A COMPREHENSIVE STRATEGY FOR SPACE

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EXECUTIVE SUMMARY

PURPOSE: This study outlines a plausible U.S. military strategy designed to counter a possible Soviet space strategy at various levels of the conflict spectrum.

SCOPE: This strategy employs existing resources and indicates those developmental resources that offer the most advantage in the near future (out to the year 2000). The primary focus of the strategy will be on military actions; however, some civilian, political and commercial activities, to the extent they influence military activities, will also be discussed.

OBJECTIVES: The primary goal of this study is to identify strategic goals and postulate strategic options that will be useful to the U.S. Space Community as they go through their own strategic development process. Secondly, it will provide proposed actions to the space cell of the global war game and other organizations working with gaming models for evaluation of developmental space strategies. Finally, it will provide a list of space related topics requiring additional research.

METHODOLOGY:

Chapter II briefly focuses on the structure and status of the U.S. and Soviet Space programs. Appendix III supplements this discussion with historical background. Chapter II ends with a summary of other developing national space programs.

Chapter III contrasts the space capabilities of the Soviets and the United States.

Chapter IV centers on the current draft national space policy. Appendix IV supplements this chapter and outlines the historical development of our national space policy highlighting the fluctuations in political emphasis.

Chapter V develops a proposal for better coordination between DoD and NASA as a precursor to strategic development.

Chapter VI presents a framework for the development of a U.S. military space strategy. First, it identifies strategic goals for space. Second, it applies these goals against the criteria outlined in FM 100-5 under the title of operational art. Simply stated, to develop a feasible campaign plan this process requires that three basic questions be sequentially answered. These questions are:

1. What conditions must be produced to achieve the strategic goals?

2. What sequence of actions is most likely to produce those conditions?

3. How should resources be applied to accomplish that sequence of actions?

The major threat this strategy is designed to counter is the Soviet space threat.

Chapter VII contains brief recommendations for the future. These focus on coordination between DoD and NASA and suggestions on the structure and organization of space forces in the future that will expedite the strategic developmental process.

PROBLEM:

Simply stated, the U.S. must establish a long term strategy based on: (1) clearly defined and realistic military goals and objectives, (2) a realistic assessment of soviet military space strategy, (3) a competitive U.S. strategy designed to counter the Soviet strategy and lastly, (4) how best to integrate and coordinate DoD's objective of national security into the civilian space program.

This research process formulated the following conclusions and recommendations:

Space control is a vital component of our national policy at present and will increase in importance at a phenomenal rate in the foreseeable future.

In peace time the sophistication and long orbital life of U.S. Space Systems provide an advantage over the Soviet Union. But this peace time advantage has precipitated a War time disadvantage. Inherent in the nature of the Soviet Space program is the requirement to maintain enormous launch capabilities to maintain system coverage and this provides them the capability to conduct highly effective surge operations in time of war.

The Strategic Defense Initiative offers a great deal of promise for superiority in space control in the near future, but any imaginable near term military space strategy must include an interim capability to effectively negate Soviet on-orbit space assets quickly and efficiently.

The absence of an ASAT in our weapons inventory may force the military to execute courses of action that risk immediate escalation of a conflict into the strategic nuclear arena in order to achieve U.S. space control. The alternatives of attacking key space personnel, space related installations and equipment well with in the Soviet Union

will be a political nightmare, even if full hostilities between the two countries already exist.

To regain total space leadership NASA must focus its efforts on the pioneering and early developmental stages of future space initiatives. Routine or operational procedures, such as satellite launch, must be taken over by DoD or incorporated by emerging commercial organizations which ever, best fits the particular mission. This action frees NASA to fulfill its true space leadership role and spreads critical space functions over a broad number of personnel and geographical locations.

A Space Mobilization Plan must be drafted to coordinate all the components of the space community during the transition from peace to war. This plan, like other mobilization actions should be tied to established DEFCON levels. At a minimum this Space Mobilization Plan must incorporate plans for: (1) integration of U.S. launch facilities and activities (NASA, military and commercial), (2) hand off civilian space systems to USSPACECOM,(3) protection of key space related facilities and personnel,(4) militarization of civilian construction equipment and personnel needed for expeditious launch site refurbishment and (5) acceleration of space related industrial activities.

As other foreign space programs come into their own,

similar information sharing and hardware control agreements must be negotiated with our allies. These agreements must include the ground work for activating an Allied Space Command for wartime coordination of space actions and assets. All such actions must then be consolidated into an Allied Space Coordination Plan (ASCP). This plan must include provisions for: (1) appointment of an Allied CINC Space, (2) Coordination of allied launches including both actual and deception operations, (3) activation of allied information sharing procedures including a transition to joint communication protocols, (4) coordination of negation operations directed at enemy space assets and (5) coordination for protection of allied space systems external to the United States.

PREFACE

We wish to take this opportunity to recognize several members of the space community who were instrumental to the completion of this project: LTC Wilkerson, U.S. Army, USSPACECOM; LTC Bishop, U.S. Air Force, Office of Science and Technology Policy; LTC Annis, U.S. Air Force, DoD liaison to NASA Headquarters; Major Stan Mushaw, U.S. Air Force, fellow student and space enthusiast here at the Naval War College. In addition, for their patience, encouragement and understanding we thank: Naomi, Eva, Patty, Natalie and Miriam.

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INTRODUCTION

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The United States must identify clear national goals

that can be translated into workable strategies at all levels of our space community. These goals must establish long-term objectives and be able to withstand the turbulence of changing political regimes and the constraint of the near term economic crunch, while simultaneously addressing the requirements of national security.

Our national security is the largest recipient of the benefits of space technology to date but is perhaps the most overlooked by the general public when assessing our national priorities and the net worth of investments in space technology.

In his chapter entitled "Friction in War", Carl Von Clausewitz States: "Every thing in war is very simple, but the simplest things are difficult." [1] The exploitation of space technologies has made a substantial contribution towards minimizing Clausewitz's friction. The impact of space-based technologies on Command, Control, Communications and Intelligence, C^3I, is felt in both the strategic and tactical arenas. This enhancement is precipitated by satisfying the ancient Sun Tzuian axiom. " Know the enemy and know yourself; in a hundred battles you will never be in peril." [2]

The perspective of space breaths new life and meaning into these words. Information gathered by space-based surveillance systems provides an instantaneous and incredibly

accurate snapshot of both strategic and tactical enemy strength , distribution and activity. This information when compiled over time generates precise, predictive models for long term development of competitive strategies. Thus, a good deal of guess work has been eliminated in the process of "Knowing the Enemy".

An immense contribution in "Knowing Ourselves" is derived from global position location systems. The ability of commanders to know where their subordinate forces are located is a tremendous force multiplier. Military history is filled with after action reports of forces that could have played a decisive role in major battles, but were left uncommitted because their location was either not known or inaccurately reported. When position location information is coupled with the ability to communicate information and orders anywhere on the planet instantaneously, critical decision process time is dramatically shortened while the uncertainty related to the course of action chosen is also substantially reduced. This uncertainty or unpredictability is the main ingredient of Clausewitz's "Friction in War".

The essence of our current military strategy for fighting the Soviets out numbered and winning is predicated on our capability to synchronize our forces and those of our allies. This synchronization is unquestionably linked to our space forces and our control of the environment in which they

operate.

This relationship clearly establishes space as a fourth medium for international conflict. Any development of national policy for space and its associated strategy must hold the preservation of national security a paramount consideration. To be successful this strategy must integrate the resources of all of our national space programs, related activities in other theaters of conflict and the assets and actions of our allies.

Based upon an analysis of Soviet capabilities and probable courses of action, this study will develop and recommend a space strategy that will retain our freedom of action in space and support our national security objectives. These objectives being: (1) deterrence, (2) the ability to fight and win on terms favorable to the U.S. and (3) if deterrence fails possessing the capability to make the most of our available resources.

Currently our space infrastructure is not fully capable of implementing the proposed strategy. Where short comings are evident, such as in the U.S. launch surge capability, recommendations will be provided for near term solutions as well as future systems that should be developed.

CHAPTER II

THE DEVELOPMENT AND STRUCTURE OF INTERNATIONAL SPACE PROGRAMS

THE U.S. SPACE COMMUNITY

Community is perhaps a very apropos term to use for the national structure of our space organizations. Webster defines community as; A group of people living together and having interests, work , etc. in common. It is precisely that loose bonding that is hindering our efforts to remain competitive in space militarily, scientifically and even commercially. Our major adversary, the Soviet Union, has a tightly organized structure that offers them several near term advantages, these will be examined later.

The U.S. space community has three major subdivisions. The military subdivision is controlled through the Department of Defense, through the Joint Chiefs of Staff to the newly formed Unified Command, the U.S. Space Command. The scientific subdivision is under the control of the National Aeronautics and Space Administration. Finally, the emerging commercial subdivision seems to have no real proponent at present, but is a topic of lively debate between NASA, the Department of Transportation and the Department of Commerce.

It is beyond the scope of this paper to fully deal with this last component of the space community although occasional reference will be made to some of the developing issues in the commercial sector and their impact on other programs.

Military Space Structure

The U.S. Space Command is the focal point of all U.S. military space operations. Its unified structure incorporates subordinate space commands from each of the major services. Appendix III outlines a short history of the evolution of the military component of the U.S. space community.

By definition the U.S. Space Command's mission falls into three broad areas: space operations, surveillance and warning, and ballistic missile defense planning. The command's space operations responsibilities include space control, directing space support operations for assigned systems and operating Joint Chiefs of Staff designated systems in support of the National Command Authorities, the Joint Chiefs of Staff and other unified and specified commands. [1]

Space control is a command mission. It includes ensuring access to, and operations in, space without interference, and, when necessary and directed, denying an adversary the use of space-based systems that support hostile military forces. Force enhancement operations include providing surveillance,

navigation and communication support to our own and allied terrestrial-based forces, while space support meets launch and orbit requirements established by operational commanders.[2]

The U.S. Space Command's surveillance and warning mission includes supporting the North American Aerospace Defense Command by providing the missile warning and space surveillance force structure and data necessary to fulfill the U.S. commitment to the North American Aerospace Defense Command. The Command is also responsible for the planning and requirements development necessary to support the mission of engaging attacking ballistic missiles during strategic conflict. [3]

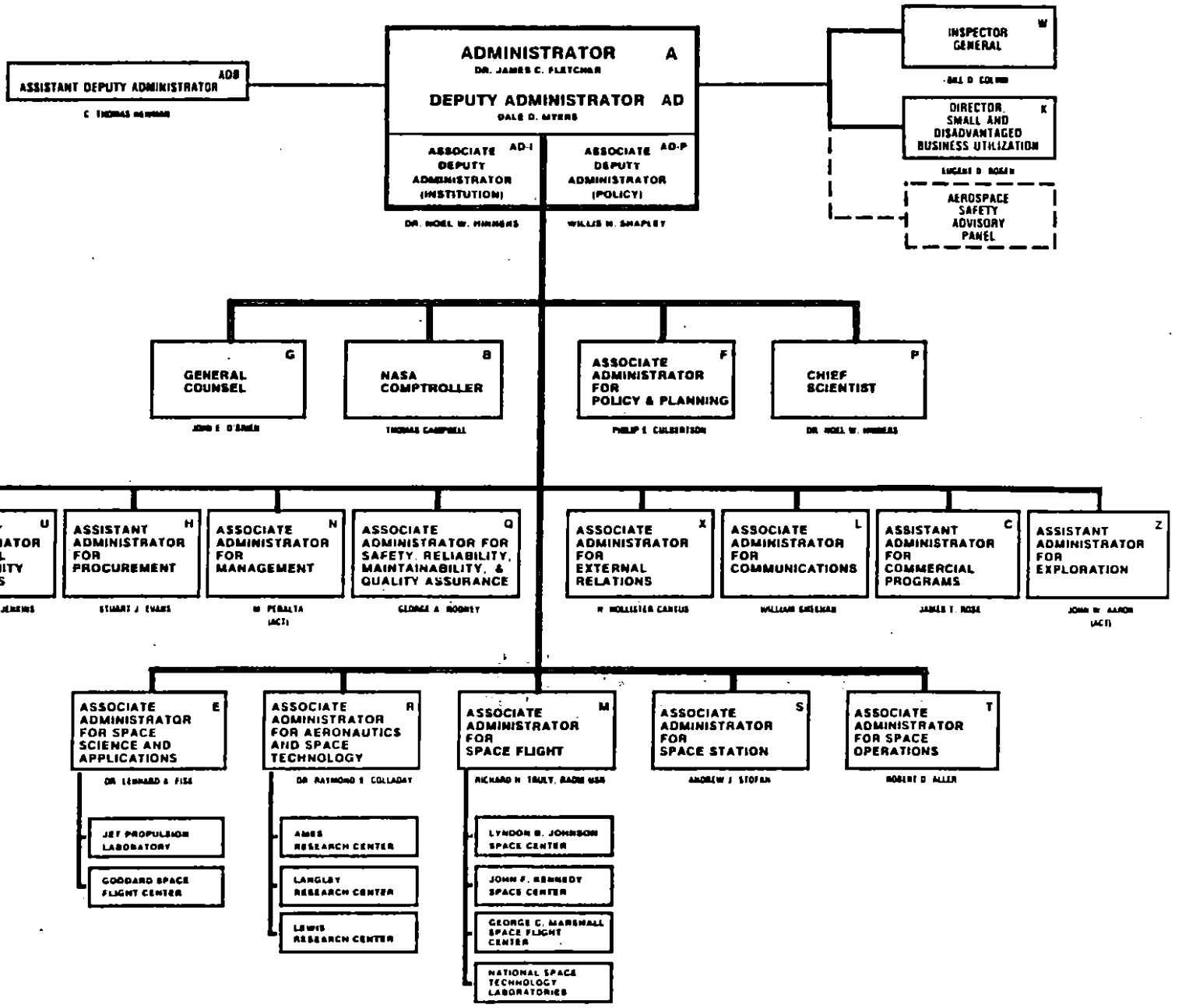
National Aeronautics and Space Administration

Appendix III contains a historical review of NASA's development and major accomplishments.

NASA's manned programs have certainly dominated the development of its public image, but with the exception of the shuttle have had a relatively small impact on national security objectives. The space station has the potential to change this trend drastically, both as the first occupied observation post on the ultimate high ground and as a space support facility for on-orbit systems.

NASA's unmanned programs, although usually much lower keyed publicly, have been equally as impressive as the manned missions. Perhaps even more important is that the development of these unmanned systems and their associated technologies has most directly benefited the Department of Defense programs. Techniques for remote observation of distant planets were easily adapted to scrutinizing activities on Earth.

Figure 1 shows the current organizational structure of NASA and reflects the guidance contained in the the new national space policy. The administrator for the "Space Station" clearly shows the near term direction for NASA.



NASA HEADQUARTERS ORGANIZATION CHART

FIGURE 1

Source: The National Aeronautics and Space Administration, "NASA Headquarters Organizational Chart," 1 October 1987.

SOVIET SPACE PROGRAM

Soviet Space Philosophy

The Soviet Union has put a lot of time, effort and money into their space program. They consider space to be an important arena both in the political and military sense. In the political sense, space becomes an opportunity for the Soviet Union to demonstrate its superiority. For example, the Soviet Union was the first to place a satellite in space, a cosmonaut in space, and a woman in space. The Soviet Union conducted these "firsts" not necessarily because of their scientific importance, but primarily because of their political importance.[4] They used this to broadcast their pre-eminence in space. In the military sense, space has become an opportunity for the Soviet Union to enhance its military posture. It was first to develop an operational ASAT and it was first to test a Fractional Orbit Bombardment System, a space vehicle that can be armed with a nuclear warhead and is designed to bypass most ground tracking systems.[5] This shows the importance that the Soviet Union places on the military advantages of space. Through its achievements, it could impress third world countries and make alliance with the Soviet Union more attractive and, at the same time, foster concern among U.S. allies.

The efforts of the Soviet Union to use space to help

achieve their political and military dominance can be seen through their philosophy on space. Their Clausewitzian nature combined with their military strategy for space has guided them in developing a space program that is designed to achieve political and military goals.

The philosophy of Carl von Clausewitz has been embedded in the Communist Party since its birth in 1917.[6] The Communist Party embraces Clausewitz's phrase, "war is not merely an act of policy but a true political instrument, a continuation of political intercourse, carried on by other means".[7] Lenin had incorporated Clausewitz's philosophy into his own and redefined war as being a violent extension of politics.[8] To the Soviets, peace is only a form of war at a lower level. During this phase, it is necessary to position oneself into a favorable military and political posture and prepare oneself for war.

The Soviets view space as an extension of its military strategy. The military importance they attach to space can be seen in the past published documents. In the the early 1960's, Marshal Vassily Sokolovsky wrote, "It would be a mistake to allow the imperialist camp to achieve superiority in this field [space]. We must oppose the imperialists with more effective means and methods for the use of space for defense purposes."[9] There are several indications that the Soviets consider space a TVD just as they do other areas of

military significance.[10] L. Tkachev states, "In the future space will become the principal theatre of military operations [TVD]."[11] This demonstrates that the Soviet Union not only considers space important for enhancing terrestrial operations, but that space will be an important military arena itself.

The military is an important part of the communist effort and, therefore, the Communist Party has given military requirements priority over other civilian needs[12]. Unable to achieve technological equality or superiority in the past with the West, the Soviet Union directed its energy towards achieving numerical superiority. They have achieved this numerical superiority in both strategic and conventional forces by allocating a large share of their GNP to support their military build-up.[13]

The Soviets continue to stress the military importance of space. A large share of the Soviet Union's most advance and productive technology is going into its military and space programs. The projected growth rate of the space program is expected to exceed overall trends in military spending. This has put an increasing demand on the Soviet economy and, for this reason, it is important to the Soviet Union that Gorbachev's modernization programs succeed. It will allow the Soviet Union to achieve their goal of a more modern, productive economy that will be able to support

advances in military and space technology without increasing their current share of the GNP.[14]

The Soviet space program has considerable military control and as such has developed some significant military applications. The Soviet philosophy is to use these military applications to gain military dominance in space through space control. Part of the Soviet space control objectives are to protect Soviet tactical and strategic strike capabilities, support Soviet tactical and strategic operations, protect the Soviet Union and client states from enemy threats, prevent enemy use of space for military, economic or political gain and enhance the Soviet use of space to further the Soviet system and goals.[15]

OTHER NATIONS

Obviously, the Soviet Union and the United States are the major players in space, but there are other players in this game that may have a significant impact on the space equation. These significant players are France, Great Britain, Japan, the Federal Republic of Germany and China.

With a rising foreign debt and a significant budget deficit, the United States will not be able to go it alone in space. Japan and West Germany have strong economies and advanced technology which may significantly aid the United States in pursuing its objectives in space. France and Great

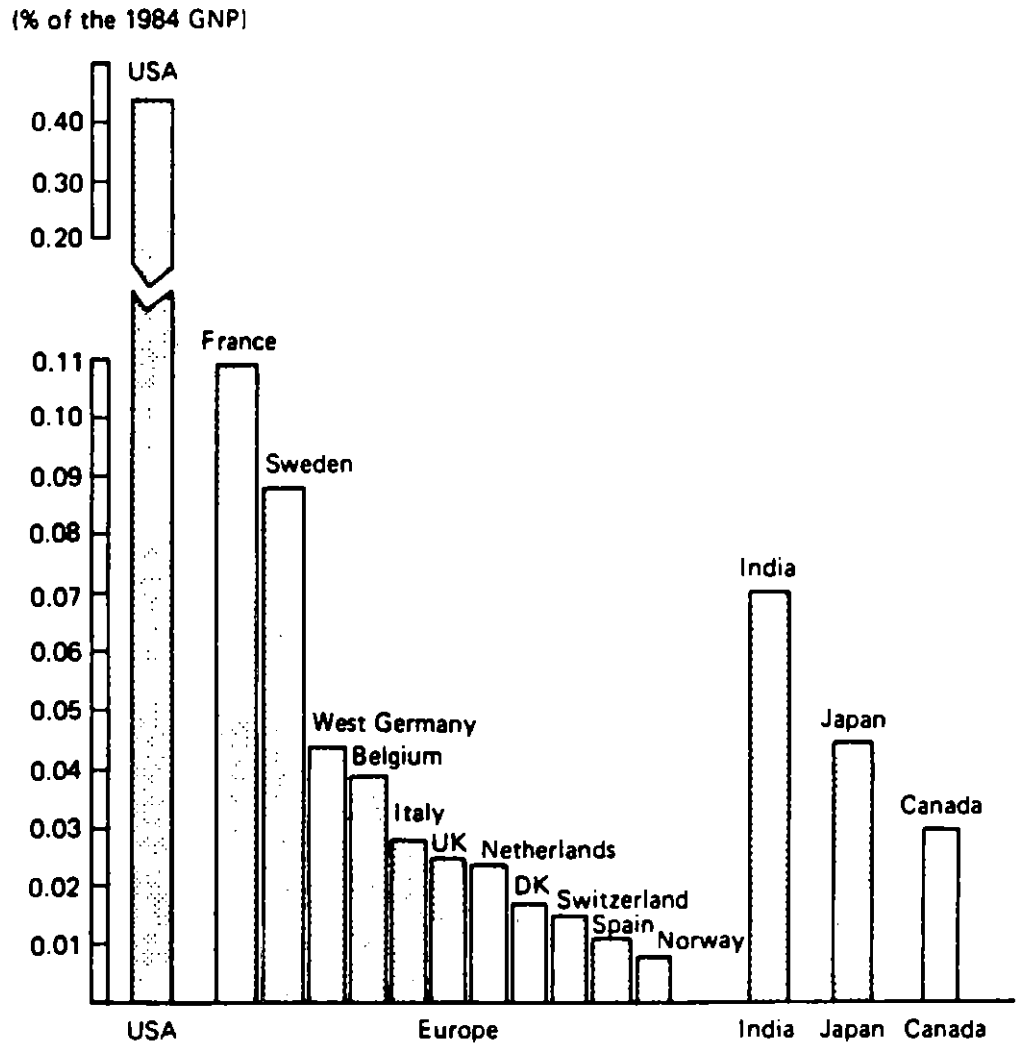
Britain as members of the European Space Agency could also be of great assistance. China will also have a significant impact on future space operations. The Soviet Union realizes the importance of these emerging national space programs as evidenced by the number of missions they have recently proposed and executed with other nations.

When assessing the international arena, it is clear that most of the major nations with significant space programs are allied with the U.S. Figures 2 and 3 show the relative budgets of the major space faring nations.

Another significant space power is the European Space Agency (ESA). Members of the ESA are France, West Germany, The United Kingdom, Italy, Sweden and the Netherlands. The ESA met in Rome in 1985 to discuss long range goals. Their future program emphasized maintaining a partnership with the U.S., particularly on the space station project and developing an autonomous European space capability. To develop this autonomous space capability, the ESA looks to develop France's Ariane 5 launcher and Hermes space plane. They also have decided to study the UK's HOTOL (horizontal take-off) space plane.[16] This autonomous ability will make the ESA a more valuable partner to the U.S. This will allow the ESA to take on an increasing share of space operations as well as foster a healthier competitive spirit of free enterprise. Due to economic constraints and

FIGURE 2

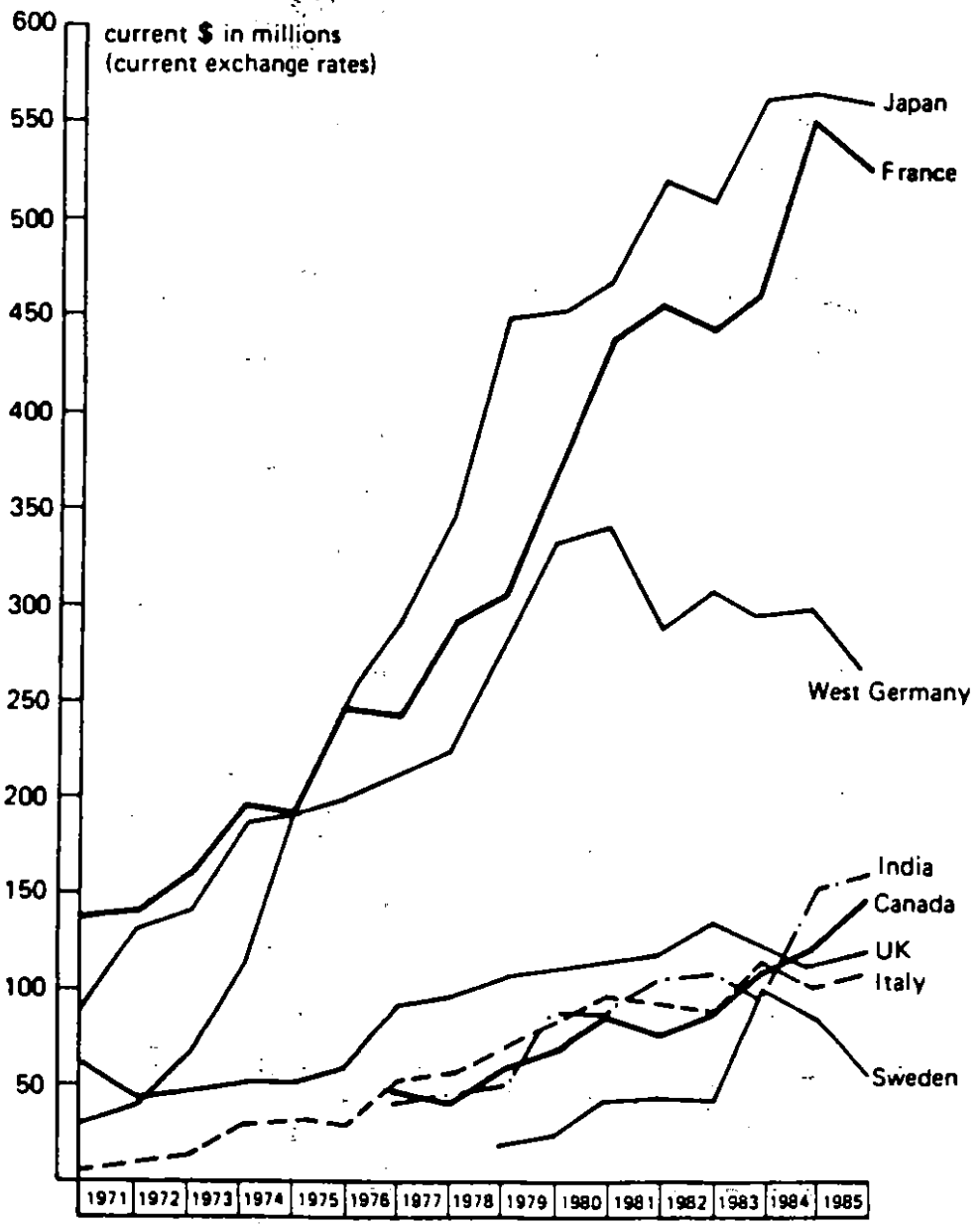
RELATIVE COMPARISON OF THE PERCENTAGE OF GNP OF
MAJOR SPACE FARING NATIONS
(EXCEPT THE SOVIET UNION AND CHINA)
ALLOCATED FOR SPACE ACTIVITIES



Source: "Euroconsult Survey of the Space Industry," Space Policy, August 1987, p. 244.

FIGURE 3

COMPARISON OF CAPITAL ALLOCATED TOWARDS
SPACE ACTIVITIES
OF MAJOR SPACE FARING NATIONS
(EXCEPT THE SOVIET UNION AND CHINA)



Source: "Euroconsult Survey of the Space Industry," Space Policy, August 1987, p. 245.

ideological similarities, the ESA will probably approach space in the same manner as the U.S., that is building long-lived, sophisticated, multifunctioned satellites.

The major significance that this has for the United States is that there are a considerable number of friendly nations that have a vested interest in space and space control. The United States must look at constructing a space alliance with the Western European nations and Japan. A Western European alliance structure, the ESA, already exists. The U.S. should look at joining this alliance in at least some limited fashion. This would give the advantage of an combined capability in space vehicles and launchers and a dispersion in location of assets and resources that the Soviets must consider. Such a coelition could indirectly strain the Soviet economy and Soviet efforts to maintain its military advantages in space.

One of the fastest growing space programs has been that of China. The Chinese space program has achieved a series of successes. The fact that these successes were accomplished without the support of the Soviet Union or the United States is significant. China has an excellent orbital tracking and rocket launcher capability. One of China's most important accomplishments has been the placing of a communications satellites in geosynchronous orbits over the Indian Ocean. These satellites are significant in providing contact with

offshore oil platforms or as relay stations for television broadcast over China. Of probably more significance is their potential use for providing an entire communications network for land, sea and air forces. Under current development is a system that will use a high resolution relief plotter. This high resolution capability will be militarily significant with regard to surface imagery scanning.[17] Given China's progress to date, they will most likely be a prominent space power in the future.

By the year 2000, the ESA, China and Japan will have significant space programs. The Soviet Union and the United States will not be the only countries vying for space control. Matters are going to become complicated and relationships will become complex. The Soviet Union will surely try to isolate the United States and any other potential enemies while pulling competing nations into its camp. It is ever so important for the United States to understand the complexities involved and be able to map out an effective strategy that will consider these emerging national space programs.

Dr. Sally Ride clearly identified this major dilemma in her controversial report to the director of NASA in August 1987:

> Leadership does not require the U.S. be pre-eminent in all areas and disciplines of space enterprise. In fact, the broad spectrum of space activities and the increasing number of space faring nations

> make it impossible for any nation to dominate in this way. Being an effective leader does mandate, however that this country have the capabilities which enable it to act independently and impressively when and where it chooses, and that its goals be capable of inspiring others - at home and abroad - to support them. It is essential for this country to move promptly to determine its priorities and to make conscious choices to pursue a set of objectives which will restore its leadership status.[18]

This situation is even more critical in military space operations. The U.S. can not currently achieve space control by itself. To effectively counter the Soviets, the U.S. must negotiate a space alliance and draft an Allied Space Coordination Plan (ASCP). Such a plan will compliment NATO and other treaties and offset Soviet wartime advantages.

CHAPTER III

SOVIET VS. U.S. CAPABILITIES

The Soviet Union has the lead over the United States in the space race. The shuttle disaster of 1986 was particularly a major set back for the U.S. space program. The U.S. has not launched a manned mission since, while the Soviet Union has been racking up record time in manned space flights. Because of this success, an American Company has contracted the Soviet Union to launch an experiment into space. Since the experiment needs some attention by the astronauts, the only alternative to the grounded U.S. manned space program was the Soviet's.[1] This is a true political victory for the Soviet space program.

What is even more frightening is the apparent lead that the Soviet Union has in military applications of space. The Soviet Union has the only operational ASAT as well as the ability to reconstitute and refurbish at a much faster rate than the U.S. There are many areas to investigate when assessing the apparent advantages that the Soviet Union has over the United States.

The Soviet Union and the United States have approached the development of their space programs in a different manner. Soviet Union has used the approach to space as it has with so many of its other enterprises. Their systems must be

simple, rugged and mission effective. Most of these systems are evolutionary in that the Soviet Union prefers to modify existing satellites rather than paying the cost of revolutionary development. This approach allows the Soviet Union to utilize known and foreseeable manufacturing techniques and technology to minimize risk in cost and failure. This simplistic approach allows the Soviet Union to incur a small cost overhead and to bring a program to fruition much sooner.[2] This approach applied to the Soviet space program resulted in a much simpler satellite system that is short-lived. This requires the Soviet Union to launch many satellites to insure continuous operations and dictates that the Soviet Union maintain a huge stockpile in order to replenish its satellites. This peacetime weakness is a tremendous wartime strength.

On the other hand, the U.S. tries to get more return on its investment by developing sophisticated space systems that are very long-lived and able to accomplish multiple tasks.[3] The U.S. satellites tend to be revolutionary, that is, the U.S. prefers to take advantage of new technology. The U.S. does not need to launch a lot of satellites and does not have the requirement to stockpile a large number of satellites to support continuous peacetime operations. In the event of a space war, the Soviet Union has the assets on hand to replace lost satellites, while the United States could not replace disabled critical assets in a timely manner. The U.S. would

loose the ability to use space to enhance its terrestrial operations.

Geographic locations of the Soviet Union and the United States have a significant impact on how these two leading space powers employ their communications satellites. The location of the Soviet Union does not allow it to reach and use geosynchronous orbits effectively for communications. Geosynchronous orbits may not be useful to the northern reaches of the Soviet Union where many of their military installations are located. Low altitude orbits are better suited to perform this mission.[4] However, non-geosynchronous, low altitude orbits suffer from two problems. First, low altitude orbits affect the lifetimes of satellites. Low altitude orbits increase drag on satellites causing accelerated orbital decay. Second, non-geosynchronous satellites do not remain stationary with respect to their position over the earth. It is necessary to launch many satellites in the same constellation in order to achieve continuous coverage over a specified area.

In contrast, the location of the United States allows it to reach and use geosynchronous orbits effectively for communications. [5] Geosynchronous orbits, being higher in altitude, suffer minimal drag and, therefore, have longer life times. Because these satellites maintain the same angular velocity as the earth, they remain in the same

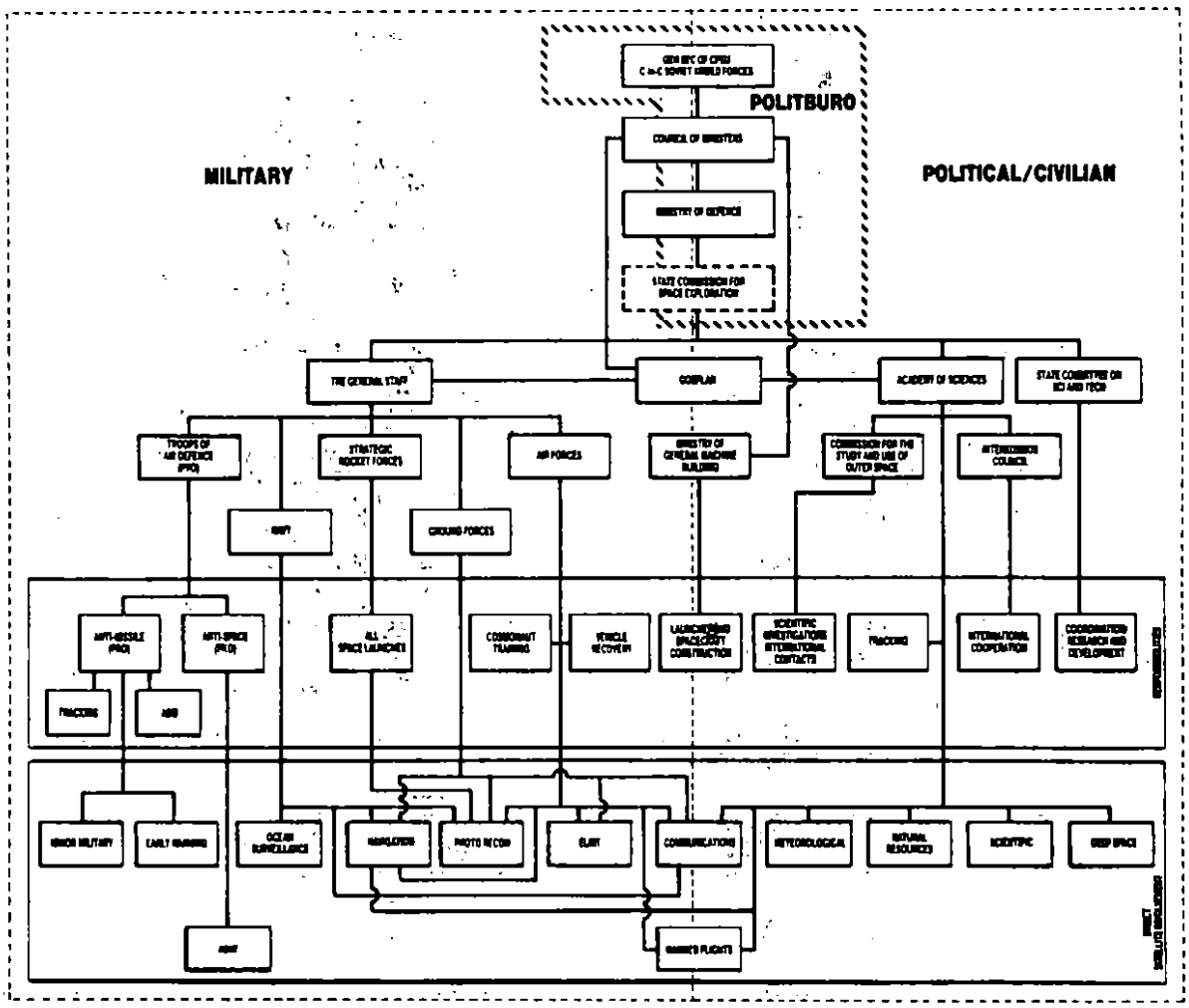
relative position with respect to the earth. Consequently, less satellites are needed for continuous coverage and this reduces the U.S.'s launch requirements.

This requirement to launch a large number of communications satellites to support the northern reaches of its country is a vulnerability for the Soviet Union that could be exploited by the United States. The U.S. could attrite these communication satellites, which are important for command and control of the Soviet northern military facilities, causing the Soviets to concentrate their efforts on maintaining these satellites. More launch resources would have to go into replacing these satellites and less into ASAT and other surge operations.

There are vast differences between the Soviet Union and the United States on how space operations are controlled. The Armed Forces of the Soviet Union control most aspects of the Soviet space program to include critical tasks of launching, vehicle recovery, cosmonaut training and most of the satellite tracking. The Soviet Union has developed its space structure to reflect its Clausewitzian philosophy. It is designed to take advantage of the military aspects of space as a potential extension of force in pursuit of their political goals. The Communist party maintains control over space utilization and the military. [6] Figure 4 shows the structure of the Soviet space program.

FIGURE 4

LINE DIAGRAM OF THE
SOVIET SPACE STRUCTURE



Source: Nicholas L. Johnson, Soviet Military Strategy in Space (New York: Jane's Publishing Company, Inc., 1987), p. 49.

In contrast, most of these same functions in the United States are under control of its civilian space agency, NASA. The United States has stressed the peaceful purpose of space and has designed its space structure to support that policy.

Since the military controls many aspects of the Soviet space program, then those space resources will be more responsive to military needs. The program has evolved from a military point of view. It has developed to enhance Soviet terrestrial operations and to survive in the realm of conflict. For the United States, there is currently no valid mechanism to transfer the control of space facilities to the military in time of crisis.

The Soviets have employed nuclear power in space on a routine basis. They have experimented with nuclear power in space since the 1960's. Nuclear power is attractive because of the relationship of its compact size to its power output. It increases the efficiency and effectiveness of many systems that rely on power output. The major drawback is the possibility of radioactive contamination during unplanned re-entry into the earth's atmosphere. The Soviets have developed methods to minimize this problem.[7]

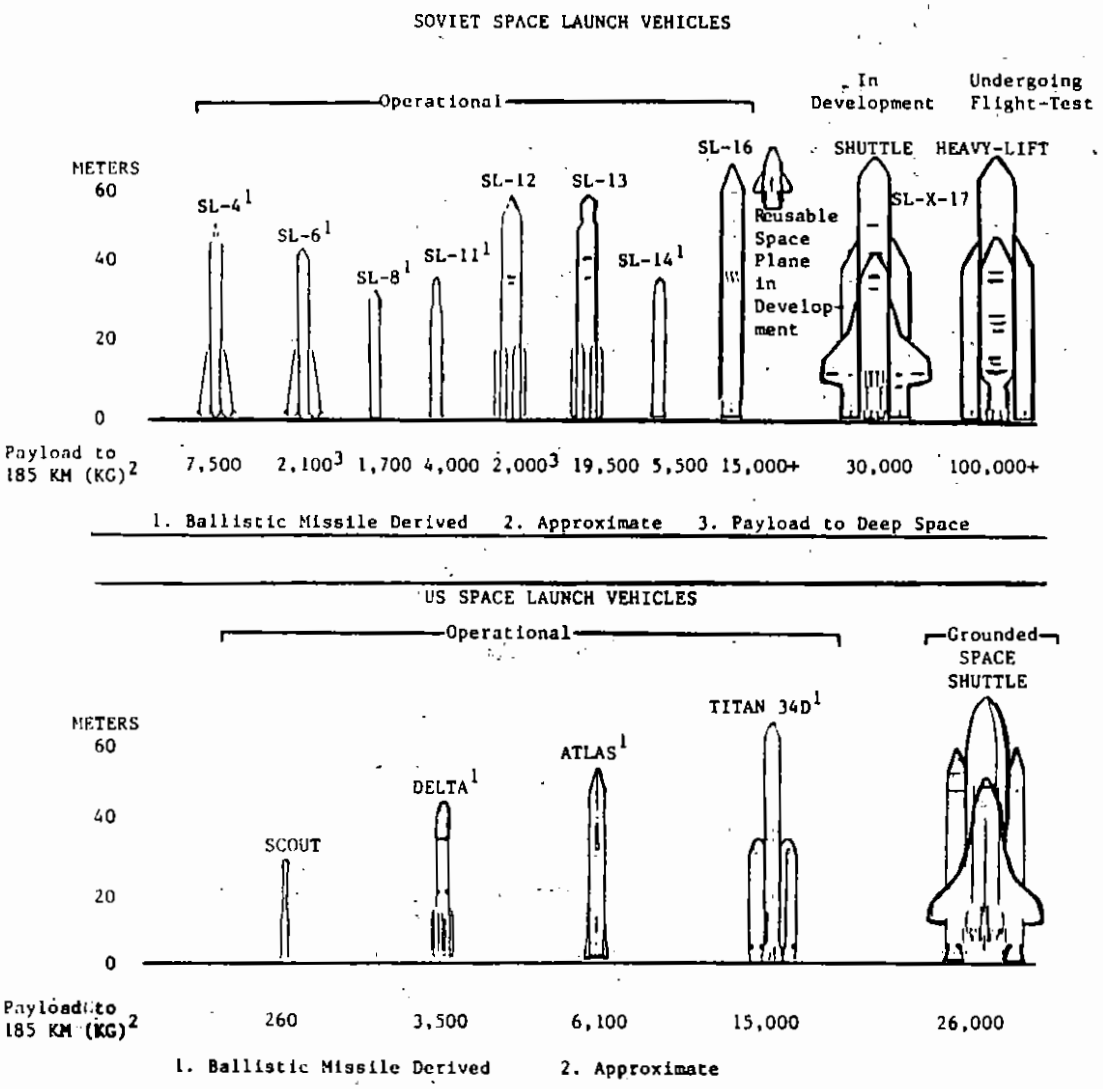
For the U.S., the use of nuclear power in space remains a sensitive political issue. Except for deep space probes,

such as Voyager II, the U.S. has refrained from using nuclear power in space.

The Soviets maintain a significant advantage in the number of space launch vehicles and lift capacity. They currently have double the number of launch vehicles of the United States (see figure 5). They are currently developing their own space shuttle and a space launch vehicle, the Energia (the SL-X-17 Heavy Launch Vehicle), that will be able to lift a payload many times the size of anything the United States is currently capable of. [8] The Energia will be the most powerful launcher ever built. It is technologically more advanced than any previous Soviet launcher. The Soviet's claim that the Energia will be able to orbit multiple-use spacecraft and heavy-gauge space equipment for scientific and industrial use. It is forecasted that the Energia will be brought into use about the year 1992. It will be used to set up a large space station that would be serviced by the Soviet shuttle. [9] Figures 6 and 7 show that the Soviets launch capability will far exceed their peace time requirements in the near future while the United States will **not** reach its peacetime requirements at its present growth rate. This lift capability will allow the Soviets to place into space directed energy ASAT's, ballistic missile defense weapons, modules for a large space station and

FIGURE 5

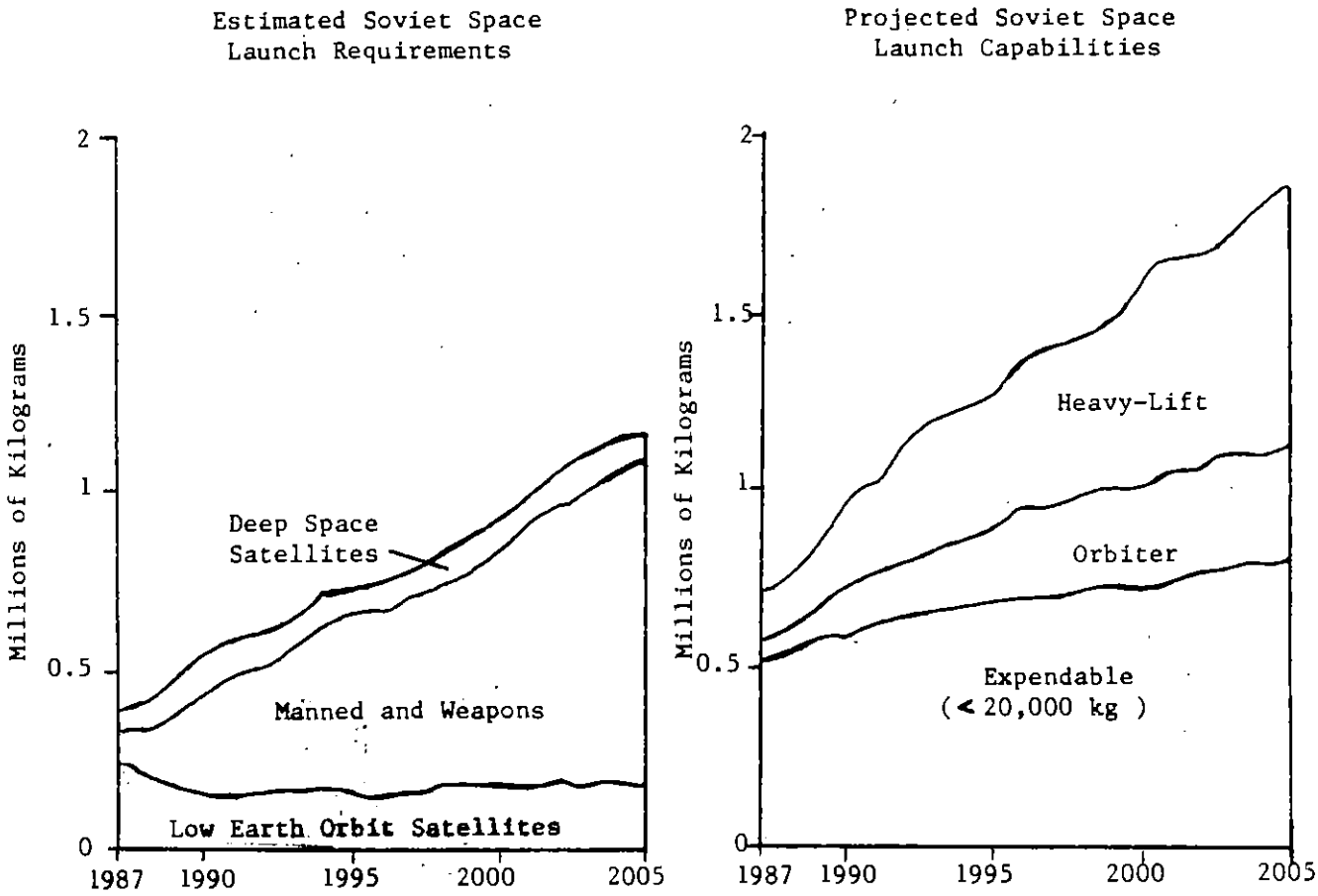
COMPARISON OF U.S. AND SOVIET
LAUNCH VEHICLES



Source: U.S. Department of Defense, The Soviet Space Challenge, 1987, p. 14.

FIGURE 6

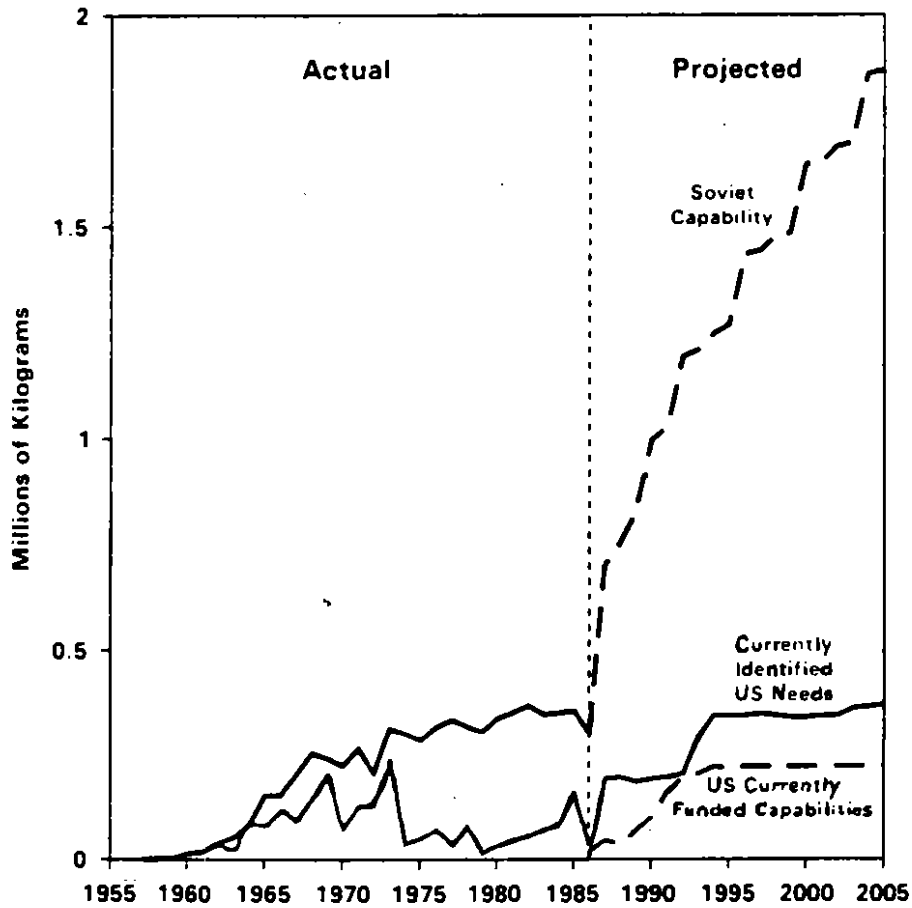
COMPARISON OF FUTURE SOVIET
LAUNCH REQUIREMENTS AND CAPABILITIES



Source: U.S. Department of Defense, The Soviet Space Challenge, 1987, p. 15.

FIGURE 7

COMPARISON OF U.S. AND SOVIET
WEIGHT TO ORBIT



Source: U.S. Department of Defense, The Soviet Space Challenge, 1987, p. 19.

components for manned and unmanned interplanetary missions.[10]

This additional lift capability plus their willingness to use nuclear power in space will allow the Soviet Union to place significant payloads in space and power them efficiently. Space-based lasers and particle beams weapons which require this power could be built and effectively used in space. These weapons are an essential part of the Soviet "Star Wars" program. This additional lift capability and the use of nuclear power is also essential to their manned Mars mission.

In the area of manned space flights, the Soviet Union has made tremendous strides. While the United States has not sent a man into space for two years, the Soviet Union has continued to stockpile man-hours in space. Soviet Cosmonaut Romanenko has spent nearly 11 months in space, bettering the old mark of 237 days, also held by a Russian cosmonaut. This is the estimated time it would take for a one-way trip to Mars.[11]

The Soviets have long been willing to take more risks than the United States in their manned space program. In many of its "firsts in space" the Soviet Union sacrificed safety, comfort and/or testing in order to be first.[12] The United States is much less resilient to failure and therefore is less willing to take risks if success is not almost 100%

guaranteed. The United States designs many backup systems into its programs and then test these backup systems until they are also 100% reliable. The perfect example of how difficult it is for the United States to recover from failure, unfortunately, was the Shuttle accident. It has severely crippled the manned space program and has been a considerable setback to NASA's prestige. Recovery from the disaster has been painfully slow. Only a series of successful missions will enable the program to get back on its feet.

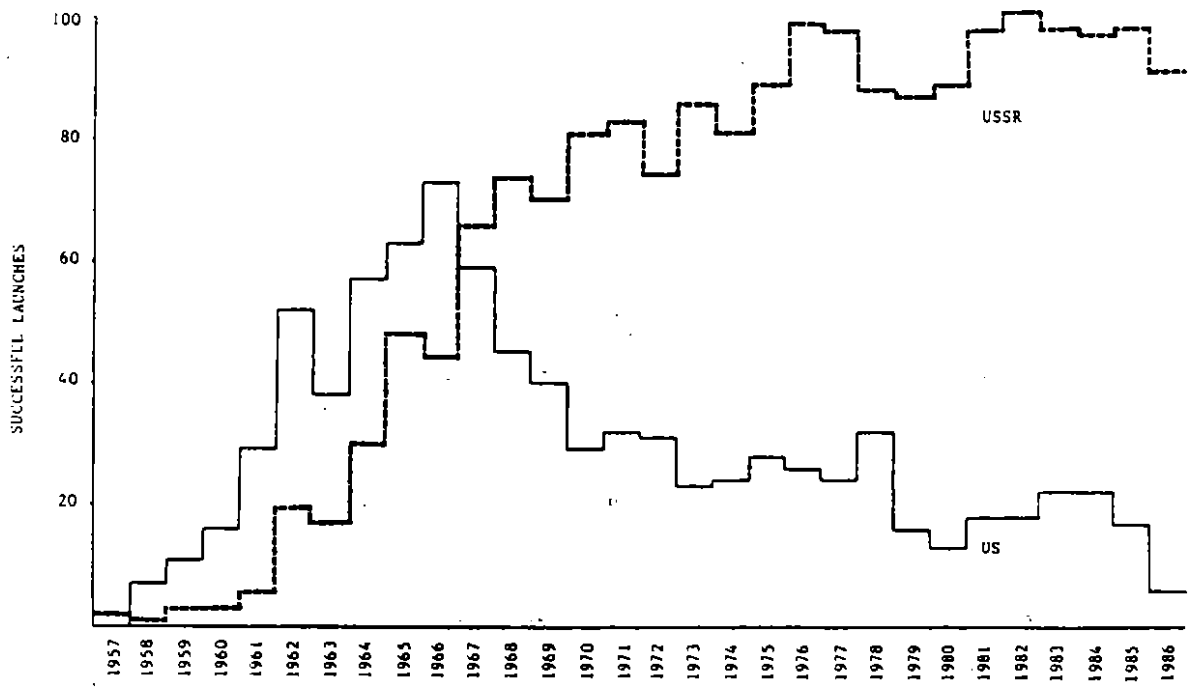
The Soviet manned space program has enabled it to get significant experience in the military applications of man in space although their stated objectives emphasize their peaceful purposes. They have gained valuable experience in being able to aim directed energy weapons. They have used laser range finders, night vision devices and optical sights in space. They have practiced techniques that will enable them to repair, inspect or disable satellites. They have conducted materials processing experiments that will enable them to produce substances with significant military applications. They have carried out earth observation experiments which can be used to locate, identify and track targets from outer space. The Soviet Union is committed to using its manned space program to achieve military superiority in space.[13]

In the late 1970's, The United States came to the conclusion that unmanned systems could do the same functions more efficiently and economically than a manned system.[14] For this reason the United States has not pursued the military man-in-space as rigorously as the Soviet Union. Today there is concern over the significant experience that the Soviet Union has obtain on the military benefits provided by putting a military man in space.

Since 1967, the Soviets have conducted more space launches than the United States. Figure 8 shows that in recent years, the Soviet Union has conducted about 100 launches a year compared to about 5 to 15 for the United States. As stated previously, there are significant reasons why the Soviet Union needs to conduct so many launches. But these reasons have given them the ability to make many launches on a fairly routine basis. This gives the Soviet Union the capability to conduct surge operations in support of military operations. This was demonstrated during the Falklands war when the Soviets conducted 28 space launches in 69 days.[15] The United States can not conduct surge operations at anywhere near the capacity of the Soviet Union.

FIGURE 8

HISTORICAL COMPARISON OF
U.S. AND SOVIET LAUNCHES



Source: Nicholas L. Johnson, Soviet Military Strategy in Space (New York: Jane's Publishing Company, Inc., 1987), p. 17.

In the past, it had been clear that the United States had the technological edge, but that edge is rapidly decreasing. Soviet satellites have been up to now plagued with poor performance and short lifetimes. They have not been anywhere near the sophistication of the U.S. satellites. However, the Soviet Union has made rapid progress in technology in the 1980's regardless of the method used to obtain it. They have devoted a considerable share of their GNP to space development. One item not reflected in their GNP is the amount of money they spend on technological transfer operations which are a vital part of their technology progress. The development of a reconnaissance satellite comparable to the U.S.'s KH-11 and the Vega probes which were used to study Haley's comet shows that the Soviet Union is capable of taking on complex tasks.[16] At their present rate of progress, it may not be long before the Soviet Union closes the technological gap. The United States which has so long boasted about its technological superiority may no longer have that advantage.

CHAPTER IV

THE NEW NATIONAL SPACE POLICY

The national space policy of the United States has been historically plagued by a lack of long term direction. The emphasis on the civilian sector and the peaceful use of space has overshadowed national security requirements. However, under Presidents Carter and Reagan, there has been a continued emphasis on the importance of space to our national security.

President Carter delegated to the Department of Defense the responsibility of identifying and integrating civil and commercial space resources into military operations during national emergencies, pursuing space systems survivability and pursuing rigorously anti-satellite capabilities not prevented by agreements. President Reagan furthered Carter's national security measures for space by initiated the SDI program and incorporating all previous policies into a single space strategy.[1] Unfortunately, these efforts were seriously hampered by the Shuttle accident and recent Soviet successes in space. President Reagan decided to revise the national space policy. The new policy was signed in January of 1988.[2]

President Reagan's new space policy commits the United States to maintain pre-eminence in space. To back up this

goal, President Reagan has also committed the monetary support for such a venture. For the military, the space policy has not changed, that is, the pursuit of national security objectives in space.[3]

To achieve pre-eminence in space, President Reagan has endorsed a Mars exploration mission and a revisit to the Moon. He has also directed the development of "pathfinder" technologies that will support these missions. [4]

The building and manning of the space station will be a key step in achieving both the Lunar and Mars goals.[5] The space station will also be valuable from a military standpoint. The space station will allow the United States to conduct military man-in-space experiments and to gain valuable knowledge and experience in the military advantages of human involvement. The United States will be able to conduct experiments such as satellite identification, recovery, refueling and repair. It will be able to experiment with equipment that can facilitate locating and targeting surface resources.

To start the United States on its goal of pre-eminence in space, President Reagan has earmarked fiscal year 89 funding to be put into upgrading the shuttle and building a balanced mix of manned and unmanned systems.[6] This will alleviate the dependence of the United State's on one primary system in which to launch payloads into space.

The new space policy also addresses other arenas that may have military significance. It will attempt to expand commercialization in space.[7] Through effective coordination between the military and the commercial sector, these commercial space assets could provide valuable diversification in time of crisis.

The new space policy has NASA taking a close look at joint ventures with the Soviet Union.[8] Politically and economically, the United States can not refuse such joint ventures. However, such programs are risky. There are inherent dangers to our national security because of the possibility of technological transfer. Much of the revolutionary technological progress that the Soviet Union has made has been the result of technological espionage. This will be a considerable opportunity for the Soviet Union to engage in such activities.

The new space policy will emphasis international cooperation in space.[9] Cooperation with allied nations will be particularly beneficial to the military. Open communications with allied and friendly nations will allow for the development of defense treaties that can include the utilization and sharing of space assets. As we have learned in the conventional and nuclear areas, the U.S. can no longer hope to be a global police force. Our Allies must share the

burden in space as well as in terrestrial defense.

The new space policy is a victory for NASA and the space community. It gives them the impetus to achieve pre-eminence in space. It is also a victory for the military. It continues those efforts that were begun under the Carter Administration. It recognizes the importance of space in support of national security. Hopefully, Congress will also see its importance, both from a civilian and military viewpoint, and fully support it. See appendix IV for the historical development of U.S. national space policy.

CHAPTER V

COORDINATION BETWEEN DoD AND NASA

Before the subject of military strategy can be tackled the interrelation between the civilian space program (NASA) and the military space program must be evaluated and several points high lighted.

Too often the competition between these two areas is overstated, but there is no doubt that they are integrally linked in terms of achieving our national objectives. Battles over "rice bowls" and "pet rocks" have developed adversarial relationships where harmony and cooperation should exist.

In her chapter on strategic option development Dr. Ride efficiently applies certain elements of business theory to the problem of developing NASA's strategic options for space leadership. Taking this approach one step further is a good way to define the civil military relationships essential for success and the future of the space program.

The business of space has expanded considerably since the 1960's. The areas of scientific research, space technology, space exploration, and space services are still open to leadership through innovation, but some are also open to leadership in more mature markets. In fact, national space

programs must look at four stages of space leadership : (1) the pioneer stage, innovation in some particular area of research, technology, or exploration; (2) the complex second stage, a continuation of a pioneering effort but with broader, more complex objectives; (3) the operational stage, with relatively mature routine capabilities; and (4) the commercially viable stage, with the potential for profit-making. [1]

The activities of a space program can be characterized by physical regions of space: (1) deep space, (2) the outer solar system (the planets beyond the asteroid belt), (3) the inner solar system (the inner planets, the Moon and the Sun), (4) high-Earth orbit, and (5) low-Earth orbit. Supporting technologies, such as launch capabilities and orbital facilities, are required to undertake all programs. [2]

The complex concept of space leadership may be broken down into logical elements to form a two-dimensional matrix. The columns of the matrix are delineated by the four leadership stages outlined previously ; the rows are the five physical regions of possible space activities, with a sixth row for supporting technologies and transportation. Each square of the matrix defines a particular area of possible leadership. [3]

This matrix analysis provides a way to conceptualize alternative courses of action and can be used to assess the

space programs of space faring nations. It is possible to be a leader in a single square through any number of different programs. [4] See figure 9.

Figure 10 compares the United States and other space faring nations from 1957 through 1977 and figure 11 continues this comparison from 1978 and projects out to 1990.

If military involvement were overlaid on this matrix it would indicate a gradual increase from the pioneering stage to the complex second stage and a peak in the operational stage. Although specific pioneering efforts such as SDI would surface as national security requires, military involvement in the first two stages should be limited to the level we see now, participation in the astronaut program and a myriad of liaison and cross training positions throughout NASA. But as a developmental technology matures into the operational stage it becomes a more lucrative target for our adversaries. Therefore more direct military involvement and control become necessary.

Accepting Dr. Rides assertion that NASA can not do every thing, these last two stages of the matrix offer great promise for developing efficient program hand off procedures. For example the dangerous launch capabilities gap precipitated by the shut down of the shuttle program could

FIGURE 9

POSSIBLE PROGRAMS TO CAPTURE
LEADERSHIP AFTER 1995

REGION OF SPACE \ LEADERSHIP STAGE	PIONEER	COMPLEX SECOND	OPERATIONAL	COMMERCIALLY VIABLE
DEEP SPACE	STAR PROBE	LUNAR OBSERVATORY		
OUTER SOLAR SYSTEM	NEPTUNE FLYBY-PROBE	CASSINI		
INNER SOLAR SYSTEM	MARS SAMPLE RETURN HUMAN EXPEDITION TO MARS	AUTOMATED ROVERS LUNAR OUTPOST	LUNAR BASE	
HIGH-EARTH ORBIT	LARGE SPACE STRUCTURES	ROBOTIC SERVICING	SPACE TRANSFER VEHICLE	SOLAR POWER SATELLITES
LOW-EARTH ORBIT	VARIABLE-G FACILITY	EARTH OBSERVING PLATFORMS	ON-ORBIT ASSEMBLY	MATERIALS PROCESSING
SUPPORTING TECHNOLOGIES AND TRANSPORTATION	NATIONAL AEROSPACE PLANE	SHUTTLE II	ASSURED ACCESS AND RETURN	COMMERCIAL LAUNCH VEHICLES

Source: Dr. Sally K. Ride, Leadership and America's Future in Space (Washington: NASA, 1987), p. 17.

FIGURE 10

LEADERSHIP MATRIX
REPRESENTATIVE ACHIEVEMENTS
1957 TO 1977

REGION OF SPACE \ LEADERSHIP STAGE	PIONEER	COMPLEX SECOND	OPERATIONAL	COMMERCIALLY VIABLE
DEEP SPACE	HUBBLE SPACE TELESCOPE INFRARED ASTRONOMICAL SATELLITE MIR KVANT MODULE			
OUTER SOLAR SYSTEM	VOYAGER	GALILEO		
INNER SOLAR SYSTEM	INTERNATIONAL HALLEY FLOTILLA COMET EXPLORER	MAGELLAN VENERA ULYSSES PHOBOS VEGA	VENERA	
HIGH-EARTH ORBIT		GLOBAL POSITIONING SATELLITE GLONASS INTERTIAL UPPER STAGE	PAYLOAD ASSIST MODEL GLOBAL POSITIONING SATELLITE TDRS	COMMUNICATION SATELLITES INTELSAT
LOW-EARTH ORBIT		SATELLITE REPAIR SALYUT SPACELAB	MIR SALYUT	LANDSAT SPOT
SUPPORTING TECHNOLOGIES AND TRANSPORTATION	STS 1 THROUGH 4 USSR SHUTTLE	STS ENERGIA H 1 ARAINE-4	TITAN IV PROTEIN PROGRESS	ATLAS/CENTAUR ARIANE TITAN 34 D PROTEIN 3 DELTA LONG MARCH

Source: Dr. Sally K. Ride, Leadership and America's Future in Space (Washington: NASA, 1987), p.19.

FIGURE 11

LEADERSHIP MATRIX
REPRESENTATIVE ACHIEVEMENTS
1978 TO 1990

LEADERSHIP STAGE / REGION OF SPACE	PIONEER	COMPLEX SECOND	OPERATIONAL	COMMERCIALLY VIABLE
DEEP SPACE	ORBITING ASTRONOMICAL OBSERVATORY-2 HIGH-ENERGY ASTRONOMY OBSERVATORY-1			
OUTER SOLAR SYSTEM	PIONEER			
INNER SOLAR SYSTEM	MARINER SURVEYOR 3 ISEE LUNA APOLLO 8.11 HELLOS VENERA VIKING 1	SURVEYOR 1 APOLLO 15 ZOND 3		
HIGH-EARTH ORBIT	SYNCOM 1.2.3 CTS INTELSAT	APPLICATIONS TECHNOLOGY SATELLITE	EARLY BIRD INTELSAT	WESTAR INTELSTAT INTERSPUTNIK INMARSTAT
LOW-EARTH ORBIT	ECHO 1 TIROS AREAL 1 SPUTNIK GEMNI VOSTOK 1 LANDSTAT	EXPLORER 1 SOYUZ 4.5 GEMNI APOLLO/SOYUZ	TIROS 5	
SUPPORTING TECHNOLOGIES AND TRANSPORTATION	SATURN 5 SALYUT 1	SKYLAB SALYUT		

Source: Dr. Sally K. Ride, Leadership and America's Future in Space (Washington: NASA, 1987), p. 19.

have been averted if the operational mission of assured access and return was diversified earlier in the life of the program. The steadily increasing military and commercial requirements clearly indicated a need for a move to a balanced launch program, responsive to the military requirements and opening up lucrative commercial opportunities. Total reliance on STS pushed NASA into an untenable situation. They were forced to try to meet the ever-increasing operational launch requirements of military and civilian programs, while attempting to keep launch cost competitive and maintain leadership in the first two stages of the matrix.

NASA must be freed of the burden of operational type activities and pursue the goals in the first two columns of the matrix. DoD through the USSPACECOM should take control of the missions such as access and return that relate to national security. And competitive commercial markets must be opened to allow the civilian sector to shoulder it's portion of the space race. A diversified approach to goals, such as assured access and return, if properly orchestrated could rejuvenate much of the robustness said to be sorely lacking in our current space community.

CHAPTER VI

STRATEGIC DEVELOPMENT

The Importance of Space

Today, space operations are extremely important to the United States given the current distribution of American forces. The United States has forces forward deployed in Western Europe, Korea and presently the Persian Gulf. The primary means of relaying information from the decision centers in the United States is through space. The loss of critical space capabilities will substantially reduce coordination between the United States and the theaters of operations, between the maritime and theater forces and between the theaters. The Soviet Union has the advantage of interior lines and, therefore, is less dependent on space for such coordination of activities. Because the United States depends more on space than the Soviet Union, it becomes necessary for the United States to develop a viable means of defending critical space assets.

It is becoming increasingly clear that military forces must be able to effectively operate in space as well as on the land and sea and in the air. A nation must be able to integrate operations in all four media to increase its chances of success. This integration relies heavily upon the rapid exchange of accurate information in order to make

timely decisions. A sound C^3I network is fundamental to such a process. The world wide military forces of the United States have such a network and they are becoming increasingly dependent upon it.

Many warfighting plans depend upon the assumption that there will be a certain amount of notification time prior to the actual commencement of hostilities. This notification time will allow the United States to prepare and mobilize its forces and resources. This notification is heavily dependent upon the C^3I system. The C^3I network allows the decision maker to see what is going on, make a decision and pass on the necessary instructions to those responsible for executing the warfighting plans. The warfighting plans of Europe and Korea are two examples that depend heavily upon advanced notification.

The SIOP also depends upon advanced notification. The assumption is that there will be enough early warning of an incoming nuclear attack that the United States will be able to launch retaliatory missiles, get the necessary bomber force airborne and secure high levels of government into a more survivable location. The C^3I infrastructure is vital in providing that early warning. The space-based C^3I assets are an integral part of this network and give the United States a valuable edge in notification time and early warning.

Since the post World War II demobilization, the United States has faithfully followed one rule in equipping and structuring its conventional and strategic forces, that is, being able to fight outnumbered and win through technological superiority. Admittedly ten years ago this concept held but a marginal chance of success. But today these capabilities are real and the lethality of the modern combined arms team in the Air Land battle or the maritime forces executing the Maritime Strategy can be devastating. The degree of this lethality is directly proportional to the degree of synchronization that can be achieved.

According to Army Field Manual 100-5, synchronization is the arrangement of the theater of operation activities in time, space and purpose to produce maximum relative combat power at the decisive point. [1] Space is absolutely essential in achieving this terrestrial synchronization. As discussed previously, this ultimate high ground provides all the ingredients of being a force multiplier for swift and total victory.

There appears to be a substantial element of our society that **scoff** at military involvement in space as a frivolous waste of time and funds. No doubt these voices have descended from the critics of the young Winston Churchill and his idea of the landship (early tank) or of the early advocates of military aviation. The theater of near earth

space and what it can offer militarily is today a reality. From the plans outlined for NASA, several other theaters in space that will require some sort of military strategy will be emerging as we progress into the twenty-first century.

Developing a Space Strategy

In order to develop a strategy for space, we must decide on a realistic Soviet strategy to work against. General John L. Piotrowski, the current Commander-in-Chief of the U.S. Space Command, generated a plausible Soviet space strategy. The essential components of such a strategy are shown in table I and figure 12. This model will be utilized with in this study in conjunction with techniques mentioned earlier as a basis for developing a comprehensive U.S. space strategy.

As stated before, the current draft of the new National Space Policy dictates three major goals for the space community. These goals, simply stated, are to meet current national security objectives, regain and retain leadership in space and rapidly increase commercial involvement in all aspects of space.

The first goal is directed primarily at the Department of Defense. DoD recognizes the importance of space and its goal of achieving space control. Space control, as defined by DoD, is to ensure friendly use of space while denying or

TABLE I

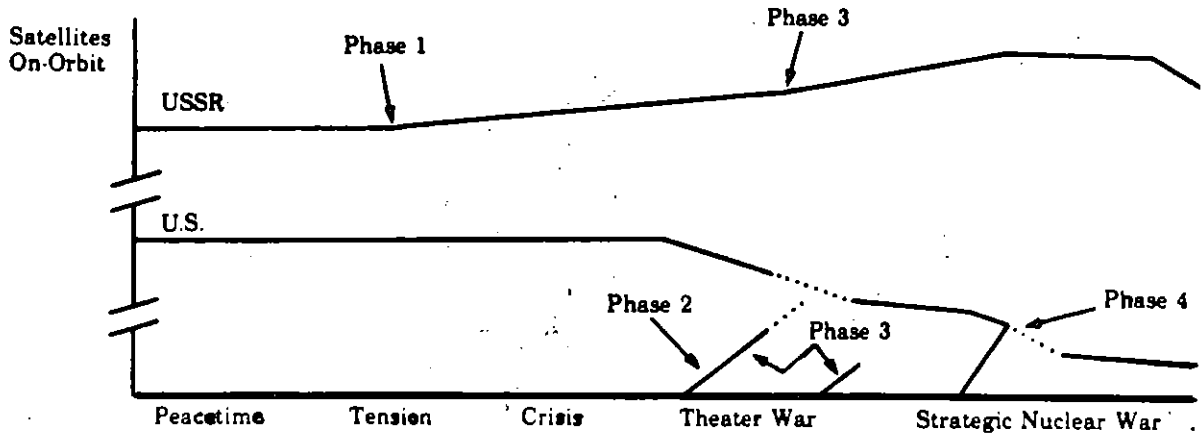
A PLAUSIBLE SOVIET SPACE STRATEGY

Soviet Goals and Supporting Actions	Outcome Desired by Soviets	Implications for U.S. and Allies
Phase 1 — Goal: Generation of space forces toward a warfighting posture.		
• Space launch surge begins.	• Rapid move to wartime space order of battle.	• U.S. and allies begin preparing additional spacecraft for launch
• Spacecraft launched and maneuvered to provide coverage of militarily significant activities and areas.	• Improved ability to locate, track and target forces. Enhanced global and localized capabilities: intelligence, navigation and environmental observation.	• Terrestrial and maritime forces and activities increasingly under Soviet surveillance.
• On-orbit spares in standby mode made operational.	• Improved command and control posture.	• Lacking a "surge" capability, U.S. and allied peacetime space order of battle must also be adequate for conflict
• MIR transitions to a war supporting role. MIR crew augmented or replaced by most experienced cosmonauts.	• Improvement in real-time force direction.	
Phase 2 — Goal: Deny U.S. and allies force-enhancement provided by spacecraft.		
• Antisatellite (ASAT) operations begin, co-orbital ASAT, laser and electronic warfare attacks. Some ASAT operations continue.	• Destruction of high value U.S. and allied force-enhancing capabilities by successful ASAT engagements.	• U.S. has no operational ASAT to respond in kind.
		• Space forces attrited at greater rate than replenishment rate.
• Sabotage and special operations against some ground supporting sites.		• Ability to support terrestrial and maritime forces degraded.
Phase 3 — Goal: Dominate space to control terrestrial events.		
• Launch surge sustained while ASAT operations continue.	• Negation of some critical elements of U.S. and allied space force.	• Losses of spacecraft in low-earth orbits must be compensated for.
	• Enhanced support to Soviet forces in preparation for strategic nuclear war.	
• Attacks against ground-based space support facilities.	• Degradation and disruption of U.S. and allied satellite control and data distribution capabilities.	• Soft and lightly defended sites lost.
		• Satellite control and data distribution shifts to mobile sites and surviving fixed sites.
	• Creation of gaps in U.S. and allied coverage and reduction in timeliness of data distribution.	• Disruptions and delays in command control and logistics communications.
Phase 4 — Goal: Soviet victory.		
• Attacks against entire U.S. and allied space infrastructure.	• Damage U.S. and allied infrastructure to degree all military utility is lost.	• Launch complexes lost, most satellite control facilities lost, on-orbit spacecraft slowly degrade.
	• Deny U.S. and allies ability to coordinate retaliatory and reconstitution activities.	• Retaliatory and reconstitution actions coordinated by other means.

Source: GEN John L. Piotrowski, "A Soviet Space Strategy," Strategic Review, Fall 1987, p. 59.

FIGURE 12

MODEL OF A
PLAUSIBLE SOVIET SPACE STRATEGY



Source: GEN John L. Piotrowski, "A Soviet Space Strategy," Strategic Review, Fall 1987, p. 58.

limiting enemy use of space when so directed by the National Command Authority. [2] The U.S. Space Command is the DoD agency that has primary responsibility for space control.

Applying the first step in the proposed strategic development process, the question, "What conditions must exist to achieve DoD's goal of space control?" must be answered. Four conditions evolve at this point. They are assured access, maintaining an effective C^3I network, protection of critical space-based and ground/sea-based assets and possessing the capability to negate enemy space-based and ground/sea-based assets. These conditions will remain fairly constant through out the spectrum of conflict, but their emphasis will change.

A comprehensive strategy must address these four conditions as they apply to all levels of conflict. The spectrum of conflict is divided into the following phases: (1) peacetime-tension-crisis, (2) conventional war and (3) strategic nuclear war and conflict resolution.

PHASE I

Space Strategy

During

Peacetime-Tension-Crisis

BACKGROUND

During this part of the conflict spectrum, The Soviet Union can be expected to commence actions designed to enhance warfighting capability. The Soviets will activate their on-orbit spares and conduct surge operations to complete or reinforce their critical force-enhancing satellite constellations. The Soviets would increase the number of their intelligence collecting satellites. They would begin preparation of their manned space station for military actions. They would prepare current ASAT and other protection/negation systems for future use. [3]

The desired outcome for the Soviets would be to enhance their capability to conduct surveillance operations against the United States and allied nations, improve direction and C^2 capabilities and enhance global and localized intelligence, navigation and environmental observation capabilities. [4]

Conditions

The four original conditions of space control apply here but the emphasis and priority on each differs. It is not the

intention of the Soviet Union to negate U.S. assets during this phase. Therefore, the four conditions of space control are modified follows:

1. Maintain a full range of C^3I capability from space.

2. Enhance assured friendly access to space.

3. Enhance capability to protect friendly critical space assets.

4. Be prepared to conduct effective negation operations against key enemy space assets.

"Maintain a full range of C^3I capability"

Sequence of Actions

During this portion of the spectrum, all actions of the United States should be oriented towards achieving a credible deterrence posture and showing resolve. The first action would be to launch the necessary C^3I satellites to fill gaps in the C^3I constellation. This action would enhance U.S. surveillance and C^2 capabilities. The second action would be to launch on orbit spares that could be recalled rapidly to replace C^3I satellites that were rendered inoperative. The third action should be continuous development of hardened satellites. The fourth action should be the coordination of space activities between DoD, NASA and the commercial sector to insure unity of effort. The Fifth action should be

coordination between U.S. and allied nations on mutual conduct of space operations. This coordination should involve delineating responsibilities and integrating assets.

Application of Assets, Present and Near Future

The United States should build and be prepared to employ survivable C^3I satellites in order to support present national security needs. The U.S. should step up industrial production to stockpile critical space assets.

USSPACECOM should accelerate planning to integrate the identified critical C^3I assets of NASA, and the commercial sector as the spectrum of conflict increases. This action should become part of a proposed Space Mobilization Plan (SMP).

Additionally, coordination with allied nations should be conducted to integrate their key critical C^3I assets. This should become part of the Allied Space Coordination Plan (ASCP). The ASCP will be designed to integrate all phases of space operations into a unified, synchronized allied effort.

"Enhance Assured Access to Space"

Sequence of Actions

The first action should be the coordination between DoD, NASA and the commercial sector on the use and responsiveness

of launch facilities and key personnel for military requirements. The second action is to develop and have on-hand the necessary number and types of launch vehicles to meet national security requirements in space. The third action should be coordination with allied nations to insure a synchronized launch effort. The fourth action should be to build additional launch sites within the U.S. This action must occur during peacetime. The fifth action should be to redesign current launch facilities with the purpose of decreasing refurbishment time.

Application of Assets, Present and Near Future

Launch facilities are critical in maintaining assured access in space. Currently the U.S. has two launch facilities. Both are located near a coast line and present easy targets for sabotage. Even though it is not a problem during peacetime, it could become a problem during times of increased tension. The United States should build at least two additional launch facilities well within the confines of the United States. The Army Corps of engineers should be the agency responsible for the supervision of the construction of new launch facilities. This will ensure that they are constructed in harmony with the Space Mobilization Plan. Commercial space firms will be contracted to do the detailed construction and be allowed to lease these facilities during peacetime.

The United States does not have a wartime surge capability. The Army Corps of Engineers should be the agency responsible for supervising the reconstruction of current national launch facilities in order to reduce refurbishment time. The Space Mobilization Plan will include identification and programming of civilian construction assets essential to refurbishment in times of crisis and war.

The U.S. should coordinate launch activities with allied nations and incorporate them into the Allied Space Coordination Plan (ASCP). The ASCP will identify launch facilities as well as essential wartime coordination procedures for allied launch control. This will facilitate the surge rate required by the United States plus give additional launch facilities at diverse locations.

The United States needs to insure that it has the number and types of vehicle launchers on hand. USSPACECOM must identify the quantity required and industry must develop the surge capability to meet these requirements. This quantitative information and the accelerated industrial procedures will also become part of the Space Mobilization Plan.

The U.S. needs to develop a heavy lift launcher in order to support SDI and the space station. This launcher will also support launch surge operations. NASA should lead this development effort, consistent with its redefined role.

"Enhance Friendly Protection Capabilities"

Sequence of Actions

The action required for the U.S. during this phase is to develop resources and establish procedures that would protect critical C^3I assets and be prepared to accelerate this process if the spectrum of conflict increases.

Application of Assets, Present and Near Future

Protecting satellites falls into two categories, passive and active measures. Passive measures include hardening and the ability to maneuver. The space shuttle and the manned space station should rehearse satellite refueling operations regularly to enhance satellite maneuverability.

The U.S. currently has no active resources to protect critical satellites. Continued funding and development of SDI is critical. Since SDI is designed to destroy intercontinental ballistic missiles, it will also be able destroy any threat ASAT that the Soviets might launch. Until SDI reaches a operational stage, the U.S. should continue to develop an ASAT weapon that will be able to destroy threat satellite systems.

Launch facilities, launch systems, space industries and key personnel offer lucrative targets. The Space Mobilization

Plan should include the use of local, federal and military police forces to provide protection to these assets.

Control stations outside the United States are also lucrative targets. The U.S. will have to plan for their protection.

The United States must coordinate with allied nations to insure integration of protection activities. Key assets and facilities will have to be identified and responsibilities agreed upon. These agreements and associated contingency plans will be included in the ASCP.

"Be Prepared to Negate Key Enemy Assets"

Sequence of Actions

Having a credible negation capability when coupled with the other sections described above, will act as a deterrent to Soviet hostile actions in peacetime. It also provides the U.S. the capability to negate Soviet assets if hostilities spill over into space in time of crisis. The existence of a well coordinated Space Mobilization Plan will also greatly enhance deterrence. First the United States should develop an interim ASAT to fill the pre-SDI negation gap. Next, targets in the following areas must be identified and prioritized: Soviet orbital ASAT's, satellites oriented against critical allied areas of interest, key ground and

sea-based space control centers, critical components at Soviet launch sites and finally, essential Soviet space personnel. Lastly, coordination for negation operation with our allies must be initiated and included in the ASCP.

Application of Assets, Present and Near Future

As stated previously, the U.S. should continue to aggressively fund and develop SDI. USSPACECOM should have control of this project to expedite the assimilation of emerging systems. Until SDI reaches an operational stage, USSPACECOM should also develop an interim ASAT capability without delay.

The USSPACECOM J2 should identify and prioritize key satellites, key launch facilities, key ground/sea control stations and key personnel. The J3 in conjunction with elements of other Unified and Specified Commands should integrate space related targets into consolidated targeting plans. These priorities and actions should be coordinated with our allies and the agreements documented in the ASCP.

PHASE II

Space Strategy During Conventional or Theater War

Background

When this point in the conflict spectrum is attained the Soviets can be expected to become increasingly belligerent. Soviet ASAT attacks become more overt, as do attacks against U.S. and allied ground-supporting space infrastructure. The Soviet goal during this phase is, quite simply, to dominate space in an attempt to increase their ability to control the outcome of terrestrial events. [5]

The plausible outcomes desired by the Soviets would include: negation of critical force-enhancing elements of the U.S. and allied ground-support space forces; degradation and disruption of satellite control and data distribution capabilities; and the creation of exploitable "gaps" in the U.S. and allied space coverage or services, including a reduction in the timeliness of data distribution. [6]

Simultaneously, the Soviets would probably continue their launch surge to strengthen support to their forces in preparation for widening or escalation of the conflict. If such Soviet operations were successful, the implications for the United States and its Allies would be serious. [7]

Conditions

The four original conditions that were defined at the

beginning of this chapter apply here as well but the emphasis and priority on each shifts with the increased levels of conflict. It is assumed that some satellites have been attacked and unrestricted negation operations have commenced. The four conditions are now:

1. Continue to protect friendly space assets.

2. Continue assured friendly access to space.

3. Regain and retain the full range of C^3I functions from space.

4. Negate critical enemy space-based capabilities.

"Protection of friendly space assets"

Sequence of Actions

Currently, the most critical elements in the U.S. Space community are the personnel that direct each phase of a space system launch, component assembly, orbital insertion and system activation. In the case of STS launches and the space station, the astronauts themselves are critical. The people occupying many of the key position represent lifetimes of institutional memory and critical experience. At a very minimum technicians require several years of hands on experience. Due to the sophistication of most of our systems they are often hand assembled by industrial teams supervised

by a small number of system experts.

Next in critical consideration are the key space facilities of the U.S. and her allies. Our limited number of launch facilities and their proximity to the coastline and the world wide dispersion and isolation of our tracking and control facilities place them next in the priorities for protection.

Third priority protection would be the extremely limited quantity of friendly launch vehicles (STS or ELV) remaining to the U.S. and the allies.

Fourth priority is protection of back up or replacement systems available for launch.

Lastly, protection of on orbit assets rounds out the definition of protection of friendly assets during this stage of conflict.

Application of Assets, Present and Near Future

For the near term then our first priority must be to identify and safe guard key individuals within the space community. As was discussed earlier, the diversification of operational and routine functions such as satellite launch must be expedited. Transfer of similar procedures from NASA to the military and civilian components of the space

community will eventually broaden the manpower base for many war time critical functions. Careful negotiations and follow on technical coordination with our allies must be initiated prior to the start of hostilities to guarantee the maximum amount of interoperability of these critical human assets.

Before sufficient distribution of space functions can be achieved the responsibility of safe guarding key personnel will be extremely difficult in our society as our experience with terrorists over the past several years has taught us. An extremely well coordinated effort between local police and federal authorities will be required. Plans to move key individuals and their families to secure temporary quarters should be executed immediately when open conventional warfare is initiated. As stated previously the long-term solution to this problem is the creation of redundant numbers of personnel qualified to do these functions.

Protection of key facilities posses an equally difficult problem. Those facilities outside the U.S. boarders offer particularly desirable targets, since the Soviets have no comparably vulnerable facilities. The solution appears to be creating highly mobile systems that can be positioned quickly to fill a gap created by the destruction of one of the fixed installations. This combined with reasonable hardening of the structures and components and viable contingency protection plans would improve their survivability. The two U.S. launch

facilities and their proximity to the coastline make them ideal from the standpoint of range safety but increases their vulnerability to raids or long range conventional weapons. Contingency plans must be developed for the defense of these facilities as well as construction of at least two more facilities further inland. Hopefully the commercial elements of the space community can assist in this project.

The protection of both launch vehicles and back up systems is directly linked to the survival of the launch facilities. The most opportune time to strike either facility would be during a pre-ignition count down, thus striking the launch facility, the launch system and the space system simultaneously.

Protecting on-orbit assets is extremely difficult. As discussed earlier the absence of an ASAT system narrows the alternatives to two; hardening and maneuvering, each of which has associated costs. Hardening cost, are basically up front. Development, assembly and increased payload weight add significantly to the cost of the space system. Maneuvering uses fuel and decreases the life of the particular space craft. This goes against our whole design theory of large complex satellites remaining on-orbit for long durations decreasing launch requirements. On-orbit refueling seems to offer some promise for the maneuver strategy. Several shuttle fights have tested parts of the refueling system. The space

station may become the ultimate answer to this problem. The technologies under development for the Strategic Defense Initiative offer the greatest promise for protecting our on-orbit assets. Although SDI is billed as the ultimate defense against strategic ballistic missile attack, it can easily be employed to protect friendly space assets and to eliminate enemy capabilities as well. This secondary mission could potentially have as great an impact on the balance of power as the elimination of the nuclear threat, particularly during periods of conventional conflict.

"Assure Friendly Access to Space "

Sequence of Actions

Assured access and protection of friendly assets are very closely related during this stage of the conflict spectrum. However, some of the factors that were considered negative with regard to protection may be beneficial to achieving assured allied access to space. The dispersion of friendly launch sites is one such factor. Careful coordination of all allied launch facilities in the execution of deceptive and real launch activities could spread Soviet surveillance and interdiction capabilities thin enough to achieve successful launches as required. The effectiveness of such a strategy could also be enhanced through careful synchronization of launch activities with other major theater

events.

Application of Assets, Present and Near Future

Coordination of launch activities during war time should logically fall on the shoulders of CinC Space as we move into conventional war. Mobilization and hand off procedures must be worked out a long time before this stage is reached. These components of the Space Mobilization Plan that include NASA and civilian launch facilities, as they become available, must be exercised on a regular basis in peacetime to insure a reasonable degree of success in war.

Emerging miniaturization technologies such as GIGI Scale Integration (GSI), allowing one billion components per micro chip[8] , will substantially decrease payload size and weight. This in turn enhances the feasibility of some recent innovative small payload launch ideas. Procedures for employing ICBMs as boosters and B-52 drop launch technologies, similar to those used to launch the X-15, will become increasingly important supplements to standard launch operations.

Coordination with our allies is politically complicated, but must be pursued aggressively. During war, there appears to be a need for an Allied Commander for Space. This position and the mechanism for selecting it must become part of the proposed Allied Space Coordination Plan. This

command would have the mission of coordinating the activities of all allied space facilities and synchronizing those activities with other major maritime, ground and air campaigns.

"Regain and Retain C^3I Functions"

Sequence of Actions

Hopefully, the actions taken to protect space assets will have substantially lessened the downward slope of the curve in figure 12 (page 53). But some loss of systems will have to be assumed at this point. Furthermore the majority of the losses will be assumed to be extracted from the low earth orbit reconnaissance satellites and to a lesser degree higher altitude communication and position location systems.

The first action would be to activate any on-orbit spares that exist. Next, the launch of any additional spares should begin. Thirdly, the planned reprograming of NASA and commercial on-orbit craft should begin. And finally, informational links to allied space assets should be activated and orbital adjustment negotiated to quickly fill any gaps in coverage.

Application of Assets, Present and Near Future

The development of on-orbit spares will be of critical importance in a strategy designed to defeat the Soviets surge

operations and anti satellite capabilities. On-orbit spares should be the preferred method of storing spacecraft because of the extreme vulnerability of hostile launch operations discussed earlier. U.S. Space Command should use the dispersed launch theory, described in the last section as part of the ASCP, to ensure the successful launch of any additional system on the ground at this stage of the conflict.

Closer ties between USSPACECOM, NASA and commercial owned satellite companies will need to be established and solidified as another portion of the Space Mobilization Plan. This section of the SMP will incorporate a detailed analysis of each non-military payload quantifying its value as a possible strategic asset, prioritizing it with all other non-military space craft and finally based on that priority, developing the communications protocols and additional software required to assume control of each space craft during a time of national crisis.

Similar coordination must be initiated through the State Department to our allies to establish at a minimum, a workable network for acquisition and fusion of allied space information and the utilization of communications channels. As each of these political agreements are reached they must be incorporated into the ASCP.

"Negate Enemy Space-Based Capabilities"

Sequence of Actions

At this point in the conflict spectrum negation of enemy assets is openly feasible for the first time. The absence of friendly ASATs will force the Allied Space Command into implementation of plans to strike the other critical nodes of the Soviet space structure. Attacks on the Soviet Motherland may not be politically out of the question. This will depend on how deeply Soviet territory has been touched by the hostilities and the nature of Soviet attacks on U.S. territory.

Negation actions will be divided into two cases, one in which ASAT weapons are assumed to exist and one in which they do not (as is the present state of affairs). In the first case the first action would be to eliminate all co-orbital Soviet weapons. Then, in conjunction with the plans of the other theater commanders, selected surveillance and communications satellites would be destroyed creating strategic gaps in the Soviet coverage. Next priority would go to maintaining those gaps as long as the operational situation requires. Any attempt to replenish these gaps or launch an ASAT would be terminated in the boost phase. Conventional strikes on space support targets within the

Soviet Union would be avoided unless attempts were made on similar U.S. or Allied installations.

Case two, a situation similar to the present where perhaps only a few experimental ASAT weapons exist, creates some very difficult choices with potentially grave political consequences. The limited ASATs would be employed against key targets designated to support the activities of the other theaters of operations. The remainder of the critical targets all lie with in the Soviet borders. These include, in order of disruptive potential; key Soviet space personnel, launch facilities and space systems and components awaiting launch. The key personnel assets of the Soviet union are even more critical then our own. Given the compartmental structure of the Soviet organizations, the chances for key individuals to become essential to specific space related functions appears to be higher than in our own system.

Application of Assets, Present and Near Future

The near future offers a myriad of options for the destruction of on-orbit space craft. The more subtle being ground and space-based lasers and directed R-F weapons and the more overt being particle beams and kinetic energy weapons. All of these developments are generated from the Strategic Defense Initiatives and controlled by USSPACECOM.

Attacking targets within the Soviet homeland will

require careful coordination between several unified commands and our allies. The best strategy would employ a combination of conventionally armed Cruise missiles, Special Operations Forces and carefully planned fifth column activities. The Special Operations plan would need to contain a highly sophisticated psychological operations annex directed at minimizing the impact of striking well within the Soviet Union and particularly against Soviet citizens. The utilization of such controversial measures must be painstakingly metered against Soviet attempts against U.S. territory and personnel. The potential for such actions to push the conflict into the strategic nuclear level is very high. The mere consideration of such an option makes a very strong case for continued aggressive development of SDI technologies as the lessor of two evils.

PHASE III

Strategic Nuclear War

and

Post Conflict Settlement

Background

When this stage is reached the entire space infrastructure comes under attack as the Soviets strive for "Victory in War". Their broad aims in global war would be to impose defeat or surrender on the United States and its allies by disrupting and destroying their military forces, to limit damage to the Soviet political, military and economic structures, and to set the stage for domination of the post war world. [9]

Conditions

Due to the expected brevity of this stage of conflict the conditions that would lead to our national goals are directly tied to any post war settlement we might contemplate. Furthermore, space-based surveillance may be the only means of gaining a true picture of the enemies status in the extreme confusion following a nuclear exchange. The conditions remain relatively the same.

1. Protect remaining friendly space assets.

2. Re-establish friendly access as soon as possible.

3. Regain full range of C^3I functions.

4. Totally negate Soviet space-based capabilities.

Sequence of Actions

Total denial of Soviet access to space is an extremely effective bargaining chip for post conflict negotiations, particularly if our SDI systems have been even marginally effective in preventing serious damage to the continental United States. The need for quickly obtaining accurate post strike assessments of damage and environmental status will be vitally important in effectively negotiating the nature of the post war world. The side that has the clearest picture of their situation and that of their enemy's will definitely have the upper hand.

The enormously difficult problems of minimizing residual casualties through accurate fallout prediction and monitoring world wide radiation levels can most expeditiously be accomplished from space. Therefore the final stage of our strategy must be directed toward preserving our space capabilities and completely eliminating our enemy's space forces.

Space support facilities must take a high priority as targets. They will generate favorable post conflict results with minimum civilian casualties. The total destruction of

these facilities coupled with the short life cycle design philosophy of the majority of Soviet space craft would lead to the inevitable U.S. domination of space.

Application of Assets, Present and Near Future

The execution of the actions described above would result from coordinated target sequencing between the USSPACECOM, using their Strategic Defense Initiative weapons, and the Strategic Defense Command's Nuclear forces. Proper sequencing of the destruction of surveillance platforms and ground targets would generated the maximum ground effects by eliminating warning and preparation time. Once again these actions must be carefully coordinated by the proposed Allied Space Command, thus insuring that the final conditions established for negotiations are favorable to our allies as well.

CHAPTER VII

CONSIDERATIONS FOR THE FUTURE

The strategy developed in the previous chapter provides direction for dealing with the problems of the immediate future, approaching the year 2000. During the course of this study and in our brief review of the history of space exploration, a common problem has grown into a recurring theme in our space community. This problem is the definition of the roles of the military and civilian components of the space community. Within the military, the individual service roles are undergoing the same confusing and sometimes redundant evolution. Definition of specific roles is a critical adjunct to strategic planning. The components of any organization must clearly understand their general mission before they can apply themselves in the process of strategic development.

Strong, if not dictatorial, role definition is ingrained in the Soviet space system and gives it great strength and consistency. But the restrictive nature of thought imposed by their society restricts their progress to that of evolution. On the other hand, within our space community stronger role definition when coupled with a freer thought environment can produce revolutionary progress.

National Structure and Role Definition

As was stated previously the basic principles of our society dictate a peaceful, purely exploratory, for the sake of knowledge, lead in our space program. This is clearly NASA'S role. To maintain the freedom and momentum demanded by this role, NASA must be capable of handing off functions that appear to be developing into routine operations, common to the entire space program, or essential to other elements of the space community. If the operation is critical to national security it should be passed to DoD. If the operation is viewed as having high economic potential it should be passed to the commercial sector. Then each of these elements of the community could fully develop the function to meet the requirements of their portion of the national goals and objectives.

Further scrutiny of the current situation within the Department of Defense with regard to role definition for space reveals similar disorder or at least a structure that has been permitted to evolve on its own without regard for truly long-term role or general mission definition. The following section represents a way of infusing long range organizational structure into DoD's contribution to the space community.

Conventional Structure Applied to a New Arena

As NASA begins to stretch the perimeter of the definition of commonly usable space, the Department of Defense must redefine its involvement and the mission of its subordinated organizations, in particular the individual services. There seems to be two distinct schools of thought on how to approach this problem. One postulates that to deal with the unique problems of this new arena, a new service should be created. This point of view will not be explored in this study. An alternative to this idea is to retain the current force structure and apply it to this new, expanded space environment.

Currently, each service is struggling to define their mission in "space". The major flaw in the majority of this thinking is that the plans are based on a very limited definition of space. This definition of the environment does not extend beyond earth orbit. NASA is rapidly expanding that operational environment with its recently announced Lunar Outpost and Manned Mission to Mars.

Traditional roles for each of the services are logically based on three environmental mediums for combat, with each service developing transitional elements to support operations across these environmental boundaries.

The Army is the primary land power with transitional

elements such as Army aviation and very limited water born assets. The Navy is the principal power on the sea with transitional elements for sea related, air and land operations. The Air Force completes the coverage of the three dimensions as the master of the atmosphere.

Furthermore, dividing these roles by operational environments has created specific doctrinal thought patterns that govern the nature of combat in these environments. Change to these thought patterns has been slow and evolutionary on a relative scale, caused by changes in technology. The Air Force, being the youngest service, exists to control the air and then use the air to project its firepower to the land or sea. It has a tendency for high velocity combat for relatively short durations. The Navy's prime mission is control of the seas. Its tendencies are for long term operations of fleets composed of large vessels carrying many people in a hostile environment. The Army is designed to control large land areas for very long durations.

By drawing a few analogies between space and our current military operational environment, we can easily translate the current service missions into meaning full divisions of effort for the distant future as well.

First of all, Earths land masses translate into the firm surface of any planet or planet like surface we might encounter. Next, define another boundary as the atmosphere

and orbital space around any planet, perhaps out to an orbital/space transfer point, as what we now call air. And finally the channels of free space between planets and other stellar objectives as what we now consider the sea.

With these mental translations in place the current roles of each of the services are easily transferred to future missions. The Army will be responsible for terrestrial type missions. The Air Force takes on the responsibility for planetary atmosphere and free space out to the orbital transfer point. And the Navy, much as it does today in the Maritime Strategy, becomes responsible for maintaining space lines of communication and commerce.

Such a re-definition of roles would also simplify some of the territorial or functional disputes currently frustrating some of our military space efforts. The Air Force would clearly retain and expand its current role with complete control of near earth space and all the assets related to it, to include SDI. The Army could begin to concentrate on developing the leap-a-head technologies required for sustained activities on the moon and possibly Mars. This would include, for example, expanding the Corps of Engineers role in space construction techniques and life support functions peculiar to the environment of each new planet. In fact each branch of the Army would have a full plate of new missions and developmental challenges associated

with space. The Navy would prepare for its role by developing space craft capable of enduring the rigors of long interplanetary space travel. This would necessarily include development of a small fighter like craft for close in fleet protection analogous to Naval aviation and eventually a fleet landing force analogous to the Marines, specializing in landings on hostile planets.

Long range role definitions such as this can greatly expedite the development of future strategies by distributing the probable areas for strategic thinking among all the services at a very early stage. It also provides a great deal of focus for their long range research and development efforts. For instance, much of the work the Army is performing now in the creation of encapsulated environments with relation to to chemical warfare could also be applicable to life on a planet with a hostile atmosphere.

The concept of unified commands and joint staffs would also be used very effectively as these new environments are added to the military's area of responsibility.

CHAPTER VIII

CONCLUSIONS

Space control is a vital component of our national policy at present and will increase in importance at a phenomenal rate in the foreseeable future.

In peace time the sophistication and long orbital life of U.S. Space Systems provide an advantage over the Soviet Union. But this peace time advantage has precipitated a war time disadvantage. Inherent in the nature of the Soviet space program is the requirement to maintain enormous launch capabilities to maintain system coverage and this provides them the capability to conduct highly effective surge operations in time of war.

The Strategic Defense Initiative offers a great deal of promise for superiority in space control in the near future, but any imaginable near term military space strategy must include an interim capability to effectively negate Soviet on-orbit space assets quickly and efficiently.

The absence of an ASAT in our weapons inventory may force the military to execute courses of action that risk immediate escalation of a conflict into the strategic nuclear arena in order to achieve U.S. space control. The

alternatives of attacking key space personnel, space related installations and equipment well with in the Soviet Union will be a political nightmare, even if full hostilities between the two countries already exist.

On both sides of any Soviet verses U.S. space conflict, an extremely critical component for retaining or denying long-term space operations are the key personnel in all phases of both nations space programs.

To regain total space leadership NASA must focus its efforts on the pioneering and early developmental stages of future space initiatives. Routine or operational procedures, such as satellite launch, must be taken over by DoD or incorporated by emerging commercial organizations which ever, best fits the particular mission. This action frees NASA to fulfill its true space leadership role and spreads critical space functions over a broad number of personnel and geographical locations.

A Space Mobilization Plan must be drafted to coordinate all the components of the space community during the transition from peace to war. This plan, like other mobilization actions, should be tied to established DEFCON levels. At a minimum this Space Mobilization Plan must incorporate plans for: (1) integration of U.S. launch facilities and activities (NASA, military and commercial), (2) prioritization and hand off civilian space systems to

USSPACECOM,(3) prioritization and protection of key space related facilities and personnel,(4) militarization of civilian construction equipment and personnel needed for expeditious launch site refurbishment and (5) acceleration of space related industrial activities.

As other foreign space programs come into their own, similar information sharing and hardware control agreements must be negotiated with our allies. These agreements must include the ground work for activating an Allied Space Command for wartime coordination of space actions and assets. All such actions must then be consolidated into an Allied Space Coordination Plan (ASCP). This plan must include provisions for: (1) appointment of an Allied CINC Space, (2) Coordination of allied launches including both actual and deception operations, (3) activation of allied information sharing procedures including a transition to joint communication protocols, (4) coordination of negation operations directed at enemy space assets and (5) coordination for protection of allied space systems external to the United States.

APPENDIX I

ADDITIONAL RESEARCH TOPICS

During the course of this study many interesting and vital subjects for further research were identified that were beyond the scope of this document. It is hoped that this appendix will serve as a source of topics for other researchers desiring to investigate topics related to space and its peripheral issues.

Issues

Analyze current civilian satellites with respect to their military utility.

* Identify software and hardware compatibility and developmental requirements.

* Develop a Space Mobilization Plan concentrating on a logical assimilation of these civilian assets into a wartime environment.

* Identify and discuss issues concerning transfer of proprietary industrial information and security issues associated with the release of military information to industrial sources.

Survey foreign space launch capabilities and assess their military potential in time of crisis.

Survey foreign space systems for possible military applications (concentrate on similar points as outlined for analysis of U.S. commercial systems.)

Discuss developing space systems and their utility in special operations.

Contrast organizational concepts for future space forces; conventional service organization verses a new separate space force.

Compare United States and Soviet personnel structures within their respective space programs.

* Identify mission critical positions.
* Assess levels of cross training and redundancy.
* Prioritize positions with relation to wartime actions.
* Develop courses of action to attack identified enemy critical positions.

* Develop courses of action for safe guarding friendly critical positions.

Develop a computerized model that will predict expected U.S. satellite loss rates while varying degrees of protection employed and the mixture and sophistication of ASAT weapons used. The result would feed calculations of the number of stockpiled systems, on-orbit spares and launch rates needed to maintain space-based capabilities.

APPENDIX II

RECOMMENDATIONS FOR GLOBAL WAR GAMING

As a method for evaluating some of the strategic recommendations contained in chapter VI of this paper, this appendix contains suggested actions correlated to the various levels of the conflict spectrum. The Naval War College's global war game provides a unique opportunity to inject these actions into a global scenario and assess their impact on other theaters of conflict. Since the development of these strategic recommendations was conducted without regard for financial constraints, a war game assessment of their synergistic impact will aid in the determination of future courses of action and cost effectiveness evaluations.

PHASE I

Peace-Increased Tension-Crisis

System Hardening This parameter can be evaluated with respect to three variables. First, the friendly system or constellation being hardened, secondly, the type of threat the hardening is designed to defeat (Kinetic Energy, Laser, R-F, EMP, Particle Beam etc.) and lastly, each of these hardening modifications should be varied by degrees of effectiveness (25%,50%,75%,100%). The most expedient way for

these factor to be injected into the War Game would be to generate them in the pre game preparations. These variations in the hardening parameter could be tabulated in matrix form showing kill probabilities for various threat systems applied against different hardening strategies. These could be printed or stored electronically in an off line data base. At the beginning of the game the Blue Space Cell would set the hardening parameters. Then as the Red Cell attempts to negate friendly space assets, they would forward information on which systems are targeted and with what weapons are being used.

System Maneuverability This parameter is varied by friendly system, with or without on-orbit refueling capability (Using STS or Space Station). Maneuverability impacts on survivability and the ability to provide continuous observational and communications coverage to a specific theater of operations on earth. Using a method similar to that described above this parameter could also be incorporated into the space systems data base. Survivability increases due to maneuver could be applied and tabulated by friendly system and the threat applied. As an appendix maneuver time and refuel times by constellation could also be tabulated.

Increasing On-Orbit Spares This parameter is varied by system and quantity of spares launched compared to assets

already in service. Once again it can be handled within the off line data base described above.

Attack on Sea-born Space Assets Given that the Soviets have made attempts on our remote ground based space facilities external to the United States, surgical strikes on space related vessels are conducted in retaliation.

Space Mobilization Plan As proposed in earlier chapters this plan could give the space cell a sequential list of actions tied to increasing DEFCON level during this phase of the game. This specifically applies to actions internal to the United States. Its implementation in a gaming environment would serve to flush out conflicts in applying various assets to this plan.

Allied Space Coordination Plan As Proposed this plan also requires specific actions during this phase of the conflict spectrum. One main action is to appoint an allied CINC Space. The space cell could assume this role and take a more direct role in inter-theater activities.

PHASE II

Conventional Theater War

Increased Launch Capabilities Consider mixture of STS and expendable launch vehicles from Kennedy and Vandenberg

and two other military or commercially owned launch sites. Also consider a limited number of launches from foreign facilities. The guidelines for these actions would be drawn from the Space Mobilization Plan and the Allied Space Coordination Plan. Deception as well as actual launch operations must be employed.

ASAT Capabilities This parameter is varied in degree from a limited air launched system (as recently proposed by the Air Force) to various incorporations of SDI prototypes and a fully operational SDI system. The Allied CINC Space will prioritize actions according to the needs of the other theater commanders and the assets he has to use.

Lack of ASAT Capabilities Conventional and unconventional alternatives employed against other critical nodes of the Soviet space system. (For example conventional air strikes against Soviet space facilities, conventionally armed Cruise or Tomahawk strikes against space facilities and equipment, Special Operations and fifth column attacks on facilities and key personnel) In this case the Allied CINC Space will request actions from the other major commands and negotiate for acceptable strike priorities.

PHASE III

Strategic Nuclear War and Post Conflict Resolution

Total Negation of Space Assets Targeting and destruction of all remaining Soviet space assets, terrestrial and on-orbit, is a very desirable condition during post conflict resolution. Greatly limiting the Soviets ability to assess ours and their own status, limits their basis for successful post conflict negotiations. The Allied CINC Space should push for high priorities for these target during this phase of conflict.

APPENDIX III

HISTORICAL DEVELOPMENT OF THE US SPACE PROGRAM

Military Space Structure

Almost since the conclusion of World War II each of the branches of the service have shown a strong interest in developing space systems and recognized the potential that space held for future military applications.

But this enthusiasm did not really begin to evolve into formal service structure until the early 1980s. The U. S. Air Force was the first and created the Air Force Space Command in September 1982. Approximately one year later the Navy activated the Naval Space Command in October 1983. Simultaneously the announcement of President Reagan's Strategic Defense Initiatives expressed a clear top down interest in space and accelerated the organizational process. In September 1985 the United States Space Command was activated. Finally in August 1986 the Army Space Agency was activated, it is scheduled for redesignation to the Army Space Command in April 1988. [1]

The majority of the components of the USSPACECOM are located in Colorado Springs, Colorado. The one exception being the Navy Space Command that is located in Dahlgren, Virginia. The Command is composed of over 600 people.

Currently about 50% are Air Force, 30% are Navy and 20% are Army. [2]

National Aeronautics and Space Administration

On October 4, 1957 the U.S.S.R. launched its first satellite Sputnik I. This event precipitated the National Aeronautics and Space Act of 1958 and in turn established the National Aeronautics and Space Administration as this country's lead agency in space.

NASA was extremely fortunate during these early years. It inherited over ten years of research and data from several on going military and civilian programs. This enabled the United States to launch it's first successful satellites; Explorer 1 on 31 January 1958 and Vanguard 1 on 17 March 1958. [3]

NASA's space programs continued aggressively in the areas of both manned and unmanned space exploration. In 1961 the first manned flight was launched carrying astronaut Alan B. Shepard to an altitude of 113 miles. This was the beginning of the Mercury program. This pioneering effort led the Gemini and Apollo programs. The Apollo Program coupled with a strong surge in our national "will" led to the first man on the moon on 20 July 1969. [4]

Two other manned programs round out NASA's list of accomplishments. The Skylab program commenced in May 1973

and the Shuttle program now known as STS (Space Transportation System) was actually started in the late 1960s but was overshadowed by the Apollo program. [5]

NASA's unmanned programs, although usually much lower keyed publicly, have been equally impressive. Perhaps even more important is that the development of these unmanned systems and their associated technologies has most directly benefited the Department of Defense programs. Techniques for remote observation of distant planets were easily adapted to scrutinizing activities on Earth.

The Mariner-Mars project was also initiated in the shadow of the Apollo program. This program was designed to study the Martian environment and was the first test of high speed telemetry systems operating at 16,200 bit-per second, digitized video, and several image enhancement techniques critical to spaced based communications. Mariner was quickly followed by the Viking project that successfully landed on Mars on 20 July 1976. Finally the deep space missions of the Pioneer and Voyager programs, launched in the early and late 1970s respectively, were models for long range space communications and control. [6]

APPENDIX IV

HISTORY OF THE U.S. NATIONAL SPACE POLICY

The basic tenets of today's U.S. national space policy were laid down during the Eisenhower Administration. President Eisenhower emphasized in his national space policy the peaceful use of space, international cooperation in space, the United States as a leader in space and the separation of the civilian and military space programs. [1] Separation of the military and civilian space programs gave NASA the lead in space activities and control over space facilities. Even though these tenets have remained constant through each administration, their focus and interpretations have changed.

In the Kennedy era, the United States was the strongest economic and military power in the world. After a few Soviet successes in space, President Kennedy, in his May 1961 State of the Union address, challenged America as a whole and the space community in particular to put a man on the moon and bring him back safely by the end of the decade. This set the direction of the space program for the next nine years and emphasized the importance of the civilian space program over the military. President Kennedy directed that all reconnaissance missions from space be conducted in secrecy and he permitted all military services to conduct research in space technology. The Air Force was given the lead in

conducting further space activities for DoD.[2] The net effect was to conceal the importance of military space matters from the public while giving the civilian space program high visibility publicly reinforcing the emphasis on the peaceful purposes of space.

During the Johnson Administration there was a shift in the emphasis of the space program. The economic crunch was beginning to be felt. Priorities had to be established and limits had to be set on federal programs. President Johnson had given his "Great Society" programs top priority. Even though President Johnson had fully endorsed President Kennedy's man on the moon mission, he cut funding for several space programs. The U.S. program became oriented towards what it could do to meet the needs of society. Only those space programs that had some commercial application or provided some domestic benefit were given top priority. [3] It was during this time that the Soviet Union started to surpass the United States in the number of launches conducted per year.[4]

During the Nixon and Ford years, the U.S. space program continued to suffer from budget cuts. President's Nixon and Ford embraced President Johnson's emphasis on what space could do for man on earth. President Nixon approved the Skylab project and the Shuttle program since both of these had the potential to meet domestic needs. [5] During this era,

the U.S. space program lost considerable momentum both in scientific research and national defense.

During the Carter Administration, there is a drastic re-orientation of the space program. President Carter's national space policy emphasized the national security aspects of space. Space was not only seen as a force enhancer, but as a warfighting medium in its own right. President Carter's policy sought to advance the interest of the United States in space and to insure the freedom to conduct all space activities that enhance the security of mankind. For the Department of Defense, this meant being able to identify and integrate appropriate civil and commercial resources into military operations during national emergencies, pursue survivability in space systems and pursue rigorously anti-satellite (ASAT) capabilities not prevented by international agreement. President Carter also endorsed parts of the policies from preceding administrations. He put continued emphasis on improvement of life on earth through space-related activities and on international cooperation in space.[6]

President Reagan further advanced President Carter's space policy. In his July 1982 announcement of his national space policy, President Reagan re-emphasized those tenets laid out during the Eisenhower administration and expanded the goal of private investment and involvement in civil

space-related activities. He amplified the national security portion of President Carter's space policy by announcing that the U.S. will conduct space activities deemed necessary for national security and that the United States would continue to pursue survivability of space systems as well as develop an effective ASAT capability. President Reagan strongly supported the space shuttle program and gave priority for its use to national security missions. In March of 1983, President Reagan announced his Strategic Defense Initiative (SDI). SDI will give further credence to space being a warfighting medium. In August of 1985, President Reagan announced his Space Strategy. This was an attempt to tie all previous policies and directives concerning space into one document that would give direction to the U.S. space program. This strategy made the shuttle the primary launch system and set out a series of goals and time lines for NASA to meet. For the Department of Defense it meant following those guidelines set forth in the 1982 space policy and, in addition, support SDI and maintain assured access by supplementing the shuttle with expendable launch vehicles. This last point was highlighted by the shuttle disaster which put many national defense projects on hold. DoD would also analyze those space systems that were critical to national security and make them more survivable according to their degree of importance.[7]

Both the Carter and Reagan administrations recognized the importance of space to national security. Both administrations oriented their space policies to reflect that importance. However important, the quest to achieve national security objectives in space has met serious political opposition. Much of this opposition centered around financial questions. The growing budget deficit, the growing foreign debt, the unwillingness to raise taxes and the failure to streamline federal programs have left the leaders of this nation in turmoil on national defense issues. The result has been a serious limit on national defense spending and has seriously impeded this nation's ability to pursue national security objectives, especially in space where there has been considerable criticism on funding programs such as SDI.

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