The Soviet Space Threat

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EXECUTIVE SUMMARY

The Soviet Union is trying to achieve total military domination of space and is succeeding in the pursuit of this objective. Recently declassified reports reveal that:

- In the last four years, the Soviet Union has doubled its annual expenditures on space.

- If the present trend continues, ten years from now the Soviets will be spending about as much on space as they now spend on their army or their navy.

In contrast to U.S. space activities, almost all of the Soviet space effort has a military objective.

- The Soviet Union and the U.S. have the same number of satellites in orbit--about 120. However, 90 percent of Soviet satellites have military missions.

- By contrast, only about one third of all U.S. spending on space has a military objective.

Because the Soviet Union has developed an anti-satellite (ASAT) capability that is not matched by the U.S., the Soviets have already achieved military domination of space in low earth orbit.

- The Soviet Union probably has a sufficient number of ASAT ("killer") satellites to destroy all U.S. and NATO military satellites in low earth orbit within one week.

- Soviet ground-based lasers probably can destroy all U.S. and NATO military satellites in low earth orbit within two to three days.

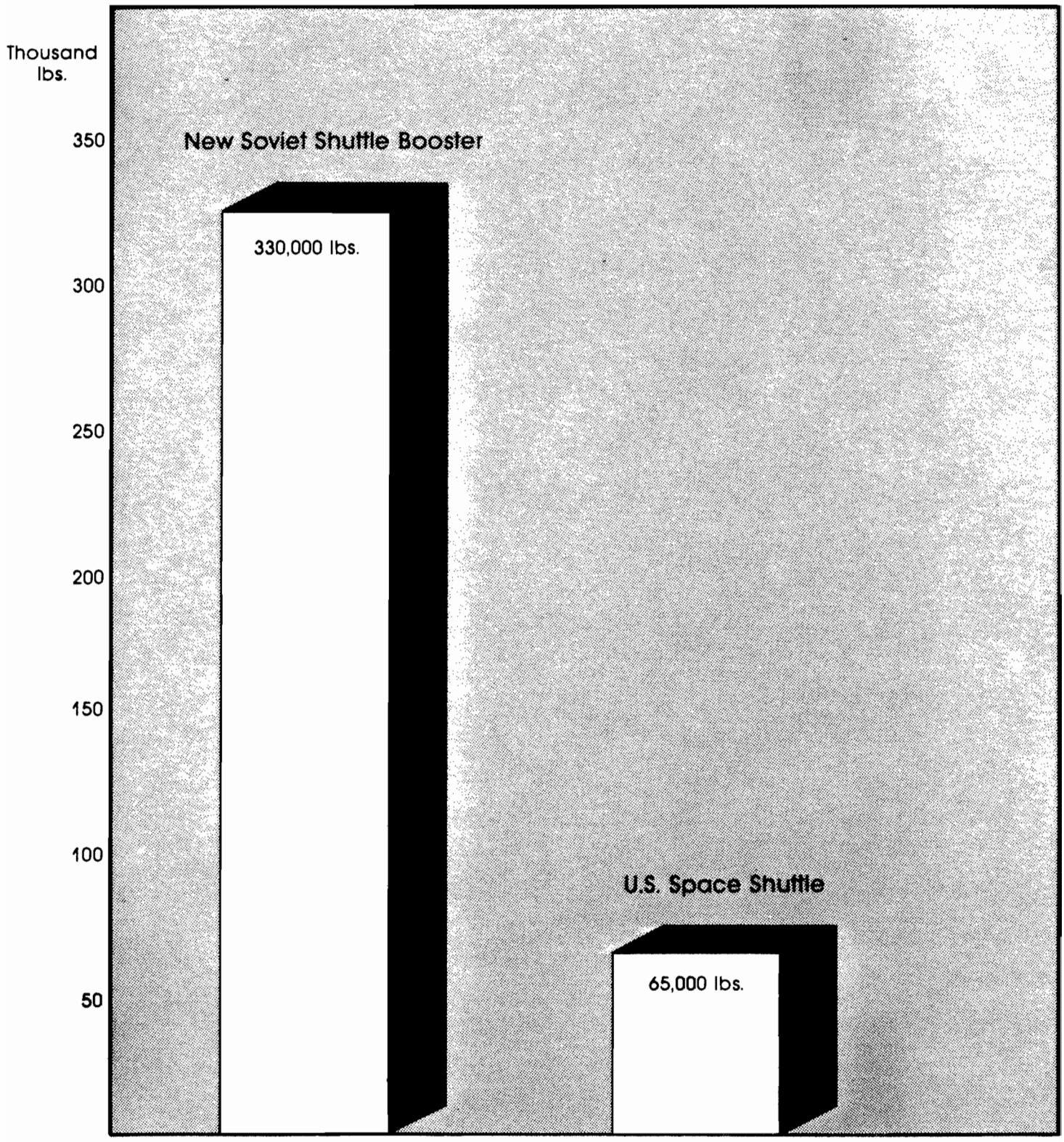
- The U.S. has no comparable capabilities.

Moreover, the Soviet Union appears to be preparing to fight a war in space. Because 75 percent of all long distance Western communications traffic goes via satellite, we are highly vulnerable to satellite warfare. The Soviets, which maintain costly ground-based back-up systems, are far less vulnerable. Moreover, the Soviets are prepared to replace lost satellites on short notice. They can double the number of satellites in orbit in a few months. We have no comparable capability.

The Soviets already have the technology to build a less-than-perfect "Star Wars" defense system against ICBMs, and they appear to be developing the key ingredients for such a system right now. In addition, the Soviets have on the drawing board plans for a 100-man command post in space, as well as plans for ASAT systems that will destroy satellites in high earth orbit.

If present trends continue, it appears that over the next decade the Soviets will succeed in achieving total military domination of space.

MAXIMUM PAYLOAD INTO LOW EARTH ORBIT



Source: National Center for Policy Analysis

INTRODUCTION

For most Americans, the "space race" is a memory tucked away in the recesses of their minds. If recalled at all, the memory evokes images of our national pride and pleasure in a peaceful race that was run well and won decisively. Until recently, this attitude was reflected within inner government circles as well. Intelligence resources applied to the Soviet space program peaked in 1969, the year American astronauts planted a colorful, metallic, U.S. flag on the surface of the moon. The Soviets tried and failed three times to get their mammoth, many-engined moon rocket to lift a payload into orbit. After their last failure, they turned their attention away from the moon, and U.S. intelligence agencies turned their attention away from the Soviet space program. Unfortunately, the new Soviet space efforts had considerably more far-reaching and menacing objectives than landings on the moon.

Fortunately, the Defense Intelligence Agency, in recent years, has made a major, renewed effort to focus on the capabilities and intentions of the Soviets with respect to space. Some of their findings are now declassified and thus available to the American people. Much of the factual material in this article is a result of this declassification.

In 1965, in a publication, Military Thought, intended for the widest possible distribution within the Soviet military officer corps, the General Staff outlined their Space Doctrine. It was "a doctrine envisaging active hostilities in space and regarding the mastery of space as a prerequisite for achieving victory in war." The Doctrine's implications are clear: Domination of space, the ultimate high ground, can prevent access to and use of space by other powers during wartime. If the objectives of this doctrine are ever achieved, the probability of Soviet success in terrestrial battles would be greatly enhanced. For the West, the credibility of our conventional deterrent would be severely lowered.

THE INDUSTRIAL BASE

The Soviet doctrine, set at the highest levels of government, was accompanied by a comprehensive plan and the long-term commitment of resources adequate to bring it to fruition. Although the U.S. space program relies on infrequent but revolutionary improvements in space capabilities, the Soviets have been steadily reaching toward their goal with small but frequent evolutionary steps. The competition is analogous to the fable of the tortoise and the hare. Vast funds have been plowed into the Soviets' space program--an average of about $10 billion per year from 1973 through 1979, not counting considerable launch and operations costs. Since then, expenditures have taken off like the rockets they have funded.

TABLE 1

THE SPACE RACE

(All numbers approximate)

	USSR	U.S.
Number of satellites currently in orbit	120	120
Launches per year	100	17
Payload launched per year (lbs)	660,000	66,000
Maximum payload per launch	330,000*	65,000**
Number of "killer satellites"	50	0
Number of manned space stations put into orbit	7	1

* Capacity of the new Soviet booster under development

** Capacity of the U.S. Space Shuttle

- In 1983, Soviet spending on space was $21 billion, not counting the costs of launching and operating its satellites. U.S. spending was $15-$18 billion, including launch and operation costs.

- Although both countries maintain about 120 satellites in orbit on a daily basis, the Soviets launch about six times as many satellites each year as does the U.S.

- The payload launched each year by the Soviets is about 10 times greater than for the U.S.

The major reason why the Soviet Union has about the same number of satellites in orbit as the U.S. does, despite its much higher launch rate, is that Soviet satellites have a much shorter life span. This is due to the fact that about half of the Soviet satellites launched each year are military surveillance satellites. These satellites cease to be useful when they run out of film, usually after only a few weeks in orbit.

The entire Soviet space effort is far more oriented toward military goals than that of the U.S.

- About 90 percent of all Soviet satellites are estimated to have a military purpose.

- By contrast, only 30 percent of all U.S. spending on space activities has a military purpose.

"Soviet Military Power--1984," published recently by the Defense Department has this to say about Soviet spending on space:

> "By all measures, the Soviet level of effort devoted to space in the 1980s is increasing significantly over the activities noted in the 1970s. The projected yearly rate of growth of the Soviet space program is expected to outpace both the annual rate of growth in overall Soviet military spending and that of the Soviet gross national product for a number of years to come."

This statement may even be conservative. If the growth in outlays continues the pattern established over the last four years, Soviet spending on space activities in the next ten years would increase to approximately $55 billion annually, or an amount about equal to what they spend for their Strategic Rocket Forces, or their Ground Forces or their Navy. That expenditure rate would be reasonable only if the Soviets considered the mastery of space to be a "prerequisite for achieving victory in war."

Part of the preparation for mastery of space is the building of a comprehensive logistics support base. The Soviets have three extensive assembly and launch complexes at Plesetsk, Kapustin Yar, and Tyuratam. The important military value of these complexes is underscored by the fact that each is surrounded by air-defense networks, including surface-to-air

missiles and manned interceptor bases. One of the complexes also may be protected by a ground based high energy laser site. These complexes have, over the years, launched 14 different types of spacecraft launch vehicles, over half of which are still in use. By contrast, the U.S. relies extensively on only one type of launch vehicle, the Space Shuttle. The U.S. Air Force is considering bids from industry and NASA to develop and produce two expendable launch vehicles per year of a new type. This is being done to provide insurance against the possibility that the Shuttle fleet of only four orbiters might be grounded for technical difficulties or plagued with airborne mishaps that can occur in any new aerospace development.

The Soviets also have more than 3200 research institutes for scientific and technological progress. Many of these support the military in its space, aircraft, naval, and ground force developments. These institutes have experienced a 30 percent growth in the last 10 years. Such large scale commitment to research and development must be accompanied by trained personnel. Those who remember the large push in the U.S. to increase the number of our country's technical graduates after the launching of the Sputnik in 1957 might be surprised to find that today:

- The U.S. graduates only about 100,000 scientists and engineers each year while the Soviet Union graduates 500,000.

- Fully 900,000 Soviet scientists and engineers are in research and development--making the Soviet R & D force the largest in the world.

Much of this large technical base has been used to give the Soviet Union its superpower status with its emphasis on military weapons systems developments and deployments. Although the largest military payoffs in space from this R & D effort are yet to come, the Soviet space program already poses a significant military threat to U.S. and NATO forces.

TODAY'S SOVIET SPACE WARFARE THREAT

Weapons Systems

The United States' space assets have become vital not only to our peacetime endeavors but to our wartime endeavors as well. The Soviets' ability to threaten those assets decreases our conventional deterrant to war. In low earth orbit the U.S. has, for example, reconnaissance, weather and navigation satellites. All would be relied on heavily in the event of a war. The Soviets have an even more impressive list of satellites in low earth orbit including one series that is nuclear-powered and that can find and relay data sufficient to target U.S. surface ships in oceans around the world. This system is known as the Radar Ocean Reconnaissance Satellite (RORSAT) system. One of these 5½-ton satellites scattered nuclear debris across Canada in a fiery re-entry into the atmosphere in 1978.

"Killer Satellites." Although the U.S. is planning, against stiff political opposition, to have an anti-satellite (ASAT) capability against low orbiting Soviet satellites by the end of the decade, the Soviets already have achieved that milestone several times over. In fact, they began testing a co-orbital ASAT in space shortly after the 1965 Space Doctrine went out to the troops. By 1971, according to the U.S. Defense Intelligence Agency, the Soviet ASAT system had achieved operational status. It is a system which uses kinetic energy (high velocity impact) for its kill mechanism. Basically, it makes a rendezvous with its target within 90 to 180 minutes after being launched from one of two launch sites at the Tyuratam space launch complex, and fires an explosive shotgun-like charge at its target. In tests to date, its effectiveness has been nearly equal to the requirements for the U.S. system still under development--and it has been in their operational inventory for 13 years! According to "Soviet Military Power--1984," the two launch sites at Tyuratam ought to be able to support at least six launches per day. This means that if there are about two dozen important U.S. and NATO satellites orbiting within 3000 miles of earth, the Soviets should be able to knock them all out handily within a week, even accounting for evasive maneuvers by some of our satellites and for unreliable ASATs. Though no one knows how many ASATs the Soviets might possess, about 40 to 50 should do the trick, and the Soviets have had 13 years to build up an inventory of ASATs and boosters. Since they routinely launch about 100 space boosters per year, an adequate inventory should be assumed.

Ground-Based Lasers. In addition to the co-orbital ASAT system, the Soviets have been hard at work developing laser technology.

- The Soviets spend three to five times more than the U.S. on laser technology, and many experts rate them as being ahead of the U.S. in this field.

- The Soviets have two ground-based test lasers with the capability to destroy satellites in low earth orbit and damage sensitive systems in satellites all the way up to 20,000 miles above the earth.

Although these are R & D systems which do not have 24-hour-per-day, high-reliability operational capabilities, they still pose a current threat to our vital military satellites. Because of the geometry of motion of both the earth and the low orbiting satellites, each of the U.S. satellites can be expected to pass a Soviet laser facility at least twice per day and, depending on the range of the laser weapon, up to four to six times per day. This means that the Soviet lasers theoretically should be able to destroy all U.S. low earth orbiting satellites in less than 12 hours. If one takes into account that it would be difficult to fire a laser beam through adverse weather, and given some degree of unreliability in the "test" systems, then a conservative estimate of two or three days should be sufficient to do the job. This is a considerable recent improvement in Soviet capability over the co-orbital ASAT system discussed above.

Electronic Warfare. The Soviets have other means to render our wartime support capability from satellites less than credible. They have the technological capability of conducting electronic warfare against our satellites regardless of altitude. Electronic Warfare (EW) is a favorite technique of the Soviets in areas other than space, and it is reasonable to presume that they would use it against our satellites perhaps even more readily than they would use the more directly provocative means noted above. Although EW techniques are numerous and some highly technical, their effects are similar to running a vacuum cleaner in the same room as a cheap TV set--the picture goes haywire until the vacuum cleaner is turned off. Satellites gathering information with sensitive electronic "ears" cocked towards an area of political tension or actual combat would be particularly susceptible to such temporary yet effective interference.

Anti-ballistic Missiles. Although this form of ASAT threat is unlikely to be used, the Soviets also possess the capability to destroy satellites in space using the nuclear warheads on their Galosh anti-ballistic missile system which rings Moscow. The liklihood of this is low, however, because of the high effectiveness of the systems already mentioned, the fact that use of nuclear weapons in such a limited manner might easily escalate, and because these weapons are, after all, in place to protect Moscow and its vast interlocking grid of ministries and technocrats.

Those in the U.S. who suggest that the U.S. ASAT program under development will militarize space should take a look at what the Soviets already have done. There are no U.S. counterparts to their ship-finding and targeting nuclear RORSATs, their co-orbital ASATs, their two ground-based laser ASATs, or their nuclear-tipped anti-ballistic missile system. They appear already to have achieved their objective of domination of space, at least in the lower reaches of that environment.

Support Systems

In addition to their ASAT and RORSAT programs, the Soviets have more than 40 other types of satellites in orbit on any given day. They typically have about 55 communication satellites for various military, governmental, diplomatic, intelligence, and civilian uses in orbits ranging from very low up to 20,000 miles above the earth. This communications system, as extensive as it is, has not been allowed to become an Achilles heel, as in the West. Though not cost effective, the Soviets have maintained redundant ground communications capabilities to guard against catastrophic losses in wartime. By contrast, it has been estimated that 75 percent of all Western long distance communications traffic goes via satellite. This traffic cannot be accomodated by existing ground communications networks.

The Soviets also operate about 24 meteorological and navigation satellites. Although these have obvious peacetime uses, their wartime

utility is enormous. Access to accurate and timely weather forecasts is a prerequisite to success of conventional warfare in modern military engagements. It also can be used to improve the accuracy of ICBM and submarine-launched missile warheads through estimates of how weather conditions in the target area may affect reentry vehicle motions and therefore its accuracy in the final seconds before impact. Navigation satellites can be used by military aircraft and they can improve the accuracy of submarine launched ballistic missiles by pinpointing the location of the submarine.

Manned Systems

The Soviet manned program far exceeds the activity level of the U.S. program. The Soviets have conducted many manned missions aboard their seven consecutive space stations, three of the mannings being for periods longer than six months. One lasted 211 days--about three times longer than the longest U.S. manned mission. That U.S. mission was aboard Skylab, the only space station we put up and which reentered the atmosphere about five years ago. The next U.S. space station will not go up for about a decade, according to the President's State of the Union address in January, 1984. Currently the Soviets have their seventh manned space station in orbit. It is visited on a routine basis by the Soyuz spacecraft bringing visitors, special instructions, and additional mission experiments. They also have developed a Progress spacecraft similar to the Soyuz which is unmanned and which rendezvous and docks to the Salyut space station in an automatic manner even when Cosmonauts are not aboard. It transfers fuel, new experiments, and supplies. A space station module as massive as the station itself has from time to time been launched into orbit and then has attached itself to the station. Articles in defense publications suggest it has a military mission and may have tested the components of a kinetic energy system that eventually could be used as part of an anti-ballistic missile network.

When the Salyut, the Progress or the Soyuz spacecraft and the space station module are all attached, the complex is about 100 feet long. Yet this station will be dwarfed in size by a future complex to be discussed later. Part of the justification for the U.S. space station now undergoing conceptual design studies is to use it as a scientific and industrial test bed--an activity the Soviets have been gaining experience on since their first station went into orbit in 1971. Their space station also offers them the opportunity to test military subsystems of future satellites in a benign environment. This allows them to avoid having to build complete space-qualified hardware to test new sensor techniques for reconnaissance satellites, for example.

Reconnaissance and Surveillance

Between 20 and 30 satellites fall into the category of reconnaissance and surveillance. These satellites have extremely high direct wartime

usefulness. Soviet photographic and electronic reconnaissance satellites were first launched in the early 1960s. They now put up about 50 per year, which account for the largest single group of each year's launches. Most of these satellites last for only a couple of weeks and then reenter after their film supply is exhausted.

These satellites are used in a variety of ways. They make accurate maps, essential for planning military campaigns, including maps of client states. They are used to keep an up-to-date record of where new, movable or moving enemy targets (such as ships, submarines, or aircraft that emit communications or radar signals) are located. They keep track of military force deployments around the globe, an activity which is especially useful in the midst of crises. In addition, the status of new weapon system developments can be monitored by combining the capability of overhead electronic and photographic systems. Other electronic eyes in high orbit keep in constant touch with Moscow while staring at U.S. ICBM sites to provide the primary means of early warning of a nuclear attack.

Launch Surge

Possibly one of the greatest space-related Soviet advantages is their ability to flood the skies with additional satellites prior to the outbreak of a major conflict. The U.S. must plan its space launches years in advance. With a limited number of launch pads and orbiters, our ability to respond to crises by space launches is severely limited. The Soviets, on the other hand, could possibly double the number of spacecraft in orbit given a few months warning as in a period of steeply rising tensions or in an actual conflict. This asymetry will persist. Note that the U.S. ASAT program is having trouble in Congress getting appropriations for only 40 ASAT missiles--hardly enough to take out vital Soviet military satellites in low earth orbit in the face of a determined Soviet launch surge.

A Mid 1980s Warfare Scenario

Assume for the sake of example that geopolitical tensions are rising and that the Soviets come to the conclusion that hostilities between the major powers are probable though not certain. What actions concerning space would be likely to be taken? It is probable that the Soviet average of 120 satellites in orbit is a number that is somewhere between peacetime and wartime requirements. If war were to occur, the Soviets could not count on having the luxury of launching satellites day after day. They would know that in certain circumstances that activity could be curtailed by their adversaries. They most likely would initiate a buildup of selected satellite systems from a carefully built reserve of satellites and boosters stored in facilities near the main launch complexes. Also, wartime requirements most likely would exceed what the Soviets in peacetime consider a full

satellite network, since they would want to provide backup satellites in orbit to make up for failed systems or satellites destroyed accidently.

Primary among the systems to be augmented would be their ICBM launch detection system. It also is likely that they would augment the crew, equipment and supplies of the Salyut space station to provide round-the-clock manned reconnaissance. They probably would start to launch photoreconnaissance satellites with increasing frequency to provide more timely information on military force movements and to provide for in-orbit spares if the war were to start. If the conflict were to go nuclear, most data bases would be destroyed and those that remained would be out of date due to the widespread destruction. Therefore, the value of correct information would go up by several orders of magnitude, and the need for post nuclear attack photoreconnaissance would be greater. Electronic surveillance satellite systems also would be augmented for some of the same reasons. Satellites capable of targeting surface fleets probably would undergo the greatest augmentations, because these are quite expensive to keep up in peacetime and because the value of accurate wartime information on the locations of our 10 to 12 carrier task forces would be nearly priceless to the Soviets. Their communications networks also would be augmented as much as possible, although satellites in geosynchronous orbit require them to use large and slow-to-launch boosters. All of the these steps could be carried out before actual hostilities occur, assuming there is enough time--say, six to ten weeks. All of these systems would help the Soviets prepare for war, should one occur.

Let us assume that tensions rise to the point of invasion by the Soviets on the NATO front. Several days before this, we could expect to see Electronic Warfare measures being used against Western satellites in order to prevent them from gathering information about critical pre-invasion actions. Coincident with the invasion itself, we could expect to see the first physical attacks of the war against Western space assets by Soviet ground-based lasers and co-orbital ASAT interceptors. Within days, all U.S. and NATO low earth orbit satellites would be out of commission with little hope of replacing them. As bad as this scenario sounds for the U.S., it is certain to get much worse in the coming decade.

TOMORROW'S SPACE WARFARE THREAT

The recent large spurt in Soviet space program spending will start to yield benefits within a couple of years. These benefits will be maximized before the middle of the next decade. An enormous increase in warfighting capability in space is forecast, as well as a concurrent increase in capability to assist, directly or indirectly, ground, sea and air forces of the Warsaw Pact. All of the developments described below are probable by 1994 or earlier. Unless the U.S. does something it is not now planning to do, and does it fast, sometime in the next decade the Soviets will have achieved their objective of mastery of space all the way out to geosynchronous

orbit--that special environment where the speed of the satellite revolving around the earth exactly matches the speed of the earth's rotation which results in the satellite appearing to remain suspended above a single spot on the equator.

Launch Systems--The Next Ten Years

Key to the expected expansion of their space program is the concurrent development of three new Soviet space launch boosters. Whereas the U.S. built its magnificent Space Shuttle at a cost of over $7 billion after years of conceptual and engineering development studies and tests, the Soviets have chosen a much cheaper and quicker way to achieve the same capability--they merely copied, then improved upon our design. NASA designs were available to anyone who wanted them and apparently the Soviets bought copies. Their decision saved them billions of dollars and will nearly double the payload they can place into low earth orbit. But the Soviet designers were not content to merely copy this advanced system. They moved the liquid oxygen--liquid hydrogen engines from the orbiter to the bottom of what would be the large external tank next to the orbiter's underbelly in the U.S. design. This gives them not an external tank, but a huge booster on its own. Some U.S. Shuttle engineers have been heard to say, "Wish we had done that in the beginning."

According to cost estimates in preliminary studies, it would cost the U.S. about another $7 billion to duplicate the performance advantage of the design that the Soviets essentially got for free. The new booster, when used with up to six much smaller strap-on boosters (but without an orbiter attached) will be able to boost at least 330,000 lbs. of payload into low earth orbit. This is five times the payload carrying capability of the orbiter itself. If the Soviets choose to add another stage, they will have the capability to place up to 100,000 lbs. of payload in geosynchronous orbit. To get an idea of just how much weight this is, consider NASA's plans to enlarge the Centaur upper stage and fit it to go into the Space Shuttle cargo bay. When that is accomplished, we will have the capability to put up about 10,000 lbs. into geosynchronous orbit, roughly 1/10 of the new Soviet capability. The military potential of these exceptionally high weights to go into low or high orbits will be discussed below.

It appears that the small strap-on boosters for the large booster are in the size range to meet the requirements for a third stand-alone booster to be used in the Soviets' new space launch vehicle fleet. Though this one would be able to put up only 33,000 lbs--less than their best booster to date--it would provide them greater flexibility and may possess other advantages as well. All of these boosters should be ready for test within the next year or two.

In addition to the three new boosters, the Soviets are expected to develop within this decade a space tug. This vehicle would provide orbit-to-

orbit transfer for satellites and manned vehicles similar to the way small twin engine propeller aircraft provide local air service at international airports after huge Boeing 747's disgorge their passengers. (The space tug, incidently, is something the U.S. Air Force and NASA originally had planned to build as part of our Shuttle program but were unable to for lack of money, among other reasons.) These new Soviet booster developments probably will be added to their already impressive number of space launch boosters and will enable the Soviets to significantly increase their space program in terms of the number of satellites in orbit as well as the size, weight, and orbital location of those satellites.

Support Systems--The Next Ten Years

Within the next decade, the Soviets are expected to deploy advanced communications, navigation and meteorological satellites which will offer them greatly increased wartime capabilities. All of these new capabilities are ones which the U.S. already has. But, when coupled with weapons systems which the U.S. does not have and does not intend to build, these capabilities will offer the Soviets singular advantages. In the communications area, it is expected that the Soviets will put up satellites capable of relaying data from or to other satellites. Because of the utility of such a system, and because its technology is readily available in the West, these satellites probably will have the ability to track and command other satellites, as in the NASA Tracking and Data Relay Satellite system. In the navigation area, it is very likely the Soviets will follow the lead of the U.S. in deploying satellites with the ability to let even fast-moving aircraft know their location instantaneously in three dimensions. This has obvious implications for the ability of tactical aircraft to hit ground targets with extreme accuracy, even at night or in bad weather.

Reconnaissance and Surveillance--The Next Ten Years

According to "Soviet Military Power--1984," the next decade will bring unspecified improvements in Soviet missile launch and warning systems as well as in their photographic and electronic reconnaissance systems. If they are able to marry the ability to transfer signals from satellite to satellite (noted above under communications satellites) with advanced sensors, it is conceivable that they could have a reconnaissance system that would work electronically instead of using film as a base. This would give them the capability to send pictures back to an intelligence center or to a battlefield command post with little time delay after the satellite passed over the area of interest.

Manned Systems—The Next Ten Years

It is in the area of manned systems that some of the most dramatic and controversial projects are being developed by the Soviets. These will either turn out to be collossal duds or extremely effective military assets. The reason for the controversy, at least in this country, is that the U.S. Defense Department has for some time now taken a dim view of military requirements for manned systems in space. For example, it is public knowledge that the Department actively opposed the plans to build a permanent U.S. space station which is now scheduled to go up between 1992 and 1994. The prevailing, though far from universal, attitude in U.S. military circles has been that there are easier and cheaper ways of doing the same missions in space. In general, these ways would focus on unmanned spacecraft.

Many of these same people routinely approve manned ships, manned tanks, manned aircraft, manned submarines, etc. Why is there such a difference in attitude when it comes to the space environment? Perhaps it boils down to how the environment of space is perceived in its relation to military missions. For many years the U.S. looked upon space as a scientific laboratory, a research and development resource, or as a place to put equipment to help air, sea and ground military forces do their job. The Soviets, on the other hand, appear to see space as just another warfare environment, as their 1965 space doctrine indicates. In the Soviet view, if one is placing systems in a warfare environment it is natural to build a number of weapons systems to control that environment.

Putting a human being on board adds an additional element of control. For example, if space is a peacetime environment only, we can predict what extremes of temperature, radiation and pressure satellites will encounter and we can safely design a system to meet the challenges of the environment. However, if space is a wartime environment, the satellite might be subjected to any number and variety of military threats from any direction. Man is needed to be able to respond to these unanticipated challenges that face the space system. These same kinds of unforeseen occurrences also will be happening down below. Perhaps well-trained and equipped military men in space might be able to influence the outcome of a battle far below the spacecraft. With this discussion as a background, we will turn to just what it is that the Soviets are planning to do with manned systems in space in the next decade.

Since 1982, the Soviets have been testing a small space plane that is either capable of being manned or is a scale model of a large manned space plane. Missions for this craft are unknown but the following suggest themselves. Such a system can be used as a ferry craft between manned space stations or as a rescue vehicle. More ominously, fitted with external fuel tanks from a large space station, a space plane could be used to inspect

another nation's satellites and destroy those satellites using small onboard rockets. The orbital reach in the latter example would be almost unlimited, and would include geosynchronous orbit. It also could be used as a quick response reconnaissance vehicle to take a look at enemy forces during wartime. Since the space plane, to date, has landed in water on its test flights, a similar naval mission can be postulated. Suppose a Soviet Radar Ocean Reconnaissance Satellite revealed the location of a large naval task force spread out over a 100-mile wide area but the location of its most important elements, such as its carrier or cruiser, were not known. A solution: a fast response space plane is launched and timed to pass over the area of interest in the first revolution around the earth and then re-enter into the ocean near a Soviet naval task force possessing the means to destroy the U.S. force.

The Soviets also are planning, within two to three years, to enlarge their present space station (which normally holds three cosmonauts and occasionally five or six), to one which can accommodate up to 12 cosmonauts. This will put it in the class with U.S. plans for its next space station. But the Soviets also are expected to build a considerably larger station, weighing perhaps a million pounds or more, which will accommodate up to 100 cosmonauts on a permanent, though rotating basis. It is this large-sized station, expected in the early-to-mid-1990s, which has some military planners worried. What can 100 highly skilled men do in space? Consider that in nuclear crises the U.S. vests backup control of all our nuclear forces in an aircraft holding a crew of only 20 highly skilled men. Though it would certainly be a backup for strategic command posts on the ground, on the seas, or in the air, such a Spaceborne Nuclear Forces Command Post is at least a possibility with this large station. With access to communications satellites, there is no reason such a command post could not do the job perhaps even more effectively than alternative means.

Another Command Post use for this large station would be for controlling space forces. Eventually, satellites will be tracked and commanded from other satellites. There is no reason why the space station cannot be used as an intelligence fusion center in space, collecting information from a large number of satellites about conditions all over the world and then commanding the satellites to focus on areas which appear to the cosmonauts and their computers to be particularly worthwhile. A special type of satellite that would likely be controlled from a large station would be an orbiting anti-satellite system which is expected in the next ten years.

If the Soviets should choose to put an antiballistic missile system in space, it would no doubt be quite extensive and in need of periodic maintenance. A large space station easily could be used as a maintenance and repair depot for such a system, or for that matter, for numerous other spaceborne systems. The large space station also could be used for reconnaissance as well as for a research and development laboratory for future military space applications. With all of this military capability on their 100-man space station, it is likely that the Soviets will have one or

more protective systems aboard which also could have offensive capabilities.

Finally, we come to the real payoff from the Soviet military space program which will result from the expenditure of an estimated $350 billion or more over the next ten years--again not counting launch and operations costs. That payoff is in weapon systems. The Soviet weapons systems fall into roughly three categories: ASAT systems, Ballistic Missile Defense Systems, and Space-to-Ground Weapons.

ASAT Systems

Within ten years, the Soviets are expected to have expanded their four current ASAT capabilities (Electronic Warfare, the Co-Orbital ASAT, two ground-based laser ASAT sites, and the nuclear-tipped Galosh antiballistic missile system) to perhaps five or more. According to "Soviet Military Power--1984,"

> "Emerging directed energy technologies are seen by the Soviets as offering greater promise for future anti-satellite application than further development of orbital interceptors equipped with conventional warheads. The Soviets could deploy anti-satellite lasers to several ground sites in the next ten years or they could deploy laser-equipped satellites either available for launch on command or maintained in orbit, or could deploy both...The Soviets could test a prototype laser anti-satellite weapon as soon as the late 1980s. Initial operational capability could be achieved between the early- and mid-1990s."

It is likely that one of these laser weapon systems will end up on the large space station for protection of the stations and for ease of testing. Laser weapon satellites could be in any orbit but the most useful would be at geosynchronous. Recall that the large booster is expected to be able to put 100,000 lbs. into that orbit although that estimated weight is somewhat less if the payload were going retrograde, or in the direction opposite to the earth's rotation. A large laser put into this type of orbit would pass within range of each of our geosynchronous satellites within about 12 hours. To see the extent of the threat that such a device would be to the free world, consider that by 1990, fully 90 percent of the West's communications traffic will flow through these satellites. Even if we ignore the damage that would be done to our defenses, just image the damage that could be done to our economies if we suddenly lost that communications ability. There are at present no plans of which the writer is aware to defend actively against the appearance of such a threat.

As mentioned previously, the current space planes or larger variants also could be used as an ASAT. They would be particularly useful in orbits in which only a few very important satellites are in residence.

The Soviets are at least equal to the U.S. in particle-beam weapon technology and these also could be used effectively as ASATs, especially against the sensitive electronic components of these systems. Such a system intended only to disrupt electronic components could be tested in space in the early 1990s and one designed to physically destroy satellites could be similarly tested by the mid 1990s.

Ballistic Missile Defense Systems

The subject of Soviet Ballistic Missile Defense (BMD) systems in space is incompletely covered by the latest Defense Department documents. However, the most likely types of defenses are laser beams, particle beam weapons, and kinetic energy (high velocity impact) devices. Since there are a number of reputable scientists and engineers in this country who maintain that we could field less than perfect directed energy BMD systems in the near future if we wanted to, and since most acknowledge that the Soviets are at least equal to us in these technologies, it is reasonable to assume that we may be facing these types of systems in the next ten years. Various estimates put the Soviets in other technological areas from three to 15 years behind the U.S. However, in the kinetic energy area, the U.S. was prepared to field such a BMD system in space (Project Defender) as far back as the late 1960s. Also, the Soviets have the world's only operational kinetic energy kill system in space and have had it for 13 years--the co-orbital ASAT. So, the prospects for the emergence of this type of space based BMD system are probably greater than for the other two kill mechanisms.

Space-to-Ground Weapons Systems

If the Soviets succeed in getting an operational three dimensional navigational satellite system as discussed earlier, they will have the key ingredient for the ability to hit targets on the earth with precision from space by using hypervelocity (tens of thousands of feet per second) non-nuclear impact devices. The implications of this for modern warfare would fill an article in itself. Imagine ships being sunk in port, munitions storage dumps destroyed, hardened silos vaporized, and numerous other high value targets taken out worldwide, within hours, without lengthy mobilization of forces or the occurrence of damage to surrounding civilian population areas.

With all the interest in Ballistic Missile Defense in this country since President Reagan's "Star Wars" speech in the Spring of 1983, it is surprising that in some ways an easier but equally effective use of laser technology in the strategic and tactical sphere has been all but ignored. It is an area in which the Soviets probably are at least equal to us. Many technologists agree that it is easier to destroy aircraft from space using lasers than it is to destroy ballistic missiles. A potential threat that we could be facing from space in the next ten years would be lasers directed against bombers,

cruise missiles, Airborne Warning and Control System aircraft, tankers, and tactical aircraft both ground and naval based.

Conclusion

Unless the U.S. develops large numbers of low altitude ASATs and ASATs capable of destroying different types of Soviet ASATs in orbits up to 20,000 miles above the earth, it is not likely that a mid-1990s warfare scenario will result in anything other than the success of the Soviet's Space Doctrine--"A doctrine envisaging active hostilities in space and regarding the mastery of space as a prerequisite for achieving victory in war." By then they may have nine types of ASAT capabilities, a 100-man Command Post in space, space-to-ground and space-to-air weapons, a less than perfect but effective ballistic missile defense system in space, and all the support satellites a modern force could wish for, with the ability to defend them.

Note: Nothing written here is to be construed as necessarily reflecting the views of the National Center for Policy Analysis or as an attempt to aid or hinder passage of any bill before Congress.

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Thomas H. Krebs recently retired as Chief of the Space Systems Branch of the Defense Intelligence Agency, and currently is Director of Research for High Frontier, a non-profit institute which promotes the commercial and military development of space, especially in the area of ballistic missile defense.

Krebs has achieved widespread recognition as the foremost U.S. expert on the Soviet space program. While at DIA, he performed the first operational warfare analyses on current and projected Soviet space programs, and developed space warfare scenarios for use in Joint Chiefs of Staff exercises. He also defined and directed the Department of Defense Space Intelligence Master Plan study, which identified serious deficiencies in the DOD Intelligence Community.

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