RECOMMENDED CHANGES IN U.S. MILITARY SPACE POLICIES AND PROGRAMS

A Paper by the Working Group on Technology, submitted to the Commission on Integrated Long-Term Strategy

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The Report of the Commission on Integrated Long-Term Strategy, Discriminate Deterrence, was published in January 1988 and is available for sale by the Superintendent of Documents, US Government Printing Office, Washington, DC 20402 for $6.50.

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COMMISSION ON INTEGRATED LONG-TERM STRATEGY

MEMORANDUM FOR THE COMMISSION ON INTEGRATED LONG-TERM STRATEGY

The Working Group on Technology is pleased to present to the Commission on Integrated Long-Term Strategy a paper, "Recommended Changes in U.S. Military Space Policies and Programs."

This paper is consonant with the Commission's report, Discriminate Deterrence, which made substantial use of the paper's findings and conclusions. The paper provides more comprehensive and detailed information underlying the Commission's report. However, this paper is the responsibility of its authors, and the Commission does not necessarily subscribe to all its details.

The authors of this paper are Albert Wohlstetter and Brian Chow. An earlier draft was the subject of a two-day symposium of selected Working Group members and other experts in the design, manufacture and operation of space systems, and in space policies and programs. The present version was written in October of last year and is published without changes. Subsequent study has only confirmed the analysis and the continuing relevance of the recommendations.

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Working Group Chairman

The Pentagon Washington, D.C. 20301-2000

Policies

I. Strategy and the policy objectives of U.S. military space programs.

The U.S. needs military satellite systems that will continue to function or be replaced with appropriate timing not only during peace but to support military operations throughout plausible important wartime contingencies. The U.S. also needs ways of degrading satellites used to support attacks on our allies or ourselves. In a war with the Soviet Union, space will be no sanctuary but will be an important determinant of the outcome of the war.

Space systems can acquire and distribute information critical for the West in defeating a Soviet invasion -- about the gathering and onset of attacks, about the location, status and movements of our own and allied forces and of adversary forces and civil society, and about the weather affecting military operations, and much else. In principle, surveillance satellites can provide information about the location and movement of enemy forces over-the-horizon and at great distances, information useful for battle management or to target specific forces as well as for warning about preparations for war. Communications satellites can distribute information over oceans and large land masses that would be essential for keeping our offense and defense forces effectively directed at achieving essential political military goals.

A Soviet invasion can benefit by analogous information. And the Soviets, much more than the U.S., have plainly designed their space systems to function in wartime. Soviet satellite systems generally are more proliferated. Their communications satellites, for example, are large in number and are placed in several different and widely separated orbits. (Practically all of our communications satellites are at geo-synchronous altitude.) Some Soviet communications satellites are small, cheap and easy to replace. The Soviets have large numbers and many types of space launch vehicles. They also have many types of ICBMs, some mobile as well as fixed. And in the past they have converted ICBMs for use in launching satellites and anti-satellites. They have demonstrated their ability to launch many satellites quickly.

How effectively each side is able to use its space systems in broad management of large battles as well as in acquiring specific targets for offense and defense systems can be a key element in deciding the outcome of conflicts between them. Each side will have strong reasons, therefore, both to degrade the other side's use of space and to protect its own. In fact, degrading the space or ground segments of an adversary's satellite and anti-satellite systems used to locate and attack elements of our own satellite systems would be one important way to protect our satellite systems themselves as well as our other military forces.

Do we have to choose between using satellites and having the capability to degrade an adversary's space systems? This is sometimes presented as if it were "a fundamental dilemma" for U.S. policy makers, requiring us to avoid either the use of satellites or any capability to degrade the functioning of another side's satellites if we are to avoid a "spiraling arms race in space". However,

(1) It presents no more a dilemma for us than does, say, our use of both tanks and anti-tank weapons; or for the Soviets in their use of both. It is in fact the normal situation of potential antagonists.

(2) There is no absolute way of separating "offense" from "defense" in space any more than on the surface of the earth or in the oceans or in the atmosphere. Whether a system is offensive or defensive depends on the context and the purpose of its user. A variety of systems used for other purposes can also be used to attack satellites. In fact satellites themselves can be so used, as the Soviets have themselves remarked; and there is no genuine way of eliminating "anti-satellites" without eliminating satellites themselves, not to mention many other systems such as ICBMs which could be used against satellites as well as for other purposes.

(3) The Soviets can attack not only our satellites at low earth orbit with their co-orbital interceptor (which we tend to focus on too exclusively), but, if they use satellites as "space mines", they can also attack our satellites at geosynchronous and other altitudes.

(4) No enforceable ban can prevent the Soviets from developing and deploying in time of peace any of several non-nuclear as well as nuclear means of degrading or destroying key space and ground elements of our satellite systems. And if we do not, in time of peace, prepare either an active or passive defense, or a means of degrading Soviet satellite systems, we cannot, in time of non-nuclear or nuclear war, deter or respond effectively to a confined attack on our satellites with a similar attack on their space systems.

(5) The idea, sometimes suggested, that if the Soviets were to attack elements of our satellite systems we should launch our ICBM force at Soviet cities -- and so to invite the total destruction of our own cities -- is hardly appropriate. Even if there were some extreme circumstance in which that were not irrational, it would be plainly reckless in response to selective Soviet actions degrading our space systems in the course, say, of a non-nuclear war.

(6) Several potential antagonists (and not only the Soviets) can attack vulnerable nodes in the ground segments of our satellite systems.

(7) In fact, there has not been nor is there likely to be, in space any more than on earth, a "spiraling exponential arms race" with each side over-reacting to moves by the other side. Quite the contrary, the United States under-reacted to the growth of the Soviet ability to attack our satellites. It has not used passive or active means to develop robust systems of satellites that could survive such attacks; nor deployed an anti-satellite capability of its own, even though, in space as on earth, there is no basis for the claim that this would lead to an exponential race.

II. Our military satellites have been designed <u>primarily</u> to perform exacting tasks in support of operations in a friendly environment in time of peace and in the transition to an unrestrained massive nuclear conflict. As a result, both the space and ground segments of many of our satellite systems, including the launch and ground control elements, have only a few very expensive critical nodes.

In peacetime, satellites can perform the important functions of monitoring arms agreements, collecting data on military capabilities and providing warning. Our peacetime systems enable a large volume of high data rate communications worldwide for our diplomatic corps and our military forces; provide continuous three-dimensional positioning for navigation worldwide; and serve other useful ends in the peacetime management of our military force.

The use of satellites to support peacetime uses of military forces is important only if it is credible that we could responsibly use our military forces in response to attack and so deter or defeat such attacks. Satellite systems can perform critical functions in such wartime uses of our military force -- provided they can survive.

III. The requirements to support military operations throughout plausible non-nuclear and selective nuclear conflicts are very different from peacetime requirements.

A theater commander in a conventional war, for example, could benefit from a robust source of information that would tell him about the movements of heavy tank divisions or whether an airbase has or does not have aircraft on it. This might be accomplished by satellite systems which trade some peacetime performance for the ability to survive or be restored under plausible repeated attacks.

A concept of operating satellite systems focused on peacetime quite naturally emphasizes increasing the mean time between random failures of our satellites to reduce the cost of replacing them. Our satellites have been so designed and many have been so placed in orbits as to last seven years or more. Our satellites are expensive, but they do not have to be replaced frequently in time of peace.

However, a concept for operating in a war with the Soviet Union would note that such a war is unlikely to last seven years and that it would be the Soviets, not random acts of nature, who would interrupt the functioning of our satellites, and call for us to replace them in a much more compressed time scale than in peacetime. Spare satellites, stored on the ground to replace those disabled, need not have all the power and other components required to function for many years, and may also be placed in much lower orbits, where they would not last as long but which in some cases would improve their performance while they lasted -- more frequent revisit times, less powerful launch vehicles needed, etc. Similarly, the criterion for designing the ground elements of the system and their contribution to total systems cost, recurring and non-recurring, will differ greatly for systems that have to survive for weeks in a very hostile environment than for systems that are designed to function for many years in a benign peacetime environment.

The marginal systems cost to protect or restore the functioning of a satellite system in a given wartime contingency needs to be compared with the marginal systems cost to disrupt or destroy it under the constraints appropriate to that contingency. One or a few satellites costing between a quarter of a billion and a billion dollars each and perhaps weighing as much as 25,000 pounds are hard to protect against, say, non-nuclear space mines weighing a thousand pounds, carrying short-range attack missiles for kinetic kill, and costing only millions or tens of millions of dollars. It is, for example, much cheaper to add maneuvers to the one-thousand-pound space mine than to a satellite an order of magnitude or more heavier; and if so lucrative and scarce a target were protected by a short-range active defense, it is worth it to the attacker to multiply attack missiles to get at least one to leak through. Distributed, less expensive satellites are easier to protect by passive or active measures. The relevant considerations of marginal systems cost for performance in wartime contingencies point toward satellite systems with lighter, cheaper, more easily multiplied, protected and replaceable space elements, and to analogous ground elements.

The origins of our military space program make it easy to understand why we have paid primary attention to peacetime rather than wartime performance of our satellites and help explain some of the mistaken opposition to rethinking our strategy in space now. Just as the laws of the sea had to be created by practice, so limits to the vertical extension of sovereignty above the atmosphere were quite uncertain until the 1960s. When the Soviets orbited satellites over the United States and were preparing to orbit more, there were apparently some who proposed shooting them down. This was clearly a bad idea since we would have lost even more than the Soviets by it. Theirs was a closed society on which we lacked some of the most elementary information about the location, size and technical characteristics of their military forces. They could likely derive such information about us from public sources. The first opposition to our own anti-satellite activity occurred in the context of the peacetime operation of satellites when mutual forbearance was a reasonable prospect. The presumption of a benign environment influenced the design of our satellites themselves and not merely our eschewal of capabilities to degrade Soviet satellite systems.

While this evolution of our space systems is understandable, it is quite mistaken to suppose that we should continue to deploy satellite systems on the assumption that we and the Soviets would continue such mutual forbearance if we were at war.

Programs

I. Monitoring for Warning of Attack on Our Satellites. A prerequisite for effective defense of satellite systems is a timely recognition of attacks on our satellites. This requires a surveillance and tracking system that itself survives and can detect, identify and track threatening space objects in real or near-real time. Currently, we lack such a capability. Moreover, while this sort of system is also very useful for strategic defense, the initial deployment for satellite defense should not be delayed by the added performance requirements and costs of strategic defense. Nor should the system's wartime robustness be significantly sacrificed by a compromised selection of constellation altitudes in order to serve both satellite and strategic defense missions.

II. Lower-Cost, Smaller Satellites for More Distributed and Restorable Systems. Some important wartime missions such as certain essential communications might be performed by satellites that cost so little that they can be replaced more cheaply than the Soviet cost of attack. The goal of DARPA's Advanced Satellite Technology Program (ASTP), or LIGHTSAT, is to support technology development to allow the Department of Defense, in the early 1990s, to field such light and low-cost satellite systems which "will provide support to operational military commanders for force planning and force execution."* The U.S. should support efforts to develop low-cost satellites and mobile launchers. It should be emphasized that these low-cost satellite systems must serve useful wartime missions. For example, we would not be greatly interested in a low-cost system for communications in the post-nuclear attack period if a small number of nuclear detonations could directly destroy most of the satellites in the system or so disturb the environment that the system could not communicate for very long periods of time.

III. Satellite System Designs for Wartime Robustness. For those wartime satellite systems which cannot be made so cheaply, it is particularly important to study many of the system aspects coherently in order to achieve a robust wartime capability. This requires a simultaneous examination of contingencies, satellite wartime as well as peacetime missions, satellite designs, satellite manufacture, satellite launch methods and other ground elements of space systems, satellite defenses, and incentives and means for ASAT attacks of both sides. Most important, we should emphasize, in applying innovations and technological advances, improved wartime performance rather than only or mainly improved performance for peacetime functions.

IV. Active Defense of Satellites. Active defense of satellites has not received enough attention as a complement to passive defenses (e.g., hardening, maneuvering and decoys). Both active and passive defenses are likely to be necessary and will enhance each other synergistically. (Acquiring an active defense of satellites is compatible with and can help in the deployment of a satellite-based ballistic missile defense of the United States or Western Europe but does not entail such a

*Proceedings of the AIAA/DARPA Meeting on Lightweight Satellite Systems held at the Naval Postgraduate School, Monterey, California on August 4-6, 1987, published by the American Institute of Aeronautics and Astronautics. Page ix.

defense.) Passive defenses alone would be inadequate. For example, the lack of active defenses would permit ASAT terminal sensors to discriminate decoys at close range and great leisure. It would be very hard to design inexpensive and credible decoys to fool ASAT sensors with such discrimination.

We should not avoid deploying such an anti-ASAT capability on the ground that it might induce the Soviets to do likewise. The Soviets will deploy such space-based ASATs or anti-ASATs if and when they think them advantageous; just as they have not given up ground-based ASATs because we did. Finally, our anti-ASAT developments should include the consideration of non-physical means of rendering ASAT systems inoperable, such as obstructing the ASAT sensors.

V. Planning Actions for Unilateral Defense. Satellites in some space systems will continue to be so expensive and critically few as to encourage attack unless they are defended. Such systems cannot survive an attack by space mines or other space-based ASAT weapons unless we enforce a self-defense zone around them -- unilaterally, bilaterally or multilaterally -- on the same grounds we use in justifying the self-defense of ships at sea against intrusions that can have no other purpose than a hostile one. We need to make clear that we would take action against a configuration of incursions that can serve no relevant purpose other than to threaten the function of our key satellites. But we also need to design our key satellite systems with enough redundancy and to deploy them in such orbits that the configurations of close-encounters caused by normal satellite operations would not be threatening to our space systems and would be clearly distinguishable from those configurations of close-encounters that are threatening.

VI. Reconstitution Capability and Mobile Launchers. We should expect not only space assets to be attacked but some losses to be inevitable even in conventional or selective nuclear, regional conflicts. It is not a viable strategy to try to protect space assets so well as to avoid losses completely. The U.S. needs a launch capability to replace attrited, as well as spent, satellites. For wartime use, we need ground mobile or submarine launch vehicles or other methods of creating uncertainty enough to survive direct attack.

At least two distinct classes of launch vehicles are likely to evolve. Heavy-lift vehicles designed to launch satellites in peacetime will generally be less expensive on the basis of cost per pound of payload. They will be appropriate not only during peacetime but during some confined conflicts in which launch vehicles do not come under serious attack or remain operable. The second class consists of light-lift vehicles which can be made mobile or movable in submarines or on land. They can be relied upon if heavy-lift vehicles are destroyed. They can also be used during peacetime military exercises, to fill gaps or for surge operations in crises. The R&D community will also find light-lift vehicles useful for launching small scientific and testing payloads.

VII. <u>Satellite Control Systems</u>. In addition to control facilities dedicated to support some individual satellite systems, we rely very heavily on the Consolidated Space Test Center at Sunnyvale, California, and Remote Tracking Stations scattered worldwide. The soon-to-be fully operating Consolidated Space Operation Center in Colorado will be the primary military satellite control facility. However, these facilities and many of the dedicated control facilities are fixed and highly vulnerable to a wide variety of threats including sabotage and missile attacks. These elements, designed essentially for use in peacetime, need to be supplemented by a satellite control system which can operate effectively in a jamming and nuclear environment and under repeated physical attacks. A CONUS-based, mobile, proliferated system is one possibility that deserves serious evaluation.

VIII. <u>A U.S. Capability to Degrade Hostile Satellites at All-Altitudes in Wartime and to Attack Ground Segments of Enemy Space Systems</u>. The U.S. should develop an all-altitude ASAT operational capability. It should have the flexibility to degrade or to deny an adversary's satellite missions temporarily or permanently. Our pursuit of ASAT should not be viewed as a direct response to the Soviet low-altitude, co-orbital ASAT program.

Rather, it is a response to much broader Soviet space activities and capabilities. These inevitably will provide the Soviets with a capability to attack our satellites. What is more, Soviet satellites will contribute greatly to Soviet military operations, including direct attack on our ground, air and naval forces in the course of a war it may wage against the Western Alliance. The U.S. needs the ability to disrupt or destroy the space or ground elements of Soviet satellite systems because they are "force multipliers." We have to be able to defend our satellite systems and to degrade enemy satellite systems for the same reasons that the United States in general needs both a defensive capability and an offensive capability on land, at sea and in the air.

IX. Military Use of Civilian Satellite Systems.

The U.S. should continue to identify and implement cost-effective measures and enhancements to civilian satellite systems, both the space and ground segments, so that they can supplement the military systems during crises and wars. Commercial communications satellites, Landsat, GOES (Geostationary Operational Environmental Satellite) and NOAA (National Oceanographic and Atmospheric Administration) satellites, and their ground nets and elements, would have military uses in communications, remote sensing, and meteorology in certain contingencies.

X. Education and Training in Space System Operations.

In order to utilize space fully for national security, we need not only the physical systems that are tailored to users' needs, but also people in all the military services to be knowledgeable enough to take advantages of these systems and to operate them. More educational and career opportunities should be provided to meet the rapidly expanding utilization of space. Equally important, future space systems should be designed for simplified operations. They should not require highly-skilled and trained personnel to monitor many of the routine activities. Finally, we need to arrive at a balance between the protection of capabilities and sources through compartmentation and the wide tactical dissemination of products in the area of operations.