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SPACE: THE FOURTH MILITARY DIMENSION

Final Report

US ARMY WAR COLLEGE

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SPACE: THE FOURTH MILITARY DIMENSION

The Strategic Defense Initiative and the Implications for Land Warfare in the Twenty-First Century

Final Report

NOTICES

DISCLAIMER

The views, opinions, and/or findings contained in this report are those of the author and should not be construed as an official Department of the Army position, policy, or decision, unless so designated by other official documentation.

COMMENTS

Comments pertaining to this study are invited and should be forwarded to: Director, Strategic Studies Institute, US Army War College, Carlisle Barracks, PA 17013-5050.

Research on this project was completed in 1985; approval for public release was received in 1986.

FOREWORD

This individual study was initiated by the Strategic Studies Institute. The author, Colonel Jan V. Harvey, contends that space has joined the land, sea and air as a separate dimension of warfare and, as such, will have at least as much impact on the way wars of the future will be fought as airpower has had on warfare in the 20th century.

Colonel Harvey examines the military applications of space and the development of national space policies and strategies, including the Strategic Defense Initiative and the emerging exotic weapons technology. He then analyses these factors in the projected global environment of the next century to assess the implications for future land warfare. He concludes that there will be significant implications for the strategy and force structure of the future Army and that the Army must now begin to prepare for these changes.

The Strategic Studies Institute is pleased to offer this study on space as a contribution to the field of national security research.

Thomas R. Stone

THOMAS R. STONE
Colonel, FA
Director, Strategic Studies Institute

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EXECUTIVE SUMMARY

This study considers space as the fourth and newest military dimension and examines the implications of spacepower and new technologies on land warfare to the mid-21st century. Its genesis was the resurgence of interest in military space operations among the senior leadership of the Army which began around 1983. Three factors can be identified as most probably being the primary causes of this increased interest in space. First, the Presidential announcement of the Strategic Defense Initiative (SDI) with its potential for completely reorienting the deterrent national defense strategy brought the issue of ground-based ballistic missile defense systems to the surface in the Army again. Ballistic missile defense had been essentially a dormant issue for eight years and had existed only as a low-level research effort being conducted at a minimal funding level just sufficient for sustainment.

Second, both the Air Force and the Navy also recently had established major commands dedicated to space operations and within the Joint Chiefs of Staff discussions had begun about establishing a unified or specified command for space operations. Since the Army had not previously considered either a service or joint space command, there had been no overall Army policy or guidance established for space activities. The Army needed to decide if it should support the establishing of a joint space command, what the impact of a joint operational command would be on land combat operations, and what, if any, the Army contribution should be.

Third, a couple of studies established that the Army was not fully exploiting the potential capabilities of space to support land combat, but it was already much more deeply dependent on space systems than was readily apparent on the surface. This dependence was increasing yearly without any planning having been done to evaluate its impact on future land combat operations' overall goals and objectives for Army participation in space activities. The Army has begun to correct these shortcomings but many far-reaching decisions need to be made in the near future.

This study examines some of the aspects of space as the fourth military dimension which need to be considered in making these decisions. The study's emphasis is on functional roles and uses of space for military purposes, so only peripheral reference is made to the threat environment. Threat projections will be significant in determining force capability and specific system requirements, but should not be the determining factors in service roles or organizational structuring since the national military power must be adaptable for appropriate application across the entire threat spectrum.

The first chapter looks at space as an arena for warfare by examining the military characteristics of the space environment and space operations as these characteristics reflect differences from the air, land, and sea warfare dimensions. Space operations are examined to the extent necessary to provide a reference base for discussing the nomenclature and parameters of orbits and space system operations of significance to present and projected military operations.

The next chapter considers the way military space-based systems developed to support military operations in the communications, early warning and surveillance, meteorology, navigation, and geodesy and mapping functional areas. The roles of the different military departments in the development and use of space systems, the impact of the military services becoming increasingly dependent on space-based systems in order to successfuly accomplish their missions, and the capabilities and limitations of space systems to provide support in peacetime and wartime environments are compared for each military service. The emergence of space systems from the domain of the research and development community into the military operations domain is examined and the impact of this transition on the design, survivability, launch strategy, and operation of future space systems is developed.

Chapter three concerns the national space policies and strategies which guided the military into the space age and analyzes the current national goals, SDI, and the national defense and space strategies which provide the parameters within which military activities in space will be focused for the foreseeable future. Achieving the goal of changing the basis for the national military deterrent strategy from an offensive retaliation threat to a defensively oriented capability has the potential for causing major changes in the allocation of defense resources and the way the total military force is structured. It is important that all the military services participate in the planning for these changes now to prepare for the transition period which will be characterized by varying mixes of offensive and defensive strategic forces and major modifications to their force structures.

Chapter four considers the problem of space warfare, the development of a ballistic missile defense system, and the emerging military space technologies which will not only be the basis for space warfare, but also have the potential for profound effects on the way wars are fought in the other dimensions.

The concluding chapter projects the global environment into the next century and develops the forms in which land power could be applied in achieving national objectives. The analogy of the historically recent addition of the atmosphere as a dimension of warfare is then used as the basis for assessing the impacts of space as the fourth dimension of warfare on the way future wars will be fought, and the implications of these changes on the 21st century Army. The capability for manned flight has had a major influence on the way military activities are conducted in every mission functional area. To assume that military operations in space will not have impacts in the other dimensions at least as significant and far-reaching as air operations is to ignore the lessons of history and to proceed into the 21st century prepared for 20th century warfare.

Space systems are becoming operational military systems, vice the research and development managed systems they have been in the past. The Army does not have the qualified personnel or organizational structure to use space and space-based systems to their fullest potential. This is an immediate requirement, and meeting this challenge will greatly facilitate in the longer range requirements of assessing and incorporating military operations in space and space technologies into land warfare, preparing the Army to fight in a four-dimensional environment, and establishing the proper perspective in the Army for space operations.

CHAPTER 1

SPACE - THE FOURTH MILITARY DIMENSION

Section I. General.

In the traditional land and sea dimensions of warfare, the physical characteristics of the environment have greatly influenced the development of the doctrines, strategies, and tactics of the military force operating in that dimension. The introduction of air as a dimension of warfare earlier in this century not only added a new operating environment with its own particular set of characteristics, it also increased the dimensional combinations, or warfare interfaces, from three to seven. The increase in interfaces follows the laws for combinations and permutations. The significance of a new dimensional interface on the doctrine, strategy, and tactics within an older dimension may be as significant as the overall impact of adding a new dimension at the national defense level, or the introduction of a major new technology to warfare. This has been well illustrated by the impact of air power on the application of land power and sea power since World War I as well as the impact of air power itself on warfare.

The addition of space as a military dimension will increase the dimensional interfaces to 15 and, incorporating the anticipated outcome of the intensive technology research from the SDI, will greatly increase the potential for further complicating the battle arenas of the future. The physical characteristics of space are at least as distinct from the air as the air is from the land or sea, and these distinctions as much as anything else drive the conclusion that space is not just a continuation of the air warfare environment but a separate military dimension.

Section II. The Environment in Space.

Space itself is far from being an empty void and is a harsh and hostile environment for both manned and unmanned satellite operations. Although atmospheric particles are widely dispersed, the effect of atmospheric drag at 150 kilometers is sufficient to cause the orbit of a satellite to decay in about one day. The atmospheric drag effect decreases with altitude, so that a satellite at an altitude of 370 kilometers will remain in orbit about one year. The effect of atmospheric drag is also a function of shape, size, and density of the satellite, as it is with aircraft in the atmosphere.[1]

The Van Allen radiation belts are part of the magnetosphere of the earth and contain high energy protons, electrons and helium nuclei. They extend from about 75 degrees north to 75 degrees south latitude, curving in at the poles. Starting between 600 to 1000 kilometers and extending out as far as 64,000 kilometers from the earth, they present a significant danger to manned space operations and all satellites require shielding against this radiation.[2] Solar winds also constantly bombard an object in earth orbit with charged particles, electrons and protons primarily, moving at approximately 500 kilometers per second; during a solar flare, the particles may be moving up to 2,000 kilometers a second. Although the ambient temperature in space is close to absolute zero, an object illuminated by the sun is without the screening protection of the earth's atmosphere and subject to the full effect of the sun's radiant heat, so extreme variations in temperature are metalurgical, electrical, and manned activity factors which must be accounted for in space operations.[3] These environmental factors do not represent insurmountable barriers but, like weather and terrain to land operations, will significantly affect military space operations.

Among the forces which act on a satellite in space, the primary one which must be overcome to achieve orbit or maneuver in space is gravity.

> Gravitation gives shape to apparently featureless space. Everybody in the solar system has a gravity well, the area around the mass in which the force of its gravity is of major significance. The more massive the body, the deeper the well, and the more force must be used to escape from its surface. The earth's well is 22 times deeper than the moon's. Hence it takes considerably less energy to move from the moon's surface to geosynchronous orbit than it does to reach that orbit from the earth.[4]

This gravity well-energy relationship is best illustrated graphically.[5]

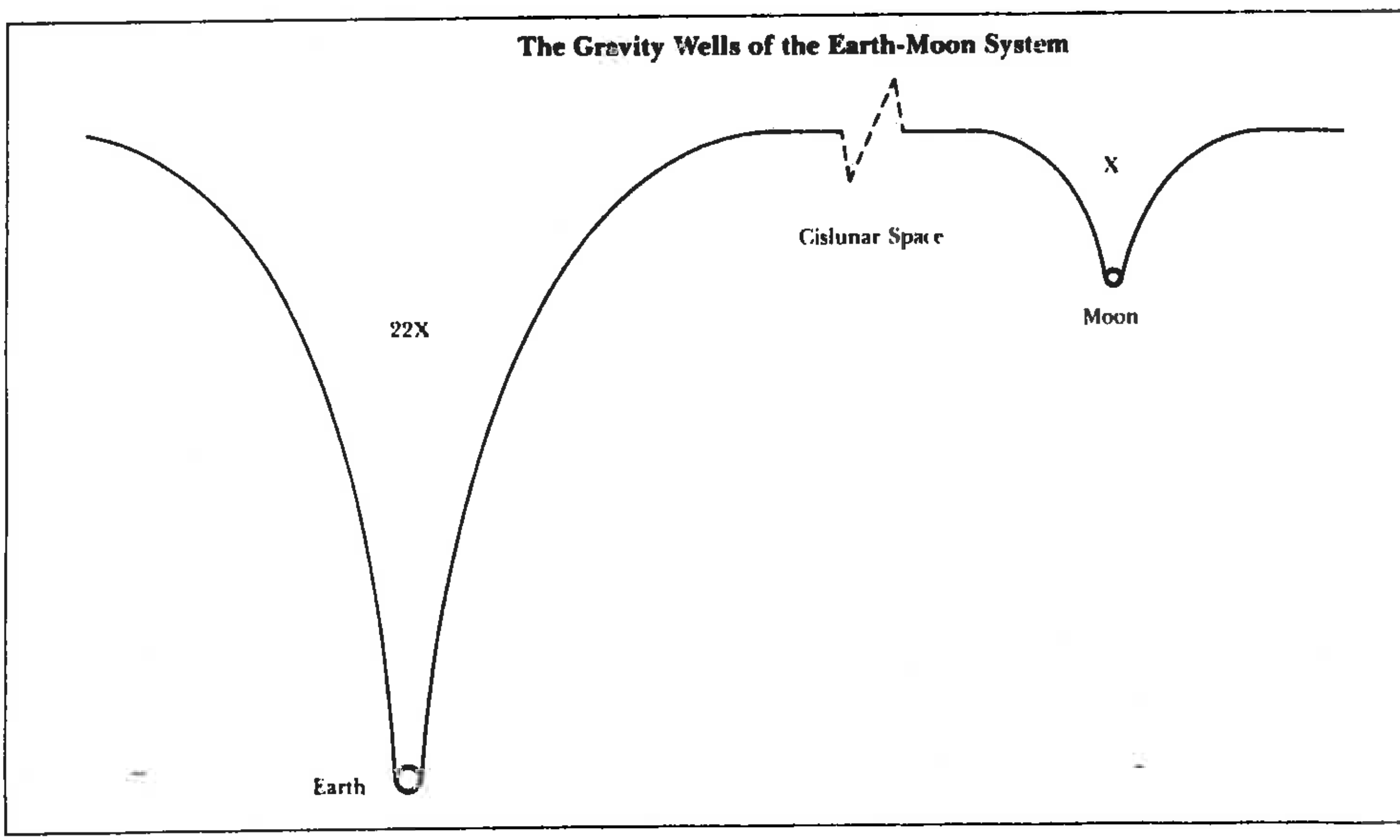

Figure 1. Gravity Wells

The measure of energy required to maneuver an object in space is represented on the diagram by movement along the gravity well curves. For example, it requires enough energy to impart a velocity of approximately 8 kilometers per second to an object in order to move it from the earth to orbit. To move an object to geosynchronous orbit, approximately one-tenth the distance to the moon, requires nine-tenths of the energy required to move the object from the earth all the way to the moon. Beyond the moon, in translunar space, the gravity well of the sun is the predominant force.

Satellites are placed into orbit using either multistaged expendable launch vehicles (ELV) or the partially reusable Space Transportation System, the space shuttle. A typical trajectory for a satellite being launched by an ELV is shown in Figure 2.

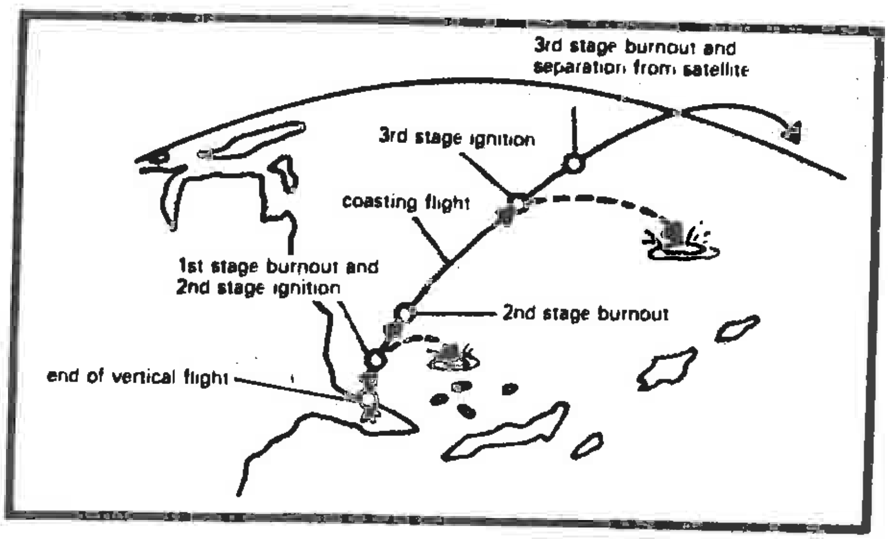

Figure 2. Flight Sequence for an ELV[6]

Section III. Military Characteristics of Space Operations.

Space is commonly defined as the region beyond the earth's atmosphere, but the boundary between air and space has not been precisely defined either physically or in national or international law.

At 80 kilometers above the surface of the earth, the atmospheric pressure is about one millionth of sea level; at 160 kilometers, it is down to one billionth.[7] In spite of these low numbers, atmospheric drag below about 100 kilometers is sufficient to cause such a rapid decay in a satellite orbit that 100 kilometers is usually selected as the boundary between air and low-earth orbits (LEO). Low earth orbits then extend up to about 500 kilometers, or the area between the earth's atmosphere and the start of the Van Allen Radiation Belts.[8] There are no uniform definitions for orbital zones although the general agreement is that differentiating between zones for military applications is significant.[9] The second orbital zone is high-earth orbit (HEO), extending from 500 kilometers up to about 35,900 kilometers, or geosynchronous orbit.[10] These zones are depicted geographically in Figure 3.

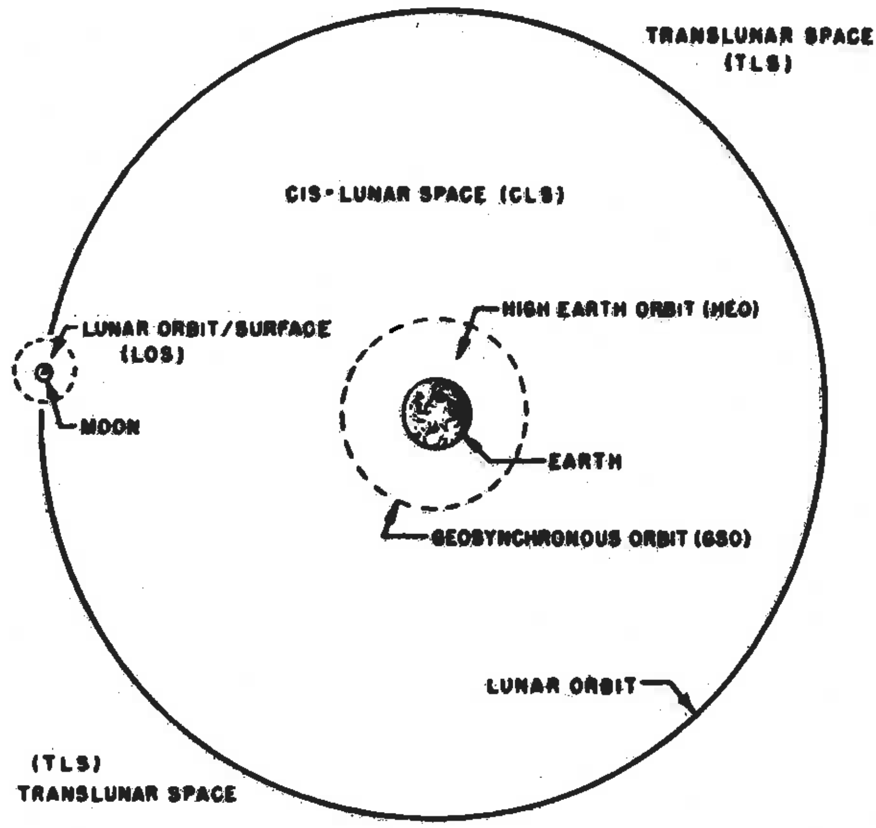

Figure 3. Military Space Operational Zones, Overall View, Earth-Moon System, to Scale[11]

These are the two zones of current significance in military space operations. In the future, as space operations and space-based weapons have more influence on military operations, cis lunar space, the zone from geosynchronous orbit out to lunar orbit at 390,000 kilometers; lunar orbit, the zone up to 100 kilometers from the lunar surface and moving in earth orbit with the moon; and translunar space, the zone from lunar orbit out to about one million kilometers from the earth, will all be militarily significant.

To optimally exploit space as a military dimension, even if only in support of air, land, and sea military operations, requires a different conceptual basis of time, distance, and energy requirements than has been required of military strategists and planners in the past. By initially idealizing the space environment, the movement of a satellite in orbit around the earth can be treated as nothing more than a special application of celestial mechanics where the consideration of pure conic orbits is sufficiently accurate for a practical understanding of the concepts.

By the year 1618, Kepler had sufficiently observed the orbits of the planets to set forth his three laws of planetary motion:

- The orbit of each planet is an ellipse with the sun at one of the foci.

- In a coordinate system with the sun at the origin, the radius vector of each planet sweeps through equal areas in equal times.

- The squares of the periods of the planets are to each other as the cubes of the semimajor axes of their respective orbits.[12]

These laws form the basis for Newton's development of the law of gravity: "The force between each planet and the sun varies inversely as the square of the distance from the sun to the planet."[13] The mathematical development of Kepler's laws establishes that the three conic orbits, elliptic, parabolic, or hyperbolic, depend on whether the total energy per unit mass of the object is negative, zero, or positive, respectively.[14] Elliptic, a special case being circular, is the common form for orbits of current military interest.

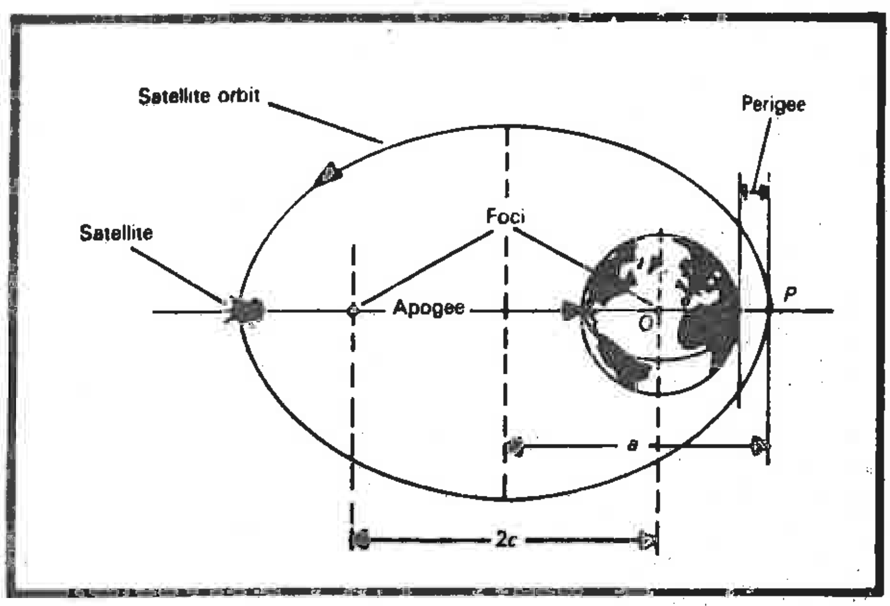

Figure 4. Geometry of a Satellite in Orbit[15]

A few parameters need to be defined in order to differentiate between, and describe the military significance of, particular orbits. The orbital plane is the plane which contains the orbit and passes through the center of the earth.

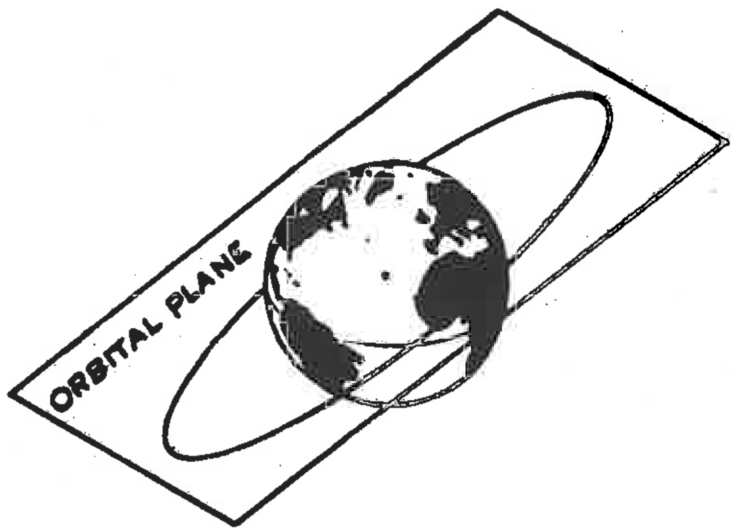

Figure 5. Orbital Plane

The intersection of the orbital plane and the earth's surface is always a great circle. The ground track of a satellite is the trace of the nadir, the point of intersection of a line between the center of the earth and the satellite and the earth's surface.

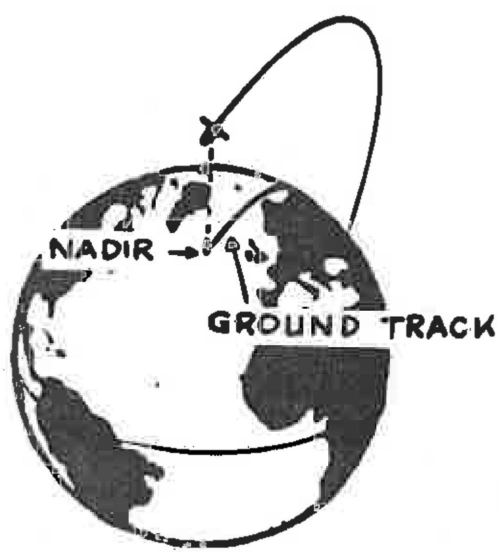

Figure 6. Satellite Ground Track

The time required for a satellite to complete one revolution of the earth is the orbital period. The angle between the orbital plane and the equatorial plane is the inclination of the orbit.

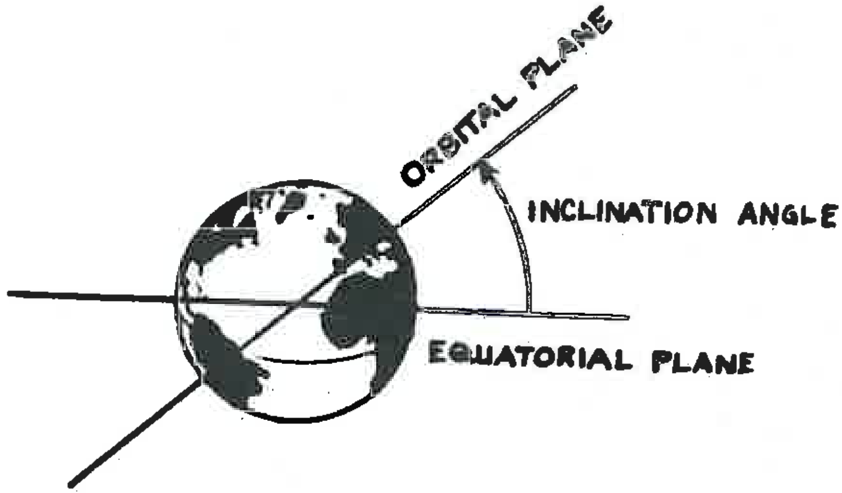

Figure 7. Inclination Angle

This inclination angle is measured counterclockwise from the equatorial plane; an orbit with an inclination of zero is an equatorial orbit, angles between 0 and 90 degrees are posigrade orbits, 90 degrees is a polar orbit, and inclinations between 90 and 180 degrees are retrograde orbits.

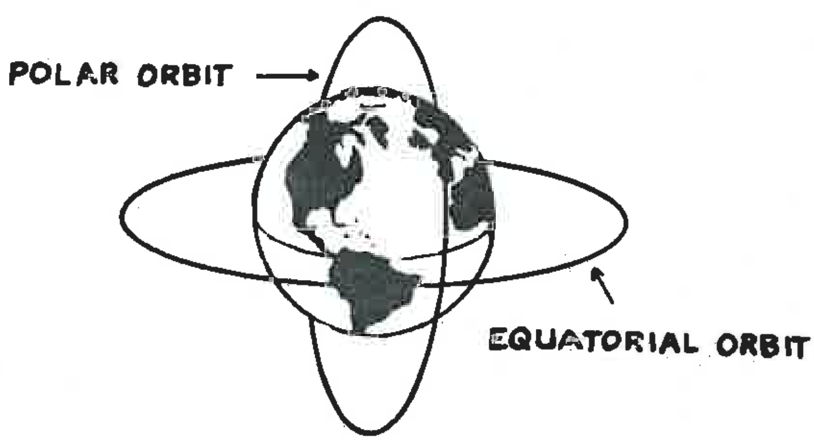

Figure 8. Satellite Orbits

If the orbital plane has a positive inclination, that is, the orbit is not equatorial, the ground track of the satellite will move north and south of the equator between latitutes equal to the inclination. However, the time spent north and south of the equator will be equal only if the orbit is circular. The ground track of a satellite in an inclined orbit therefore appears, on a flat map of the earth, as a sinusoidal trace which is compressed because of the earth's rotation. This compression, always westerly, is called regression. The amount of regression of successive ground traces is approximately equal to the orbital period times the angular velocity of the earth, 15 degrees per hour. A satellite with a period of 90 minutes would have a regression of approximately 22.5 degrees which means that every 16 orbits (24 hours), the ground tracks would coincide.

The altitude of a satellite is measured from the earth's surface, the radius of an orbit from the center of the earth. The highest altitude of a satellite is the apogee, and the lowest altitude, closest point to the earth, is the perigee, as shown in Figure 4.

The radius of apogee and radius of perigee are the farthest and closest distances to the center of the earth. In a circular orbit, apogee and perigee are equal and the single value, altitude, describes the orbit. From the equations of orbital motion, it is apparent that the velocity in orbit decreases and the orbital period increases with altitude. At an altitude of 35,900 kilometers, the period is 24 hours which makes this orbit particularly useful. A satellite in a circular 24-hour orbit will complete one-half a revolution in the same time the earth completes one-half a rotation, so that the north- and south-bound equatorial crossing points will coincide and the ground track, for an inclined orbit, will be a figure eight, extending from pole to pole for a polar (90 degree) orbit. With an inclination of zero degrees, equatorial orbit, the satellite ground track will be a single point on the equator. The 24-hour orbit is termed geosynchronous and the geosynchronous equatorial orbit, geostationary. Since a satellite in geostationary orbit appears to be in a fixed position when viewed from the ground and is visible from a little over 42 percent of the earth's surface because of its altitude, this is a valuable orbit for communications relay and earth surveillance satellites. Typical geosynchronous earth coverage is shown in Figure 9.

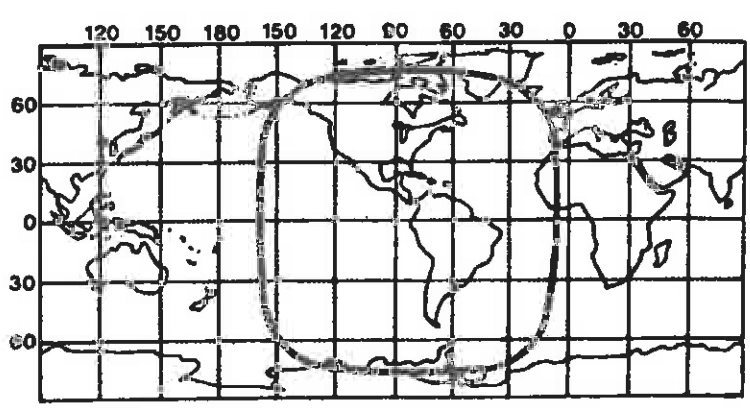

Figure 9. Maximum Earth Coverage of a Geostationary Satellite Located Over Panama[16]

The earth is not a homogenous sphere, and the bulge at the equator has the effect of causing the orbital planes of posigrade orbits to precess (that is, rotate) to the west and satellites in retrograde orbits to precess to the east. The precession is zero for polar orbits and has no meaning for equatorial orbits. The precession rate will also vary with the altitude of the satellite. The specific military application of this orbital characteristic is the sunsynchronous orbit; an orbit inclined between 95 and 105 degrees, at altitudes between 160 and 1600 kilometers, such that the orbital precession is about one degree per day which results in the relationship between the angle of the sun and the satellite remaining constant throughout the year as the earth rotates around the sun.

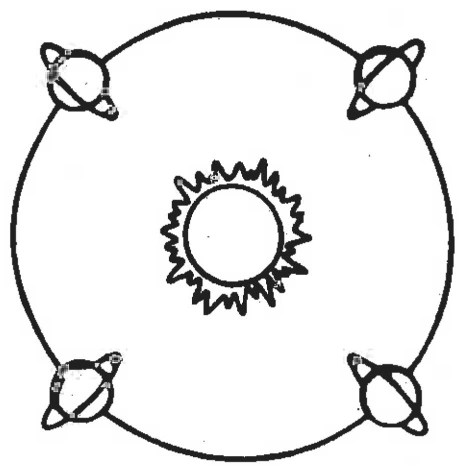

Figure 10. Annual Precession of Orbital Plane in a Sunsynchronous Orbit

This unique orbit is significant for comparative photography and other sensing activities from satellites.

The equatorial bulge also causes precession of the major axis of inclined elliptical orbits within the orbital plane. This precession moves the nadir of the apogee and perigee of the satellite. At inclinations of 63.4 and 116.6 degrees, the precession rate is zero, the orbit is stable, so that the apogee and perigee locations remain at the same latitude. The 63.4 degree highly elliptical (apogee at about 40,000 kilometers, perigee at about 500 kilometers) twelve-hour, or semisynchronous, orbit has been named Molniya from the Russian satellite which first used it. It is useful for communications relay satellites since it is a stable orbit and provides extensive time over the northern high latitude regions beyond the view of geosynchronous satellites.[17]

Typical orbits for military satellite systems are illustrated in Figure 11.

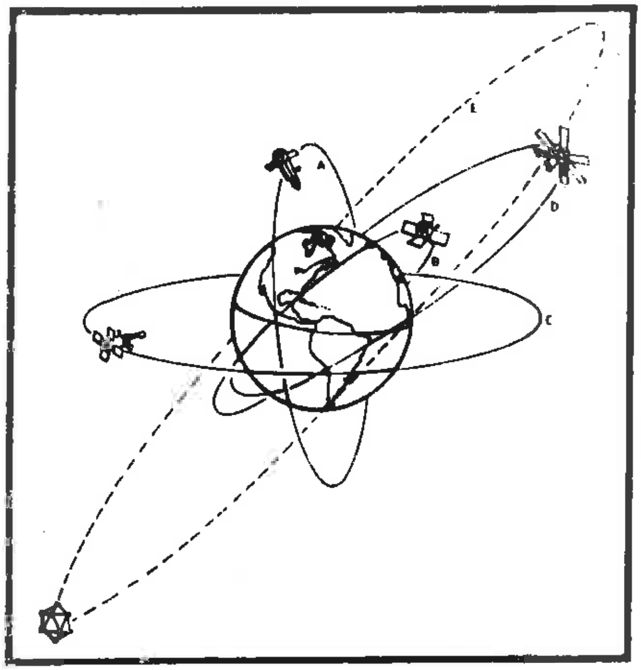

Figure 11. Military Space System Orbits[18]

A - Meteorological
B - Navigation, Ocean Surveillance, or Communications
C - Early Warning Surveillance and Communications (Geostationary)
D - Communications (Molniya)
E - Nuclear Detonation Detection

The type of earth coverage which can be obtained from a satellite constellation is illustrated by a system of 16 satellites in four orbital planes with four satellites in each plane. Each plane is separated by 90 degrees and, within a plane, the four satellites are 90 degrees apart. Each orbit is inclined at 54.7 degrees and each satellite has a period of six hours. Figure 12 shows the ground track for one satellite in one day. Figure 13 shows the ground tracks for all sixteen satellites for half of one revolution, or three hours.[19]

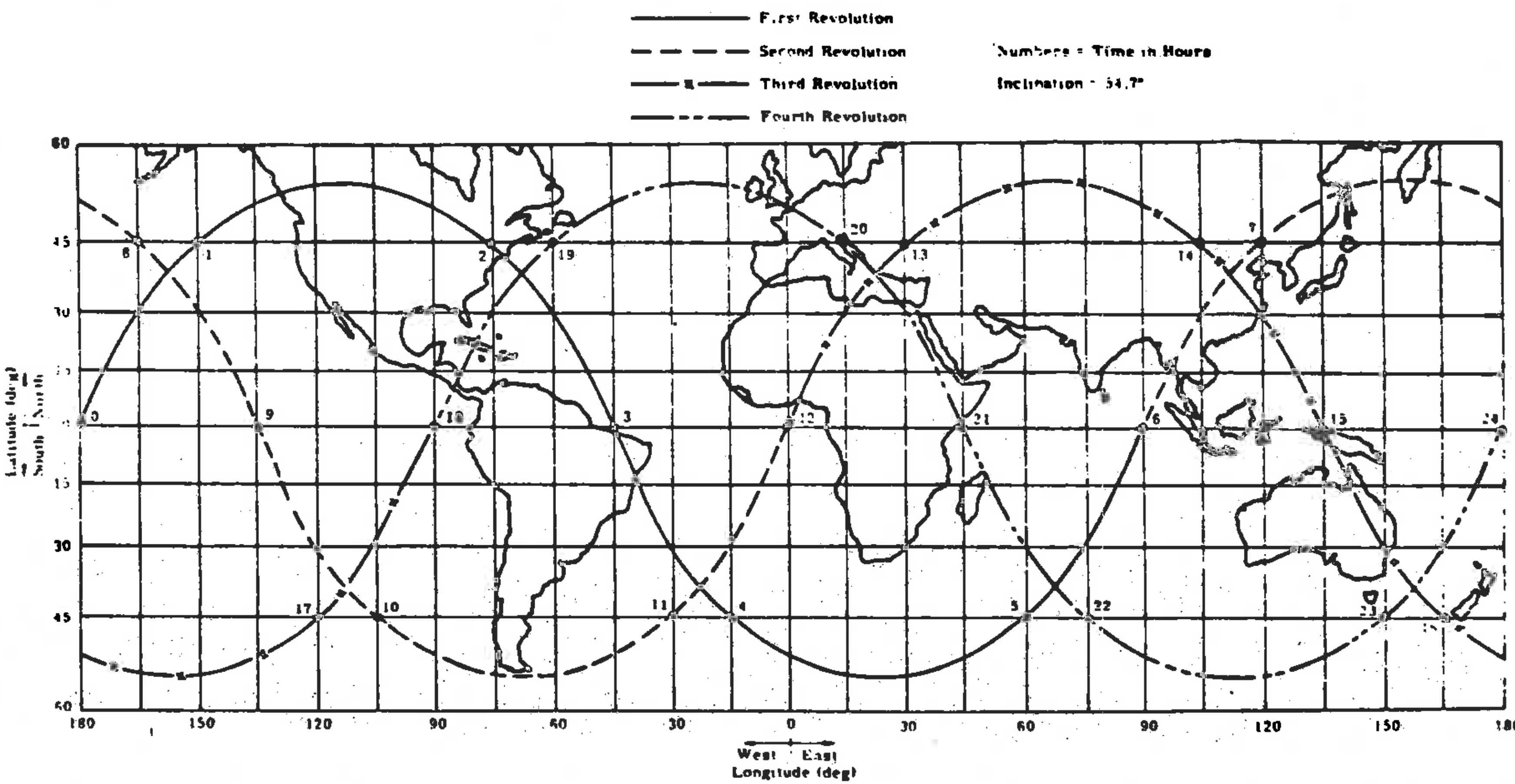

Figure 12.

Ground Track for One Satellite During a Day

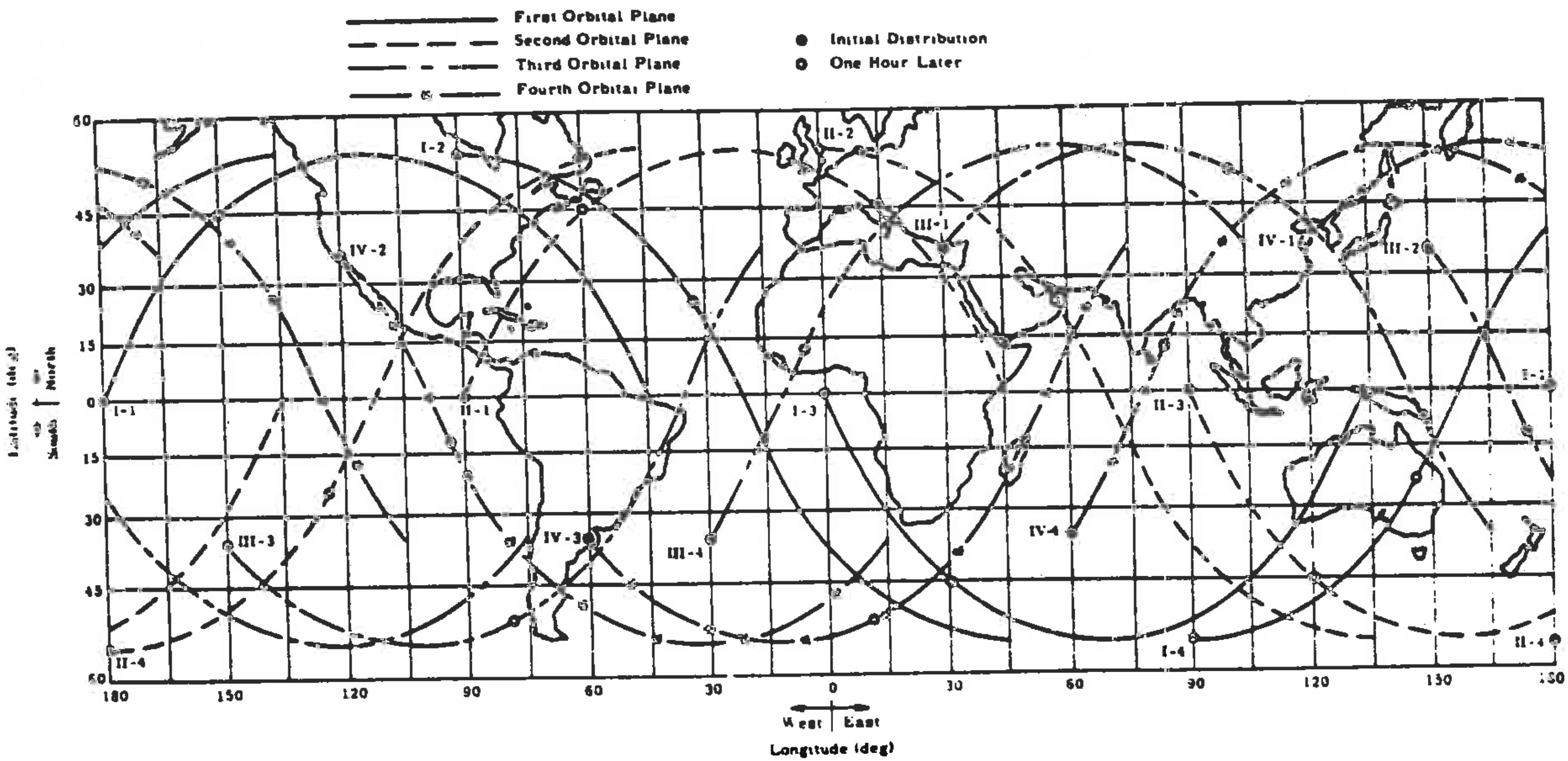

Figure 13.

Ground Tracks for 16 Satellites During Half a Revolution

CHAPTER 1

ENDNOTES

1. Robert B. Giffen, US Space System Survivability: Strategic Alternatives for the 1990's, Washington, DC: National Defense University Press, 1982, p. 6, and endnotes.

2. William J. Durch, ed., and Dean A. Wilkening, National Interests and the Military Uses of Space, Cambridge: Bollinger, 1984, p. 12.

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6. Bhupendra Josani, ed., Outer Space-A New Dimension of the Arms Race, Cambridge, Oelgeschlager: Gunn & Hain, Inc., 1982, p. 5.

7. Durch, pp. 12-13.

8. G. Harry Stine, Confrontation in Space, Englewood Cliffs: Prentice-Hall, 1981, p. 64.

9. See also Giffen, pp. 6-8; Durch, p. 22; and Ra'anan and Pfaltzgraff, pp. 33-34.

10. Stine, p. 64, and Durch, p. 22.

11. Stine, pp. 64, 66.

12. Jorgen Jensen, et al, Design Guide to Orbital Flight, New York: McGraw-Hill Book Co., Inc., 1962, p. 9.

13. Ibid.

14. Ibid., p. 10.

15. Josani, p. 8.

16. Ibid., p. 126.

17. Orbital nomenclature and characteristics can be found in many sources. For consistency, JCS Manual, Joint Service Tactical Exploitation of National Systems, Appendix C, Washington, DC: 1981, was used as the source. The formula for percentage of the earth's surface visible from a satellite as a function of altitude (in nautical miles): $1-(c/(c+h))$

$$A = \frac{1 - \left(\frac{3444}{3444 + h}\right)}{2} \; 100$$ is from Jensen, pp. 771-773.

$\left(\frac{c}{c+h}\right)$ $\left(1 - c/(c+h)\right)$

18. Josani, p. 45.

19. Jensen, pp. 821-822.

CHAPTER 2

THE MILITARY ROLE IN SPACE

Section I. General.

Since the beginning of the space age, there has been a steady, albeit uneven, increase in the involvement of the military services in space-based systems. This increased involvement has been accompanied by a parallel increase in the dependency of the services on space-based systems for the capability to accomplish their respective defense roles and missions, both in peace and war.

Section II. Space Systems.

Although the environment introduces new distinctive and unique factors for space-based systems, they generally have the same characteristics and requirements of the other dimensional-based systems; in particular this is true of weapons systems. These characteristics can conveniently be placed into two categories for system analysis purposes: those which relate to the internal operation of the system itself, and those which relate to the conduct of the mission or function of the system. For example, a communications or surveillance system can be analyzed as an operating system totally disregarding the content of the data being communicated by the system, and the customer of the functional product does not require detailed knowledge of the operating aspects of the system in using the product. A space-based system has, in addition to its mission-performing elements, requirements for launching, tracking, on-orbit maneuvering, status reporting (telemetry), and command and control elements or subsystems which are common to all systems. The integration of these subsystems with the data links connecting the ground-based and the space-based components is as essential to the mission performance of the system as the mission components themselves; in fact, mission components may well be layered on system operational components, especially in the command and control and data link elements. In analyzing the capability and survivability or vulnerability of a space-based system, all the subsystems and data links must be included since each is essential to effective system operation.

Current military space systems fall generally into six functional categories: communications, surveillance, photo reconnaissance for monitoring treaty compliance, meteorology, navigation, and geodesy. Each of these categories will be examined briefly to establish: the extent of involvement and dependence of the military services, the current status of technology exploitation, and future developments and their impact on the military services. The early space policy implementation decisions within the Defense Department had a marked effect on the way space systems were developed and operated so that, in some cases, dependence by individual military service is not clearly resolvable. Also, most early space systems tended to be single function oriented while later generations have incorporated elements from more than one functional category into the same satellite platform, indicating a more mature technology and an increased confidence in the reliability of space-based platforms themselves.

Communications, the essential element to command and control throughout the military establishment, have become heavily dependent on satellite relay systems and, as volume and channel requirements continue to increase, this dependence grows. Current estimates, to include the Army, are in the 70 to 80 percent range for long-haul communications traffic.[1] "Without military comsats, it would be difficult, if not impossible, to exercise the high level of C^3 currently required. Thus, the military combat networks are vital nodal points for long-haul communications as well as for tactical purposes."[2]

Communications relay was one of the first military applications of satellites. By the mid-1960's, communications satellites were being placed in geostationary orbit, which remains the most common orbit for these systems. Far-north latitude coverage is provided by communications relays in the highly elliptical, Molniya semisynchronous orbit. Currently, third generation Defense Satellite Communication System (DSCS) geostationary satellites, an Air Force launched and operated, Defense Communications Agency controlled system, comprise the major defense system. Wide ocean area coverage was sought by the Navy and when the Air Force could not meet the requirement, the Navy developed the geosynchronous Fleet Satellite Communications System. The Air Force also developed the Molniya Orbit Satellite Data System and the Air Force Satellite Communication System, which has transponders on other system host satellites.[3] The Army uses channels on any system which can support its requirements but has not developed a system of its own. The overall defense requirement for satellite communications relay far exceeds the capability of the current military systems. Entire commercial communications satellites have been leased by military services in addition to many individual channels which are leased from commercial communications satellite companies.[4] Because the defense strategic concept calls for the forward deployment of US military forces, the communications requirement is necessarily extensive, and satellite relay "is both technically efficient and politically non-troublesome."[5] Unfortunately, most of the communications satellites used by the military services were not designed for operation in a wartime environment. The national intent expressed by the SDI, to shift from a purely offensive deterrent force to a defensive deterrence strategy, will require survivable communications links and "all new military communications satellites will be hardened against EMP and lasers, will have high resistance to jamming, and will include encryption equipment to provide secure data links."[6] The Military Strategic, Tactical and Relay (MILSTAR) communications satellite system, which should be operational by the end of the decade, represents the type of communications satellite system which will be supporting field commanders in the future. MILSTAR will have ground to orbiting satellite links and a satellite-to-satellite cross-link capability in the event ground stations are destroyed. The system will operate in the EHF (extra high frequency) range which greatly improves the data capacity and is inherently jam resistant because of the very narrow band width. The satellites are hardened against nuclear effects, fully encrypted, and equipped with electronic counter-countermeasure (ECCM) systems. Air, sea, and ground-based hardened terminals are being developed by the respective military departments.[7] Long-range planning conceives a completely interoperable ground and space-based communications network with diverse transmitting modes in several frequency ranges which could eventually provide the survivable and redundant communications capability currently required to support US military operations worldwide.[8]

New technology may also provide a solution to a longstanding strategic communications problem of specific Navy concern, communications with submarines at operational depths. The oceans are significantly transparent to only two frequency ranges, extremely low frequencies (ELF) and visible light. The directed energy weapons technology program discussed in Chapter 4 also supports solving the distortion and pointing accuracy problems necessary for a satellite relay, blue-green laser submarine communications system which is now in the early program development stage. A laser system would have an additional advantage over an ELF system of being hardened against nuclear effects.[9]

The satellite system for missile launch detection has a major role in a defensive deterrent strategy. The second group of satellite systems in this category are the nuclear detonation detectors. The current system, Vela, has been operational since 1963 and provides monitoring for treaty compliance and nuclear proliferation in peacetime.[10] The follow-on system, Integrated Operational Nuclear Detection System (IONDS) will be deployed as a secondary payload on each global positioning system, the NAVSTAR, navigation satellite. Cross-linked and deriving its positioning data from the host system, IONDS will be a survivable system for providing "precise location, yield, and height of burst information on any nuclear explosion, worldwide."[11] Survivability is important since this system will provide the intelligence to assess the damage resulting from any nuclear exchange.

The policy that there would be minimal publicity given to military space operations to avoid adverse foreign reaction set forth during the Kennedy Administration has resulted in only a single acknowledgement, by President Carter in 1978, that the United States engages in photographic reconnaissance from space platforms for the purpose of verifying treaty compliance. Conversely, the products of satellite collection of meterological data are available several times daily to anyone, at least in the free world, who owns a television set. Orbiting satellite platforms completely revolutionized meteorology. Providing for the timely collection and analysis of highly transient weather information on a worldwide basis still has not made weather forecasting an exact science, but has eliminated much of the uncertainties about weather which complicated planning by field commanders in earlier times. The primary military weather system is the Defense Meteorological Satellite Program (DMSP) "which consists of satellites flying at an altitude of approximately 833 km in a near polar, sun-synchronous orbit. They take about 101 minutes to complete an orbit and each scans a 2,960 km-wide area. Each satellite can cover the entire surface of the earth in about twelve hours; consequently, one is used to provide morning and the other afternoon weather."[12] "Infra-red and daylight images with a resolution of 0.3 miles are stored by the satellite and then passed through ground terminals to the Air Force Global Weather Central which analyzes the data and makes it available worldwide to both military and civilian users."[13] This weather system with its capabilities for denied area coverage and timely information distribution has had significant impact on deep targeting and planning at both strategic and operational levels.

The Navy initiated the development of space-based systems for position location and navigation. The first operational system, Transit, was deployed in 1964 and is still operational.[14] Transit provides position accuracy to about 150 meters to military users and one nautical mile to commercial maritime shipping.[15] The follow-on navigation system, NAVSTAR, mentioned above in connection with the nuclear detection system, had its first six developmental satellites placed in orbit from 1978 to 1980. A full 18-satellite production constellation will be completely operational by 1988.[16] NAVSTAR will provide military users with 16 meter, three-dimensional, position accuracy and 0.01 meter per second velocity accuracy during any weather conditions, 24-hours a day, anywhere on the earth's surface or in the atmosphere.[17] Commercial users will be able to receive unencrypted data from the system which will give position accuracy to within 100 meters.[18] The satellites are placed three each in six orbital planes in semisynchronous, polar, circular orbits. The receivers are completely passive and range from the 5.4 kilogram manpack for individual soldiers to multichannel units for use on surface ships, submarines, and aircraft.[19] "Space-based nevigation systems are revolutionizing military navigation because of the significant advance in positional accuracy they provide. Such navigational accuracy can give both tactical and strategic forces a decided advantage. Any pilot, company commander, or ship's captain will attest to the value of knowing position to within 1,000 meters, let alone 10 meters."[20]

Geodetic satellites have often not received the recognition they deserve for their military contribution. Providing information on the size and shape of the earth's surface and its shifting gravitational fields, they are now essential for mapping, charting, and targeting for military purposes. For example, geodetic satellites are expected to improve SLBM accuracy by 10 percent based on southern hemisphere and northern Pacific area gravitational field measurements.[21]

An examination of the current technology, development, and military use of space-based systems reveals some common characteristics among the systems and trends which may be significant in planning for future roles and missions in space. Using the standard Army terminology for functional areas, up to now the military uses of space systems have been exclusively in the functional area of combat support vice combat or combat service support, which is very analogous to the early use of aircraft by the land and naval services. In this role, space-based systems have not been developed to undertake new missions, rather the technology and new dimension have been used to extend the capability to accomplish existing missions more efficiently, effectively, or into geographical areas not otherwise accessible.

Early space platforms were consistently developed to carry a single function system. Multipurpose satellites carrying several systems have been placed in orbit only recently; however, growing confidence in the performance and reliability of satellites should increase this trend. Although each satellite system normally supports more than one service, each system has a single designated proponent, normally the Air Force, and it is a simple fact that the system proponent has the dominant influence in establishing the operational capabilities of the deployed system.

Another common characteristic of current space-based systems has had a significant impact on the way the military uses of space have developed. With a single exception, no space-based system has ever become operational in the normal sense of that term. The space-based systems have been developed, launched into orbit, and operated throughout their entire life-cycles as developmental items by the Research and Development (R&D) components of the military departments. Except for the Defense Support Program, which is under the operational command of the Commander-in-Chief, Air Defense Command, none of the current military space systems are within the Unified and Specified Command structure, the legally mandated mechanism for the employment of the military forces of the United States. This characteristic is also in the process of changing, and may totally disappear in the not-too-distant future. The organizational evolution to bring space systems out of R&D and into the operational environment began in the Air Force and has progressed to the establishment of a unified command, US Space Command, as of September 23, 1985. While organizational changes are the visible results of the evolution in the way space is viewed by the military services, the underlying forces driving these changes will have longer military range impacts.

Section III. The Air Force Role.

Early defense policy decisions provided the basis for the Air Force to become the dominant military service in space. The Air Force has specific responsibility for: "Managing military space operations including: launch, command and control, on-orbit sustainment, and refurbishment of military space vehicles for all military space systems."[22] The Air Force space operations doctrine which has developed to support this mission "is based on the concept that space is the outer reaches of the Air Force's operational medium--the aerospace, which is the total expanse beyond the earth's surface. Space, then, is an operational environment that can be used for conducting Air Force missions."[23] Beginning in 1978, the leadership of the Air Force became concerned that the organizational structure within the Air Force was not adequate to support the ever-increasing amount of space activity. In February 1979 the Space Mission Organization Planning Study was completed which provided four organizational objectives which the Air Force should pursue:

- The Air Force should be the DOD executive agent for space.

- The Air Force should seek operational control of the shuttle for all national security missions.

- The Air Force should acquire operational military capabilities in space.

- The Air Force should make organizational adjustments to assume the operational posture needed to achieve these objectives.[24]

As a result of this study, the Air Force was given operational control of the space shuttle for all designated national security missions and the construction of a Consolidated Space Operations Center (CSOC) was begun which will provide a consolidated facility for the command and control of defense manned and unmanned space systems. Internally, the Air Force created an Air Force Systems Command Deputy Commander for Space Operations and split space and ballistic missile functions into separate divisions. Although this was a significant reorganization, a further evaluation of the Air Force organization for space operations by the Air Force Scientific Advisory Board in 1980 concluded that "Given current capabilities and potentials of space systems, the Air Force organization for operational exploitation of space is inadequate."[25] Following an extensive study in which seventeen management and operational deficiencies were identified within the organization for space operations, the Air Force decided to transition space operations into a new major command, the Air Force Space Command, established on October 1, 1982, with the recommendation that as this command matured, it should be considered for Specified Command status.[26] A description of the command is at Appendix D.

At least as significant as the establishment of an operational major command for space was the emerging of a standard doctrinal concept into Air Force space doctrine for the first time: "Operational requirements must define and drive technology and systems development."[27]

The Air Force has made a major commitment of personnel and resources toward the goal of a combat as well as a support role for the space dimension of warfare. A shuttle launch facility has been completed at Vandenberg Air Force Base in California.[28] Feasibility studies have been completed and follow-on study contracts have been awarded for the development of a transatmospheric vehicle "that will be able to take off from a military airfield, insert itself into the upper reaches of the atmosphere and the lower regions of space, and go around the planet in 90 minutes."[29] The Air Force is also proceeding with the development of a new complementary expendable launch vehicle (CELV) which will have the same capability to place space systems into geostationary orbit as the space shuttle. This program will implement the defense space launch strategy approved in January 1984 which provides for an assured launch capability. The space shuttle will remain the primary launch vehicle, but CELV's will be regularly launched to maintain the operational capability in the event of a conflict situation during which a manned launch of the shuttle might be considered too risky or technical problems preclude timely shuttle availability to launch a critical military system.[30]

The Air Force has also expanded its education program to ensure the future availability of officers trained for the space dimension. In addition to post graduate programs offered at the Air Force Institute of Technology, the Air Force Academy has both core curriculum requirements and two optional degree programs in astrophysics.[31]

- The Air Force role in space has been concisely summarized by Edward C. Aldridge, the Under Secretary of the Air Force:

> The usefulness of space assets in support of military forces is far greater than we envisioned it would be ten years ago. We did not anticipate the number of

communications satellites we would have and the degree to which we would depend on them.[32]

The future requirement which the Air Force has defined is set forth in the Air Force Space Plan: "To prevail in theater conflict, the Air Force must seize the initiative and quickly achieve both air and space superiority....Space superiority is required to ensure that our space-based assets are available to support theater forces. Superiority in space will require a robust force structure and the capability to destroy hostile space systems."[33] The Air Force goals are equally succinct: "to increase the warfighting capability of operational commanders by using space systems, and to integrate space forces into a cohesive national capability to deal with threats vital to US security interests."[34]

Section IV. The Navy Role.

Although not as heavily committed, in terms of resources, to space-based systems as the Air Force, the Navy is very much dependent on space-based systems, especially for navigation, communications, and meteorology. Among the military services, the Navy is the largest tactical user of space-based systems, and, like the other services, has a continually growing dependence on space systems.[35] "Beginning in 1962, satellites were used on a regular basis to communicate with ships at sea, which led to the Fleet Satellite Communications System in 1970."[36] The Navy also led in the development of the first space-based navigation system, the Transit system, which became fully operational in 1968 and has become the primary navigation system for all combatant ships, and which is critical to maintaining the required location accuracy of fleet ballistic missile submarines during long sea deployments.[37]

As a result of a Chief of Naval Operations directed evaluation of Navy space programs which determined that the widely dispersed space activities needed an organizational focus, the Navy established its own Space Command on October 1, 1983.[38] Initially the command was given operational responsibility for the Transit and Naval Space Surveillance Systems, with responsibility for communications satellites, military and leased, being added one year later.[39] In addition to providing direct operational support to the fleets, the command has a second priority to "minimize the effects on the Navy of surveillance by Soviet ship-tracking and targeting satellites."[40]

The Navy has indentified four main areas for future emphasis in space operations:

- Strong operational thrust in fleet support from space.
- An effective long-range planning capability for future programs.
- Adequate numbers of trained, educated and experienced people to drive the Navy's space programs.

• Wide-spread awareness of the value of space to the peacekeeping, crisis management and war fighting capability of the Naval Forces of the United States.[41]

Navy developmental efforts for future space systems are currently focused into two systems: the ground-based Relocatable Over-the-Horizon Radar for broad area ocean survillance and the satellite-based Navy Remote Ocean Sensing System to provide general oceanographic and environmental data to support all naval warfare missions. Although it is a joint program, the Navy remains a strong supporter for the development of a space-based radar-infrared sensor which would meet the long-range surveillance coverage requirements of the fleets which cannot be met by existing systems.[42]

Commodore Truly, then commander of Navy Space Command, summarized the Navy role in space:

> The Navy recognizes the use of space as an integral part of naval warfare. The very survivability and battle utility of naval forces are totally linked to our full and resourceful use of space. To consider otherwise would deny today's fleet new operational systems commensurate with its mission assignments. Space systems are integral to our present Naval structure and can only increase their importance to us in the future.[43]

Section V. The Army Role.

The Army stepped in with personnel and resources to lead the development of rocket and space technology, at least in the non-Communist world, starting where the Germans left off with the A.4 and advancing to the first successful US satellite launch in 1958. In many respects this represented the high-water mark of the Army role in space. Following the defense policy decision that long range ballistic missile development would be an Air Force responsibility and the departure of the core of Army space expertise to the newly formed NASA, the remaining Army role was in the development of the ground-based antiballistic missile systems which had been underway since 1955.

Beginning in 1962 with the first Nike-Zeus interception of a ballistic missile, through the Sentinel and the Safeguard operational deployment in 1975, the Army continued to advance space technology and develop missile systems. The cancellation of Safeguard in 1976 reduced the Army's effort to research only, with a corresponding significant reduction in funding, but the Army research effort provided much of the technological foundations which supported beginning the SDI efforts in 1983. The Army, specifically the US Army Strategic Defense Command, (formerly the Ballistic Missile Defense Organization (BMDO)), is currently involved in all five technology areas of SDI and can expect to have a continuing role as SDI programs advance.[44]

As space-based combat support systems developed and expanded in several areas to become the predominant systems in their functional area, the Army dependence on space-based systems increased accordingly, even though the

Army was neither the developer nor operator of the systems. Communications systems provide a good example for examining the impacts of this growing dependence on space systems in the conduct of Army missions.

Communications within operational echelons, an Army division or corps, and to a large extent between the corps and its higher tactical headquarters, have little or no dependence on satellite systems. However, inter-theater communications, required to direct the employment by the unified commander of the operational echelons, are operated by the Defense Communications Agency, and are very heavily dependent on space-based systems. Although the operational commander does not have a communications satellite ground terminal in his command, the availability and survivability of communications satellites must be his concern because without them, his capability to receive operational direction will be severely degraded. With the operational capability of MILSTAR, the dependence on satellite communication will be more evident at lower operational Army echelons since satellite ground terminals will be a part of the command. The point is that the Army operational commander may be just as dependent on space systems as his Air Force or Navy counterpart, but may not have as much awareness of this dependence as they do. This dependence certainly carries over into meterological systems today, and will include navigational systems with the operational capability of NAVSTAR.

Recognizing that the Army had limited influence over the design, planning, and operation of space systems because it was a user instead of an owner, and that this might have resulted in the Army not exploiting the capabilities offered by space as well as it should, the Army had a study on the Army Utilization of Space Assets done by the Army Science Board in 1983-84. The conclusions resulting from this evaluation asserted that the Army is not exploiting the full potential offered by space systems and technology; that to achieve better utilization of space requires that substantial Army resources be committed; and that a positive, high-level statement is required which supports the advocacy of space exploitation on an equal, competitive basis with other demands for Army resources.[45]

Driven by concerns about the effective utilization of space, the high dependence on space-based systems and their questionable survivability and joint actions to establish space as the operational domain of a separate unified command, the Army has taken actions to review its current posture, policies and organizational structure for dealing with space. In May 1984, an Army Space Office was established within the Army Staff to provide a focus and a coordination point for joint and internal Army actions relating to space. In August 1984, a general officer level Army Space Council was established to consider policy concerning current Army activities in space and the future role of the Army in space, and to provide policy recommendations and guidance for Army space-related activities. The Army has also initiated an expanded study effort in an attempt to develop its own space plan, a strategy for future Army exploitation of space and space technology.[46]

To summarize its current role in space, the Army is heavily dependent on space-based systems for support in executing assigned missions even though it does not operate any space systems itself, has not been a driving force behind the development of space-based systems, and has no comprehensive plan for exploiting the full potential of either current or developing space technologies. Recognizing deficiencies in the current status, the Army has undertaken steps to reevaluate its role in space and develop a plan for the future.

Section VI. Joint Activities.

Although defense policy decisions made it inevitable that space system development and operation would be multiservice, these programs were not joint in the normal operational sense. The entry of the Joint Chiefs of Staff, the Joint Staff, and the Unified and Specified Commands into space activities has been a recent endeavor essentially confined to a single action, the establishment of a new unified command for space operations. As early as 1958, a few senior leaders recognized that the establishment of a separate unified command for space was needed to provide the means for directing scientific and technological developments toward meeting defense needs, instead of waiting for technology and systems to be developed and then deciding how to use them.[47] The first step was finally completed in 1983 when a recommendation to establish a new unified command was sent to the President by the Secretary of Defense.

Approximately one year after the recommendation was made, the President approved the establishment of the United States Space Command (USSPACECOM) on November 20, 1984 with an effective date of not later than October 1, 1985.[48] While the detailed assignment of missions and functions for the space command has not been finalized, it will "provide an organizational structure that will centralize operational responsibilities for effective use of military space systems...and will enhance our planning for future use of these and follow-on systems."[49] Space Command will, for the first time, bring space fully into the operational dimension of the Unified and Specified Commands.

CHAPTER 2

ENDNOTES

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10. Jasani, p. 58.

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12. Sundaram, p. 1024.

13. Reginald Turmill, ed., Janes Spaceflight Directory, London: Jane Publishing, Inc., 1984, p. 242.

14. Durch, p. 49.

15. Turnill, p. 248.

16. Turnill, p. 248; and Sundaram, p. 1024.

17. Turnill, p. 248.

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19. Ibid.

20. Robert B. Giffon, US Space System Survivability: Strategic Alternatives for the 1990's, Washington: NDU Press, 1982, p. 14. When this was written, 24 NAVSTAR satellites were planned for the constellation. This would have provided for six satellites to be in view at any time, instead of four for the 18 satellite constellation, which would have provided for the 10 meter accuracy quoted vice the 16 meters cited in the text. Budgetary constraints caused the reduction of the constellation to 18 satellites.

21. Durch, p. 50; and Turnill, p. 249.

22. Air Force Manual 1-6, Military Space Doctrine, 15 October 1982, para 3-1.b.(2).

23. Ibid., p. iii. It is worth noting that at the time of publication, 1982, the basic Air Force doctrinal manual, AFM 101, 1979, was also being revised to reflect space as an operational medium and not just as one of the missions of the Air Force. This 1979 document was the first time space operations had been included as an Air Force mission.

24. Charles W. Cook, Organization for the Space Force of the Future, January 21, 1981. Paper prepared by the Deputy Assistant Secretary of the Air Force, Space Plans and Policy, for the US Air Force Academy Military Space Doctrine Symposium, April 1-3, 1981, p. 4.

25. US Air Force Scientific Advisory Board, "Summer Study of Space," 1980, as quoted in Cook, p. 3.

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28. See Stephen J. Leon, "West Coast Shuttle Operations," Space World, September 1984, pp. 22-25.

29. James W. Canan, "Bold New Missions in Space," Air Force Magazine, June 1984, p. 88, quoting Stanley A. Tremaine, Deputy for Development Planning at Air Force Systems Command's Aeronautical Systems Division.

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47. James M. Gavin, *War and Peace in the Space Age*, New York: Harper & Bros, 1958, pp. 284-285.

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CHAPTER 3

NATIONAL SPACE POLICY AND STRATEGY

Section I. General.

In the previous chapter, the various involvements of the military departments in space activities and national and defense space policy decisions were noted several times as having a direct bearing on the way space activities were initiated and the lines along which the space programs developed. A comprehension of national level space policies and their development is important to understanding how the current military role in space developed and, in particular, to formulating concepts for future roles and involvement in space activities.

Section II. Space Policy.

Policy provides the goals or objectives and establishes the parameters within which strategies or plans are developed to achieve the desired ends. As such, a national policy may establish priorities, functional responsibilities, or boundaries and constraints that implementing strategies and programs will have to operate within; all will have significant impacts on the role and the manner in which a department or agency conducts its activities. Of particular significance is the area of appropriation and allocation of resources where a significant difference between the Executive and Legislative branches of government over the aims, direction, or priority of a policy can create a high level of uncertainty and turbulence at the execution levels within a department.

Several characteristics of national policies have a direct bearing on an analysis of space policy and the resulting effects on the Department of Defense and the Army. In general, a policy may be either proactive or reactive, event or personality driven, and explicit or implicit in the decisions or activities of the organization. Also, any given policy will rarely, if ever, stand alone; it will interact and often conflict with other policies with the result being guidance specific only to a single set of conditions and without general applicability.

Also, over time as a policy is infused through the levels of a department, it becomes so embodied in the bureaucratic procedures and institutional memory that it may not be readily apparent which resulting effects are directly attributable to any given policy. These characteristics all contributed to the way the US space policy developed and, specifically, to the current role of the Army in space.

As December 17, 1903, at Kittyhawk is significant in adding a third dimension to the progress of mankind, two days, October 3, 1942, and October 4, 1957, stand out as marking the beginnings of the fourth dimension--space. On October 3, 1942, space was added to the land, sea and air as an arena of warfare with the first successful test firing of a German A.4 rocket from Peenemuende. This rocket, better known as the V-2 (Vergeltungswaffe-2) through the German propaganda campaign, carried a 750 kilogram warhead to an altitude of 100 kilometers, travelled 193 kilometers downrange, and landed within four kilometers of the intended point of impact.[1] The age of the ballistic missile was born. Following the flight, Major General Walter Dornberger, the project director, made what would be considered the first space policy announcement in an address to the A.4 project team:

> The following points may be deemed of decisive significance in the history of technology: we have invaded space with our rocket and for the first time we have used space as a bridge between two points on earth; we have proved rocket propulsion practical for space travel. To land, sea and air may now be added infinite empty space as an area of future intercontinental traffic, thereby acquiring political importance. This third day of October 1942 is the first of a new era of transportation--that of space travel. So long as war lasts, our most urgent task can only be the rapid perfection of the rocket as a weapon. The development of possibilities we cannot yet envisage will be a peacetime task. Then the first thing will be to find a safe means of landing after the journey through space.[2]

German scientists and engineers formed the nucleus for the emerging space technology development program in the United States in the years following World War II. The Army maintained the most significant of the small space research and development programs and the national space policy of the Eisenhower administration (1952-60), space-for-peace, precluded the use of military hardware in any major space activity.[3] The constraints of this policy and the absence of a national level space organization to provide leadership and direction to the fledgling space programs contributed to the United States failing to exploit the potential available to be the first nation to place an artificial satellite into earth orbit.

The first man-made object was placed into orbit around the earth by the Soviet Union on October 4, 1957. Sputnik I weighed 83.5 kilograms, was .6 meters in diameter and was placed in a 252 by 903 kilometer orbit. In an immediate attempt to respond to this challenge, the United States accelerated its nonmilitary-based Vanguard satellite program to a December 1957 launch, only to have the rocket fail and burn just off the launch pad.[4] Problems related to the Vanguard program, together with the November 1957 Soviet Union launch of Sputnik II, led to a presidential modification of the space-for-peace policy to permit the Army to proceed with a satellite launch using the Redstone-derived Jupiter C rocket and a solid propellant fourth stage, the combination known as Juno. Using this system, the first US satellite, the 8 kilogram Explorer I, was orbited on January 31, 1958.[5]

This was a period of national policy turmoil. The Soviet space launches coincided with a Soviet high altitude H bomb detonation and aroused concern in Congress and the media that the United States was behind the Soviet Union in defense and technology. Congressional action in February established extraordinary committees for space matters and authorized the Department of Defense to establish the Advanced Research Project Agency. Defense had the responsibility for the space program since it had the only space capability, even though this was in direct conflict with the stated national policy for using space only for scientific and peaceful purposes.[6]

In an effort to reestablish civilian control over the space program and reaffirm his policy of only peaceful uses of space, in April 1958, President Eisenhower proposed the establishment of a new agency, the National Aeronautics and Space Administration (NASA) which would control national space efforts. No military space programs or activities were envisioned in this proposal. The Congress found the national policy implicitly contained in this proposal unacceptable and used the National Aeronautics and Space (NAS) Act of July 1, 1958, which authorized the establishment of NASA on October 1, 1958, to dictate dual national space program responsibilities, thereby establishing by law a new national space policy.

> The Congress declares that the general welfare and security of the United States require that adequate provision be made for aeronautical and space activities. The Congress further declares that such activities shall be the responsibility of, and shall be directed by, a civilian agency exercising control over aeronautical and space activities sponsored by the United States, except that activities peculiar to or primarily associated with the development of weapons systems, military operations, or the defense of the United States (including research and development necessary to make effective provision for the defense of the United States) shall be the responsibility of, and shall be directed by, the Department of Defense....[7]

This division between the military and civil aspects of US Government activities in space has remained basically unchanged throughout the remaining evolution of national space policy.

The next milestone to have an impact on the US space policy and programs was the successful single orbit of a man in space; the 89-minute flight of Major Uri Gagarin in the Soviet Vostok I on April 12, 1961. The United States responded with the successful 15-minute suborbital flight of Alan Shepard in the Mercury "Freedom 7" on May 5, 1961, which set the stage for President Kennedy's May 25 address to Congress which established the first national space goal.[8]

> ...I believe that this nation should commit itself to achieving the goal, before this decade is out, of landing a man on the moon and returning him safely to earth. No single space project in this period will be more impressive to mankind, or more important for the long-range exploration of space; and none will be so difficult or expensive to accomplish....In a very real sense, it will not be one man going to the moon--we make this judgment affirmatively--it will be an entire nation.[9]

The basic organizational structure existed, as did a national space policy set forth by Congress; this statement of a goal, which excited the population and gained its support, was the catalyst needed to energize the system and generate the large appropriations required for major advances into space.

The implementation of the congressionally mandated defense responsibilities in space resulted in the development of four general defense policy guidelines for space activities by the end of the Kennedy administration. First was the subtle change from the early Eisenhower policy that space was to be used only for nonmilitary purposes to the policy that space was not to be subject to national sovereignty and was to be used for peaceful purposes. Second, in support of the first, the military uses of space were not to be publicized in order to reduce the potential for adverse foreign reactions. Third, minimal effort would be devoted to the development of space-based weapons systems. No apparent advantages were seen at this time in placing weapons in space and, with the exception of the early landbased antisatellite developments, all efforts were confined to research and feasibility studies. The fourth guideline was that the United States would seek international agreements which would establish international recognition of the first three guidelines as the basis for legitimate national space activities.[10]

Within these broad and vague policy guidelines, and under the general program guidance of the Director of Defense Research and Engineering, each military service was permitted to conduct preliminary research and development of space-based systems to meet identified requirements. The advanced development, deployment, and operation of all space systems would be the responsibility of the Air Force unless the original service could support retention.[11]

In summary, then,

> By the end of the Eisenhower administration, the foundations of each of the major military space programs had been laid. Similarly, between October 1957 and October 1963 the policy guidelines that have determined the subsequent exploitation of space were also formulated. Successive administrations have reaffirmed these guidelines with relatively few diversions or contradictions.[12]

However, as noted earlier, policies do not exist in isolation, particularly where resources are in contention. Following the successful first landing and return of men from the lunar surface in 1969, the national goal set by President Kennedy had been met and a reevaluation of the priority and future of space programs were undertaken. This resulted in an announcement by President Nixon on March 7, 1970, that

> ...space expenditures must take their proper place within a rigorous system of national priorities....What we do in space from here on in must become a normal and regular part of our national life and must therefore be planned

in conjunction with all of the other undertakings which are also important to us.[13]

The immediate impacts of this announcement were the early termination of the Apollo lunar landings in December 1972 and the curtailment of proposed manned interplanetary exploration. The national emphasis had shifted from prestige in space to the economics of space operations. The 1972 approval of the development of a reusable space transportation system, the space shuttle, left only one surviving manned space program.[14] Although the major impact of the Nixon administration policy was in the civilian sector, a comparison of NASA and DOD budget authority shown in Figure 14 illustrates the overall trend in space activities which resulted from the lowering of priority.

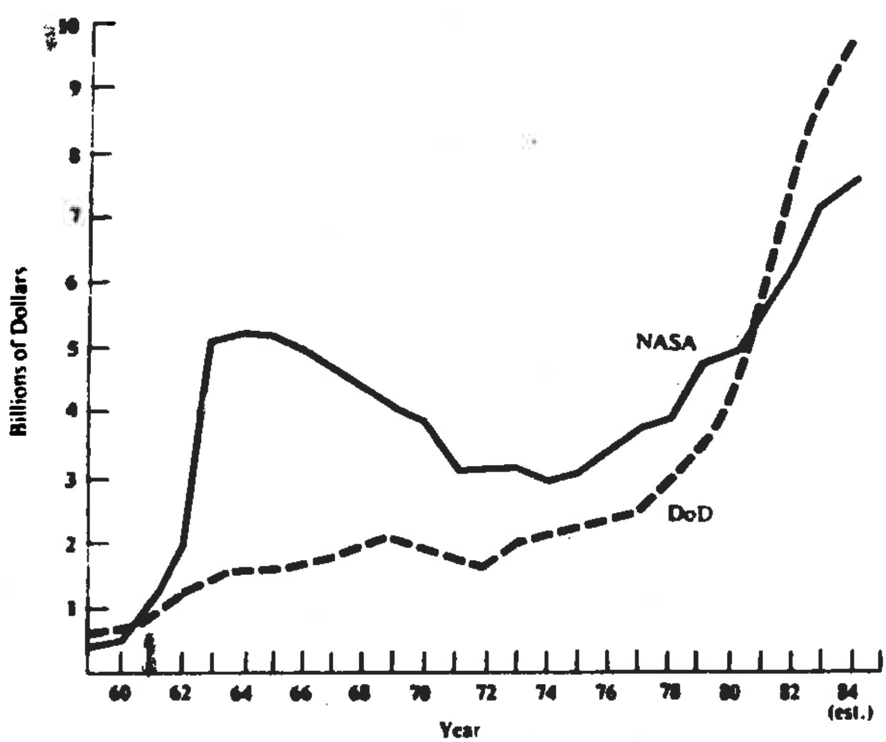

Figure 14. DOD and NASA Budget Authority for Space Related Activity, 1959-84 (Unclassified Accounts Only)[15]

The analysis of national policy space developments and the implementation within the Department of Defense, coupled with the related policy decision to give the Air Force the responsibility for the development of long-range, land-based missile systems, and the increasing internal pressures for Army reallocation of resources to Southeast Asia, provided the environment in which the Army descended from the position of being the lead service in space in the 1950's to no more than a customer of space-based systems in the 1970's. The system developer will normally establish the design criteria and mission capabilities of any new system. Other user requirements may be considered, and possibly even be satisfied, but the developer will devote resources primarily toward his own requirements and will be the predominant driver of final system characteristics. The development of Army systems to provide interfaces between Army elements and space systems and a minimally funded research effort for the land-based Ballistic Missile Defense (BMD) Program constituted the Army resource commitment to space-related activities. This occurred without either an established internal policy or strategies for taking the Army into the space age. Lack of an internal sense of direction with respect to space activities has been prevalent throughout the Defense establishment, which led defense analyst Colin Gray to state: "Notwithstanding a quarter century of space experience, the U.S. today remains confused as to what its space policy should be, how it should think about the military uses of space, and how military space activity may affect national military policy as a whole."[16] Before attempting to address the very significant changes which occurred in national security and space policies and goals in the early 1980's, it is necessary to understand why this situation existed and why it was even more prevalent in the Army. Gray's analysis of military space policy concluded that five factors have contributed directly to this inability to formulate a clear and meaningful space policy.

First is the introduction of a new dimension into warfare which is not compatible with the conceptions of warfare, strategy, and and doctrine developed over many years of experience by senior military officers in their own service environment. Second, program decisions can be and are made in their own very narrow context without the necessity of having to place them into a broader strategic context. Third, and closely related to the second, is that space systems have been developed in both a technology-push and requirements-pull environment, but always the primary driving force has been to achieve the most cost-effective solution to an already existing mission requirement. Then the lack of an organization centrally focused on space as a dimension of warfare led to fragmented technological developments and exploitation. Fourth, space weapons technology is in itself very immature, so the ever-present high uncertainty surrounds projections of what the environment of space warfare will actually be like. And lastly, in such new technology situations, military organizations historically proceed very deliberately in effecting changes in thought about conducting warfare. Normally only time, and in many cases demonstrated performance in combat, will reduce uncertainty and accelerate strategic and program development.

> Given the profound technical uncertainties pertaining to the projection of space combat potential, a policy bereft of any very specific national security vision is certainly prudent. What was lacking in US military space policy was recognition of the possibility that full military exploitation of space might enable US policymakers to effect a genuine revolution in strategy.

Even without strategic vision, the US might someday have discovered that through many minimal policy decisions a revolution in warfare had been implemented. However, as a general rule, progress is more likely if one knows where one wants to go.[17]

As with several preceeding administrations, President Reagan initially had an interagency group review all aspects of space activities from August 1981 until June 1982. The result was a complete restatement of national space policy which was released on July 4, 1982. This policy statement:

> reaffirms the national commitment to the exploration and use of space in support of our national well being and establishes the basic goals of United States space policy which are to:
>
> strengthen the security of the United States;
>
> maintain United States space leadership;
>
> obtain economic and scientific benefits through the exploitation of space;
>
> expand United States private sector investment and involvement in civil space and space related activities;
>
> promote international cooperative activities in the national interest; and
>
> cooperate with other nations in maintaining the freedom of space for activities which enhance the security and welfare of mankind.[18]

The main tenets contained in earlier space policy statements, space treaties which the United States has entered into, and unilateral US positions on space taken in international forums are carried forward into this policy statement essentially intact. However, the statements of sovereign rights and responsibilities and the use of space in support of self-defense are more clearly stated in these underlying principles which were set forth with the new policy:

- The United States is committed to the exploration and use of space by all nations for peaceful purposes and for the benefit of mankind. "Peaceful purposes" allow activities in pursuit of national security goals.

- The United States rejects any claims to sovereignty by any nation over space and over celestial bodies, or any portion thereof, and rejects any limitations on the fundamental right to acquire data from space. -

- The United States considers the space systems of any nation to be national property with the right of passage through and operation in space without interference. Purposeful interference with space systems shall be viewed as an infringement upon sovereign rights.

- The United States encourages domestic commercial exploitation of space capabilities, technology, and systems for national economic benefit. These activities must be coexistent with national security concerns, treaties and international agreements.

- The United States will conduct international cooperative space-related activities that achieve scientific, political, economic, or national security benefits for the nation.

- The United States space program will be comprised of two separate, distinct and strongly interacting programs--national security and civil. Close coordination, cooperation and information exchange will be maintained between these programs to avoid unnecessary duplication.

- The US Space Transportation System (STS) is the primary space launch system for both national security and civil government missions. STS capabilities and capacities shall be developed to meet appropriate national needs and shall be available to authorized users--domestic and foreign, commercial and governmental.

- The United States will pursue activities in space in support of its right of self-defense.

- The United States will continue to study space arms control options. The United States will consider verifiable and equitable arms control measures that would ban or otherwise limit testing and deployment of specific weapons systems, should those measures be compatible with US national security.[19]

The retention of the separate but interactive role of civil and defense space activities was reinforced and clarified in the guidance applicable to both elements:

- The national security and civil space programs will be closely coordinated and will emphasize technology sharing within necessary security constraints. Technology transfer issues will be resolved within the framework of directives, executive orders, and laws.

- Civil earth-imaging from space will be permitted under controls when the requirements are justified and assessed in relation to civil benefits, national security, and foreign policy. These controls will be periodically reviewed to determine if the constraints should be revised.

- The US Government will maintain and coordinate separate national security and civil operational space systems when differing needs of the programs dictate.[20]

To monitor the implementation of the policy, a Senior Interagency Group was established as a permanent body. Chaired by the Assistant for National Security Affairs with representation generally at one level below Cabinet rank from both national security and civil agencies with a direct interest in space policy, it has the charter to rapidly refer space policy issues to the President when his decision is required.[21]

The most radical changes were made in the national security guidance. If the four guidelines for defense space activities carried forward from the Kennedy years were vague and somewhat negative in their approach toward militarizing space, the four new statements were both positive and specific in their guidance.

- Survivability and endurance of space systems, including all system elements, will be pursued commensurate with the planned use in crisis and conflict, with the threat, and with the availability of other assets to perform the mission. Deficiencies will be identified and eliminated, and an aggressive, long-term program will be undertaken to provide more assured survivability and endurance.

- The United States will proceed with development of an antisatellite (ASAT) capability, with operational deployment as a goal. The primary purposes of a US ASAT capability are to deter threats to space systems of the United States and its allies and, within such limits imposed by international law, to deny any adversary the use of space-based systems that provide support to hostile military forces.

- The United States will develop and maintain an integrated attack warning, notification, verification, and contingency reaction capability which can effectively detect and react to threats to US space systems.

- Security, including dissemination of data, shall be conducted in accordance with Executive Orders and applicable directives for protection of national security information and commensurate with both the missions performed and the security measures necessary to protect related space activities.[22]

Although the policy does not explicitly state that defensive weapons systems will be deployed in space, this option is certainly left open in the third statement. This policy announcement[23] provided the basis in 1984 for the promulgation of a national space strategy.

Section III. Space Strategy.

Within the framework of established policy, strategies are developed as the plan for achieving the national goals and objectives. To examine the national space strategy as it relates to defense, it is first necessary to review the overall national security objectives and defense strategy so that space strategy can be considered in its proper perspective as one element of these more encompassing domains.

The paramount national security objective, although stated in slightly different terms from time to time, has been essentially constant over the life of the nation. It is: "To preserve the United States as a free nation at peace, with its fundamental values intact."[24] From this general objective statement follow supporting objectives which more definitely specify the current, and more transitory, goals which the defense strategy and implementing programs are designed to achieve. There are currently nine such supporting objectives:

- Safeguard the United States, its allies, and friends from aggression and coercion;

- Ensure continued U.S. access to the oceans and space;

- Protect American citizens abroad;

- Protect U.S. economic interests worldwide by maintaining steady access to energy supplies, other critical resources, and foreign markets;

- Maintain close and productive relations with our allies and friends abroad and work closely with them to build and maintain regional stability in areas of shared vital interests;

- Inhibit the expansion of Soviet control and military presence throughout the world, while increasing the costs of supporting or using subversive, terrorist, and other aggressive forces, for the Soviet Union or any other nation or group espousing such tactics;

- Support the development and preservation of democratic political institutions in other nations;

- Limit Soviet military advantages by strengthening U.S. and allied military capabilities, and by preventing the flow of militarily significant technologies and resources to the Soviet Union; and

- Pursue equitable and verifiable arms reduction agreements to create a stable and secure military balance and deterrence at lower levels.[25]

Although these supporting objectives are tailored to a specific time and environment, they continue to reflect the national character and values of the main objective; that is, that the United States is a status quo country intent on preserving rather than increasing its sovereignty. This leads directly to a nonaggressive defense strategy, basically stable in nature, which tends to be driven more by outside events than internal pressures. The entire defense strategy has been well summarized into two elements:

- To deter aggression and coercion against the United States and its allies, friends, and vital interests.

- Should deterrence fail, to seek the earliest termination of conflict on terms favorable to the United States, our allies, and our national security objectives, while seeking to limit the scope and intensity of the conflict.[26]

Deterrence of aggression is the key to this defense strategy, but the concept and application of deterrence in our national strategy has undergone considerable modification in this century.

The geographical separation of the United States from aggressive nations effectively precluded the necessity for any significant concern on the part of national strategists for most of our history. Advancing technology gradually diminished the barrier of geographic distance in the projection of military power and, therefore, the deterrent value inherent in physical separation. The coupling of the atomic bomb with the accurate ballistic missile capable of intercontinental range raised deterrence to the forefront for US defense strategists. From the end of World War II through most of the 1960's, the United States either had a complete monopoly or overwhelming superiority in this new era of strategic nuclear warfare. The credible US threat of reacting with a nuclear attack which could not be defended against or responded to in a like manner acted as a deterrent to aggression, at least on a worldwide scale. This threat also deterred aggression directed against those nations which the United States was committed to defend for all practical purposes just as if they were within US sovereignty.

The containment of strategic nuclear capability was a stated goal of the United States; but obviously, at least in retrospect, not one which the United States would use military power, conventional or nuclear, to achieve. Historically, the containment of technology has not been achievable in general, and certainly not against a nation aggressively pursuing technology and willing to devote significant national resources toward it. The steadily increasing strategic nuclear capability of the Soviet Union created a new situation where the two "superpowers" confronted each other, each with the capability to project overwhelming amounts of military power into the territory of the other, generally regardless of who launched first, and with little or no capability to defend against such an attack. This situation, named "mutually assured destruction" (MAD) existed but certainly has not become a static or stable standoff situation. Continued improvements in the military effectivenss of the weapons systems themselves, and continuous growth in the quantity of Soviet systems are the characteristics which describe the strategic deterrence environment confronting the Reagan Administration prior to announcing the Strategic Defense Initiative.

Section IV. The Strategic Defense Initiative.

In his address of March 23, 1983, the President reviewed the history of national defense strategy and arms control in the nuclear age concluding that the continuing reliance on retaliatory capabilities was becoming less stable and that the United States must develop an alternative approach. The goal of the program is ambitious, to reduce the danger of nuclear war by developing defenses which will be the "means of rendering these nuclear weapons impotent and obsolete."[27]

If SDI concepts are ever implemented, it would be important to maintain effective nuclear retaliatory capabilities until they are no longer required, to increase conventional capabilities to deter non-nuclear aggression, to continue our defensive commitments to allies and, through the arms control negotiation process, to seek the reduction of offensive nuclear capabilities on both sides. The key to strategic defense is the capability to intercept and destroy strategic nuclear missiles before they reach their targets, and the initiative of SDI is "a comprehensive and intensive effort to define a long-term research and development program to begin to achieve our ultimate goal of eliminating the threat posed by strategic nuclear missiles."[28] No specific reference was made to space-based weapons systems in the announcement of SDI, and it is too early in the research program to speculate on the kinds of systems whether ground-based or space-based that might prove desirable to employ. Any simple analysis of the ballistic missile intercept problem, however, identifies space as the predominant arena, based both on emerging weapon system technologies and time availability of a target missile. The ballistic missile defense problem and new technologies will both be addressed in more detail later in this report. For strategic analysis purposes, three aspects of SDI are of primary significance. First, SDI is a research program. No particular technology or type of weapon system is prescribed, although the emphasis is on non-nuclear technologies. Second, as does any research program, SDI needs focus. It is focused only at ballistic missile defense (BMD), primarily since this is the most difficult of the strategic defense problems and the one which has previously not been effectively solvable with existing technologies. The solution to the BMD problem would then open the way for rebuilding the air defense capability which was allowed to seriously deteriorate after ballistic missiles became the primary strategic threat weapons. Third, the SDI will be conducted within the constraints of the current treaty environment. Specifically, the ABM treaty limits the development and deployment of BMD systems and this obligation is clearly incompatible with achieving the ultimate goals of strategic defense. However, the SDI research program can and will be conducted in compliance with the treaty.[29]

To implement SDI, the Strategic Defense Initiative Organization (SDIO) was established as a separate element in the Department of Defense in March 1984. The SDIO is directed by Air Force Lieutenant General Abrahamson who reports directly to the Secretary of Defense. The SDIO has defined four phases in the development of strategic defense. First, a Research Phase extending into the early 1990's would include focused research which would provide a future president and Congress the data required for an informed systems development decision. Second, should such a system prove feasible, in a Systems Development Phase prototype systems would be designed, built and tested. Third, during a Transition Phase, systems would be incrementally and sequentially deployed. Fourth, in the Final Phase, highly effective systems would be in place and offensive ballistic missiles significantly reduced since they no longer constituted an effective offensive threat. The goal for entering into the final phase is prior to the year 2000.[30]

To arrive at a point in the early 1990's when informed decisions about development of strategic defense systems can be made, research is being conducted by the SDIO in five key technology areas: directed energy weapons; kinetic energy weapons; surveillance, acquisition, tracking, and kill assessment systems; battle management and command, control, and communications systems; and survivability, lethality, and support technologies.[31] Concurrent with this research program, the Department of Defense has increased efforts to upgrade the long neglected air defense surveillance and interceptor forces and to complete the test and evaluation of an antisatellite (ASAT) system by FY 1987. The goal of the ASAT program is an operational system effective against low earth orbit satellites.[32] These programs are as critical to a strategic defense capability as the BMD oriented SDI program but tend to attract less interest since the technologies are more mature.

Section V. A New Space Strategy.

Following the establishment of SDIO, and congressional support for at least the initial efforts of the SDI, an overall strategy for achieving space goals and implementing the national space policy was approved by the President on August 15, 1984. This strategy addresses: the Space Transportation System, the civil space program, the commercial space program, and national security space programs. The national security portion of the strategy provides the overall plan within which the military services will develop implementing strategies and programs. The strategy emphasizes the following areas:

- Maintaining assured access to space through expendable launch vehicles as well as STS.
- Enhancing the survivability of critical space systems.
- Stemming the flow of space technology to the Soviets.
- Continuing study of space arms control options.
- Ensuring all national security space programs support SDI.
- Developing new space capabilities through a vigorous space technology program.[33]

This strategic guidance is now a part of the US national military strategy, which has, at least in recent history, been based on these fundamental elements: credible deterrence, forward defense, and collective security. In concept form, these strategic fundamentals translated into a defense program of strategic nuclear equivalence; maintaining a forward deployed military presence in those areas which represented a high US defense commitment, and a central reserve supported by the strategic mobility capability to deploy US forces when and where they might be needed.

Within this dynamic framework of goals, policies, and strategies, the military services have developed their force structure, systems, and doctrine to accomplish their specific missions and roles in national defense. Before projecting these out into the next century and examining how they interact with space as the latest dismension for warfare, the emerging technologies will be examined to assess their potential impact on the traditional dimensions of the military services--land, sea, and air warfare.

CHAPTER 3

ENDNOTES

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27. Ronald Reagan. Peace and National Security: A New Defense. Speech delivered to the American People from the White House, Washington, DC: March 23, 1983. Reprinted from Vital Speeches of the Day, Vol. XLIX, No. 13, April 15, 1983 (reproduced at Appendix B).

28. Ibid.

29. See Chapter 4.

30. James A. Abrahamson, "The Strategic Defense Initiative," Defense, August 1984.

31. Weinberger, 85 Report to the Congress, p. 213. Specific aspects of space-based weapons are described in more detail in Chapter 4.

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CHAPTER 4

MILITARY TECHNOLOGIES IN SPACE: THE SDI PROBLEM

The challenge set forth in the Strategic Defense Initiative is to develop the technologies and systems to defend against the threat posed by strategic nuclear missiles. The analysis of this challenge logically starts with the threat. The flight of a single strategic ballistic missile has four distinct phases: boost, busing, midcourse, and terminal which essentially represent four distinct types of targets with different characteristics and environments. These phases are shown in Figure 15.[1]

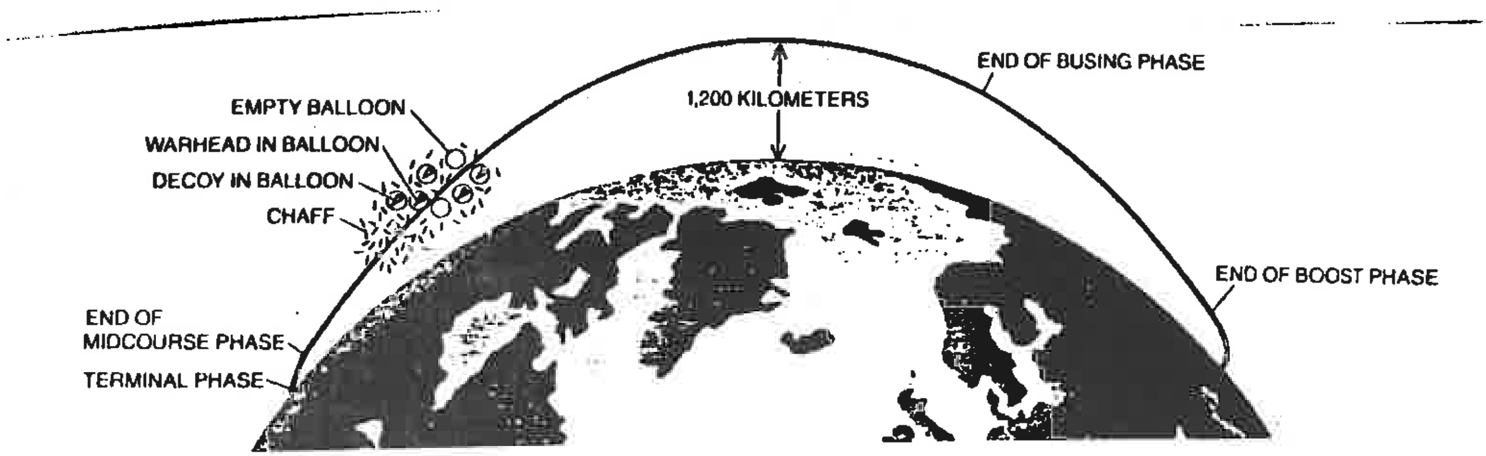

Figure 15. Phases of a Ballistic Missile Flight

The boost phase lasts from three to five minutes, from launch to final-stage rocket burnout and separation well above the earth-space boundary. The busing phase, which exists only for multiple warhead or reentry vehicle (RV) systems, is the period during which individual RVs are expelled from the carrier, or post-boost, vehicle, possibly also along with decoy or other deceptive devices. The midcourse phase consists of the now separated cluster of RVs diverging toward their individual targets in ballistic trajectories. This is the longest phase and may last up to 20 minutes, depending on the range of the ballistic missile. The terminal phase is the decay of the ballistic trajectory as the RV reenters the earth's atmosphere down to detonation of the warhead or impact with the earth's surface. The SDI approach to this threat is to develop the optimal technologies for destroying missiles in each phase of flight, thus achieving a layered defense so that each successive layer compensates for inefficiencies, i.e., leakage, through the preceeding layers. The technologies required to solve the ballistic missile defense threat can be grouped into several specific categories. "Before any ballistic missile intercepts can take place, the attacking objects must be detected, identified, located, and tracked."[2] Technology projects for surveillance, acquisition, tracking, and kill assessment have been established within the SDIO to examine technologies which could accomplish these functions. In addition, research on launch vehicle and logistical requirements (to include power supply), battle management technology, the integration of all system components and the command and control of subsystems, survivability and vulnerability countermeasures, and weapon system technology programs are being conducted by the SDIO to complete the total system research effort.[3]

The Army demonstrated at least proof-of-principle for a non-nuclear, kinetic energy, late midcourse phase, kill capability in the June 1984, Homing Overlay Experiment. Equipped with a long-wave-length infrared sensor and launched from the ABM Test Range at Kwajelan, the experimental flight vehicle homed on the target, an ICBM reentry vehicle lauched by a Minuteman I from Vandenberg AFB, and destroyed it at 160 kilometers altitude with an unfolding (like an umbrella frame), rib-type, nonexplosive warhead. The two objects had a closing velocity of almost six kilometers per second. Since the destructive effect of a kinetic energy weapon is proportional to the mass multiplied by the velocity squared, the kill effectiveness of very small objects can be greatly increased by increasing the velocity. In the relative void of space, the only significant force acting on the projectile is gravity, which greatly extends the effective range of pellet or shrapnel-type warheads detonated by a conventional explosive.

Another method of increasing effectiveness is to increase the velocity of the projectile itself. A technology under development to accomplish this is the electromagnetic rail gun. "The technique involves the use of homopolar generators to store several megajoules of energy used to generate mega-ampere currents producing an electromagnetic driving force on the projectile."[4] Velocities up to ten kilometers per second have been achieved for projectiles weighing a few grams; with development of more efficient technologies, velocities up to 100 kilometers per second should be achievable. Projectives at such velocities would probably have only a space-to-space kill capability because of the severe atmospheric heating which occurs at velocities in excess of five kilometers per second.[5] An advantage of kinetic energy high velocity interceptors is the capability for on-board homing which reduces the effectiveness of evasive countermeasures. A repetitive firing electro-magnetic rail gun has been demonstrated in a laboratory by researchers at the University of Texas.[6] A major disadvantage is that velocities of 100 kilometers per second, about 60 times the muzzle velocity of the M1 tank, 105 mm sabot round, are comparatively very slow in the space warfare environment where reengagement decisions will have to be made in tenths of seconds.

Such reengagement times are possible with weapons systems velocities at or near the speed of light; about 300,000 kilometers per second, which is achievable within the developing technologies of directed energy weapons. Directed energy weapons system technologies also fall into two general categories: laser systems and particle beam systems. A particle beam weapon system would be a stream of charged or neutral subatomic particles accelerated to near-light speed and focused on the target. A charged particle beam could be used within the atmosphere because, as it is propagated, it bores a self-focusing hole through the air; however, it may be impossible to propagate a well-collimated charged beam in space because of the effects of electron repulsion and the geomagnetic field. However, a neutral beam, produced by the acceleration of negatively charged hydrogen atoms and then stripping off one electron, could be effective in space. Particle beam technology is at the proof-of-principle stage with advances in weight reduction, power resources, beam intensity and focusing technologies required before weapon system development can be considered.[7]

The other directed energy weapons technologies are in the realm of laser beams, the most mature of these being infrared chemical lasers, fueled by hydrogen fluoride or deuterium fluoride. These lasers, which get their energy from the fuel which powers the laser, currently have the highest potential for being the first deployed space-based directed energy weapons system. Research is also being conducted in the area of shorter wave length, therefore higher destructive effect per unit time, excimer, or rare gas; lasers which would have enough power for an "impulse kill" instead of the "burn through" kill of the longer wave length infrared chemical lasers.[8]

The problem of placing large and heavy excimer laser power supplies in orbit could be solved by placing the laser on the ground and reflecting the beam onto the target through a series of flexible mirrors, as shown in Figure 16.[9]

The pulsed lasers, which are shown on a connecting arm, but could just as well be on a separate satellite, are offset from the laser mirror to provide pulses from space to earth. The analysis of the distortion in these pulses will permit the ground based laser to compensate for atmospheric distortion in the laser beam transmitted from the ground. The laser shown is an 0.3 micrometer, ultraviolet, wave length beam which would be relayed from the mirror in geosynchronous orbit to a second mirror in a polar orbit which would in turn refocus the beam onto the ballistic missile while it was still in the boost phase.[10] The capability to remove the effects of atmospheric distortion from a laser beam being transmitted from the ground into space is a demonstrated technology.[11] More recent technological developments have indicated that it may be possible to apply techniques used in phased array radars and to place ten or more small excimer lasers together in a cluster and combine their output into a single powerful beam. This technology would reduce the system weight-to-power-output ratio and open the possibility for space basing of an excimer laser weapons system.[12]

Research is being conducted on even shorter wave length lasers.

> The free-electron laser operates by means of a beam of electrons which are made to emit laser radiation as they pass through a wiggler magnet, a tube-shaped magnetic field. The wave length of the radiation is tunable by adjusting the magnetic field and it has been demonstrated that operation in the ultraviolet and x-ray part of the spectrum is possible. While the efficiency of the free-electron laser may be quite high--at least theoretically--it remains to be seen whether a sustained, high power output can be produced.[13]

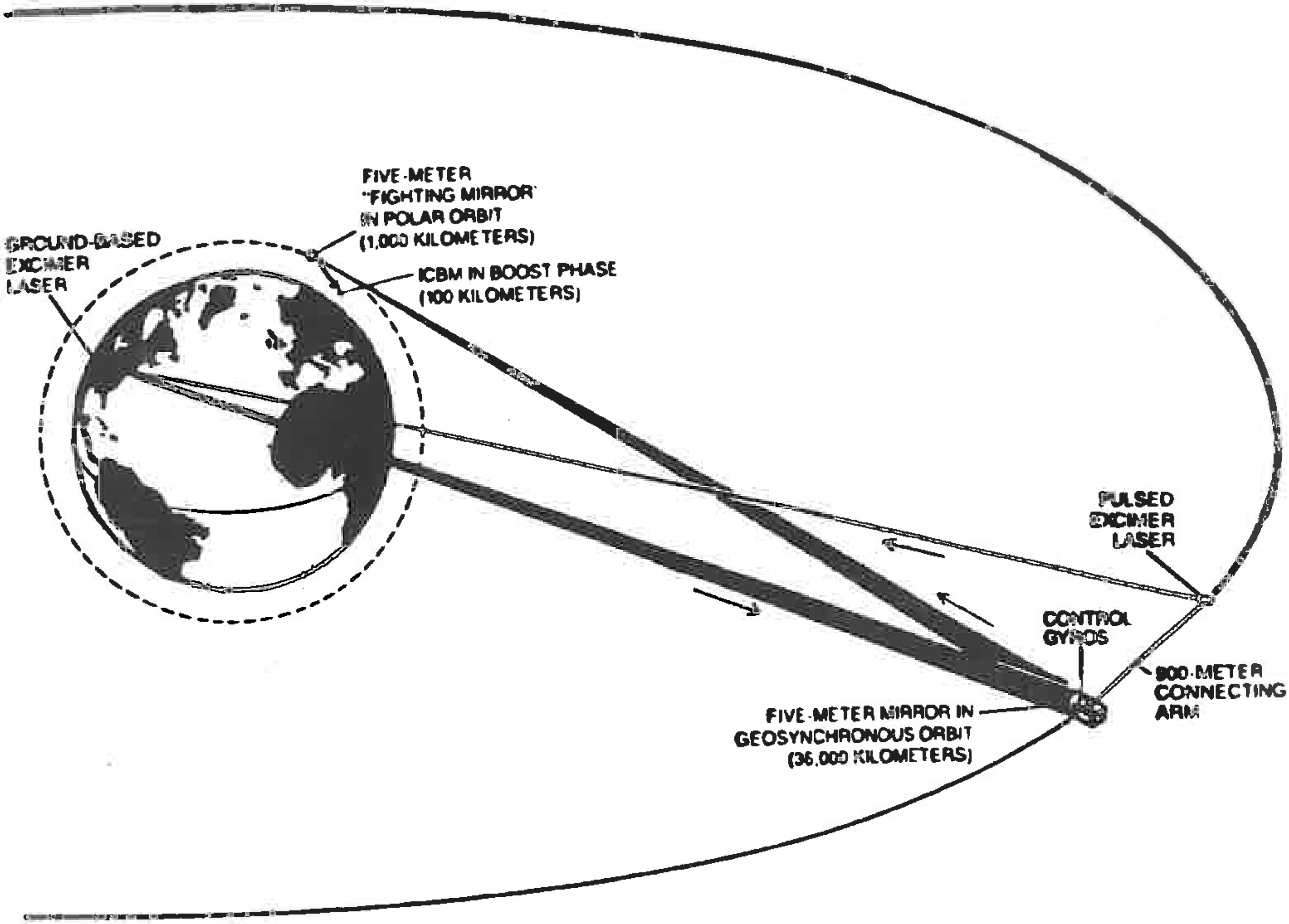

Figure 16. Ground-Based Laser BMD System

The X-ray laser consists of a cylindrical array of thin fibers surrounding a nuclear explosive. The thermal X-rays generated by the nuclear explosion stimulate the emission of X-radiation from the atoms in the fibers. The light produced by an ordinary optical laser can be highly collimated, or directed, because it is reflected back and forth many times between the mirrors at the ends of the laser. An intense X-ray beam, however, cannot be reflected in this way, and so the proposed X-ray laser would emit a rather divergent beam; for example, at a distance of 4,000 kilometers, it would make a spot about 200 meters across.[14]

As shorter wave length laser technology progresses, two physical characteristics become more important. First, the amount of energy per photon increases as the wave length decreases and, second, the capability of materials to reflect the laser, thus reducing the destructive effects, decreases as wave length decreases.[15] Research is now underway to examine the feasability of gamma ray lasers, or grasers. A gamma ray laser, with a wave length of about 100-millionth of a centimeter, would carry significantly more energy than an x-ray laser. "Consequently, it would be considerably more effective than an x-ray laser as a directed energy weapon system."[16] Research into gamma ray laser development is in very early stages, but illustrates that if there is a technological plateau in directed energy weapons, it is far from being reached.

The main thrust of weapons technology research is examination of technologies for achieving kills during the boost phase of ballistic missile flight. This is so for two significant reasons: first, destroying one missile in boost phase is equivalent to the destruction of up to twelve or more separate, independently targeted, nuclear warheads in later phases; and, second, destruction would occur before decoys or other post-boost deceptive countermeasures could be initiated. In terms of the overall defense system effectiveness, the deployment of even a moderately effective boost phase kill capability would greatly reduce the number of targets confronting the weapons systems in the later phases, thereby not only simplifying the battle management problem but also increasing the available engagement time per target.

Directed energy technologies being developed primarily for their destructive properties also have a major role, at much lower energy levels, in the surveillance, target tracking, and target discrimination functions. The currently deployed ballistic missile launch detection capabilities include both ground and space-based programs. Ballistic missile launch information is combined with space monitoring information collected primarily by the ground-based Ballistic Missile Early Warning System (BMEWS) radars covering polar orbits and trajectories, Pave Paws solid-state phased-array radars on the east and west coasts of the United States, and the Ground-based Electro-Optical Deep Space Surveillance (GEODSS) system with five high powered telescopic systems deployed around the world.[18]

Targeting data would be passed to a group of lower orbiting sensor platforms using the new technologies of space-based synthetic aperture radars, optical synthetic aperture systems using laser beams rather than radar, or long wave infrared sensors, to provide for the continuous tracking of the ballistic missile and reentry vehicles throughout the trajectory.[19] Laser tracking has demonstrated the capability for extreme accuracy, measuring the distance to a reflector placed on the moon to within 1.7 centimeters, or about two-thirds of an inch, a distance of over 230,000 miles,[20] and long wave infrared sensors of the type used in the Homing Overlay Experiment are credited with being able to detect heat equivalent to a single human body at ranges in excess of one thousand miles against the background of space.[21] These technologies not only support the tracking function which must be effective if the overall system is to be effective, but also have a role in overcoming one of the possible countermeasures which would be actively employed to degrade the ballistic missile defense system--the use of decoys.

A technology for discriminating between a lighter decoy and the heavier warhead is to pulse the reentry vehicle with a laser and measure the reaction of the reentry vehicle, the lighter decoy reacting more to the energy transfer from the laser pulse than the warhead.[22] Similarly, warheads and decoys, being of different compositions, would radiate and lose heat generated by atmospheric friction during the boost phase at different rates during post-boost phases of the trajectory.

Decoys are but one of several methods discussed in the literature which could be used to try to negate or degrade the effectiveness of a ballistic missile defense system. These suggested possible countermeasures range from positive actions to destroy or disable portions of the defense system, building faster booster rockets, shielding, or spinning boosters against laser effects, all the way to simply building so many ballistic missiles that the defense system could not handle the target load confronting it. In analyzing countermeasures, several generally applicable factors need to be considered. First, the presence of a ballistic missile defense perceived to be effective by the Soviets would introduce uncertainties throughout their strategic military establishment which would not be present in the absence of the defensive system. Second, there would be a cost if countermeasures were to be applied. Modifications which add weight to the ballistic missile reduce either range or payload capability. In this regard, the layering of the defensive systems to destroy missiles in each phase of the trajectory would become critical since, for a countermeasure to be effective, it would have to degrade the defense system for more than a single phase or a single kill technology. However, this would not be a one-sided effect. The introduction of positive measures to destroy or degrade the defense system would require improvements to enhance the survivability of the defense system which would have corresponding costs. US policy has repeatedly emphasized that the United States will not develop or deploy advanced defenses against ballistic missiles unless they are survivable and cost-effective. The cost-effectiveness criterion is far more than an economic argument. It requires that any future defensive systems provide clear disincentives to overwhelm them with a proliferation of offensive forces.

Finally, and perhaps the key technology area in ballistic missile defense, is the battle management system. Battle management, as used in the SDI context, includes the complete command and control system with all the interconnecting communications links which would manage the resources and operations of a ballistic missile defensive system. The major outside input to the battle management system would be the current state-of-the-world in the form of the applicable decision criteria, rules of engagement, which would establish the readiness posture and degree of autonomy of the system in accordance with the guidance of the National Command Authority. Internally, the management system would monitor and control the location and operational status of each individual component of the system as well as the threat environment. "Space object detection and tracking data will be coming in from different sensors with varying credibility at different data rates. For each object, this data must be analyzed and correlated quickly, and impact points extrapolated, in order for there to be timely discrimination, assessment, and identification."[23] These processes would then enable the management system to identify and report that information, either on the defense system itself or on an event which was outside its autonomous operational control criteria. During an engagement, the battle management system would additionally assign surveillance sectors for target tracking to sensors, assign targets to weapons systems, conduct kill assessment, and reassign targets as required.[24] Such a highly automated system will be required because "The complexity of the strategic defense C^3I battle-management tasks is such that unaugmented human decision-making will be impossible."[25] It has been estimated that data rates on the order of ten million bits per second would be required to operate the system, and such rates are within the current communications technology capability. However, the operating speeds for the computers needed for the battle management system to operate effectively are beyond that which can be done today. The exact requirements have not yet been defined, but estimates for the processing of information from a single optical sensor are on the order of 10,000 million operations per second.[26] One area of technology which is being investigated is optical computers, where photons, which have no mass, are used instead of electrons to carry information within the computer. An optical computer could have greatly increased computational capability over a conventional electronic computer of the same size.[27]

This is certainly not a complete review of all the technology developments being undertaken, or which will be required, for a strategic missile defense system to be developed and deployed.[28] However, it provides examples of some of the more critical areas where technological development is required and illustrates some emerging technologies which also have the potential for radically altering the way combat is conducted in the air, land, and sea dimensions as well as in space.

CHAPTER 4

ENDNOTES

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CHAPTER 5

CONCLUSIONS AND THE IMPACT ON LAND WARFARE IN THE 21ST CENTURY

Whether it is termed a dimension, medium, environment, or arena, unquestionably space has joined with the land, sea, and air in any consideration of the employment or projection of military force as an element of national power. Although currently confined to a support role, space systems are becoming increasingly more vital to the execution of landpower, seapower, and airpower missions; and the era of space power is rapidly approaching. With the deployment of a military power projection space force will come the development of spacepower doctrines, strategies, and tactics for the employment of that force. If history is a teacher, this will be a continuous and evolutionary process with each new concept for spacepower being exercised, evaluated, and revised before being accepted for operational use. Neither can spacepower concepts be developed in the isolation of the space environment because the technologies of warfare have progressed far beyond the period where the only interdimensional combat interface which had to be considered was an area a few miles either side of the shoreline. The theory and practice of warfare is a multidimensional discipline; a change in the doctrine or strategy in any one dimension will impact on all the others just as a technological advance in one will affect all to some degree.

Land [illegible] on space

The Army today stands on the threshold of the age of four dimensional warfare. Already deeply committed to space systems for land combat support, the Army faces the challenge of preparing the landpower force to operate effectively in a future warfare environment where space-based weapons systems will have as much or more influence on land combat as airpower has today. That the Army has not fully exploited the potential of space and space technology to support land combat operations is not as much a condemnation as it is a reflection of the current technological era. What is more important is that the Army now evaluate emerging military technologies, begin to adapt them to land combat, and develop the knowledge and expertise to transition landpower into the age of space warfare with a thorough understanding of technologies and dimensions which will influence military combat operations. Assessing the implications of spacepower on the projection or employment of landpower by the Army of the future requires that future developments and changes in landpower technology and in the mission environment of the Army be considered along with the interactive effects of spacepower, airpower, and seapower.

To prepare for the conduct of land warfare operations in the future, the Army attempts to establish the characteristics of the future environment by developing trends from the past and projecting them forward in time. Within a broad perspective, this technique provides a reasonable basis for structuring, equipping, and training the future Army. Although the confidence in the accuracy of the projected environment must decrease as the trends are projected further into the future, this can be compensated to a large extent by correspondingly less rigid long-range force structure decisions since more time will be available to adjust to and incorporate unforeseen circumstances.

Four current trends are considered to be of current special significance to the Army:

- The continuing Soviet military buildup in strategic nuclear, tactical nuclear, and conventional forces leading to an increased capability to project power beyond the Eurasian landmass;

- the increasing incidence of international terrorism sponsored by soverign states;

- the increasing incidence of low intensity conflicts, predominantly in third-world or developing nations, which have been supported by widespread proliferation of sophisticated conventional armaments; and

- increasing industrial nation vulnerabilities as a result of growing dependence on overseas energy resources and raw materials.[1]

Based on the analysis of these trends, the Army Chief of Staff predicts that "the future global environment is likely to be characterized by greater diffusion of power, increased interdependence, reduced political and economic stability, and greater vulnerability to conflict."[2] In this environment, the conventional landpower forces of the United States and its allies are envisioned as having an increased role in the deterrence of all types of conflict by raising the nuclear threshold and by containing crises and low intensity conflicts below the level of superpower confrontation.[3] This projection is being equated to a landpower force which maintains capability to conduct military operations anywhere in the spectrum of conflict with an increasing emphasis on light, highly mobile, self-contained, and rapidly deployable forces capable of implementing US strategy in the higher-probability lower-intensity conflict situations.

Against these, admittedly very general, projected landpower force characteristics the implications and interactions of spacepower need to be assessed. The most recent historical analogy to draw upon is the technology development of the internal combustion engine which removed the remaining constraint to manned flight and led to the evolution of airpower as an element of military power. The more recent technology of jet engines had a significant impact on the doctrines, strategies, and tactics of the Air Force but has not been nearly as significant to the interaction of airpower and landpower as the technology of the helicopter.

In its early roles, the airplane supported combat operations in the areas of communications and reconnaissance, providing capabilities to enhance the effectiveness of ground combat which had theretofore not been available to the ground commander. Gradually ground commanders began to rely more and more on these enhanced capabilities and incorporate them into their operational planning, thereby becoming more dependent on them for success on the battlefield. They also became more aware of the threat posed by these same capabilities in the hands of the enemy and began to take actions on the ground to conceal activity and deny the enemy access to the airspace above their lines. At least up to this point, the analogy between aircraft and space systems is almost exactly parallel with the exception that the early aircraft were procured directly from civilian developers and were essentially indistinguishable from their civilian counterparts. Having a world war occur early in the development of aircraft undoubtedly accelerated the military development and employment process. As the experience with aircraft in combat grew, the capabilities of the new technology were rapidly expanded into new mission areas, air-to-air warfare began to develop in its own right, and bombs became a direct means of influencing the outcome of ground combat. The influence of aircraft on the conduct of naval warfare had a spillover effect which finally resulted in the abolishing of one Army branch, the Coast Defense Artillery, whose mission had become inconsequential. Two new Army branches were formed--Air Defense Artillery and the Air Corps--and even after the Air Force was formed, the Army again found its internal use of aircraft so pervasive that Army Aviation was reestablished as a branch. In addition to the direct combat roles of interdiction and close air support, and the reconnaissance and communications roles mentioned above, the aircraft has had a significant impact on almost every functional aspect of the Army and land warfare: movement to combat, rapid deployment, airborne, and air assault; artillery airborne target acquisition and fire adjustment; logistical resupply; medical evacuation; airborne command posts; and special operations forces, just to itemize a few.

The importance of this analogy lies in the understanding that the interactive role of airpower and landpower expanded and changed during each period of conflict since the introduction of the airplane. Sometimes this was driven by new technology, sometimes by battlefield experience and requirements, and sometimes by the nature of the land combat. Some of the changes were envisioned during peaceful interludes but more often they originated during the conflict which is not unusual since armed conflict has always tended to act as a catalyst for technological as well as operational developments.

Some important aspects of the development of airpower are relevant and can be applied to spacepower and its future interaction with landpower. In the area of combat support, the trend for space systems to link directly with successively lower echelons of forces can be expected to continue. The largest implication of this trend for the Army results from the multiplier effect as lower tactical echelons become directly involved. A basic knowledge of how space systems operate and detailed knowledge of the operating characteristics, capabilities, and limitations of directly supporting systems will be required throughout the Army, much more so than is required today. This will necessitate modernization of the Army training and education system for all personnel, and the addition of indicators into the personnel management system to support the proper use of personnel who have acquired specific knowledge or experience in space operations or advanced technologies.

The systems themselves must be made responsive to the Army's requirements for the future. Space-based systems have begun the transition from the research and development domain into the domain of operationally deployed defense forces. This transition should not only facilitate the inclusion of space activities in operations planning but also increase the influence of operational force requirements on the development of new space systems. This proper and necessary step in the incorporation of spacepower into warfare also carries with it the requirement for increased knowledge and understanding of space system employment parameters and concepts, as well as new technology developments, which can be focused toward satisfying military operational requirements.

Systems development lead times can be extensive; the Army must know its future requirements, determine the best basing mode for the systems to be designed to meet these requirements, and drive the technology and system development. Space is a new dimension with different characteristics and technologies that have not been fully assimilated into the "Army system," so this requirement becomes more important if the Army is going to be able to exploit all options and get the best results for the resources it has to expend. These criteria may lead the Army into developing space-based systems designed primarily to meet specific Army requirements instead of relying on other service developers to provide the required capabilities to support landpower missions. Total system trade-off analyses will establish the parameters for the Army to reenter the space system arena. The key element for the Army is to have the internal capability to consider and knowledgeably evaluate the space system solution co-equally with all other options to meet requirements.

Although the United States has not decided whether to develop or deploy defenses against ballistic missiles, strategic defense will undoubtedly become more significant to the Army in the future. Which technology or combination of technologies might be directly incorporated into operational systems that will move combat power into the space dimension remains speculative, but the firm national commitment to SDI research has been established and is being supported by congressional funding. The other elements of strategic defense, air defense and space defense, are also essential and will require resourcing before strategic defense can become the operational national deterrence strategy.

The Army contribution to strategic air defense was reduced to almost nonexistence following the intoduction of the ballistic missile as the primary strategic threat against the United States. The entire US strategic air defense capability will consist of four F-15 equipped interceptor squadrons and eleven Air National Guard squadrons by FY 1986. The major area of air defense improvement is for a surveillance capability to eliminate serious gaps around the perimeter of the continental United States.[4] To counter the aircraft and cruise missile threats, the Army role in air defense can be expected to expand concurrently with the deployment of ballistic missile defense capabilities. The resource implications for the Army will be highly significant, even though they cannot now be defined. The incorporating of SDI technology development, integrating four dimensional continental defense command and control systems, and the rebuilding and manning of an Army continental air defense capability will challenge the management system of the Army to the utmost in view of the projected Army mission environment of the future, which made no reference to strategic defense considerations.

The role of the future Army in ballistic missile defense is also not yet defined. The Army has led the research and development of ground-based ballistic missile defense systems from the beginning, but as was shown by the policy decisions on ballistic missile systems, this does not guarantee a role in the final operational ground-based ballistic missile defense systems employment. However, the Army should not have to anticipate that the restructuring for operational strategic defense forces would have to come entirely from within existing landpower programs. For example, throughout the transition phase there could be reductions in the strategic offense forces which should offset some of the strategic defense requirements.

Over the next several years, the national balance of land, sea, air, and spacepower forces will be determined for the next century. This balance will provide the basis for future defense programming and resource allocation decisions. To the extent that a military service can influence these decisions, it is incumbent on the Army, as the national proponent for landpower, to have thoroughly assessed the role of landpower in national defense in the 21st century and to have incorporated the role of space power into its planning. How well this can be accomplished, and it will be a continuous and evolutionary process, will establish the parameters for structuring and equipping the force. The senior Army leadership for the first quarter of the 21st century is on active duty or receiving pre-commissioning training now; these future leaders must be made knowledgeable of the dimensions in which our security will be maintained.

The words of General James H. Doolittle remain as true today as they were in 1959, and are as significant to the Army as they are to the Air Force or Navy:

> We, the United States of America, can be first. If we do not expend the thought, the effort, and the money required, the another and more progressive nation will. It will dominate space, and it will dominate the world.[5]

CHAPTER 5

ENDNOTES

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APPENDIX A

THE WHITE HOUSE
FACT SHEET
National Space Policy

The President announced today a national space policy that will set the direction of US efforts in space for the next decade. The policy is the result of an interagency review requested by the President in August 1981. The ten-month review included a comprehensive analysis of all segments of the national space program. The primary objective of the review was to provide a workable policy framework for an aggressive, farsighted space program that is consistent with the Administration's national goals.

As a result, the President's Directive reaffirms the national commitment to the exploration and use of space in support of our national well-being, and establishes the basic goals of United States' space policy which are to:

--strengthen the security of the United States;

--maintain United States space leadership;

--obtain economic and scientific benefits through the exploitation of space;

--expand United States private sector investment and involvement in civil space and space related activities;

--promote international cooperative activities in the national interest; and

--cooperate with other nations in maintaining the freedom of space for activities which enhance the security and welfare of mankind.

The principles underlying the conduct of the United States space program, as outlined in the Directive are:

--The United States is committed to the exploration and use of space by all nations for peaceful purposes and for the benefit of mankind. "Peaceful purposes" allow activities in pursuit of national security goals.

--The United States rejects any claim to sovereighty by any nation over space or over celestial bodies, or any portion thereof, and rejects any limitations on the fundamental right to acquire data from space.

--The United States considers the space systems of any nation to be national property with the right of passage through and operation in space without interference. Purposeful interference with space systems shall be viewed as an infringement upon sovereign rights.

--The United States encourages domestic commercial exploitation of space capabilities, technology, and systems for national economic benefit. These activities must be consistent with national security concerns, treaties and international agreements.

--The United States will conduct international cooperative space-related activities that achieve scientific, political, economic, or national security benefits for the nation.

--The United States space program will be comprised of two separate, distinct and strongly interacting programs--national security and civil. Close coordination, cooperation and information exchange will be maintained among these programs to avoid unnecessary duplication.

--The United States Space Transportation System (STS) is the primary space launch system for both national security and civil government missions. STS capabilities and capacities shall be developed to meet appropriate national needs and shall be available to authorized users--domestic and foreign, commercial and governmental.

--The United States will pursue activities in space in support of its right of self-defense.

--The United States will continue to study space arms control options. The United States will consider verifiable and equitable arms control measures that would ban or otherwise limit testing and deployment of specific weapons systems, should those measures be compatible with United States national security.

SPACE TRANSPORTATION SYSTEM

The Directive states that the Space Shuttle is to be a major factor in the future evolution of United States space programs, and that it will foster further cooperative roles between the national security and civil programs to insure efficient and effective use of national resources. The Space Transportation System (STS) is composed of the Space Shuttle, associated upper stages, and related facilities. The Directive establishes the following policies governing the development and operation of the Space Transporation System:

--The STS is a vital element of the United States space program, and is the primary space launch system for both United States national security and civil government missions. The STS will be afforded the degree of survivability and security protection required for a critical national space resource. The first priority of the STS program is to make the system fully operational and cost-effective in providing routine access to space.

--The United States is fully committed to maintaining world leadership in space transportation with a STS capacity sufficient to meet appropriate national needs. The STS program requires sustained commitments by each affected department or agency. The United States will continue to develop the STS through the National Aeronautics and Space Administration (NASA) in cooperation with the Department of Defense (DOD). Enhancement of STS operational capability, upper stages and methods of deploying and retrieving payloads should be pursued, as national requirements are defined.

--United States Government spacecraft should be designed to take advantage of the unique capabilities of the STS. The completion of transition to the Shuttle should occur as expeditiously as practical.

--NASA will assure the Shuttle's utility to the civil users. In coordination with NASA, the DOD will assure the Shuttle's utility to national defense and integrate national security missions into the Shuttle system. Launch priority will be provided for national security missions.

--Expendable launch vehicle operations shall be continued by the United States Government until the capabilities of the STS are sufficient to meet its needs and obligations. Unique national security considerations may dictate developing special purpose launch capabilities.

--For the near term, the STS will continue to be managed and operated in an institutional arrangement consistent with the current NASA/DOD Memoranda of Understanding. Responsibility will remain in NASA for operational control of the STS for civil missions and in the DOD for operational control of the STS for national security missions. Mission management is the responsibility of the mission agency. As the STS operations mature, the flexibility to transition to a different institutional structure will be maintained.

--Major changes to STS program capabilities will require Presidential approval.

THE CIVIL SPACE PROGRAM

In accordance with the provisions of the National Aeronautics and Space Act, the Directive states that the civil space program shall be conducted:

--To expand knowledge of the Earth, its environment, the solar system and the universe;

--to develop and promote selected civil applications of space technology;

--to preserve the United States leadership in critical aspects of space science, applications and technology; and

--to further United States domestic and foreign policy objectives.

The Directive states the following policies which shall govern the conduct of the civil space program:

--United States Government programs shall continue a balanced strategy of research, development, operations, and exploration for science, applications and technology. The key objectives of these programs are to: (1) preserve the United States preeminence in critical space activities to enable continued exploitation and exploration of space; (2) conduct research and experimentation to expand understanding of: (a) astrophysical phenomena and the original and evolution of the universe through long-lived astrophysical observation; (b) the Earth, its environment, its dynamic relation with the Sun; (c) the origin and evolution of the solar system through solar, planetary, and lunar sciences and exploration; and (d) the space environment and technology to advance knowledge in the biological sciences; (3) continue to explore the requirements, operational concepts, and technology associated with permanent space facilities; (4) conduct appropriate research and experiementation in advanced technology and systems to provide a basis for future civil applications.

—The United States government will provide a climate conducive to expanded private sector investment and involvement in space activities, with due regard to public safety and national security. These space activities will be authorized and supervised or regulated by the government to the extent required by treaty and national security.

—The United States will continue cooperation with other nations in international space activities by conducting joint scientific and research programs, consistent with technology transfer policy, that yield sufficient benefits to the United States, and will support the public, nondiscriminatory direct readout of data from Federal civil systems to foreign ground stations and the provision of data to foreign users under specified conditions.

—The Department of Commerce, as manager of Federal operational space remote sensing systems, will: (1) aggregate Federal needs for these systems to be met by either the private sector or the Federal government; (2) identify needed research and development objectives for these systems; and (3) in coordination with other departments or agencies, provide regulation of private sector operation of these systems.

THE NATIONAL SECURITY SPACE PROGRAM

The Directive states that the United States will conduct those activities in space that it deems necessary to its national security. National security space programs shall support such functions as command and control, communications, navigation, environmental monitoring, warning, surveillance and space defense. The Directive states the following policies which shall govern the conduct of the national security program:

—Survivability and endurance of space systems, including all system elements, will be pursued commensurate with the planned use in crisis and conflict, with the threat, and with the availability of other assets to perform the mission. Deficiencies will be identified and eliminated, and an aggressive, long-term program will be undertaken to provide more-assured survivability and endurance.

—The United States will proceed with development of an anti-satellite (ASAT) capability, with operational deployment as a goal. The primary purposes of a United States ASAT capability are to deter threats to space systems of the United States and its Allies and, within such limits imposed by international law, to deny any adversary the use of space-based systems that provide support to hostile military forces.

—The United States will develop and maintain an integrated attack warning, notification, verification, and contingency reaction capability which can effectively detect and react to threats to United States space systems.

—Security, including dissemination of data, shall be conducted in accordance with Executive Orders and applicable directives for protection of national security information and commensurate with both the missions performed and the security measures necessary to protect related space activities.

INTER-PROGRAM RESPONSIBILITIES

The Directive contains the following guidance applicable to and binding upon the United States natioal security and civil space programs:

--The national security and civil space programs will be closely coordinated and will emphasize technology sharing within necessary security constraints. Technology transfer issues will be resolved within the framework of directives, executive orders, and laws.

--Civil Earth-imaging from space will be permitted under controls when the requirements are justified and assessed in relation to civil benefits, national security, and foreign policy. These controls will be periodically reviewed to determine if the constraints should be revised.

--The United States Government will maintain and coordinate separate national security and civil operational space systems when differing needs of the programs dictate.

POLICY IMPLEMENTATION

The Directive states that normal interagency coordinating mechanisms will be employed to the maximum extent possible to implement the policies enunciated. A Senior Interagency Group (SIG) on Space is established by the Directive to provide a forum to all Federal agencies for their policy views, to review and advise on proposed changes to national space policy, and to provide for orderly and rapid referral of space policy issues to the President for decisions as necessary. The SIG (Space) will be chaired by the Assistant to the President for National Security Affairs and will include the Deputy Secretary of Defense, Deputy Secretary of State, Deputy Secretary of Commerce, Director of Central Intelligence, Chairman of the Joint Chiefs of Staff, Director of the Arms Control and Disarmament Agency, and the Administrator of the National Aeronautics and Space Administration. Representatives of the Office of Management and Budget and the Office of Science and Technology Policy will be included as observers. Other agencies or departments will participate based on the subjects to be addressed.

Peace and National Security

A NEW DEFENSE

By RONALD REAGAN, *President of the United States**

Delivered to the American People from the White House, Washington, D.C., March 23, 1983

THANK YOU for sharing your time with me tonight. The subject I want to discuss with you, peace and national security, is both timely and important — timely because I have reached a decision which offers a new hope for our children in the 21st century — a decision I will tell you about in a few minutes — and important because there is a very big decision that you must make for yourselves. This subject involves the most basic duty that any President and any people share — the duty to protect and strengthen the peace.

At the beginning of this year, I submitted to the Congress a defense budget which reflects my best judgment, and the best understanding of the experts and specialists who advise me, about what we and our allies must do to protect our people in the years ahead.

That budget is much more than a long list of numbers, for behind all the numbers lies America's ability to prevent the greatest of human tragedies and preserve our free way of life in a sometimes dangerous world. It is part of a careful, long-term plan to make America strong again after too many years of neglect and mistakes. Our efforts to rebuild America's defenses and strengthen the peace began two years ago when we requested a major increase in the defense program. Since then the amount of those increases we first proposed has been reduced by half through improvements in management and procurement and other savings. The budget request that is now before the Congress has been trimmed to the limits of safety. Further deep cuts cannot be made without seriously endangering the security of the nation. The choice is up to the men and women you have elected to the Congress — and that means the choice is up to you.

Tonight I want to explain to you what this defense debate is all about, and why I am convinced that the budget now before the Congress is necessary, responsible and deserving of your support. And I want to offer hope for the future.

But first let me say what the defense debate is not about. It is not about spending arithmetic. I know that in the last few weeks you've been bombarded with numbers and percentages. Some say we need only a 5 percent increase in defense spending. The so-called alternate budget backed by liberals in the House of Representatives would lower the figure to 2 to 3 percent, cutting our defense spending by $163 billion over the next five years. The trouble with all these numbers is that they tell us little about the kind of defense program America needs or the benefits in security and freedom that our defense effort buys for us.

What seems to have been lost in all this debate is the simple truth of how a defense budget is arrived at. It isn't done by deciding to spend a certain number of dollars. Those loud voices that are occasionally heard charging that the Government is trying to solve a security problem by throwing money at it are nothing more than noise based on ignorance.

We start by considering what must be done to maintain peace and review all the possible threats against our security. Then a strategy for strengthening peace and defending against those threats must be agreed upon. And finally our defense establishment must be evaluated to see what is necessary to protect against any or all of the potential threats. The cost of achieving these ends is totaled up and the result is the budget for national defense.

There is no logical way you can say let's spend X billion dollars less. You can only say, which part of our defense measures do we believe we can do without and still have security against all contingencies? Anyone in the Congress who advocates a percentage or specific dollar cut in defense spending should be made to say what part of our defenses he would eliminate, and he should be candid enough to acknowledge that his cuts mean cutting our commitments to allies or inviting greater risk or both.

The defense policy of the United States is based on a simple premise: The United States does not start fights. We will never be an aggressor. We maintain our strength in order to deter and defend against aggression — to preserve freedom and peace.

Since the dawn of the atomic age, we have sought to reduce the risk of war by maintaining a strong deterrent and by seeking genuine arms control. Deterrence means simply this. Making sure any adversary who thinks about attacking the United States or our allies or our vital interests concludes that the risks to him outweigh any potential gains. Once he understands that, he won't attack. We maintain the peace through our strength; weakness only invites aggression.

This strategy of deterrence has not changed. It still works. But what it takes to maintain deterrence has changed. It took one kind of military force to deter an attack when we had far more nuclear weapons than any other power; it takes another kind now that the Soviets, for example, have enough accurate and powerful nuclear weapons to destroy virtually all of our missiles on the ground. Now this is not to say the Soviet Union is planning to make war on us. Nor do I believe a war is inevitable — quite the contrary. But what must be recognized is that our security is based on being prepared to meet all threats.

There was a time when we depended on coastal forts and artillery batteries because, with the weaponry of that day, any attack would have had to come by sea. This is a different world and our defenses must be based on recognition and awareness of the weaponry possessed by other nations in the nuclear age.

We can't afford to believe we will never be threatened. There have been two world wars in my lifetime. We didn't start them and, indeed, did everything we could to avoid being drawn into them. But we were ill-prepared for both — had we been better prepared, peace might have been preserved.

For 20 years, the Soviet Union has been accumulating enormous military might. They didn't stop when their forces exceeded all requirements of a legitimate defensive capability. And they haven't stopped now.

During the past decade and a half, the Soviets have built up a massive arsenal of new strategic nuclear weapons — weapons that can strike directly at the United States.

As an example, the United States introduced its last new intercontinental ballistic missile, the Minuteman III, in 1969, and we are now dismantling our even older Titan missiles. But what has the Soviet Union done in these intervening years? Well, since 1969, the Soviet Union has built five new classes of ICBM's, and upgraded these eight times. As a result, their missiles are much more powerful and accurate than they were several years ago and they continue to develop more, while ours are increasingly obsolete.

The same thing has happened in other areas. Over the same period, the Soviet Union built four new classes of submarine-launched ballistic missiles and over 60 new missile submarines. We built two new types of submarine missiles and actually withdrew 10 submarines from strategic missions. The Soviet Union built over 200 new Backfire bombers, and their brand new Blackjack bomber is now under development. We haven't built a new long-range bomber since our B-52's were deployed about a quarter of a century ago, and we've already retired several hundred of those because of old age. Indeed, despite what many people think, our strategic forces only cost about 15 percent of the defense budget.

Another example of what's happened: In 1978, the Soviets had 600 intermediate-range nuclear missiles based on land and were beginning to add the SS-20 — a new, highly accurate mobile missile, with three warheads. We had none. Since then the Soviets have strengthened their lead. By the end of 1979, when Soviet leader Brezhnev declared "a balance now exists," the Soviets had over 800 warheads. We still had none. A year ago this month, Mr. Brezhnev pledged a moratorium, or freeze, on SS-20 deployment. But by last August, their 800 warheads had become more than 1,200. We still had none. Some freeze. At this time Soviet Defense Minister Ustinov announced "approximate parity of forces continues to exist." But the Soviets are still adding an average of three new warheads a week, and now have 1,300. These warheads can reach their targets in a matter of a few minutes. We still have none. So far, it seems that the Soviet definition of parity is a box score of 1,300 to nothing, in their favor.

So, together with our NATO allies, we decided in 1979 to deploy new weapons, beginning this year, as a deterrent to their SS-20's and as an incentive to the Soviet Union to meet us in serious arms control negotiations. We will begin that deployment late this year. At the same time, however, we are willing to cancel our program if the Soviets will dismantle theirs. This is what we have called a zero-zero plan. The Soviets are now at the negotiating table — and I think it's fair to say that without our planned deployments, they wouldn't be there.

Now let's consider conventional forces. Since 1974, the United States has produced 3,050 tactical combat aircraft. By contrast, the Soviet Union has produced twice as many. When we look at attack submarines, the United States has produced 27, while the Soviet Union has produced 61. For armored vehicles including tanks, we have produced 11,200. The Soviet Union has produced 54,000, a nearly 5-to-1 ratio in their favor. Finally, with artillery, we have produced 950 artillery and rocket launchers while the Soviets have produced more than 13,000, a staggering 14-to-1 ratio.

There was a time when we were able to offset superior Soviet numbers with higher quality. But today they are building weapons as sophisticated and modern as our own.

As the Soviets have increased their military power, they have been emboldened to extend that power. They are spreading their military influence in ways that can directly challenge our vital interests and those of our allies. The following aerial photographs, most of them secret until now, illustrate this point in a crucial area very close to home — Central America and the Caribbean Basin. They are not dramatic photographs but I think they help give you a better understanding of what I'm talking about.

This Soviet intelligence collection facility less than 100 miles from our coast is the largest of its kind in the world. The acres and acres of antenna fields and intelligence monitors are targeted on key U.S. military installations and sensitive activities. The installation, in Lourdes, Cuba, is manned by 1,500 Soviet technicians, and the satellite ground station allows instant communications with Moscow. This 28-square mile facility has grown by more than 60 percent in size and capability during the past decade.

In western Cuba, we see this military airfield and its complement of modern Soviet-built MIG-23 aircraft. The Soviet Union uses this Cuban airfield for its own long-range reconnaissance missions, and earlier this month two modern Soviet antisubmarine warfare aircraft began operating from it. During the past two years, the level of Soviet arms exports to Cuba can only be compared to the levels reached during the Cuban missile crisis 20 years ago.

This third photo, which is the only one in this series that has been previously made public, shows Soviet military hardware that has made its way to Central America. This airfield with its MI-8 helicopters, antiaircraft guns and protected fighter sites is one of a number of military facilities in Nicaragua which has received Soviet equipment funneled through Cuba and reflects the massive military build-up going on in that country.

On the small island of Grenada, at the southern end of the Caribbean chain, the Cubans, with Soviet financing and backing, are in the process of building an airfield with a 10,000-foot runway. Grenada doesn't even have an air force. Who is it intended for? The Caribbean is a very important passageway for our international commerce and military lines of communication. More than half of all American oil imports now pass through the Caribbean. The rapid build-up of Grenada's military potential is unrelated to any conceivable threat to this island country of under 110,000 people, and totally at odds with the pattern of other eastern Caribbean States, most of which are unarmed. The Soviet-Cuban militarization of Grenada, in short, can only be seen as power projection into the region, and it is in this important economic and strategic area that we are trying to help the governments of El Salvador, Costa Rica, Honduras and others in their struggles for democracy against guerrillas supported through Cuba and Nicaragua.

These pictures only tell a small part of the story. I wish I could show you more without compromising our most sensitive intelligence sources and methods. But the Soviet Union is also supporting Cuban military forces in Angola and Ethiopia. They have bases in Ethiopia and South Yemen near the Persian Gulf oilfields. They have taken over the port we built at Cam Ranh Bay in Vietnam, and now, for the first time in history, the Soviet Navy is a force to be reckoned with in the South Pacific.

Some people may still ask: Would the Soviets ever use their formidable military power? Well, again, can we afford to believe they won't? There is Afghanistan, and in Poland, the Soviets denied the will of the people and, in so doing, demonstrated to the world how their military power could also be used to intimidate.

The final fact is that the Soviet Union is acquiring what can only be considered an offensive military force. They have continued to build far more intercontinental ballistic missiles than they could possibly need simply to deter an attack. Their conventional forces are trained and equipped not so much to defend against an attack as they are to permit sudden, surprise offensives of their own.

Our NATO allies have assumed a great defense burden, including the military draft in most countries. We are working with them and our other friends around the world to do more. Our defensive strategy means we need military forces that can move very quickly — forces that are trained and ready to respond to any emergency.

Every item in our defense program — our ships, our tanks, our planes, our funds for training and spare parts — is intended for one all-important purpose — to keep the peace. Unfortunately, a decade of neglecting our military forces had called into question our ability to do that.

When I took office in January 1981, I was appalled by what I found. American planes that could not fly and American ships that could not sail for lack of spare parts and trained personnel and insufficient fuel and ammunition for essential training. The inevitable result of all this was poor morale in our armed forces, difficulty in recruiting the brightest young Americans to wear the uniform and difficulty in convincing our most experienced military personnel to stay on.

There was a real question, then, about how well we could meet a crisis. And it was obvious that we had to begin a major modernization program to insure we could deter aggression and preserve the peace in the years ahead.

We had to move immediately to improve the basic readiness and staying power of our conventional forces, so they could meet — and therefore help deter — a crisis. We had to make up for lost years of investment by moving forward with a long-term plan to prepare our forces to counter the military capabilities our adversaries were developing for the future.

I know that all of you want peace and so do I. I know too that many of you seriously believe that a nuclear freeze would further the cause of peace. But a freeze now would make us less, not more, secure and would raise, not reduce, the risks of war. It would be largely unverifiable and would seriously undercut our negotiations on arms reduction. It would reward the Soviets for their massive military buildup while preventing us from modernizing our aging and increasingly vulnerable forces. With their present margin of superiority, why should they agree to arms reductions knowing that we were prohibited from catching up?

Believe me, it wasn't pleasant for someone who had come to Washington determined to reduce Government spending, but we had to move forward with the task of repairing our defenses or we would lose our ability to deter conflict now and in the future. We had to demonstrate to any adversary that aggression could not succeed and that the only real solution was substantial, equitable and effectively verifiable arms reduction — the kind we're working for right now in Geneva.

Thanks to your strong support, and bipartisan support from the Congress, we began to turn things around. Already we are seeing some very encouraging results. Quality recruitment and retention are up, dramatically — more high school graduates are choosing military careers and more experienced career personnel are choosing to stay. Our men and women in uniform at last are getting the tools and training they need to do their jobs.

Ask around today, especially among our young people, and I think you'll find a whole new attitude toward serving their country. This reflects more than just better pay, equipment and leadership. You the American people have sent a signal to these young people that it is once again an honor to wear the uniform. That's not something you measure in a budget, but it is a very real part of our nation's strength.

It will take us longer to build the kind of equipment we need to keep peace in the future, but we've made a good start.

We have not built a new long-range bomber for 21 years. Now we're building the B-1. We had not launched one new strategic submarine for 17 years. Now, we're building one Trident submarine a year. Our land-based missiles are increasingly threatened by the many huge, new Soviet ICBM's. We are determining how to solve that problem. At the same time, we are working in the Start and I.N.F. negotiations, with the goal of achieving deep reductions in the strategic and intermediate nuclear arsenals of both sides.

We have also begun the long-needed modernization of our conventional forces. The Army is getting its first new tank in 20 years. The Air Force is modernizing. We are rebuilding our Navy, which shrank from about 1,000 in the late 1960's to 453 ships during the 1970's. Our nation needs a superior Navy to support our military forces and vital interests overseas. We are now on the road to achieving a 600-ship Navy and increasing the amphibious capabilities of our marines, who are now serving the cause of peace in Lebanon. And we are building a real capability to assist our friends in the vitally important Indian Ocean and Persian Gulf region.

This adds up to a major effort, and it is not cheap. It comes at a time when there are many other pressures on our budget and when the American people have already had to make major sacrifices during the recession. But we must not be misled by those who would make defense once again the scapegoat of the Federal budget.

The fact is that in the past few decades we have seen a dramatic shift in how we spend the taxpayer's dollar. Back in 1955, payments to individuals took up only about 20 percent of the Federal budget. For nearly three decades, these payments steadily increased and this year will account for 49 percent of the budget. By contrast, in 1955, defense took up more than half of the Federal budget. By 1980, this spending had fallen to a low of 23 percent. Even with the increase I am requesting this year, defense will still amount to only 28 percent of the budget.

The calls for cutting back the defense budget come in nice simple arithmetic. They're the same kind of talk that led the democracies to neglect their defenses in the 1930's and invited the tragedy of World War II. We must not let that grim chapter of history repeat itself through apathy or neglect.

Yes, we pay a great deal for the weapons and equipment we give our military forces. And, yes, there has been some waste in the past. But we are now paying the delayed cost of our neglect in the 1970's. We would only be fooling ourselves, and endangering the future, if we let the bills pile up for the 1980's as well. Sooner or later these bills always come due, and the later they come due, the more they cost in treasure and in safety.

This is why I am speaking to you tonight — to urge you to tell your Senators and Congressmen that you know we must continue to restore our military strength.

If we stop in midstream, we will not only jeopardize the progress we have made to date — we will mortgage our ability to deter war and achieve genuine arms reductions. And we will send a signal of decline, of lessened will, to friends and adversaries alike.

One of the tragic ironies of history — and we've seen it happen more than once in this century — is the way that tyrannical systems, whose military strength is based on oppressing their people, grow strong while, through wishful thinking, free societies allow themselves to be lulled into a false sense of security.

Free people must voluntarily, through open debate and democratic means, meet the challenge that totalitarians pose by compulsion.

It is up to us, in our time, to choose, and choose wisely, between the hard but necessary task of preserving peace and freedom and the temptation to ignore our duty and blindly hope for the best while the enemies of freedom grow stronger day by day.

The solution is well within our grasp. But to reach it, there is simply no alternative but to continue this year, in this budget, to provide the resources we need to preserve the peace and guarantee our freedom.

Thus far tonight I have shared with you my thoughts on the problems of national security we must face together. My predecessors in the Oval Office have appeared before you on other occasions to describe the threat posed by Soviet power and have proposed steps to address that threat. But since the advent of nuclear weapons, those steps have been directed toward deterrence of aggression through the promise of retaliation — the notion that no rational nation would launch an attack that would inevitably result in unacceptable losses to themselves. This approach to stability through offensive threat has worked. We and our allies have succeeded in preventing nuclear war for three decades. In recent months, however, my advisers, including in particular the Joint Chiefs of Staff, have underscored the bleakness of the future before us.

Over the course of these discussions, I have become more and more deeply convinced that the human spirit must be capable of rising above dealing with other nations and human beings by threatening their existence. Feeling this way, I believe we must thoroughly examine every opportunity for reducing tensions and for introducing greater stability into the strategic calculus on both sides. One of the most important contributions we can make is, of course, to lower the level of all arms, and particularly nuclear arms. We are engaged right now in several negotiations with the Soviet Union to bring about a mutual reduction of weapons. I will report to you a week from tomorrow my thoughts on that score. But let me just say I am totally committed to this course.

If the Soviet Union will join with us in our effort to achieve major arms reduction we will have succeeded in stabilizing the nuclear balance. Nevertheless it will still be necessary to rely on the specter of retaliation — on mutual threat, and that is a sad commentary on the human condition.

Would it not be better to save lives than to avenge them? Are we not capable of demonstrating our peaceful intentions by applying all our abilities and our ingenuity to achieving a truly lasting stability? I think we are — indeed, we must!

After careful consultation with my advisers, including the Joint Chiefs of Staff, I believe there is a way. Let me share with you a vision of the future which offers hope. It is that we embark on a program to counter the awesome Soviet missile threat with measures that are defensive. Let us turn to the very strengths in technology that spawned our great industrial base and that have given us the quality of life we enjoy today.

Up until now we have increasingly based our strategy of deterrence upon the threat of retaliation. But what if free people could live secure in the knowledge that their security did not rest upon the threat of instant U.S. retaliation to deter a Soviet attack; that we could intercept and destroy strategic ballistic missiles before they reached our own soil or that of our allies?

I know this is a formidable technical task, one that may not be accomplished before the end of this century. Yet, current technology has attained a level of sophistication where it is reasonable for us to begin this effort. It will take years, probably decades, of effort on many fronts. There will be failures and setbacks just as there will be successes and breakthroughs. And as we proceed we must remain constant in preserving the nuclear deterrent and maintaining a solid capability for flexible response. But is it not worth every investment necessary to free the world from the threat of nuclear war? We know it is!

In the meantime, we will continue to pursue real reductions in nuclear arms, negotiating from a position of strength that can be insured only by modernizing our strategic forces. At the same time, we must take steps to reduce the risk of a conventional military conflict escalating to nuclear war by improving our nonnuclear capabilities. America does possess — now — the technologies to attain very significant improvements in the effectiveness of our conventional, nonnuclear forces. Proceeding boldly with these new technologies, we can significantly reduce any incentive that the Soviet Union may have to threaten attack against the United States or its allies.

As we pursue our goal of defensive technologies, we recognize that our allies rely upon our strategic offensive power to deter attacks against them. Their vital interests and ours are inextricably linked — their safety and ours are one. And no change in technology can or will alter that reality. We must and shall continue to honor our commitments.

I clearly recognize that defensive systems have limitations and raise certain problems and ambiguities. If paired with offensive systems, they can be viewed as fostering an aggressive policy and no one wants that.

But with these considerations firmly in mind, I call upon the scientific community who gave us nuclear weapons to turn their great talents to the cause of mankind and world peace: to give us the means of rendering these nuclear weapons impotent and obsolete.

Tonight, consistent with our obligations under the ABM Treaty and recognizing the need for close consultation with our allies, I am taking an important first step. I am directing a comprehensive and intensive effort to define a long-term research and development program to begin to achieve our ultimate goal of eliminating the threat posed by strategic nuclear missiles. This could pave the way for arms control measures to eliminate the weapons themselves. We seek neither military superiority nor political advantage. Our only purpose — one all people share — is to search for ways to reduce the danger of nuclear war.

My fellow Americans, tonight we are launching an effort which holds the purpose of changing the course of human history. There will be risks, and results take time. But with your support, I believe we can do it.

FACT SHEET

NATIONAL SPACE STRATEGY

INTRODUCTION

On August 15, 1984, the President approved a National Space Strategy designed to implement the National Space Policy, as supplemented by the President's 1984 State of the Union Address. The strategy identifies selected, high priority efforts and responsibilities, and provides implementation plans for major space policy objectives. This strategy is consistent with other space-related National Security Decision Directives and other Administration policies. A summary of the strategy's contents is provided below.

THE SPACE TRANSPORTATION SYSTEM (STS)

\- Insure routine, cost-effective access to space with the STS. The STS is a critical factor in maintaining U.S. space leadership, in accomplishing the basic goals of the National Space Policy, and in achieving a permanent manned presence in space. It is the primary space launch system for both national security and civil government missions. As such, NASA's first priority is to make the STS fully operational and cost-effective in providing routine access to space.

Implementation: The STS program will receive sustained commitments by all affected departments and agencies. Enhancements of STS operational capability, upper stages, and efficient methods of deploying and retrieving payloads will be pursued as national requirements are defined.

NASA and Department of Defense will jointly prepare a report that defines a fully operational and cost-effective STS and specifies the steps leading to that status. This will be prepared and submitted for review by the Senior Interagency Group for Space - SIG(Space) - no later than November 30, 1984.

The STS will be fully operational by 1988. On October 1, 1988, prices for STS services and capabilities provided to commercial and foreign users will reflect the full cost of such services and capabilities. NASA will develop a time-phased plan for implementing full cost recovery for commercial and foreign STS flight operations. At a minimum, this plan will include an option for full cost recovery for commercial and foreign flights which occur after October 1, 1988. OMB, in consultation with DOC, DOT, DOD, NASA and other agencies will prepare a joint assessment of the ability of the U.S. private sector and the STS to maintain international competitiveness in the provision of launch services. This analysis should include an assessment of all factors relevant to foreign ELVs, U.S. ELVs and the STS. NASA will keep OMB fully apprised of the elements of its time-phased plan as it is being developed. Both the time-phased plan and the OMB analysis will be submitted for review and comment by the SIG(Space) and the Cabinet Council on Commerce and Trade no later than September 15, 1984, and subsequently submitted for the President's approval in order to permit their consideration in the development of the FY 1986 budget.

The Department of Defense and NASA will jointly conduct a study to identify launch vehicle technology that could be made available for use in the post-1995 period. The study should be completed by December 31, 1984.

THE CIVIL SPACE PROGRAM

- Establish a permanently manned presence in space. NASA will develop a permanently manned Space Station within a decade. The development of a civil Space Station will further the goals of space leadership and the peaceful exploration and use of space for the benefit of all mankind. The Space Station will enhance the development of the commercial potential of space. It will facilitate scientific research in space. It will also, in the longer term, serve as a basis for future major civil and commercial activities to explore and exploit space.

Implementation: As a civil program, the Space Station will be funded and executed by NASA beginning in FY 1985 with the goal of the establishment of a permanently manned presence in space within a decade.

- Foster increased international cooperation in civil space activities. The U.S. will seek mutually beneficial international participation in its civil and commercial space and space-related programs. As a centerpiece of this priority, the U.S. will seek agreements with friends and allies to participate in the development and utilization of the Space Station.

Implementation: NASA and the Department of State will make every effort to obtain maximum mutually beneficial foreign participation in the Space Station program, consistent with the Presidential commitment for international participation and other guidance. The broad objectives of the United States in international cooperation in space activities are to promote foreign policy considerations, advance national science and technology; maximize national economic benefits, including domestic considerations; and protect national security. The suitability of each cooperative space activity must be judged within the framework of all these objectives. Consistent with these objectives, the SIG(Space) will review all major policy issues raised by proposed agreements for international participation on the Space Station program prior to commitments by the U.S. Government.

- Identify major long-range national goals for the civil space program. Major long-range goals for the civil space program are essential to meeting the national commitment to maintain United States leadership in space and to exploit space for economic and scientific benefit.

Implementation: In accordance with the FY 1985 NASA Authorization Act, the President will appoint a National Commission on Space to formulate an agenda for the United States space program. The Commission shall identify goals, opportunities, and policy options for United States civilian space activity for the next twenty years. Upon submission of the Commission report to the President, the Office of Science and Technology Policy, in cooperation with NASA and other appropriate agencies, will review the report and will provide their comments and recommendations to the President through the SIG(Space) within 60 days of the submission of the Commission report.

- Insure a vigorous and balanced program of civil scientific research and exploration in space. The U.S. civil space science program is an essential element of U.S. leadership in space, a vehicle for scientific advancement and long-term economic benefits, and a valuable opportunity for international cooperation.

Implementation: NASA and other appropriate agencies will conduct their activities in a manner that will maintain a vigorous and balanced program of civil space research and exploration. NASA will explicitly factor the broad spectrum of capabilities necessary for space science into the planning and development of the manned Space Station and will implement those plans in a manner that will lend stability and continuity to research in the space sciences. Furthermore, the Office of Science and Technology Policy, in conjunction with NASA and other appropriate agencies, will review and define the goals and missions of the various civil agencies in the area of earth sciences research and will provide their recommendations in a report to the SIG(Space) by April 1, 1985.

COMMERCIAL SPACE PROGRAM

- Encourage commercial Expendable Launch Vehicle activities. The U.S. will encourage and facilitate commercial expendable launch vehicle operations. U.S. Government policies will promote competitive opportunities for commercial expendable launch vehicle operations and minimize government regulation of these activities.

Implementation: The Department of Transportation will carry out the responsibilities assigned by Executive Order 12465 on Commercial Expendable Launch Vehicle Activities.

Appropriate agencies will work with Department of Transportation to encourage the U.S. private sector development of commercial launch operations in accordance with existing direction.

The U.S. Government will not subsidize the commercialization of ELVs but will price the use of its facilities, equipment, and services by commercial ELV operators consistent with the goal of encouraging viable commercial ELV launch activities in accordance with existing direction.

- Stimulate private sector commercial space activities. To stimulate private sector investment, ownership, and operation of civil space assets, the U.S. Government will facilitate private sector access to civil space systems, and encourage the private sector to undertake commercial space ventures without direct Federal subsidies.

Implementation: The U.S. Government will take the following initiatives:

- Economic Initiatives. Tax laws and regulations which discriminate against commercial space ventures need to be changed or eliminated.

- Legal and Regulatory Initiatives. Laws and regulations predating space operations need to be updated to accommodate space commercialization.

- Research and Development Initiatives. In partnership with industry and academia, government should expand basic research and development which may have implications for investors aiming to develop commercial space products and services.

- Initiatives to Establish and Implement a Commercial Space Policy. Since commercial developments in space often require many years to reach the production phase, entrepreneurs need assurances of consistent government actions and policies over long periods.

NASA, Department of Commerce, and Department of Transportation all have roles and will work cooperatively to develop and implement specific measures to foster the growth of private sector commercialization in space. A high level national focus for commercial space issues will be created through establishment of a Cabinet Council on Commerce and Trade (CCCT) Working Group on the Commercial Use of Space. The SIG(Space) will continue its role of coordinating the implementation of policy for the overall U.S. Space Program.

NATIONAL SECURITY SPACE PROGRAMS

- Maintain assured access to space. The national security sector must pursue an improved assured launch capability to satisfy two specific requirements -- the need for launch system complementary to the STS to hedge against unforeseen technical and operational problems, and the need for a launch system suited for operations in crisis situations.

Implementation: In order to satisfy the requirement for assured launch, the national security sector will pursue the use of a limited number of ELVs to complement the STS.

- Pursue an long-term survivability enhancement program. The national security sector must provide for the survivability of selected, critical national security space assets to a degree commensurate with the value and utility of the support they provide. This will contribute to deterrence by helping to ensure that potential adversaries cannot eliminate vital U.S. space capabilities without considerable expenditure of their own resources.

Implementation: The high priority and emphasis on survivability reflected within the Department of Defense space programs will continue.

- Stem the flow of advanced western space technology to the Soviet Union. The U.S. cannot be complacent about the increasing Soviet efforts to erase the U.S. advantage through vigorous Soviet research and development efforts and through technology transfer.

Implementation: All agencies of the Government will cooperate in order to prevent the transfer of space technology to the Soviet Union and to its allies, either directly or through third countries, if such transfer is potentially detrimental to the national security interests of the United States.

- Continue to study space arms control options. The United States will continue to study space arms control options.

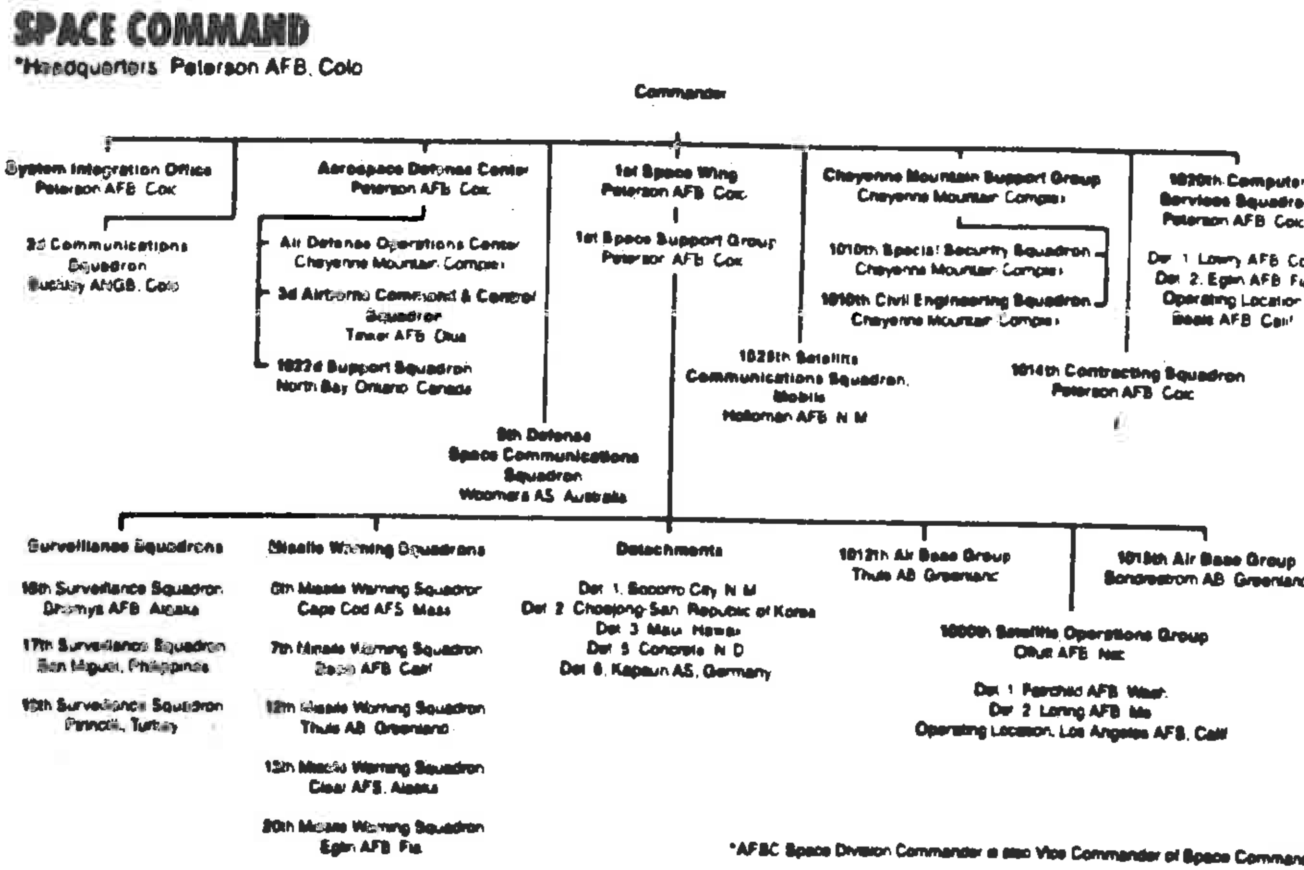
Implementation: The Senior Arms Control Policy Group will continue to study a broad range of possible options for space arms control. The studies will be undertaken with a view toward negotiations with the Soviet Union and other nations, compatible with national security interests. All actions will be conducted within the constraints of existing treaty commitments.

- Insure that DOD space and space-related programs will support the Strategic Defense Initiative. In light of the uncertain long-term stability of offensive deterrence, an effort will be made to identify defensive means of deterring nuclear war. The U.S. has been investigating the feasibility of eventually shifting toward reliance upon a defensive concept. A program has been initiated to demonstrate the technical feasibility of enhancing deterrence through greater reliance on defensive strategic capabilities. The Department of Defense will posture its space activities so as to preserve options to support the demonstration of capabilities as they are defined and become available, and as justified by the state-of-the-art technology.

- <u>Maintain a vigorous national security space technology program to support the development of necessary improvements and new capabilities.</u> The changing nature of the world environment presents new challenges at the same time as advances in technology present new opportunities.

<u>Implementation</u>: The Department of Defense will provide strong emphasis on advanced technology to respond to changes in the environment, to improve our space-based assets, and to provide new capabilities that capitalize on technological advances.

SPACE COMMAND



COMMAND DESCRIPTION:

The Space Command mission is to manage and operate assigned space assets, centralize planning, consolidate requirements, provide operational advocacy, and ensure a close interface between research and development activities and operational users of Air Force space programs. Space Command is also the major command responsible for the strategic defense mission area.

Space Command has approximately 6,000 Air Force military and civilian personnel and about 2,000 contractors worldwide. It has three bases: Peterson AFB, Colorado; and Thule and Sondrestrom AFBs in Greenland; and four Air Force stations: Clear AFS, Alaska; Cavalier AFS, North Dakota; Falcon AFS, Colorado; and Cape Cod AFS, Massachusetts.

The Commander of Space Command also serves as Commander in Chief of the North American Aerospace Defense Command, a binational command consisting of US and Canadian forces, and as Commander in Chief of the Aerospace Defense Command, a US specified command.

The Vice Commander of Space Command is the Commander of the Air Force Systems Command's (AFSC) Space Division, located at Los Angeles AFS, California.

On October 1, 1982, the Air Force established the Air Force Space

Technology Center at Kirtland AFB, N.M., which reports to Space Division (AFSC).

The Air Force Space Technology Center works on basic technology; Space Division is responsible for research, development, acquisition, launch, and checkout; and the operational Space Command then assumes on-orbit control, management, and protection responsibilities.

Additional Space Command resources include:

Satellite Systems: Initially assigned are two operational satellite systems--the Satellite Early Warning System and the Defense Meteorological Satellite Program and associated ground control and tracking networks. The Space Command also will operate and manage two satellite systems currently under development—the Department of Defense navigational satellite system called the Global Positioning System (GPS), and Milstar, the next-generation strategic and tactical military satellite communications system.

Missile Warning and Space Surveillance Sensors: The Space Command operates twenty-two worldwide space and missile warning units. The missile warning and space surveillance network consists of radars and optical sensors.

The 1st Space Wing: The 1st Space Wing was established on January 1, 1983, at Peterson AFB to manage the operational satellite systems and the ground-based sensors throughout the world. Together these sensors continuously monitor strategic ballistic missile and space launch sites.

Space Communications Division: The division, with sixteen subordinate units and more than 1,400 personnel located worldwide, operates and maintains communications-electronics systems for space surveillance and missile warning and selected data-processing equipment for the Cheyenne Mountain Complex in support of the communications needs and air traffic control services of the Space Command, Aerospace Defense Command, and North American Aerospace Defense Command.

The Space Defense Operations Center: The three space defense tasks—satellite surveillance, satellite protection, and satellite negation—are now, or will be, performed from the Space Defense Operations Center located in the Cheyenne Mountain Complex. This one-of-a-kind space command post is a fusion center where intelligence and operations come together. This center also maintains the status of all national security and civilian satellites.

The Consolidated Space Operations Center (CSOC): Located near Peterson AFB, it will have two primary missions: controlling operational spacecraft and also planning, managing, and controlling all Department of Defense Space Shuttle flights.

One side of the Consolidated Space Operations Center will be a Satellite Operations Complex, which will be interoperable with the Satellite Test Center at Sunnyvale AFS, California. The other side will be a Shuttle Operations and Planning Complex that will functionally replicate the capability of the Johnson Space Center at Houston, Texas.

The Satellite Operations Complex should be operational in 1986, and the Shuttle planning and control capability by the late 1980s.

APPENDIX E

THE DEFENSE SPACE LAUNCH STRATEGY

[The following is the text of the new Defense Space Launch Strategy approved January 23 by Defense Secretary Caspar W. Weinberger, which spells out the DOD's plans for use of the Space Shuttle and complementary expendable launch vehicles.]

Policy

"Defense space launch strategy has been developed in response to validated DOD assured space launch requirements and implements the launch policies contained in the National Space Policy and the Defense Space Policy. The National Space Policy identifies the Space Transportation System (STS) as the primary U.S government space launch vehicle, but recognizes that unique national security requirements may dictate the development of special purpose launch capabilities. The Defense Space Policy states that:

'While affirming its committment to the STS, DOD will ensure the availability of an adequate launch capability to provide flexible and operationally responsive access to space, as needed for all levels of conflict, to meet the requirements of national security missions.'

Requirements

"The DOD has a validated requirements for an assured launch capability under peace, crisis and conflict conditions. Assured launch capability is a function of satisfying two specific requirements — the need for complementary launch systems to hedge against unforeseen technical and operational problems, and the need for a launch system suited for operations in crisis and conflict situations. While DOD policy requires assured access to space across the spectrum of confict, the ability to satisfy this requirement is currently unachievable if the U.S mainland is subjected to direct attack. Therefore, this launch strategy addresses an assured launch capability only through levels of conflict in which it is postulated that the U.S. homeland is not under direct attack. Additional survivability options beyond an assured launch capability are being pursued to ensure sustained operations of critical space assets after homeland attack.

Strategy

"Near Term: Existing Defense space launch planning specifies that DOD will rely on four unique, manned orbiters for sole access to space for all national security space systems. DOD studies and other independent evaluations have concluded that this does not represent an assured, flexible and responsive access to space. While the DOD is fully committed to the STS, total reliance upon the STS for sole access to space in view of the technical and operational uncertainties, represents an unacceptable national security risk. A complementary system is necessary to provide high confidence of access to space particularly since the shuttle will be the only launch vehicle for all U.S. space users. In addition, the limited number of unique, manned shuttle vehicles renders them ill-suited and inappropriate for use in a high risk environment.

"The solution to this problem must be affordable and effective and yet offer a high degree of requirements satisfaction, low technical risk, and reasonable schedule availability. Unmanned, expendable launch vehicles meet these criteria and satisfy DOD operational needs for a launch system which complements the STS and extends our ability to conduct launch operations further into the spectrum of conflict. These systems can provide unique and assured launch capabilities in peace, crisis and conflict levels short of general nuclear war. These vehicles are designed to be expendable and the loss of a single vehicle affects only that one mission and would not degrade future common, national launch capabilities by the loss of a reusable launch system."

DEFENSE SPACE LAUNCH STRATEGY (Contd.)

"The President's policy on the Commercialization of Expendable Launch Vehicles states that the goals of the U.S. space launch policy are to ensure a flexible and robust U.S launch posture, to maintain space transportation leadership, and to encourage the U.S. private sector development of commercial launch operations. Consistent with this policy, the DOD will pursue the use of commercially procured ELVs to meet its requirements for improving its assured launch capabilities. For requirements that cannot be satisfied by commercially available ELVs, unique DOD developments may be undertaken for special purpose launch capabilities.

"The STS will remain the primary launch system for routine DOD launch services. Unmanned, expendable launch vehicles represent a complementary capability to the STS and will be maintained and routinely launched to ensure their operational viability. To accomplish this, selected national security payloads will be identified for dedicated launch on ELVs, but will remain compatible with the STS

"Long Term: While commerical expendable launch vehicles represent an affordable and available solution to the unique DOD space launch requirements into the early-1990s, the need for other DOD launch capabilities to meet requirements beyond then must be evaluated and validated. This effort must be initiated immediately in order to ensure that future national security space missions are not constrained by inadequate launch capability. The evaluation should examine potential DOD launch requirements, such as the need for a heavy lift vehicle, and should attempt to take maximum advantage of prior investments in the U.S launch vehicle technology base

Implementation

"As Executive Agent for launch vehicles, the Air Force will take immediate action to acquire a commercial, unmanned, expendable launch vehicle capability to complement the STS with a first launch availability no later than FY 1988 These vehicles must provide a launch capability essentially equal to the original STS weight and volume specifications.

"In addition, the Air Force, in conjunction and coordination with other Services, affected agencies and departments, will

"a) identify specific national security systems that will be used on the commercially procured expendable launch vehicles and the proposed peacetime launch rate required to maintain an operationally responsive posture.

"b) develop a comprehensive space launch plan to meet projected national security requirements through the year 2000 This strategy will be submitted to the Secretary of Defense for approval and validation

"The Defense Space Launch Strategy will be reflected in the FY '86 Defense Guidance Plan."

APPENDIX F

REPORT OF THE ARMY SCIENCE BOARD AD HOC PANEL ON THE ARMY'S UTILIZATION OF SPACE ASSETS

I. REPORT

This report represents the conclusions, recommendations, and a very brief synopsis of the supporting discussion of an ad hoc working group established in March 1983, to consider the subject of Army utilization of space assets. In its work, the group received briefings on a substantial number of national systems, and discussed the applicability of spaced-based systems to significant Army requirements. There was substantial background in the group concerning national and other systems and reasonable familiarity with current and evolving Army doctrine. In discussion, emphasis was placed on the needs of commanders of corps and divisions.

In essence, the group has concluded that the Army has performed very well in deriving valuable support for its ability to discharge certain assigned missions by the skillful use of modest budgets, recognizing, however, that the Army is only a (minor) user of available systems, and does not have a great deal of influence in the design and operation of the systems. This raises the two questions of whether or not these systems can always be relied upon to be available to support the Army's tactical needs in times of stress or conflict, and secondly, if the Army were a larger player, might systems be designed and/or fielded in sufficient density to meet Army needs more fully.

As matters stand today, the Army's approach to space utilization is not commensurate with the potential benefit of such utilization. The group has concluded that space as a place for platforms, and space technology itself, offer realistic prospects of providing the Army with substantial improvements in communications, position location, determining the battlefield environment and, most importantly, the ability to see deep into an enemy's territory for intelligence and targeting purposes.

Effective pursuit of this prospect requires a substantial commitment by the Army of money, people and facilities. In order to evaluate proposals for increased exploitation of space technology, the Army must provide for advocacy of such exploitation within its budget. This will require a high level statement of commitment to admit space exploitation into full candidacy for tangible Army support against other demands for Army resources. Resources adequate to support effective advocacy of space technology must be sufficient to all sound planning for the implementation of space technology in systems. Such planning requires the assessment of officers of appropriate rank and organizational positions to the planning task.

In any case, the Army is certain to benefit from competent and effective advocacy of applying space technology to support its missions. Accordingly, the working group recommends that the Army establish a structure to assure such effective advocacy. Further, the Army must declare itself willing to give consideration to those allocations of resources proposed by its own advocates of using space technology more completely than the Army now does or plans to do.

The central conclusions of the working group are:

1. Space technology can bring substantial support to important Army missions.

2. There is a clear need for reconsideration of current Army space policy at the top levels of DA civilian management and Army military command.

3. There is a clear need for formal promulgation of an updated Army space policy.

4. There is a clear need for the Army to provide within itself expert ability on an adequate level of authority and scale to identify, evaluate and advocate exploitation of space to meet Army tactical requirements.

In light of its conclusions, the working group recommends:

1. That the Secretary and Chief of Staff of the Army develop and announce an Army Space Policy designed to serve the tactical needs of the Army.

2. That appropriate officers and civilian officials of the Department of the Army be directed to develop a plan to implement the updated Army Space Policy.

3. That an officer with a position on the Army Staff, of sufficient rank and authority to make things happen, be directed and authorized to serve as the person responsible for day-to-day direction of Army participation in space activities.

4. That the Army establish career incentives for its officers to become experts in the definition, acquisition and operation of space systems, and to practice such expert abilities together with different, traditional Army skills.

The essence of an Army Space Policy advocated by the working group is:

> <u>The Army will accept into full candidacy for support by personnel, funds, and facilities any space system that can be shown to offer significant advantages to Army missions, and the Army will take the steps needed to assure that such full candidacy be expertly supported.</u>

The working group does not wish to convey an impression that favors a "parochial" space policy for the Army. It does not suggest who should "own and operate" space systems that serve the Army. It does emphasize its belief that the Army can benefit greatly from space systems but can be well served only by systems which are assuredly available to serve the operational needs of corps and division commanders. To obtain the service of such systems will require, in the working group's opinion, substantial participation by the Army in the setting of operational requirements, establishing technical specifications and funding acquisition and operation. One source of the working group's belief is that where critical Army participation has been evident, e.g., in the TENCAP program, tremendous support to our field elements has occurred and is further evolving.* Assuring Army ability to participate in this way is the main objective of the working group in proposing that the Army open good career opportunities to space experts among its officers.

The working group also wishes to make clear its belief that Army use of space systems may or may not result in duplication of capabilities obtainable in other ways. In particular, space-based systems may provide capabilities alternatively realizable through the use of aircraft or Remotely Piloted Vehicles (RPV's).

The group believes that the Army should choose platforms from among the possible space and air-supported vehicles giving appropriate weight to basic technical factors (e.g., distance to the observable horizon), acquisition and operating costs, and importantly, survivability. The group estimates that some very important capabilities can only be based in space. It also believes that costs of operationally equivalent air-supported systems are likely to be as large as those of space-based systems. Finally, the group believes that the complicating of an enemy force's burden in destroying systems by including space-based assets among them should be given appreciable weight by the Army.

*The success of TENCAP should not reinforce the policy of very limited commitment. There are important opportunities that even a top performer like Army TENCAP cannot exploit because of limited resources.

II. PEOPLE

In the judgement of the working group, it is pointless for the Army to consider the military worth of assuring a larger role in the exploitation of space technology unless it is prepared to offer satisfying, rewarding careers to officers who desire to become experts in the technology and operational application of that technology. The group has neither the qualifications nor the inclination to challenge the wisdom of the policy that emphasizes the fundamental requirement that any officer possess broadly applicable command ability in combat, combat support, combat service support and general management. It does believe, however, that providing career incentives to develop and maintain specialized expert capability applicable to the performance of its assigned missions is in the best interest of the Army. The group urges that appropriately qualified officers be encouraged and enabled, in adequate numbers, to become space experts <u>as well as</u> sound military commanders.

It is, of course, difficult to be specific about the number of such careers that should be opened up to Army officers. At present, there may be about 100 officers of the Army who are assigned to jobs related to space. Many of these officers are not technical or operational experts.

This number and this fact lead to an estimate in the working group that starting about 20 new space specialist careers each year is reasonable. The group estimates that a suitable Army goal would be to develop a pool of about 500 officer experts in space technology and operations. At any time, about half of the pool should be assigned to jobs involving space systems and the remainder should be given more conventional command assignments.

The working group believes that the personnel policy briefly presented above cannot be made to work unless the Army establishes a chief space officer on the Army Staff. The duties of such an officer would be to serve as a point of contact for officers and units with space-related roles, to be the source of authoritative information for the Chief of Staff and other senior Army officers, to be the advocate of applications of space technology for the benefit of the Army, and to give direction and leadership to the Army's officer space experts.

III. SYSTEMS

The group was briefed on a number of space systems in the development or in a conceptual stage, and many of our members have familiarity with space systems from other of their activities. We attempted in our discussions to relate the capabilities of these systems, and of evolving space technology, to various Army missions, while also being alert to the limitations of space systems. The trade-off between cost and revisit time, for example, is a major one for surveillance systems. It was clear that there are several important applications which have the potential for adding significantly to the Army's ability to conduct difficult missions.

We weighed the advisability of including detailed analysis of Army utilization of space systems in this report and concluded that doing so is inadvisable for reasons given later in this section. It is desirable to state briefly, for purposes of illustration, a few aspects of exploiting space for Army needs. Specifically:

Reconnaissance and Intelligence Deep in Enemy Territory

Location of enemy command centers, recognizing and tracking enemy forces, and numerous other functions must be accomplished at unprecedently large distances if new and developing Army combat doctrine (including integrated operations with the Air Force) is to achieve practicality. Such deep seeing can, of course, be done with aircraft. However, it is very doubtful that adequate coverage, timeliness and acceptable loss rates could be achieved and sustained. Moreover, current space systems are not designed appropriately to furnish Air-Land combat commanders with needed, timely information. New systems are unlikely to do so unless the Army's influence on new system design and acquisition is substantially increased.

Communications Beyond Line-of-sight

It seems to be certain that under new doctrine, small, lean Army forces will need to operate deep in enemy territory and will need to communicate with higher echelon commanders. Such forces will also need to know accurately their own locations. This implies that small, practical, reliable, man-carryable communication and position locating systems will be needed. Indeed, necessary exploitation of very "smart" devices using very modern dense (i.e., small) solid state devices may require transmission to and from satellites in order to achieve needed "bandwidths," i.e., information channel capacities.

Combat Environment

Such "simple" but crucial combat relevant information as close cover and soil trafficability cannot be reliably furnished at present in many plausible conflict situations. Such information may be obtained by sending people to observe and communicate what they observe or by conceivable improvements in current environmental sensing satellite systems. In either case, it seems clear that the Army has a significant need to play a strong role in the design and acquisition of satellite systems.

Beyond the brief summary illustrations above, the group decided against detailed assessment of the contributions to the Army capability that space systems could make for two reasons:

1. At the broad level of our review, the utility of space to the Army is essentially self-evident. The practicality and costs of such utilization upon which further action will depend, will require a detailed assessment, an assessment that we strongly urge the Army to undertake.

2. Classification. A discussion of systems and technology would require that this report be classified; yet the primary issues at this time center on questions of policy and personnel. To facilitate an open discussion of this matter, we believe the systems and technology issues should be dealt with separately. To the extent our panel can help at that stage, we stand prepared to do so.

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APPENDIX G

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FORMATION OF UNITED STATES SPACE COMMAND (USSPACECOM)

Secretary of Defense Caspar W. Weinberger announced today that the President has decided to authorize activation of a new unified command: U.S. Space Command (USSPACECOM). It follows an examination by the Joint Chiefs of Staff of the actions necessary to meet unified and specified commanders' requirements and the subsequent recommendation by both the Joint Chiefs and the Secretary of Defense to form the command.

The new unified command will better serve U.S. interests and the needs of our allies worldwide by providing an organizational structure that will centralize operational responsibilities for more effective use of military space systems. The Department of Defense (DOD) uses space systems to preserve our national security by performing such functions as communications, weather forecasting, navigation, and warning. This new command will improve the utilization of our current systems and will enhance our planning for future use of these and follow-on systems.

To activate this new command, the Joint Chiefs of Staff have established the Joint Planning Staff for Space (JPSS), a Directorate on the Joint Staff, to develop the necessary transition plans. Among the decisions to be made are specific responsibilities for the new command, what forces will be assigned to it, where it will be located, and how large a staff it will have.

The U.S. Space Command may be viewed as an operational parallel to another significant consolidation, the Strategic Defense Initiative Organization (SDIO). The SDIO, established as an agency reporting directly to the Secretary of Defense earlier in 1984, has been directed to conduct research programs to determine the technical feasibility of ballistic missile defense. The new unified command will have responsibility for operational military space systems, but will not have research responsibilities nor, in particular, management control over the SDIO.

The U.S. military use of space has always been non-aggressive and in full accordance with international law. We have performed military activities in space for over 25 years. These activities have been fully consistent with our treaty obligations governing activities in space, our policy commitment to the peaceful uses of outer space and the inherent right of self defense as recognized in the U.N. Charter.

-more-

On September 1, 1982, the Air Force Space Command was formed, and the Navy established the Naval Space Command on October 1, 1983. A unified U.S. Space Command with Air Force, Navy, Army, and Marine Corps participation is the next evolutionary step.

Once our implementation plan has been finalized, we will be providing formal notification, as appropriate, to the Congress.

-END-

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CINC, US REDCOM

CINC, US CENTCOM

CINC, US SPACECOM

J-3

J-5

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20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

This study considers space as the fourth and newest military dimension and examines the implications of spacepower and new technologies on land warfare to the mid-21st century. Its genesis was the resurgence of interest in military space operations among the senior leadership of the Army which began around 1983. Some studies had established that the Army was not fully exploiting the potential capabilities of space to support land combat, but it was already much more deeply dependent on space systems than was readily apparent

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SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered) on the surface. This dependence was increasing yearly without any planning having been done to evaluate its impact on future land combat operations' overall goals and objectives for Army participation in space activities. The Army has begun to correct these shortcomings but many far-reaching decisions need to be made in the near future. This study examines some of the aspects of space as the fourth military dimension which need to be considered in making these decisions as space systems become operational military systems. The author concludes that the Army does not have the qualified personnel or organizational structure to use space and space-based systems to their fullest potential. This is an immediate requirement, and meeting this challenge will greatly facilitate in the longer range requirements of assessing and incorporating military operations in space and space technologies into land warfare, preparing the Army to fight in a four-dimensional environment, and establishing the proper perspective in the Army for space operations.