporary and reversible and the later two permanent."

This set of parameters clearly suggests that a full-spectrum of capabilities will be needed to achieve the desired objectives.

In order to support this full-spectrum effort, the U.S. Congress authorized and appropriated an additional $7.5 million in FY99 to pursue an enabling research and technology development. Further, in what is a noteworthy action as an indication of prioritization, DOD says it proposes to continue funding for the program in the FYDP. Allocations within the spending plan are: (1) surveillance - $0.5 million (2) protection - $1.5 million; (3) prevention - $0.8 million, and (4) negation - $4.7 million.[50]

The amount, while welcome, is not large compared to others in the FY99 research, development, technology and evaluation (RDT&E) programs within, for example, the Air Force.[51] Apparently, however, it is just about at the level most people within DOD feel is appropriate, considering the threat. Whether this also considers desired long-term capabilities is, however, less certain. Even more disconcerting is that many analysts and proponents question the survivability of the RDT&E money for space control, as the military utility will be questioned. Whether utility will be questioned based on threat, culture, or something else then becomes key. With funding for the F-22, once thought inviolable, being challenged, programs considered more esoteric, including ASATs broadly defined, will likely find it difficult to compete in the annual budgets and the FYDP without strong internal organization champions and support. Supporters of space control are appropriately concerned and anxious to build momentum behind their efforts. In Washington, inertia can be as important as substance.

Clearly, the situation is now one where the primary question concerning ASAT development is that of defining the appropriate pace. Along the spectrum of opinions there will continue to be a small contingent of pure "space sanctuarians" who will oppose any and all space control asset development. There will also be those who feel that the weaponization of space is inevitable. In the middle, however, are those who want to continue to develop capabilities at a level commensurate with need, considering budget. The issue for the future which will determine the appropriate pace for space control capabilities development appears to be whether those in the middle will base their need assessment on a realistic look at the future, or if they will be driven primarily by more parochial considerations.

CONCLUSIONS

The military is clearly in the lead in its thinking about satellite system vulnerabilities. Ironically, however, institutional priorities and a more nuanced political and technical environment than in the past seem to dictate that the conservative course of action traditionally pursued regarding ASATs, characterized by only occasional program R&D support, will continue. Now, though, conservatism is apparently the result of fiscal prioritization of programs within the military itself, rather than strategic political and legal debate.

ENDNOTES

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[3] Aaron Wildavsky, *The New Politics of the Budgetary Process* (New York: Harper-Collins, 1992).

[4] See: Marc J. Berkowitz, "Antisatellites and Strategic Stability," *Airpower Journal* (Winter 1989).

[5] Paul B. Stares, *The Militarization of Space, U.S. Policy 1945-84,* (Ithaca, NY: Cornell University Press, 1985), 112. Stares' book provides a comprehensive history of the different positions and input of the various presidential administrations to ASAT development. See also the Federation of American Scientists website for a short, alternative historic and program overview. www.fas.org

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[7] Roger Handberg and Joan Johnson-Freese, "The return of the American military to crewed spaceflight: hypersonic and other visions," *Space Policy* (November 1997): 295-304.

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[9] Stares, 179.

[10] See Andrei Gromyko, Foreign Minister of USSR Request for Inclusion of a Supplementary Item in the Agenda of the 38th Session: Conclusion of a Treaty on the Prohibition of the Use of Force in Outer Space and from Space Against Earth 1-2, U.S. Doc. A/38/194 (1983).

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[13] David A. Koplow, "Back to the Future and Up to the Sky: Legal Implications of 'Open Skies' Inspection for Arms Control," *79 Calif. L. Review 421*, citing Grossman, "Keep the Eyes in the Skies," *Christian Science Monitor,* June 30, 1989, at 19, col.1.

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[16] Bruce A. Hurwitz, *The Legality of Space Militarization* (North-Holland, 1986), 127.

[17] Hurwitz, 128.

[18] Hurwitz, 135.

[19] Pamela Meredith, "The Legality of A High-Technology Missile Defense System: The ABM and Outer Space Treaties," *The American Journal of International Law* (April 1984).

[20] Major John E. Parkerson, Jr., "International Legal Implications of the Strategic Defense Initiative." *116 Mil L. Rev. 67* (Spring 1987): 66-156.

[21] Parkerson 99, 100.

[22] Parkerson 101, See also fts. 192-197.

[23] *Washington Post,* October 9, 1985, A21.

[24] Parkerson, 102.

[25] *New York Times,* October 23, 1985, A22.

[26] Hurwitz, 165. It should also be noted that the Soviet Union was widely believed to have violated the Treaty by building a large ballistic missile radar station near the city of Krasnoyarsk in Siberia.

[27] Determination No. 19, *50 Fed. Reg. 34, 441* (1985)

[28] Richard Halloran, "Air Force Proposes Abandoning Anti-Satellite Weapon to Reduce Budget," *The New York Times,* 18 December 1987, A35.

[29] *Aviation Week & Space Technology,* 19 July 1993.

[30] Department of Defense, Space Control Technology Plan, Report to Congress provided in response to the FY1999 National Defense Authorization Act Conference Report.

[31] Steve Weber, "ASAT Proponents Fail to Reverse White House Policy," *Space News,* 19-25 September 1994, 7.

[32] Pat Cooper, "U.S. Political Battles Threaten Antisatellite Project," *Space News,* 17-24 June 1996, 6. The *Washington Post* reported in January 1985 that the Army was progressing rapidly with the ground-based leg of SDI, and that parts of the system could be deployable prior to 1990. Named Army projects centered on rocket-launched sensing devices, the airborne optical system, a mobile radar system, and new interceptor missiles with non-nuclear kill mechanism. January 30, 1985, A1.

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[34] Jonathan Wright, "Connected: U.S. military moves closer to star wars," *The Daily Telegraph,* London, 21 May 1998, 4.

[35] For an update on the KE-ASAT saga, see: *Defense Daily,* "Kinetic Energy Anti-Satellite System Hangs in the Balance", June 29, 1999, 1.

[36] "Space on a Shoestring," *Discover,* June 1995, 60. Clementine 1 won the 1995 "*Discover*" Aviation and Aerospace award.

[37] James Adams, "Pentagon in missile plan to save world," *The Times,* London, March 24, 1996, 1.

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[41] "Searching for Policy Coherence: The DoD Space Architect as an Experiment," with Roger Handberg, *Joint Forces Quarterly,* Summer 1997.

[42] See "NASP as an American Orphan: Bureaucratic Politics and the Development of Hypersonic Flight," with Roger Handberg, *Spaceflight,* March 1991, for another example of a cancelled aerospace program which was a bureaucratic orphan.

[43] See: John Shaw and Simon P. Worden, "Space, Power, and Strategy II," University of Hull, U.K. 1999.

[44] This argument draws on the same logic that is sometimes heard in conjunction with why there should be no separate space force: because if there would be, then the weaponization of space follows as an inherent consequence, in support of the as yet undefined but apparently force-on-force-required related mission. That proposition, however, begs the question of whether that assumed weaponization is not or will not intrinsically occur without the existence of a space force. See, for example, the programs such as spaceplanes discussed in: Bill Sweet, "Securing Space for the Military," *Jane's International Defense Review,* March 1, 1999, 1; Riley D. Mison, John A. Corder, "Battle Space Control—something is missing," Naval Institute *Proceedings,* January 1998, 84-85.

[45] Report of the Quadrennial Defense Review, "The Secretary's message," Secretary of Defense William S. Cohen, May 1997.

[46] The Army was looking at doctrinal changes, including capabilities-based planning, even before the QDR. See: David Jablonsky, "U.S. Military Doctrine and the Revolution in Military Affairs," *Parameters,* Autumn 1994, 18-36.

[47] See: U.S. Army, TRADOC Pamphlet 350 series, or Opfor Battle Book at http://www-cgsc.army.mil/ctac/refpubs/st100-3/index.htm

[48] See: Michael Brown, *Flying Blind* (Cornell University Press, 1995); James Lebovic, *Foregone Conclusions,* (Westview, 1996); David S. Sorenson, *The Politics of Strategic Aircraft Modernization,* (Greenwood Publishing, 1995).

[49] DODD 3100.10, July 9, 1999.

[50] Department of Defense, Space Control Technology Plan, Report to Congress provided in response to the FY1999 National Defense Authorization Act Conference Report.

[51] See: www.dtic.mil/comptroller/99budget/r1unclas.pdf for a complete listing.