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Presently between them the United States and the Soviet Union have about 150 active satellites in orbit. In another three or four years there will be about 200. But the United States is in danger of being at the mercy of the Soviet Union in space because we are almost totally incapable of prorecting our satellites from being damaged or destroyed by Soviet space weapons.

If we are to believe a report in *Aviation Week & Space Technology*, the Soviet Union is already operating an antisatellite battle station. Supposedly armed with clusters of infrared homing guided interceptors, this station could destroy many US spacecraft. It is said to be in low orbit around the earth.[1] Another source tells us that since October 1968 the Soviers have tested 19 killer satellites, of which 12 have been recognized by American experts as fully or partially successful.[2]

In contrasr, until 1975, the United States devored very lirtle research and development to antisatellite (ASAT) weapons. The first and only such weapon system, emplaced on Kwajelein Atoll and Johnston Island in the Pacific, was abandoned early in the seventies and by 1975 had been completely dismantled. The reason for dismantling that system, says a *Business Week* report, centered on the fact that the system was armed with nuclear warheads, and rhe United States believed that a nuclear explosion in space would release so much radiation that US satellites might also be damaged.[3]

As both superpowers rely increasingly on satellite systems, so does the likelihood of space warfare increase. Already both powers depend upon complex space systems for civilian and military communications, for navigation, photographic and electronic intelligence garhering, for early warning of attacks by ICBMs, for arms control treaties' verification, and for meteorological data collecrion. According to *Business Week*, over 70 percent of US overseas military communications are routed via space relays. The magazine quotes a defense planner as saying that "The more you rely on space as a force multiplier, the more probability of action there is against space vehicles." When it comes to ASAT weapons, the report says that thus far the Soviets clearly have been playing cat to the US mouse.[4]

The authors of a national intelligence estimate, *Aviation Week* tells us, believe the Soviet Union has a ground-based high-energy laser (HEL) weapon that could damage or destroy any US spacecraft in orbit within 1,000 nmi. of the earth. The magazine reports further that US analysts believe the Soviets are close to perfecting a multishot laser capable of destroying spacecraft at altitudes up to 3,105 nmi. and that other Sovier development programs are aimed at developing laser weapons with ranges of 24,840 nmi.[5] The fruition of such weapons would make many medium

altitude US satellites and early warning satellites in geostationary or geosynchronous orbits vulnerable to destruction.

It seems obvious that to be able to protect US satellites and to be able to destroy any foe's, the United States must accelerate the development of an ASAT weapon. The Navy in particular must be in a position to protect itself from Soviet space systems. As we shall see, this can be accomplished by combining the F-14 fighter with the product of an Air Force program.

Space Arms Treaties and Agreements. For nearly two decades, the superpowers have written treaties and agreements in an effort to control the placement and use of weapons in space. However, ASAT weapons seem either to have been excluded from or neglected in all these.

Then, in June 1978, the United States and the Soviet Union agreed to negotiate an arms control agreement on ASAT weapons. But on 24 December 1979, while preparations were underway for the fourth round of these talks, the Soviets invaded Afghanistan, the United States discontinued the talks immediately, and they have not since been resumed. While the talks were underway the Soviets voluntarily suspended their ASAT testing program. Unfortunately, once they were discontinued, the Soviets resumed testing with the launch of Cosmos 1174 on 18 April 1980. Additionally, a US intelligence report in May 1981 asserted that there was evidence ". . . of a Soviet project to develop a space-based laser weapon that we believe may have an ASAT application."[6] While the Soviets are developing an ASAT capability in both near and far-term weapons systems, the United States has neither reopened the ASAT arms control talks nor, until recently pursued an ASAT weapon system actively. It is time for us to do something; and particular emphasis must be placed on a system for at-sea use.

Launching from Tyuratam in Central Asia, the Soviets have tested or employed four methods of intercepting satellites since 1968: perigee matching, apogee matching, co-orbital, and non-co-orbital. The perigee matching method attacks its target at its point of minimum height from the earth; the apogee matching method attacks its targets at its maximum height in an elliptical orbit; the co-orbital type of attack intercepts the target in a circular orbit and draws near its target in a close orbit; and the non-co-orbital type intercept places the ASAT into a smaller orbit than that of its target and then maneuvers upwards towards it. Additionally, the Soviet Soyuz program features an orbiting space station complex which could act as a platform for missiles and military missions performed by robot hunter-killer satellites.[7]

If an ASAT passes within one kilometer of a target, it is considered to have accomplished a "kill," for at that distance it can explode itself and fragments or pellets will destroy the target. Unclassified sources state that all 12 successful or partly successful tests flown since 1968 met the "kill" criterion.[8] Since 1976, five single-orbit attacks (intercept method unstated) have been conducted, with two being classified possible successes using the one kilometer criterion. Five other tests since 1976 involved two orbits of the interceptor (intercept method unstated) to make an attack, and three of those were considered partial successes. Available unclassified sources lead one to believe that most of the aforementioned tests were completed within 24 hours of the interceptors being launched against a target

satellite. Clearly, then, an imminent danger exists, for a Soviet ASAT attack conducted in a single earth orbit would allow the United States little time in which to recognize that one of its spacecraft was in danger. The Soviets' unequivocal advantage seems even larger when one considers that within the past five years, Soviet boosters have placed 39 cosmonauts into earth orbit, and more than 30 Soyuz spacecraft have been flown, accumulating about double the manhours in space the United States has.[9] Though the US space shuttle program is cutting into that advantage, the Soviets remain ahead in manned space time.

Speculation on the Soviet ASAT weapons reveals a belief that they use an adaptation of the SS-9 ICBM. The highest altitude listed for this interceptor is about 1,250 nmi. At this altitude, the Soviet ASATs are considered to be effective against many US photo-reconnaissance, electronic intelligence, and meteorological satellites, as well as some communications and navigation satellite networks. The Space Shuttle is also vulnerable to attack by these weapons.[10] The *Business Week* reporters suggest that the Soviet ASAT system would be capable of "putting our eyes out" by eliminating US spy satellites and disrupting communications in case of a breakout of nonnuclear hostilities between Nato and the Warsaw Pact.

The now retired General Daniel O. Graham an ex-Army intelligence officer, believes that in the last two decades of the 20th century an increasingly critical segment of civil and military activity has moved into space. Clearly, either the Soviet Union or the United States will eventually establish a strategic superiority in space. Soviet activities, he concluded, especially in the development of killer satellites, indicate a determination to win that race for military dominion.[11]

"Whoever gains control of space and the 'high ground' of future wars could shift the balance of power so decisively as to equate with world domination; and so far the United States trails the Soviet Union," say the authors of the *Business Week* report, who add that the US space effort would represent a "technological Pearl Harbor" if its effort does not get a steady infusion of additional funds.

More than four years ago *Aviation Week* reported that the United States had three ASAT systems under development or evaluation: a Vought Corporation kamikaze-type homing interceptor warhead, a satellite system having either high energy laser or particle beam weapon (PBW) capabilities, and a conventional spacecraft with an unspecified weapon system utilizing the Air Force Space Shuttle for delivering that spacecraft into orbit.[12] Of the three development programs, the Vought kamikaze system appears to be the only one from which we can soon hope for results. Operational HELs and PBWs are still far in the future, and because the Space Shuttle is not a quick reaction vehicle, it is not a competitor for the job.

Gerald Ford was the first president in many years to decide to pursue an ASAT program actively. Two days before leaving office, he ordered the rapid deployment of a new ASAT weapon that would be more sophisticated than the current Soviet weapon. His decision resulted from a study indicating that the Soviets had begun testing a nonnuclear ASAT. However, soon after President Carter assumed office, he capped ASAT spending because he was dedicated to smaller defense budgets and was idealistically committed to the "maximum pacification of space." The practical effect of this was that there was almost no United States ASAT research and development. In June 1978, just before the United States and the Soviet Union began to talk about ASAT weapons, Carter said, "The United States will pursue activities

in space in support of its right of self defense and thereby strengthen national security, the deterrence of attack, and arms control agreements."[13] (It was shortly after that that the *Aviation Week* article on the three ASAT systems was published.) Still, he failed to lift the ASAT spending cap. But a year later in a Presidential Directive, he said that "While the United States seeks verifiable, comprehensive limits on ASAT capabilities and use, in the absence of such agreements, the United States will vigorously pursue the development of its own capabilities."[14] At the same time, he conditionally lifted the spending ban. This turnabout was brought about as the result of a recently completed NSC study which compared US and Soviet ASAT capabilities. The President might also have come to believe that it would be ludicrous to ask the Soviets to abandon their ASAT weapons in return for nothing more than a promise on our part not to test such weapons. In any event, six months later the talks ended abruptly because of the Soviet invasion of Afghanistan. The Reagan policy has accelerated the development of ASATs, and in particular HELs and PBWs, reportedly for two reasons: (1) the continued series of tests by the Soviets of their ASAT system, and (2) a renewed interest in a ballistic missile defense system.[15]

The current US ASAT program falls under the space defense program, of which the Air Force's Space Division is the centralized authority. The objectives of the program are to improve the survivability of US satellites and spacecraft, to improve US surveillance capabilities from space, to improve command and control of US space vehicles, and to develop ASAT weapons.

The major near-term US ASAT weapon, that being developed by Vought, centers on a missile launched from an F-15 fighter. The missile weighs 2,600 pounds, is 20 inches wide, and nearly 18 feet long. First-stage power following launch is provided by the booster of a short-range attack missile, and a small Altair 3 solid rocket motor provides second-stage power. The rocket motor contains small hydrazine thrusters for three-axis control.[16] This system is credited as being effective against targets less than 1,000 nmi. from earth. For targeting satellites in geosynchronous orbits at higher altitudes, the system's miniature homing vehicle (MHV) can be fitted to a larger, ground-based booster. The system is relatively small and compact, offers extensive flexibility through use of the F-15s as launching vehicles, and can be flown from a wide variety of launch points for proper timing to execute a kill. This system could be employed against either an enemy's satellites or his ASAT weapons. The Soviet ASAT system has operated within range of the Vought system, and it has shown limited orbital inclinations. This indicates that it has a quite regular flight path which should ease the task of a US ASAT weapon attempting an interception.

Though the ASAT is launched from the F-15, it is commanded from the Aerospace Defense Command's Space Defense Operations Center, located in Cheyenne Mountain, Colorado Springs, Colorado. The commands are given by voice rather than by data link, and are required in order to tell the flight crew the proper course, altitude, and airspeed at which to fly the intercept during the upward zoom that will be part of the ASAT launch. They are also needed to tell the flight crew when to launch the weapon.

Upon launch, the weapon, guided by an inertial system, a long wave-length infrared homing system, and an optical sensor, will rocket upward, shedding weight as it goes, to ram the target. By the time it reaches the target it will weigh about 34

pounds. Even though it will not explode, that will be sufficient, for when the weapon traveling at hundreds of miles per hour strikes the satellite, which is moving at 17,500 miles per hour, there will be nothing but fragments.[17]

Launching the ASAT from the F-15 is expected to present no aircraft configuration problems. There will be no target acquisition displays placed in the aircraft specifically for ASAT missions. The F-15 will take off without any guidance to the MHV other than those received from the ground. Although primary control of an ASAT mission is envisioned to be from Colorado Springs, it is possible that direct communications with the intercept aircraft could be from a command site nearer the F-15's launch position, using a prototype mission operations center which the Air Force Space Division is developing. This is a small console set with a dedicated computer that will be tied into the North American Air Defense space tracking capabilities.[18]

The tentative cost of each missile and booster is approximately $1 million.

While it may be comforting to know that research and development in HELs and PBWs continues, the Navy cannot wait until such exotic weapons become a reality, for they are perhaps decades away from being operationally feasible. It is evident that a battle group needs some means to combat both active (ASAT) and passive (photo/electronic reconnaissance, et al.) Soviet satellites. The Navy has its own interests in the use of space; i.e., the need for all-weather navigation satellites, the precision-aiming of SLBMs, and the surveillance of sea activities. The Navy must ensure that US satellites transmit in usable form necessary data directly to the fleets and should war come, that Soviet satellites do not. But it is obvious that the Navy cannot ensure these things.

A prime target for a US naval ASAT system would be the ocean surveillance satellites that assist the Soviets in targeting our ships. In 1979, Seymour L. Zieberg, deputy undersecretary of defense for research and engineering (strategic and space systems) told Congress: "The principal motivation of our ASAT program is to put us in a position to negate Soviet satellites that control Soviet weapons systems that could attack our fleet. Our ASAT should be principally motivated by the fact that the Soviets have satellites in their force that can track, locate, and assist in targeting the elements of our military forces."[19]

The Air Force development of the F-15 as an ASAT launch platform has progressed to the point that incorporation of the concept for a battle group ASAT weapon should be easy. It might be possible to incorporate in the battle group an Air Force crew with an F-15 modified for carrier operations. But, because Navy flight crews are already trained in carrier operations, and little difficulty is anticipated in modifying the F-14 to carry the weapon, it would probably be better to do the natural thing and use the Navy F-14 team. With the addition of the F-14-launched ASAT weapon, current technology should enable the battle group commander to destroy Soviet satellite systems orbiting at altitudes of up to 1,000 nmi. Targets that would be in range of this ASAT system would include many photo-reconnaissance satellites, electronic intelligence (Elint) and electronic intelligence ocean reconnaissance (Eorsat) satellites, radar ocean surveillance (Rorsat) satellites, as well as meteorological navigation, and some communications satellites.

Problem Areas. Assuming the modification of the F-14 to carry the weapon is practical and that procedures are set up for loading, launching, and flying such missions, the

Navy will have to decide whether this is the best use of a scarce front line fighter. Because the Air Force Space Defense Operations Center is the centralized management and operations center with functional responsibilities that interface with all space activities, close coordination would be required between Navy and Air Force program managers.

Assuming that the Navy pursues the F-14 as an ASAT weapon launch platform, the most significant problem may very well be the communications interface between the Navy and the various Air Force agencies in the execution of such a mission. Another significant problem could arise should the communications link be by satellite and the Soviets mount a preemptive strike against US communications satellites. However, it appears that the Soviets presently possess the capability to strike only the low-level US communications satellites. Still, it is apparent that the entire communications question will require detailed examination.

Because the intelligence community can predict accurately the overhead times and locations of the passive Soviet satellite network, the battle group commander would have the timely and accurate data required to plan an antisatellite strike. This, when used by the F-14 and the ASAT system, would give the commander powers he now lacks to protect his command.

How then should the battle group commander use this new weapon? Its tactical employment will require answering many questions. What rules of engagement will permit the use of the weapon? Would its use be construed as a hostile act? Would a hot or cold war environment dictate the use or nonuse of the weapon? Would the battle group commander be forced to dedicate two or even more F-14s for an ASAT mission, or could the aircraft still perform its primary mission as a fighter? Could the F-14 carry more than one ASAT weapon? These and other questions would require extensive investigation before any true tactics could be developed.

Although the United States has made some spectacular ventures into space, we still lag behind the Soviet Union in the area of space weapons. The mere introduction of ASAT weapons should lead one to recognize the importance of space systems.

The United States should continue to seek arms control agreements for ASAT weapons in spite of the failure of the 1978-1979 talks in Helsinki. But the United States cannot expect to negotiate an agreement if we have nothing with which to negotiate. Unless the United States continues actively the research, development, and eventual deployment of a capable ASAT weapon, then the Soviets will not only have no reason to negotiate, but will also continue to possess a dangerous advantage over the United States.

NOTES

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