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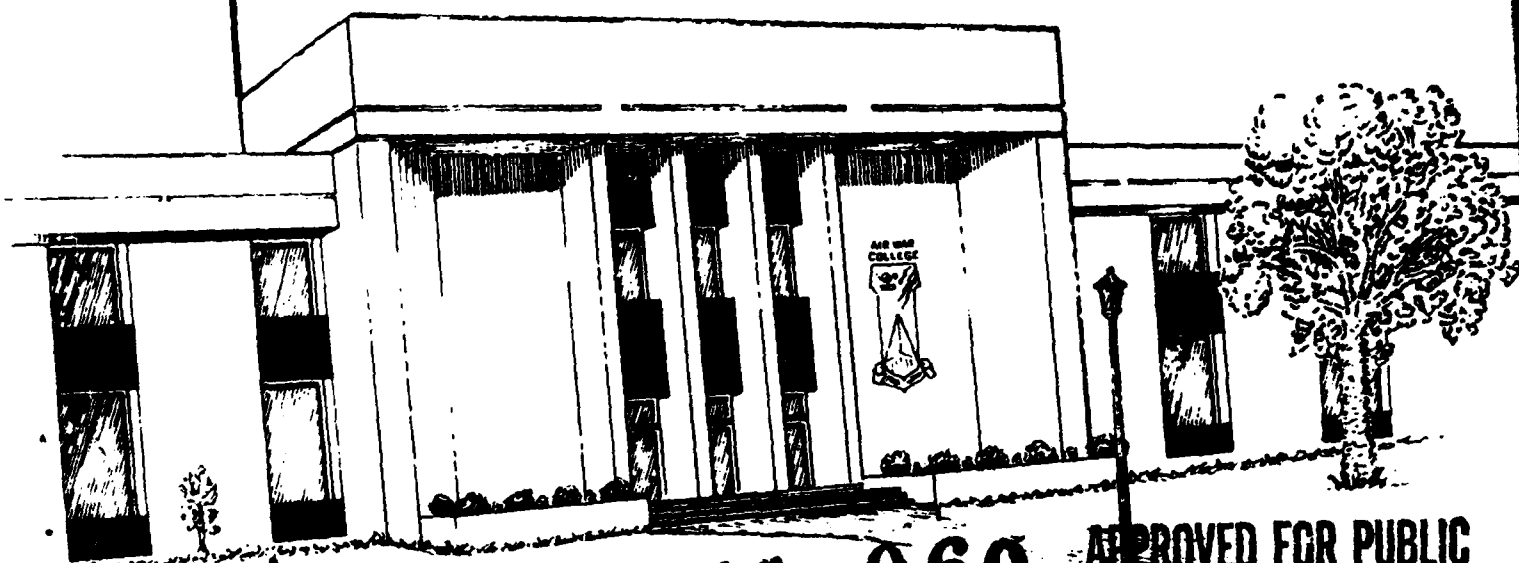
RESEARCH REPORT

NATIONAL SPACE POLICY

LT COL ERNEST B. SUTTON

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AIR UNIVERSITY
UNITED STATES AIR FORCE
MAXWELL AIR FORCE BASE, ALABAMA

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NATIONAL SPACE POLICY

by

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A RESEARCH REPORT SUBMITTED TO THE FACULTY

IN

FULFILLMENT OF THE RESEARCH

REQUIREMENT

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MAXWELL AIR FORCE BASE, ALABAMA

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AIR WAR COLLEGE RESEARCH REPORT ABSTRACT

TITLE: National Space Policy

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National space policy forms the foundation for decisions and direction for the United States national space program. This review begins with the Eisenhower era and the launching of Sputnik 1, considered by most as the start of the space race with the Soviet Union for national space preeminence. Succeeding administrations are discussed to provide the historical setting affecting the actions of presidents, leaders within NASA, the DOD, and Congress as well as other players in the national space arena. This review analyzes the latest national space policy, established by President Reagan in February, 1988. Finally, specific space development programs are offered as topics which will demand the attention of future administrations.

BIOGRAPHICAL SKETCH

Lt Col Ernest B. Sutton attended the University of Florida where he graduated with a Bachelor of Science degree in Social Studies with an emphasis on political science. After Office Training School, he graduated from the USAF pilot school and went to Vietnam to fly in a tactical electric warfare squadron. In 1972, he was assigned to Mather AFB, California, where he first served as a KC-135 pilot, and later on the Wing staff. He then served for five years at Maxwell AFB, Alabama. At Squadron Office School he was a Section Commander, Chief of Research, and Curriculum Directorate Operations Officer. At the Air War College, he served as Executive Officer to the Commandant. He completed his tour of duty at Maxwell as a Distinguished Graduate of the ACSC class of 1982. While at Maxwell, he received a MS degree in Personnel Management. From 1982 to 1987, he was assigned to NATO where he first served as the Chief of Flight Training for E-3A AWACS, and later, as the Deputy Chief of Plans and Programs. Lt Col Sutton is a graduate of the Air War College, class of 1988.

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INTRODUCTION

To begin this review, the United States Air Force, Air University Space Handbook is instrumental in providing insights toward an understanding of space policy. The Space Handbook offers the following description:

Space policy defines in broad terms the basic goals and principles of the U.S. space program. Space policy is shaped by national interests and security objectives and constrained by fiscal considerations and U.S. objectives under international law. Perhaps policy formulation is the most critical element of the national planning process because it provides the framework for the subsequent development of military space strategy and the identification of future system requirements. (36:15-1)

It is the national space policy then, that provides national command authority the format to express the direction the U.S. space program should pursue based on national interests and national security objectives. National space policy provides the foundation for both present day space program objectives and long range plans confined by the limitations imposed by the budget and international law.

How has the U.S. space policy been utilized to consolidate and crystalize U.S. space program goals, with U.S. national prestige as the benchmark, and U.S. national security interests at stake?

Unanswered questions, and the issues which spawned them, about today's U.S. space program are in part the results of space policy decisions from the past. A review of the development of U.S. space policy sets the stage for an analysis of space policy as it exists today, and what it might be for the future. This review of the national space policy will begin with the Eisenhower administration.

CHAPTER II

THE HISTORY OF NATIONAL SPACE DEVELOPMENT: A NARRATIVE REVIEW

Eisenhower's Caution

"To state with certainty the beginning of the space age would be difficult. But, if you were to ask a significant number of people, a majority would surely reply "Sputnik" - meaning, of course, Sputnik 1..." (32:40)

On 4 October 1957, at a cocktail party at the Soviet embassy in Washington, were a number of the world's leading experts in the space satellite field. These dignitaries were in Washington to attend a meeting of the committee for the International Geophysical Year (IGY). Walter Sullivan, science writer for the New York Times, answered an early evening phone call from his office, wherein he was informed of a most significant bulletin from Moscow. Mr. Sullivan approached Richard Porter of the U.S. Earth Satelliet Commission, and whispered, 'It's up.' They relayed the word, quietly, to Dr. Lloyd Berkner, head of the U.S. program for the International Geophysical Year. Dr. Bernker rapped for silence. "I wish to make an announcement," he said. "I've just been informed that a Russian satellite is in orbit at an elevation of 900

kilometers. I wish to congratulate our Soviet colleagues on their achievement." (19:9)

Years earlier when Mr. Eisenhower took office he had systematically begun to embark on his "New Look" policy, the cold war strategic concept following the death of Joseph Stalin, aimed at preventing future conflicts, such as Korea, with a strong reliance on Strategic Air Command nuclear weapons. (10:14)

Concurrently, the U.S. and the Soviet Union expended considerable efforts and resources in developing a new rocket technology which would be capable of propelling strategic offensive weapon systems--weapon systems carrying thermonuclear devices developed by both nations as exemplified by the August 1953, Soviet test of the hydrogen bomb. The development of the U.S. ballistic missile program received the "highest possible priority in the use of talent, money, and material." (33:15) By mid-1955, however, the U.S. ballistic missile community was miffed at the Soviet testing of intermediate range ballistic missiles (IRBM) capable of striking Western European allies more than 1,000 miles away. (32:41)

Later in 1955, the National Security Council (NSC) repeated the Teapot Committee prognosis from the previous year, stating

that the nation was in grave danger without an effective intercontinental ballistic missile (ICBM). Additionally they said that the Massive Retaliation policy would lose its deterrent value and the U.S. would be vulnerable to the possibility of a thermonuclear Pearl Harbor. (32:43)

President Eisenhower's decision was to select the navy development program known as Project Vanguard, even though the army's Ballistic Missile Agency, employing Wernher von Braun and a team of German rocket experts captured at the conclusion of World War II, had already developed reliable launch vehicles that probably *could have put a U.S. satellite into orbit in early 1957*. (19: 33)

Following the 1957 launch of Sputnik 1, in March 1958, the Vanguard finally was successful in its first orbital flight. This marked a period of competition throughout the Administration as civilian and military agencies grappled for management of the U.S. space program. (32:47)

President Eisenhower selected the National Advisory Committee for Aeronautics (NACA), which was renamed NASA for National Aeronautics and Space Agency, as the nucleus of the space management organization when he signed the National Aeronautics and Space Act of 1958. All agencies within the aerospace industry

were not content with these arrangements, such as the Air Force, which was disturbed over the loss of its MISS program funding. The Army was resistant toward NASA's attempt to transfer the von Braun development team of the Army Ballistic Missile Agency into NASA. But the President was supportive of the new space agency."

(10:24) In November 1958, NASA acquired the Naval Research Laboratory and Project Vanguard and moved to the Goddard Space Flight Center built on government land near Greenbelt, Maryland.

(32:54) NASA, under the direction of its first administrator, Thomas K. Glennan, established the necessary organizational infrastructure to make it a viable governmental agency.

The National Aeronautics and Space Act was the first expression of an official national space policy. The policy, dedicated to the peaceful use of space, separated civilian and national security space programs with an emphasis on international cooperation for the benefit of all mankind. (36:15) It provided a "framework for overall R and D policy for flight activities...provisions for the conduct of military space efforts in DOD... made reference to the scientific and applications objectives of the program, but it also listed objectives pertaining to technological development, national leadership in aeronautics and

space science and technology, and national defense." (19:56)

At the mid-point of President Eisenhower's second term in office, with the enactment of national space policy, came the establishment of the governmental agency to conduct space activities. This gave the U.S. the tools needed to take the leadership role in space. NASA launched three rockets loaded with scientific instruments into deep space, succeeded in placing three new satellites into orbit, and developed high-technology rocket and satellite test facilities. Yet, during the remainder of President Eisenhower's tenure, NASA succeeded in only 8 launches in 25 attempts. (32:55)

During the same period, the Air Force continued to make advances in space activities as the DOD space program manager. The USAF launched the Pioneer 1 to a height of 71,000 miles accomplishing the deepest space penetration of the era, and placed into orbit the first communications and meteorological satellites, and conducted the first recoveries of space vehicles in midair and in the ocean. (32:55)

The Space Act of 1958 had established the individual charters for both NASA and DOD. "Nearly all of these [space] efforts, however, were programs in which NASA held the lead role. In the

majority of cases, with the exception of reconnaissance, the military requirement for a space program could not be pushed through or justified. As a result, NASA's unmanned scientific missions proliferated while the Air Force played mostly a support role." (32:56)

"Therefore, the nation's first space policy (a framework for which many exciting possibilities existed under the new Space Act) as practiced by the Eisenhower administration, can be characterized as conservative, cautious, and constrained." (36:15-5) "The nation's first definition of its space policy contained more words of conservation and caution than of exuberance and excitement. Those who were to take charge of the development of space policy in the Kennedy administration and in the early years of the Johnson administration would have a different view." (19:56)

The Kennedy Moon Race

President John F. Kennedy clearly stated his perception of the significance of space through the magazine Missile and Rockets in October 1960, during his presidential campaign when he stated, "...we cannot run second in this vital race. To insure peace and

freedom, we must be first...This is a new age of exploration; space is our great New Frontier." (19:61)

Once in office, President Kennedy continued to believe in the need for an active space program but was undecided about the priorities within the U.S. space program and how the space program fit into the overall scheme of his new administration. (19:61)

Steady advances in space ventures by the Soviet Union helped to crystallize President Kennedy's perception of space importance and the disparity of capabilities between the superpowers. The successes in Soviet heavy lift capability and rocket technology were alarming. At the very onset of the Kennedy administration, the Soviets had numerous space firsts to include three moon probes, the first satellite photography of the back side of the moon, and the successful launch and recovery of two dogs from earth orbit. (19:69) In addition, Khrushchev confidently announced Soviet intentions to put a man into space. (19:64)

The U.S. manned space flight program had been delegated to NASA rather than DOD by President Eisenhower in August 1958, prior to the formal establishment of NASA as a governmental agency. Objections from senior leadership within the Air Force had been vehement. However, they lacked the steadfast support of the

Secretary of Defense necessary to successfully present the objections to the president. Project Mercury was the name of NASA's manned program, scheduled for suborbital and earth orbital flights. The Air Force, continued to plan for a follow-on manned flight assignment after Mercury. It cooperated with NASA by providing "boosters, launching facilities, technical assistance, astronauts, and in conjunction with the navy, logistical support; it wanted the project to succeed to prove the viability of man in space and to demonstrate its own capabilities as part of the total effort. On the other hand, the Air Force was critical of NASA's management of Mercury; it felt that it could do a better job in managing manned space activities, and that its direction of these efforts would be advantageous to the nation by combining military and technological objectives in one program." (19:67)

In January 1961, President Kennedy decided to place Vice President Lyndon Johnson in charge of the U.S. space program. Johnson immediately set to task by selecting James E. Webb as the new NASA administrator. This followed the resignation of Mr. Glennan at the completion of the Eisenhower administration. Mr. Webb was, by formal education, a teacher and attorney. However, he had served as an able administrator during his service as the

Director of the Bureau of Budget from 1946 until 1949. His career then led to a three years as Under Secretary of State. (32:58)

In addressing the President on January 30th, Mr. Webb confided that he did not feel secure in accepting the nomination without his having a background as either a scientist or engineer. President Kennedy responded to Webb's hesitance by saying that the decisions and policies of the nation's space program involve both the national and international arena. The president asked that Webb take the job because of his experience with national policy. (10:40)

Mr. Webb proved to be an able administrator indeed, for he excelled at congressional relations. He had noted success with the House and Senate Space Committees as well as with the Subcommittee on Independent Offices of the House Appropriations Committee, which held the purse strings to NASA's programs. (19:72)

With Webb in place, Vice President Johnson turned his attention toward the revitalization of the National Aeronautics and Space Council (NASC). (32:59) Eisenhower, as president, had considered the council impractical and unnecessary. In 1960, President Eisenhower had asked Congress to abolish the council while voicing his disagreement with the space act concept because

it entailed a single civil-military space program which he felt was unattainable and the statutory concept of such a program caused confusion. It had been Johnson (then Senate Majority Leader) who had convinced President Eisenhower at the end of his second term in office, not to tie the hands of the next president who might deem the services of the council necessary. (19:66) Johnson's success regarding the council's survivability during the Eisenhower administration was surpassed under Kennedy when the Vice President was chosen as the Council's Chairman and the curator of the nation's civil-military space policy. (32:59) Edward Welsh was chosen to be executive secretary to the Council.

The bond between Welsh, Johnson, and Webb in addition to the personal drive for success in space programs by President Kennedy, served as a formidable force in gaining monetary commitments to NASA's space goals. Although limited to \$1.1 million by the Eisenhower administration, NASA's FY 1962 budget input was \$300 million (with additional funds necessary for the development of launch vehicles, scientific projects, and the Apollo program). (19:73)

While President Kennedy was deliberating on the NASA budget, the Soviets made good their promise to put the first man into space

with Vostok 1, piloted by Major Yuri Gagarin on an 89 minute, single orbit flight around the earth on 12 April 1961. The Soviet Union did not pass up that opportunity to espouse the virtues of socialism and the technological superiority and scientific achievements of the great Soviet state. Nikita Khrushchev, with great pride, announced to the world, "In forty three years of Soviet government, formerly illiterate Russia...has traveled a magnificent road...this victory is another triumph of Lenin's idea...this exploit marks a new upsurge of our nation in its onward movement toward communism." (10:52) Public and congressional reaction in the U.S. was similar to the shock of the Sputnik 1 launch and it resulted in great concern for the national progress in space. (32:60)

Within three days of the legendary Vostok 1 flight, President Kennedy was deeply involved in the Bay of Pigs incident in which the CIA sponsored a Cuban insurrection that was crushed in a mere four days. Following the debacle, President Kennedy sent the historic memorandum to Vice President Johnson:

In accordance with our conversation I would like for you as Chairman of the Space Council to be in charge of making an overall survey of where we stand in space.

1. Do we have a chance of beating the Soviets by putting a laboratory in space, or by a trip around the moon, or by a rocket to land on the moon, or by a rocket to go to the moon and back

- with a man. Is there any other space program which promises dramatic results in which we could win?
2. How much additional would it cost?
 3. Are we working 24 hours a day on existing programs. If not why not? If not, will you make recommendations to me as to how work can be speeded up.
 4. In building large boosters should we put our emphasis on nuclear, chemical, or liquid fuel, or a combination of these three?
 5. Are we making maximum effort? Are we achieving necessary results? I have asked Jim Webb, Dr. Wiesner, Secretary McNamara and other responsible officials to co-operate with you fully. I would appreciate a report of this at the earliest possible moment. (19:74)

Vice President Johnson had little time to respond to the President's memorandum due to a scheduled 15-day tour of Southeast Asia beginning on 9 May. With time playing such a crucial role, Johnson met with leaders of NASA, the DOD, the Bureau of the Budget, and the President's Science Advisor and head of PSAC, Dr. Wiesner. In addition, he "tested the waterfront" on significant space program revisions with civic leaders and friends in the Senate for probable public reaction. (32:61)

On 28 April, Johnson answered President Kennedy's questions and added the following conclusions from his research efforts:

- a. Largely due to their concentrated efforts and their earlier emphasis upon the development of large rocket engines, the Soviets are ahead of the United States in world prestige attained through impressive technological accomplishments in space.
- b. The U.S. has greater resources than the USSR for attaining

space leadership but has failed to make the necessary hard decisions and to marshal those resources to achieve such leadership.

c. This country should be realistic and recognize that other nations, regardless of their appreciation of our idealistic values, will tend to align themselves with the country which they believe will be the world leader--the winner in the long run. Dramatic accomplishments in space are being increasingly identified as a major indicator of world leadership.

d. The U.S. can, if it will, firm up its objectives and employ its resources with a reasonable chance of attaining world leadership in space during this decade. This will be difficult but can be made probable even recognizing the head start of the Soviets and the likelihood that they will continue to move forward with impressive successes. In certain areas, such as communications, navigation, weather, and mapping, the U.S. can and should exploit its existing advanced position.

e. If we do not make the strong effort now, the time will soon be reached when the margin of control over space and over men's minds through space accomplishments will have swung so far on the Russian side that we will not be able to catch up, let alone assume leadership.

f. Even in those areas in which the Soviets already have the capability to be first and are likely to improve upon such capability, the United States should make aggressive efforts as the technological gains as well as the international rewards are essential steps in eventually gaining leadership. The danger of long lags or outright omissions by this country is substantial in view of the possibility of great technological breakthroughs obtained from space exploration.

g. Manned exploration of the moon, for example, is not only an achievement with great propaganda value, but it is essential as an objective whether or not we are first in its accomplishment--and we may be able to be first. We cannot leapfrog such accomplishments, as they are essential sources of knowledge and experience for even greater successes in space. We cannot expect the Russians to transfer the benefits of their experiences or the advantages of their capabilities to us. We must do these things ourselves.

h. The American public should be given the facts as to how we stand in the space race, told of our determination to lead in that

race, and advised of the importance of such leadership to our future.

i. More resources and more effort need to be put into our space program as soon as possible. We should move forward with a bold program, while at the same time taking every practical precaution for the safety of the persons actively participating in space flights. (10:56)

Vice President Johnson's reply provided Kennedy with hope for the near future of the U.S. space program, but the accomplishments of Alan Shepard on 5 May made the President even more optimistic. The young astronaut accomplished the first American space flight on a 15-minute suborbital journey aboard Mercury capsule's Freedom 7. (32:61) Three days later, the President awarded Shepard the NASA Distinguished Service Medal at the White House Rose Garden followed by a drive down Pennsylvania Avenue to the cheers of 250,000 Americans, a press conference, and later that evening, to a NASA victory dinner. (2:79)

Alan Shepard's first U.S. space flight received international attention and inflamed Khrushchev who quickly pointed out that American success in suborbital flight was insignificant when compared to Russia's Earth orbit spectacular. (10:60). But Shepard's epoch voyage inspired Americans to think to the future. As one broadcaster said,

I can't help but think of how things will be 10, 20, or even

30 years from today when we'll look back on the events of the past few hours and think to ourselves how crude the first (manned) rocket flight was. But then I suppose regular trips to the Moon will be undertaken by more refined spacecraft and I can't help but think that this wonderful, strange, and almost other-worldly event that took place today is only the beginning for this country and that so many greater things are to come and that many other brave men like Alan Shepard will follow him into space. (2:79)

The words of the media anchor man, "...regular trips to the Moon will be undertaken by more refined spacecraft...the space flight of Alan Shepard swept away any reservations concerning the space race to the moon that John F. Kennedy may have kept to himself." (10:60) Three weeks after Alan Shepard's voyage, *President Kennedy addressed a joint session of both houses of the Congress presenting an ambitious and unprecedented space policy goal in stating:*

...I believe that this Nation should commit itself to achieving the goal, before the 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 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 judgement affirmatively-- it will be an entire nation. (32:62)

Prestige and international leadership were clearly the main objectives of the Kennedy space program. Science was secondary, and military security was always involved, because the ability to

reach the moon was an index of technological capabilities and crucial to missile and nuclear war. (19:75)

The announcement by President Kennedy to land on the moon was received with varying degrees of enthusiasm within the NASA community. Professional desires vis-a-vis the scientific exploration of space pitted scientists in one camp and engineers into yet another, when science and Earth-based applications were held hostage to unparalleled financial requirements for manned flights. (2:95)

While NASA scientists were experiencing concern over the prioritization of funds, the DOD space activities program methodically progressed. The Air Force developed a mirror-image program in meteorology, communications, and reconnaissance satellites with significantly superior resolution capabilities. Under a major Air Force reorganization, the Ballistic Systems and Space Systems Divisions were created within Air Force Systems Command developing a man-rated Atlas D booster and later the two-man-rated Titan II. Previously, in 1957, the Air Force had joined forces with NACA developing a space glider with maneuvering reentry capability when entering orbit. The X-20 Dyna-Soar program was cancelled in 1963 prior to test flight when

the Air Force pursued the Manned Orbiting Laboratory designed to put a military manned space station in near-earth orbit. (32:64)

With the Congress annually approving President Kennedy's budget, complete with significant space expenditures, the President further enhanced NASA's role in the space program during a speech at Rice University on 12 September 1962:

We sail on this new sea because there is new knowledge to be gained, the new rights to be won, and they must be won and used for the progress of all people...

We choose to go to the moon...in this decade and do the other things, not because they are easy, but because they are hard, because that goal will serve to organize and measure the best of our energies and skills, because that challenge is one that we are willing to accept, one we are unwilling to postpone, and one which we intend to win, and the others too.

It is for these reasons that I regard the decision last year to shift our efforts in space from low to high gear as among the most important decisions that will be made during my incumbency in the office of the President.... (10:68)

To sum up the impact of President Kennedy's tenure, the national space program flourished--Kennedy made it happen. His assignment of Vice President Johnson to the responsibility of overseeing national space activity was an important step in the process. Kennedy revitalized the NASC and encouraged the House and Senate Space Committees to actively participate in space

policy. (19:77) The President's commitment to land an American on the moon was unwaiverable. On 25 May 1961, during a family gathering he said, "I firmly expect this commitment [of going to the moon] to be kept. And if I die before it is, all of you here now just *remember when it happens, I will be sitting up there in heaven in a rocking chair just like this one, and I'll have a better view of it than anybody.*" (10:37) Rifle shots in Dallas kept President Kennedy from seeing the moon walk and took from the nation a president who was decisive in space policy making--a president who provided clear direction from the top.

Johnson's Continuation

When Lyndon Johnson became president there were few who believed he would oversee the U.S. space program with any less enthusiasm than he had under either Eisenhower or Kennedy. As a politician, Johnson had a greater involvement and a more thorough knowledge than anyone of the status and capabilities of the national space program. He quickly dispelled any notion of a reduction in priority for space activities during his inaugural address in claiming the requirement to assure our preeminence in

the peaceful exploration of outer space with the cooperation of other powers or alone if necessary. (10:89)

In his abbreviated first term, President Johnson continued with Kennedy's space program built on international prestige and a balanced commitment to technological progress, commercial and military applications, scientific achievement, economic stimulus, and political opportunities. (32:66)

President Johnson's first term became the proverbial "heyday" for NASA. Its budget and personnel strengths rose to unmatched levels resulting in 10 flights in 1965 and 1966, supporting 20 astronauts launched from Titan IIs supplied by the Air Force, while accomplishing a 100 per cent safety record. (32:67)

The Air Force was equally as successful during the early phase of Johnson's tenure. Of special significance were the advances in satellite technology including the Tiros series of meteorological satellites, the Transit series for the Navy, and the Mariner Venus and Ranger moon probes. Of major importance to the DOD national security interests, were successful accomplishments in communications satellite technology and nuclear detection satellites that served well beyond their projected lifespan. Additional satellites provided increases in quality of life for

Americans, as typified by the Syncom III Communications satellite supplying Olympic coverage to the United States from Japan.

Advances in satellite capability involving joint-nation cooperation were also experienced during Johnson's early presidency. Examples include, the passive communications Project Echo program with the Soviet Union, and the Alouette ionospheric gathering satelliet with Canada. (32:66)

Rocket booster technology was advanced by the Air Force during this time as well, serving as the "bus" required to transport these high-technology systems to their orbits. At the heart of U.S. heavy lift capabilities was the completion of the two-man-rated Titan II booster which was successfully tested with two separate unmanned launches as the Air Force prepared for dual astronaut Gemini flight early in 1965. While the Titan II displayed technical prowess with large payload requirements, Atlas-Agena, Thor-Agena, and Scout boosters launched dozens of other projects in support of NASA and DOD, satisfying a wide range of weight and special interest requirements. (32:66)

The Soviets were accomplishing significant events in space as well. They conducted the first "walk" in space on 18 March 1965. This 10-minute floating in space attached to a 16-foot line was

given a great deal of world-wide press coverage. (33:270)

As President Johnson transitioned into his second term in the White House, he began to reassess the prioritization of the national space program vis-a-vis U.S. commitments to Vietnam. The heavy toll of American lives in Southeast Asia, the continuing barrage of national media coverage of bloodshed and atrocities, and anti-war demonstrations and protests around the country, played heavily on the president and the nation. Vietnam indeed affected all aspects of American life and the space program was no exception. The national controversy over Vietnam impacted the views of the public and of Congress on the space program. Specifically, Vietnam directly contributed to the following widely-held attitudes:

1. Large-scale space activities were a fiscal burden that the nation could not afford along with the war;
2. The lunar landing was a frivolous and expensive undertaking; funds earmarked for space could better be spent on urban problems; and
3. The lunar landing had lost much of its significance, since the real competition with communism was now on the battlefield (in addition, it appeared that the Soviets were slackening in their own manned space activities. (19:94)

These first two attitudes suggested that the financial burden of Vietnam was a prime consideration at the heart of ever-increasing debates about national spending. When discussions about spiralling inflation were aired, the burden of Vietnam

inevitably came to the foreground of the conversation. President Johnson and the Congress voiced concern for all government spending resulting in a threat to federal aid to U.S. cities, arousing criticism and heated debate. The 1966 convention of the National League of Cities linked military and space activities, questioned their national priority. Detroit's Mayor Cavanaugh argued that a delay of the Apollo program for only a few weeks would save enough money to restore cuts made in urban programs in low-income housing, poverty, and education. One National League of Cities delegate stated that, "NASA Administrator Webb was more concerned with life on Mars than life in Chicago or Los Angeles." Mr Webb responded to the criticism trying to put the expenditures of the space program and its significance to America in perspective stating, "Neither I nor any other leader in the space program has ever suggested that the space program should have priority over the needs of the American city...further...the space program promises benefits in medicine, communications, and other fields that would improve the quality of life on earth." (19:95)

Although Mr Webb had spent many years previously in government life supporting city programs, the conflict between urban and space program expenditures was evident to all. Attitudes about Vietnam,

space, and social programs were soon to have far reaching effects on NASA's budget.

An additional effect upon NASA during the Johnson administration was the change in the approach to space Johnson represented when compared to Kennedy. Kennedy's competitive spirit spilled over into the space arena wherein he envisioned the attainment of national pride and prestige following each American success in the New Frontier. He developed the Peace Corps, formed partnerships with Latin America and strengthened ties with European allies--these were outer-directed goals. (19:92)

President Johnson, on the other hand, provided an inward-looking emphasis with his "Great Society" program designed to improve the standard of living for Americans with life today as the capstone, as opposed to Kennedy's dreams of tomorrow. (19:92) While the Great Society program succeeded in directing attention toward housing problems, and levels of poverty and education, the raising of expectations created natural concerns for the competition of funds represented by the national space program. Public concerns about the value of the space program were openly voiced, while a behind-the-scene rift between manned program proponents versus science (and science applications) proponents

vied for support to serve their individual interests.

Conflict between these two factions within the space community began during the Kennedy administration and the struggle became more vocal during Johnson's tenure. In the beginning years of Kennedy's term in office, science and applications programs had taken great strides with Tiros weather satellites, space science probes from the Explorer series, the discovery of the Van Allen radiation belts, and the close fly-by of Venus. Kennedy's emphasis on the lunar landing resulted in a disproportionate expenditure of funds toward manned programs such that three-fifths of NASA research and development budget was funnelled into manned flight programs. (19:80)

As the requirement for manned programs increased throughout the Kennedy years, the question within NASA was how to avoid sacrificing science and applications projects to the lunar landing goal. When the director of manned programs within NASA, Brainerd Holmes, could not convince Mr. Webb to transfer funds out of the unmanned budget and into the manned budget, the clash was leaked to the press. As a result, President Kennedy called a White House meeting between himself, Johnson, Webb, Holmes and Seamans. Webb was convinced that a balanced space program supporting

manned flight plus science and technology programs were required, prompting the following letter to President Kennedy as the basis for his position:

The manned lunar landing program, although of highest national priority, will not by itself create the pre-eminent position we seek. The present interest of the United States in terms of our scientific posture and increasing prestige, and our future interest in terms of having an adequate scientific and technological base for space activities beyond the manned lunar landing, demand that we pursue an adequate, well-balanced space program in all areas, including those not directly related to the manned lunar landing. We strongly believe that the United States will gain tangible benefits from such a total accumulation of basic scientific and technological data as well as from the greatly increased strength of our educational institutions. For these reasons, we believe it would not be in the nation's long-range interest to cancel or drastically curtail on-going space science and technology development programs in order to increase the funding of the manned lunar landing program in fiscal year 1963.
(1982)

President Kennedy acknowledged Webb's wisdom and supported a continuation of science and applications programs, to include university grants for scientific projects and research and development, to continue throughout the administration. His directions were clear and definitive.

When Johnson moved into the White House there was considerable debate within the scientific community as to what the scientific and technological space priorities should be, however,

there was unanimity in the scientific community in holding that scientists should make the determination. Scientists were concerned that the NASA agency was controlling scientific and application decisions through a conglomerate of administrators, space specialty engineers, special interest groups within the House and Senate Space Committees, and space industry personalities. Although scientists possessed a mechanism in the PSAC to voice opinion and recommendations for a prioritization of scientific and technological programs, NASA decision makers often ignored their professional advice. (19:84)

Phillip Abelson, editor of Science magazine (the official publication of the American Association for Advancement of Science), described the justification of the national space program around (1) the propaganda value of beating the Soviets, (2) possible military applications, (3) technological fall-out, and (4) scientific values. Abelson went on to say that propaganda values were "fleeting," military applications "remote," technological fall-out "unimpressive," and scientific accomplishments "bleak," realizing the prioritization of manned-flight programs versus those of scientific programs. (19:85)

Scientists openly insisted that instruments should replace the

astronaut. The manned versus unmanned space debate would persist throughout the tenure of each succeeding administration.

One of the greatest blows to the national space program came on 27 January 1967, when a fire broke out at Launch Complex 34 aboard Apollo Saturn-204, killing Air Force Lieutenant Colonels Edward White and Virgil Grissom and Navy Lieutenant Commander Roger Chafee. Following an extensive investigation after the disaster, both NASA and the contractor, North American Aviation, were severely criticized for being derelict. (19:296) Days before the incident, a quality control inspector and receiving inspection clerk named Thomas Baron, *expressed concern about* "lack of adequate quality control, personnel supervision, documentation, and safety in tests involving toxic chemical and potentially inflammable materials," but his reputation for crying "wolf" too often combined with the concept that, "the test [at Launch Complex 34] was not considered hazardous...no propellants involved...firecrews were on standby rather than at the alert pad," resulted in a mission green light. (2:274)

North American had been previously criticized in an inspection report by the NASA Apollo program director, Maj Gen Samuel Phillips, in December 1965, concerning contractor procedures and

many believed the Agency had covered up the Phillips report. Media coverage served a crippling blow to NASA, for in the final analysis, the nation no longer believed in the infallibility of the Agency. In addition, its relationship with Congress was seriously shaken, as expressed by Congressman John Wydler of the House Space Committee in stating that NASA would "no longer be taken at face value." (19:98) Congressional hearings rekindled the man versus unmanned debate and fostered media criticism for NASA's strides to accomplish so great a task in such a short period of time, such that, "disaster was almost inevitable." (2:280)

Three months after the tragedy at the Cape, the Soviet Union experienced a fatality as well. Vladimir Komarov was killed in the first Soyuz flight when parachute lines became twisted during the recovery phase. The cosmonaut was crushed upon impact with the ground. (36:CRS-12)

Johnson persisted in his personal attempts to continue with Kennedy's space efforts, but the budget for NASA began to plummet immediately before and after the tragic fire. For example, the FY 1966 NASA budget was \$163 million less than the previous year. (19:90) Financial reductions for NASA continued through the remainder of Johnson's administration with a \$219 million budget

cut in 1968 bringing the budget to \$4.37 billion (representing a \$1 billion cut over 1965 expenditures). (32:67)

The president was successful in spite of budget cuts and the divergence of national interests at home and abroad to continue with significant projects within DOD and NASA. He provided continued support for the manned orbital laboratory (for which he asked Congress for a \$430 million funding effort) and various nuclear propulsion projects. (19:91)

Johnson was able to keep the Apollo program free from large budgetary reductions in order to maintain the lunar-landing schedule. The circumlunar flight of *Apollo 8* during the Christmas season in 1968 was a significant milestone in the U.S. space program, but it came at a time when the consistent reductions in the NASA budget prompted Mr. Webb to say that the United States was no longer pursuing its goal of preeminence in space. (10:91)

In the shadow of the tragic fire at Launch Pad 34 on 27 January 1967, and in the wake of serious budget reductions for NASA at the end of the Johnson administration, James Webb announced his resignation in September 1968. He had been the champion of the Agency for seven and one half years, and was replaced by his deputy, Thomas Paine, as the acting administrator.

During his administration, President Johnson continued with the Kennedy objective of placing an American on the moon. He continued in spite of pressures created by Vietnam--an extremely unpopular war that affected all Americans. He continued to push toward the Kennedy dream, but allowed cuts in NASA's budget to make way for his Great Society program wherein he drew criticism not doing enough, fast enough. Johnson's general support for military programs resulted in significant advancements in propulsion and satellite technology, and continued enthusiasm for the manned orbiting laboratory.

The most persistent space program debates during Johnson's tenure surrounded the questioning of the necessity to put man into space, and the relative emphasis of science and applications.

The nation, under Johnson, witnessed the most agonizing space program defeat and one of its most spectacular successes. The fire that took the lives of Grissom, White, and Chafee stopped the NASA program for one and one half years and cast space program doubts in the minds of many Americans. The triumph of Apollo 8, portraying Earth as the big blue marble during its circumlunar voyage, rekindled the American competitive spirit and national pride. In his memoirs, Johnson alluded to the great and potential

conquests offered by space when he said, "The new adventures in space that lie ahead will bring with them excitement and new accomplishment as great as anything we have witnessed in the epic period just past, when we proved ourselves once more to be the sons of the pioneers who tamed a broad continent and built the mightiest nation in the history of the world." (10:91)

Nixon-Ford

During President Nixon's inaugural address, he said the following concerning space, "...Those who could be our adversaries, we invite to a peaceful competition--not in conquering territory or extending domination, but in enriching the life of man. As we explore the reaches of space, let us go to the new worlds together--not as new worlds to conquer but as a new adventure of mankind..." (10:99)

President Nixon appointed key figures in managing the national space program beginning with his selection of Lee A. DuBridge as science advisor. He followed the custom established by Kennedy of appointing the Vice President as chairman of the National Aeronautics and Space Council. Robert C. Seamans, Jr. was selected as Secretary of the Air Force, and Nixon's nomination of Dr. Paine

as NASA Administrator was confirmed on 5 March 1969. (32:71)

President Nixon was an accomplished politician and the publicity potential of the U.S. space program for the executive office was not lost on him. He dispatched the Apollo 9 aircrew to the Paris Air Show and later sent astronaut Frank Borman on a goodwill trip to Europe and the Kremlin stating the need to band together with other people on this earth in the high adventure of exploring the new areas of space.

The Apollo 9 and Apollo 10 missions had been highly successful with all tasks of the lunar landing performed (except the actual touchdown). Astronauts Tom Stafford, Gene Cernan, and John Young had crossed the last hurdle on Apollo 10 with only 51 days remaining before man, an American, would set foot on the moon during Apollo 11. (2:338) Nixon arranged full honors following the landings of Apollos 9 and 10, but Nixon "pulled out all stops on Apollo 11," in signing his name below the Lunar Module Eagle plaque with the message, "We Came In Peace For All Mankind." President Nixon received ample criticism from the press for taking credit for the work of key executives, administrators, and astronauts of the past. Herb Block's Washington Post cartoon showed Nixon atop the shoulders of a man with U.S. space program

written on his back while Nixon carried the sign, "The Nixon Plaque; We came in peace for all mankind and in glorification of a certain president." (10:101)

Regardless of Nixon's true motives, his participation in the Apollo 11 mission was substantial. The evening prior to the launch he telegraphed Neil Armstrong, Michael Collins, and Edwin 'Buzz' Aldrin stating that this event would be a, "triumph all men will share." (10:101) He also declared 21 July as a National Day of Participation, commemorating American and Soviet space heroes who had previously given their lives in preparation for this epoch event.

Although it followed in the wake of the great successes of Mercury, Gemini, and Apollo flights of the past, the moon landing mission captured the hearts and minds of the world. Media coverage and the number of visitors converging on the Cape were beyond belief. Two hundred Congressmen, 60 foreign ambassadors, 19 governors, and 40 mayors made arrangements to observe the event. Also present were some of the true "workhorses" of the national space program such as George Low, the man who conceived and nurtured the moon landing mission long before Johnson presented the concept to Kennedy. Along with Low were Jim Webb

and Werhner von Braun. As the nation and the world readied itself for this unique moment in history, the Los Angeles Herald Examiner carried the following comment, "It is with an almost breathless sense of awe that we await tomorrow's blast-off...mere words cannot capture the immensity of the flight...Quite literally, man will be attempting a final break of the chains which have bound him to this earth." (2:341)

Apollo 11 launched without incident, and at an elapsed time of 109 hours, 24 minutes, and 15 seconds into the mission, Neil Armstrong was at the foot of the ladder descending to the moon's surface from the Lunar Module. The event was captured on TV and as the world listened, Armstrong spoke to mission control stating, "I'm going to step off the LM now. That's one small step for man. One giant leap for mankind." (2:352)

When the Challenger returned to earth eight days after launch, President Nixon addressed the three astronauts from their quarantine trailer on the aircraft carrier Hornet saying:

I think I am the luckiest man in the world, and I say this not only because I have the honor to be President of the United States, but particularly because I have the privilege of speaking for so many in welcoming you back to earth...I was thinking, as you know, as you came down, as we knew it was a success, and it had only been eight days, just a week, that this is the greatest week in the history of the world since the Creation, because as a

result of what happened in this week, the world is bigger, infinitely..., as a result of what you have done, the world has never been closer together. (10:101)

Neil Armstrong's long-remembered comments were in a sense both historic and symbolic. The achievement of man through Apollo 11 in overcoming the elements of space, while achieving victory through an engineering miracle, was viewed by many as one of man's greatest accomplishments. For others, the lunar landing marked the onset of a new era in the struggle of man to overcome both physical and social obstacles that restricted the good life on earth. (19:108)

For NASA, the lunar landing represented proof positive that manned flight was important and that given sufficient resources, manned flight could be a resounding success. There were those who believed that the U.S. should extend the triumph of Apollo 11 toward the expressed goals of NASA to include the space shuttle, the space station, and in the near future, to missions to Mars. NASA envisioned a series of science and applications programs as well. Yet, to others outside NASA, the lunar landing was an anticlimax to a costly government program. The NASA budget had steadily been reduced by \$500 million per year between 1966 and 1970, with a concurrent decline in space related employment from

420,000 to 190,000 during the same period. (32:72)

By the summer of 1969, NASA officials were concerned about the alarming budget-reduction trend. Nevertheless, NASA was engaged in a number of space projects such as Skylab, a series of unmanned planetary missions, the Earth Resources Technology Satellite and the full-scale development of the space shuttle.

(19:109)

During the 1968 presidential campaign, the Republican party had pledged support for military space activities. The Air Force proposed that near-earth manned space operations fell within the military arena and therefore, sought approval for the Manned Orbiting Laboratory that began during the Johnson administration.

(19:109)

Leaders in the aerospace industry were keenly interested in supporting both NASA and the DOD in space ventures. Although interests in NASA's post-Apollo proposals were preeminent within a certain sector of the industry, DOD projects commanded top priority because military projects provided seven times the business as did NASA. (19:110)

Lee DuBridge, the Presidential Science Advisor and chairman of PSAC, was highly supportive of science and applications

missions. However, he did not favor a national space program that fostered unnecessary safety hazards, nor was he supportive of an emphasis on manned space flight. (19:110)

Although the American public had taken great pride in the lunar landing flight, there did not appear to be any tangible evidence in the way of changes brought about by Apollo 11. There were no precious metals from the journey such as gold or silver, nor any other raw material available upon which the United States was dependent on foreign governments. (19:114)

President Nixon was not openly committed to providing executive support to a healthy national space program. During the 1968 election campaign he had expressed a requirement to decrease NASA expenditures pending a more stable economy. The strains of Vietnam, the national economy, and social programs were instrumental in diverting Nixon's attention. Nixon assumed a "wait and see" attitude. (19:111)

Key members of the Nixon administration were tasked to review the national space program and make recommendations for a comprehensive program for the 1970s, under the auspices of the Space Task Group (STG). During the formation of the STG, President Nixon stated that it, "was necessary for me to have in the near

future recommendations of the direction which the U.S. space program should take in the post-Apollo period...[and to report other] possibilities of significant cost reductions in the launching and boosting operations of the space program." (10:103) Membership in the STG included Vice President Spiro Agnew (Space Council Chairman), Secretary of Defense Melvin Laird, Thomas Paine, and Lee DeBridge. (19:115) The STG published three alternatives: First, the United States could establish a 50-man space station orbiting the earth, an orbiting lunar space station, a lunar-surface base, and a manned flight to Mars by 1985. A reusable carrier would be needed to "shuttle" between the earth's surface and the earth-orbiting station, and a reusable "space tug" would be needed to service the lunar orbital station. Second, it could establish the earth-orbiting space station, along with the reusable shuttle, but eliminate the lunar projects and postpone the manned Mars launch to 1986; or Third, the nation could develop the earth-orbital space station and the shuttle but defer any decision on the manned Mars landing, keeping it only as a goal to be realized before the end of the century." (32:72)

Nixon's response to the STG report was voiced through White

House Press Secretary Ron Ziegler who stated that the president concurred with the STG recommendation to reject excessive space ventures such as : (1) to land men on Mars as soon as possible regardless of cost, and (2) to eliminate manned space flight after the completion of Apollo." (10:104)

During the president's budget address, he voiced the monetary application toward his space program decisions in lieu of the STG report. "Man has ventured to the moon and returned--an awesome achievement. In determining the proper place for future space activities we must carefully weigh the potential benefits... I have received many exciting alternatives for the future. Consistent with other national priorities we shall seek to extend our capabilities--both manned and unmanned." (10:104)

Soviet space capabilities, especially in manned flight, were gaining recognition. Two Soviet cosmonauts set a new space-flight endurance record of 17 days, 16 hours, and 59 minutes. (29:250)

President Nixon would not announce an ultimate space policy decision until March 1970. It was through his policy statement that he repeated the STG concept of a balanced program of three general purposes which should guide the space program, exploration, scientific knowledge, and practical application. No

new space projects were identified. Additionally, the manned mission to Mars was forecast for the future with no timetable mentioned. President Nixon was equally vague in his remarks about the space station and shuttle. He directed continued work on the space station (Skylab), and further study on the shuttle, albeit, in the absence of an endorsement for any form of reusable vehicle.

(19:128)

The president's space policy statement assigned an intermediate priority to the national space program, taking additional national priorities into account as stated in the following, "...space expenditures must take their proper place within a rigorous system of national priorities...We must realize that space activities will be a part of our lives for the rest of time." (29:261)

Nixon's caution toward the space program was reflected in the FY 1970 NASA budget. The president cut the budget by \$45 million to the \$3.772 billion level, representing a quarter of a billion dollars less than the 1969 figure. Congress further complicated NASA's planning process by reducing the NASA budget to \$3.749 billion. (32:73) In addition, Congress cut the Air Force's Manned Orbiting Laboratory and the X-20 Dyna Soar entirely. These

programs were eliminated for two reasons: first, the Air Force had developed unmanned capabilities in the form of robotics, and second, manned programs weren't justifiable in terms of military utility. (1:154)

As a result of executive and congressional budget reductions, NASA was forced to slip the Skylab schedule into 1973-74 and cancelled the last three lunar landing missions altogether (Apollo 18, 19 and 20). Monies earmarked for the space station and shuttle were released to other projects to which NASA was committed. (32:74)

As NASA was making budget reductions, the Soviet Union forged forward with another space first. The first space station, Salyut 1, was placed into orbit in April, 1971. (35:15)

In May, Nixon met with his new NASA Administrator, James C. Fletcher, White House staffer Peter Flanagan, and OMB Director George Schultz to crystallize his thoughts on the national space program plan. He then presented to Fletcher the following program constraints:

- [1] No major increase in NASA's budget level.
- [2] Any manned program which would be developed in the billions of dollars category would have to satisfy OMB's "cost effectiveness criteria."
- [3] The Shuttle would have to advance the state of the art in

space vehicles, but use as much of the Apollo technology as possible.

[4] The program would have to be achievable in a reasonable short time (hopefully by the end of 1976, which turned out to be impossible), but not a "crash program" in the Apollo sense. (10:105)

Fletcher and his deputy, George M. Low, were in agreement that the NASA program consisted of a balanced program between manned activities, and space science and applications ventures. They were equally convinced that the Space Shuttle should not overshadow the NASA budget as did Apollo in the 1960s. (10:105)

Shultz, Flanagan, and eventually, President Nixon were presented with all space shuttle options wherein the largest payload version was touted as the most cost effective. The Shuttle consisted of a reusable orbital stage about as large as a DC-9. Three large liquid hydrogen-liquid oxygen engines provided the thrust requirement. Fuel was stored in a large external tank which was not recoverable. (35:CRS 23)

As NASA considered the costs for the shuttle, there was great concern within the Agency over budgetary appropriations for the remainder of the 70s. Following discussions between Fletcher and OMB an "agreement" was obtained permitting NASA to plan on a \$3.4 billion budget for an indefinite period (based on 1971 dollars).

Nixon, and in short order, Ford, faced a dilemma in trying to

balance the competition for budget dollars and keep the space program alive. But during the 1972 election year, cutbacks in NASA programs seemed inevitable. The Nuclear Engine for Rocket Vehicle Application Program and the High Energy Astronomy Observatory were severely limited in scope. The shuttle program was high on NASA's list of priorities, and the Agency hierarchy impatiently awaited the anticipated good news from the White House.

President Nixon made the Space Shuttle decision in late 1971, and presented his announcement to Fletcher and Low at San Clemente in January, 1972. (10:105) The commitment to the shuttle was based on three reasons:

First, it promised to drastically reduce launching and operational costs through reusable vehicles;

Second, it was of value to DOD. The Air Force had followed the shuttle studies since cancellation of the MOL program but did not give its support until NASA redesigned the cargo bay to accommodate DOD payloads; and

Third, it would employ an additional 40,000 aerospace workers by the mid-1970's, which was important to forecast in an election year. (32:76)

In 1973, the U.S. launched Skylab into orbit but a series of

problems resulted in an abandoned project. The U.S. made three attempts at repairs while the Skylab was suspended in orbit.

(27:125)

In the wake of Watergate, President Nixon attended his last session with a NASA audience during the awards ceremony for the Skylab 3 astronauts at the Lyndon B. Johnson Space Center in Houston. After recognizing each of the astronauts, the president seemed to reflect on his personal feelings about space when he said he would like to make a space voyage in spite of his blood pressure. He talked then about the Spanish, French and British explorers and the strength and faith of the American pioneers. "A great people must always explore the unknown. Once a great people gives up or bugs out, drops out of competition for exploring the unknown, that people ceases to be great." (10:107)

Gerald R. Ford became the 38th president of the United States under the most unusual of circumstances. He was nominated by Nixon and confirmed by the Congress to take the place of the departed Spiro T Agnew as Vice President. Little did the Grand Rapids, Michigan, congressman realize that his involvement within the highest levels of the U.S. government was not complete. Watergate created yet another vacancy which Ford was to fill in

August, 1974. The nation had endured Watergate and the Vietnam war, leaving deep scars on the nation and the executive office as well.

When serving as Vice President, Ford had no direct link with NASA as had his predecessors, since Nixon had abolished the National Aeronautics and Space Council, severing the chairmanship post. As President, he restored the position of Presidential Science Advisor and retained James Fletcher as NASA administrator.

Ford's support for Fletcher and NASA projects, to include the Shuttle, were instrumental in creating increases in the NASA budget during the Ford administration. When President Ford replaced Nixon, the FY 1974 space budget was \$4.6 billion, of which \$2.9 billion was earmarked for NASA. In FY 1975, the total budget was increased to \$4.9 billion, and in FY 1976, the budget was further increased to \$5.3 billion. In Ford's final year in office the space budget rose to \$6 billion, with NASA's share at \$3.4 billion. (10:113)

The most significant space program accomplishment during Ford's administration was the Apollo-Soyuz Test Project (ASTP), conducted during the summer of 1975. The ASTP was a joint

venture with the Soviet Union involving the morning launch of the Soyuz and an afternoon launch of the Apollo on 15 July. The two space vehicles would rendezvous two days later and allow individual crew member transfer operations while both vehicles were mutually docked. (Baker p 512)

The one-time ASTP venture was a technological success for both the U.S. and the Soviet Union and a political success as well. President Ford and Chairman Brezhnev enjoyed long dialogs with ASTP crews assembled in orbit with considerable news coverage throughout the mission by the media around the world. President Ford welcomed the two Soviet cosmonauts and three American astronauts in a special White House ceremony following the completion of the mission.

Both nations took precautions to protect private technology. Nevertheless, the Soviets gained insights into NASA documentation procedures during visits to U.S. facilities. The U.S. astronauts also visited the Soviet launch site and met people in the Soviet space program who were inaccessible before. (35:CRS 15)

There were those in NASA who were very enthusiastic about the ASTP. Many hoped that success would generate new joint

ventures in space. One NASA official said, I would rather go to Mars with Russian help than not get there at all." (40:114)

Nearly four months after the ASTP mission, James Fletcher presented his views on the future of the space program in an address to the National Academy of Engineering. During his presentation, the NASA Administrator expressed concern for the health and viability of the national space program saying:

Today our space programs are heavily oriented in the 'problem-solving' direction, and have produced notable accomplishments [i.e. meteorological, communications, navigation, and resources satellites, and the re-usable Space Shuttle will add to man's flexibility to the near-Earth space environment and open the way for manufacturing and processing of new materials that cannot be duplicated on Earth...] These programs all have a common denominator--they are all space programs structured to provide direct service to mankind...and will be expanded...In concentrating on the 'now' problems we are forced to ask questions about the future: Are we losing sight of the 'dream'? Are we sacrificing our destiny in order to satisfy our desire for immediacy in everything? (10:115)

Fletcher's concerns about the future space program was an expressed concern of others as well, leading to legislation on the space issue in the spring of 1976. President Ford signed the National Science and Technology Policy, Organization and Priorities Act of 1976 on 11 May. The act established a White House Office of Science and Technology wherein its director would be the Presidential Science Advisor. The OSTP was designed to formulate

long-range space program goals within the umbrella of energy problems and issues. It was not long after the act was signed by President Ford that criticism was rendered regarding the ineptitude of the act to clearly address future space goals. The act was also dubbed an election-year gimmick. (10:117)

President Ford proclaimed 19 July 1976, as Space Exploration Day, commemorating the seventh anniversary of Apollo 11's Eagle landing on the moon's surface. A few months later, President Ford announced the intended name of yet another space vehicle as important as the Eagle had been to the nation. The name was the 'Enterprise' and the ship was the Space Shuttle, scheduled to be complete on 17 September. The Enterprise was to serve as the "workhorse" for the U.S. space program into the 1990's. (10:119)

The Nixon-Ford administrations represented a questionable period of time for the U.S. space program. At the onset, President Nixon was engulfed in the glory and prestige of the fulfillment of Kennedy's dream--*Neil Armstrong accomplished the 'small step for man, and the giant leap for mankind.'* But the end of a great era in U.S. space projects came to an end with the conclusion of the Apollo series. Nixon, and Ford to follow, set about not to kill U.S. space expenditures, nor to expand them, rather, to keep them alive.

Nixon seemed personally overwhelmed with U.S. space ventures, yet he did not envision the political gain in prestige was worth the political risk that great expenditures would demand. It is interesting to note that President Ford never visited the Cape during his White House tenure, and in his subsequent autobiography, "he does not refer--by index subject, name, word, or picture on any page--to American space affairs before or during his presidency." (10:111)

Carter

President Jimmy Carter came to the White House as the ex-governor of Georgia without previous exposure to space related issues. The space program had not been a topic during his election campaign. Once in office, even his selection of an administrator for NASA was low-key and late, compared to the normal selection process exercised by past presidents. President Carter's tardiness was based on the delay in choosing a science advisor at the onset of his administration. The science advisor typically was used to screen and recommend people to the president for several agency-head positions, with the NASA Administrator post as one of the most crucial.

It was not until March 1977, that President Carter selected Dr. Frank Press as the Science Advisor to the President. Dr. Press was a geophysicist and an internationally recognized specialist on earthquakes. He had conducted seismic experiments on the moon during the Apollo series and previously had managed governmental underground nuclear tests. President Carter had such faith in the capabilities of Dr. Press that he appointed him as director of the Office of Science and Technology Policy as well. (10:124)

Following the delay in selecting Dr. Press, President Carter waited until June to nominate Dr. Robert A. Frosch as NASA Administrator even though Press had recommended him to the president months before. Dr. Frosch was a proven research administrator, considered by those who knew him as an intellectual with a cryptic sense of humor.

The job for Dr. Frosch was monumental. He was charged with the task of reviving NASA's science and applications programs while confronting Zero-base budgets, a rampant national inflationary trend, and rising Shuttle costs. Dr. Frosch used every management tool at his disposal to reduce Shuttle requirements. He deferred scheduled activity to the following year, borrowed production funds for development, deferred the flight schedule, and

cancelled the purchase of one orbiter. (32:79)

Although the Carter administration got off to a rather slow beginning in addressing space issues, the president was deeply involved in a variety of domestic problems and international dilemmas. Zero-base budgeting at home and detente, plus, what evolved into a fervent commitment to human rights issues abroad, were high on President Carter's list of priorities. Early on, Carter was beset by the energy crisis with the resultant creation of a new Department of Energy. On the international front, the negotiations with the Soviet Union regarding the Strategic Arms Limitation Treaty consumed a great deal of the president's energies. In addition, the treaties with the Panama Canal and the U.S. involvement in treaties between Israel and Egypt were significant issues demanding Carter's attention. (10:125)

Late in 1977, the American public was astounded by the modified Boeing 747 that carried the Space Shuttle Enterprise in piggy-back fashion during tests at Edwards Air Force Base, California. The Shuttle was now called the Space Transportation System (STS)--the means of providing access to space for the U.S.. The USAF was actively involved in joint testing with NASA on the Enterprise at both the Marshall Center in Huntsville and at the

Kennedy Space Center.

Discussions and cooperation on space ventures between the U.S. and Soviet Union were further advanced during the Carter administration. In late fall 1977, President Carter signed a five-year agreement involving joint manned flight and an international space station. By the end of the year, conversation between the Superpowers frequently centered around lengthy space missions involving the Enterprise and Soviet Salyut space station. The joint Intercosmos Scientific exchange program with the Soviets was also actively discussed, drawing excitement from the American scientific and science application community. (10:126) Other scientific endeavors at the time involved space telescopes, solar energy plants, and various proposals for experiments on the moon and other planets.

The most significant accomplishment regarding space activities during the Carter administration was the release of the Presidential Directive on National Space Policy (PD 37) by the White House on 20 June 1978. This space policy document was the result of a directive issued by the president to the Policy Review Committee of the National Security Council (NSC) to review existing policy which forms the basis for national space activities.

President Carter agreed to the stipulations of the NSC provided for in the document which established ground rules for the balance and interaction of our space programs to insure achievement of the interrelated national security, economic, political, and arms limitation goals of the United States. (10:126) The NSC Policy Review Committee (PRC) charged itself with the mission of providing advice on changes within the national space policy to the president. The Director of the Office of Science and Technology Policy could serve as PRC Chairman.

President Carter's space policy was an important first step in defining broad national goals with some long-range objectives, written out in specific terms. Sweeping statements were made concerning the need for communications, navigation, command and control, warning and surveillance, space defense, and environmental monitoring systems for national security reasons. DOD was tasked to address survivability of space assets and develop an anti-satellite capability. (32:80) Carter was firm regarding his position on both the right to use space and to protect U.S. assets in space. (16:3)

The Space Transportation System was defined in PD37 as a joint effort between NASA and DOD with management

responsibilities belonging to the

Agency. The STS would service commercial and government users from other nations as well as satisfying domestic requirements.

(10:128)

The accentuated recognition of the DOD role in space affairs within PD 37 caused a great deal of concern within civilian space circles. The resultant anxiety acted as a catalyst in the formulation of PD42, U.S. civil Space Policy, which was released only four months later. However, PD42 was even less aggressive in tone and content than was PD 37 in outlining civilian space programs for the next decade. The aerospace industry and, in particular, Congress were outspoken in their criticism of the vague goals established in PD 42 . (32:81)

President Carter's space policy placed into writing, in PD 37 and PD 42, the existing NASA and DOD roles initiated during the Eisenhower era, and prescribed in the National Aeronautics and Space Act of 1958. President Carter's policy was consistent with his concern for the welfare of mankind. (10:129)

President Carter wanted very much to see the first test flight of the STS Columbia prior to possible nomination and reelection in November 1980. Columbia's technical problems and an unfavorable

electoral college crushed Carter's hopes as the nation selected an ex-actor and ex-governor as its Chief Executive.

The Reagan Transition

Although Reagan stepped into the White House in 1980, it wasn't until February 1981, that space became a topic for the new president during his statement to Congress saying, "we plan to continue" the space program, "we believe... that a reordering of priorities to focus on the most important and cost effective NASA programs can result in a savings of a quarter of a billion dollars." The following budget proposal for FY 82 indeed captured Reagan's suggestions with a reduction of \$600 million below proposal.

(32:83)

The preceeding month, Dr. Frosch had resigned as NASA administrator leaving his deputy, Dr. Al Lovelace, at the helm. President Reagan then began to install new faces in key space program positions. First, he selected James Beggs as administrator of NASA and replaced Al Lovelace with Dr. Hans Mark (former Secretary of the Air Force under Carter) to serve as Deputy Administrator. Maj Gen James Abrahamson was selected as the Associate Administrator of NASA for the Space Shuttle Program.

The President also selected Dr. George Keyworth as science advisor.

It was in the spring of 1981, that the Shuttle gained extensive media coverage with the first flight of the Columbia. This voyage represented the first *manned* U.S. space flight in six years demonstrating successful takeoff and landing and the opening of cargo doors while in orbit. Later in the year, the Columbia would complete its second mission designed to test the mechanical arm used in transferring materials into and out of the cargo area. The second voyage was cut short due to electrical problems. (39:22)

The success generated by Columbia prompted Reagan to direct a NASA interagency review of the future goals for the STS. Following NASA's study, tests and operational flights increased drastically.

Significant unmanned space activities late in 1981 surrounded the Voyager 2 mission, which was making its closest approach to Saturn. The Voyager 2 spacecraft far surpasses the 1980 exploits of Saturn by Voyager 1 in taking photographs of the planet and its complex system of rings.

On 4 July 1982, President Reagan issued National Security Decision Directive Number 42 containing his national space policy statement. The stated goals were: (1) strengthen security; (2)

maintain leadership; (3) obtain economic and scientific benefit through exploration of space; (4) expand private sector investment; (5) promote international cooperation; and (6) maintain the freedom of space. Reagan reaffirmed the concept of Shuttle-only access to space in saying that the STS is "the primary space launch system for both national security and civil government missions." ELVs would only continue until the STS can meet governmental requirements. (18:50)

Also in 1982, the Soviets gained another space first, with the launch of Ms. Svetlana Savatskaya. Ms. Savatskaya was the first woman to venture into space as part of a visiting mission to Salyut 7. (35:CRS xvii)

In March 1983, President Reagan changed the pace and the emphasis on the U.S. national space program when he announced his decision to develop the Space Defense Initiative (SDI). SDI is designed to protect population centers against Intercontinental Ballistic Missiles (ICBM) attack. To devalue ICBMs in the mind of the Soviet planners is to create uncertainty and therefore deterrence. (20:2).

The means or technology to attain this stopping power against Soviet ICBMs has taken many forms since President Reagan first

announced the concept. Directed energy weapons, such as lasers and particle beams, and kinetic energy weapons, represent the mainstay of SDI weapons research. (5:61)

Opponents in the U.S. have voiced concern over the cost of SDI with reported price tags soaring to the \$1 trillion level. Over time, cost estimates around \$120 billion seem more realistic for a three-layered kinetic system using both space-based and ground-based rocket systems. Even the space-based laser system is believed possible for as low as \$200 billion. Proponents suggest that several hundred billion dollars over 10 years may not seem excessive when compared to \$700 billion in Medicare and \$260 billion in farm subsidies over the same period of time. (20:5)

Those who are for or against SDI are analogous to prevailing attitudes about cats--people either like them a lot, or dislike them with equal fervor. The greatest champion in favor of the concept is, of course, President Reagan. But there are those, such as senators Sam Nunn and Carl Levin, who oppose SDI on the ground that it violates the 1972 Anti-ballistic Missile Treaty. A great debate has transpired over the legal issue of a "narrow" interpretation of the treaty. It is interesting to note that the U.S. presented a similar verbage to the Nunn-Levin amendment to the

Soviets during the 1972 treaty negotiations. The Soviets refused at that time since they had an SDI program of their own. (38:14)

The Soviets themselves represent those at the very far end of the opponent spectrum. Immediately after Reagan's announcement, Yuri Andropov demanded an international agreement banning weapons in outer space. The Soviet Communist Party general secretary stated, "Recent developments have demonstrated that the use of space-based military technology is being assigned an even greater role in the United States strategic plans, including those announced by the top United States leadership." (39:102)

In short, they believe the U.S. can do it, and such fear has brought them to the nuclear negotiating table, post haste. The idea of using SDI as a bargaining chip has gotten much coverage in the media. (17:18) President Reagan stands firm against the concept.

While debates were on-going regarding SDI, the national space program gained a tremendous shot-in-the-arm in the following month of April 1983, with the STS Challenger flights. The April voyage was the first mission for the Challenger, which would repeat its success with flight number two in June. The first mission allowed Story Musgrave and Donald Peterson the first space walk in nine years.

The June, 1983 Challenger mission drew even more headlines as it captured the public's imagination with the presence on board of the first American woman astronaut. Sally K. Ride performed the role of mission specialist during the nearly perfect six-day mission. Ride and other astronauts of the five member crew demonstrated the ability to rendezvous and retrieve space objects such as the West German SPAS_01 satellite. Crew members practiced using the Challenger's mechanical arm to release and then retrieve the damaged West German satellite. (28:18)

President Reagan was quick to point out additional success with the Challenger the following year when during its seven-day mission it allowed repairs to the Solar Maximum Mission Satellite (Solar Max). Reagan explained that the 5,000 pound Solar Max had been damaged after launch in February, 1980 on a mission to study solar phenomena, including solar flares. An electronics module failure though had crippled the Satellite. The Challenger captured the Satellite allowing the crew to conduct the repairs. President Reagan explained that the \$50 million Challenger mission would, naturally, more than offset the \$235 million Solar Max replacement cost. The president added that the Challenger also conducted tests on 57 space-age materials for heat, cold, and the

cosmic rays of outer space. (39:52)

The issue of the commercialization of space resulted in the signing of an executive order early in 1984, involving private launch of satellites into space. President Reagan directed the Transportation Department to develop and coordinate a commercial program that would assist private enterprise in developing satellite launch capability.

In August, 1984 President Reagan again addressed the commercialization of space and provided further guidance on the STS and civil space program when he announced his National Space Strategy. The six page White House release fact sheet was drawn from a nine page "secret" document. According to NSC director of space programs, Gilbert Rye, "...this is the first document of its kind to lay out in any coherent manner, a list of priorities that cover the total U.S. space program." The unclassified version expressed the intent to make the STS self sustaining to allow commercial enterprise to develop expendable launch vehicles (ELVs) without governmental competition. DOD, on the other hand, was directed to procure ELVs to complement the Shuttle and maintain assured access to space. Other Commercial Space Program initiatives include the pricing of governmental launch

facilities, equipment, and personnel by commercial ELV companies to be very enticing.(26:95)

The President's strategy charged NASA and DOD to outline the most cost-effective STS possible which would then be prepared by the Senior Interagency Group for Space (SIG Space).

President Reagan's National Space Strategy listed specific guidance for the civil space program beginning with a charter to establish a permanent manned presence in space. To accomplish the objective, NASA was to develop a permanently manned Space Station within the decade. In addition, Reagan was to appoint a SIG Space agency to manage a wealth of space study activities and report directly to the President. (26:98)

The most tragic space related event to occur during Reagan's two terms in the White House came on 28 January 1986, with the loss of all seven crew members. The nation was stunned as it watched the explosion on national television only 74 seconds after takeoff from Cape Canaveral, Florida. Christa McAuliffe, the first citizen observer, a Concord New Hampshire high-school teacher was one of the seven fatalities. The tragedy followed 24 successful Space Shuttle missions, but it understandably raises questions about the future of the U.S. space program. (4:3)

President Reagan immediately appointed a Shuttle Commission to determine the reason for the disastrous Challenger crash. The Commission report harshly criticized NASA stating that the tragedy could have been avoided. The solid rocket booster problem had been identified yet the contractor, Morton Thiokol, failed to fix it by treating the problem as an acceptable flight risk. NASA middle managers, especially at the Marshall Space Flight Center, were also severely criticized in the report for ignoring the problem. (39:88)

In accordance with President Reagan's directions for NASA in 1982, the Agency released a new draft in 1986 for the \$8 billion manned Space Station scheduled for assembly in the 1990's as a joint venture with other nations. Several new concepts were included in the new draft to include the capability to permit tending through scheduled visits as opposed to permanent manning. The crew size was also reduced from 6 to 8 rather than 10. The Space Station was referred to as the next logical step by NASA in orbital flight activities. (39:178)

While the U.S. discussed space station plans, the Soviets launched Mir, their second generation space station. The following year, 1987, the Soviets had completed preparations to allow

permanent presence in space. (9:14)

In the last months of the Reagan administration, the President signed a new National Space Policy statement, released by the White House on 11 February 1988. (25:1-11) This review will analyze Reagan's policy and draw attention to particular areas of interest for future administrations.

Reagan's National Space Policy

To analyze the president's new space policy, this review will present two space program concepts which will be used as a "yardstick" with which to measure Reagan's policy.

During the research phase of this review, numerous space program concepts were identified as possible courses of action to revitalize the U.S. space program. What is commonly called the Ride Report and officially titled, "NASA Leadership and America's Future in Space," provides a backdrop for an effective civil space program. The 63-page report by the first U.S. woman in space was conducted over an 11 month period with help from a handful of unnamed NASA members from the new Office of Exploration. The Ride Report was commissioned by the NASA administrator, James Fletcher. (15:64)

Although the senior NASA leadership are encouraged by the report, they do not strongly endorse the document. Many NASA leaders suggest the report is a useful planning tool rather than a plan which can stand on its own merit. (7:26)

The Ride Report states that the U.S. has lost leadership in two areas, the exploration of Mars and manned operations in low-Earth orbit. Ride recommends four initiatives to include: (1) Mission to Planet Earth, using satellites which will allow eventual prediction of global changes; (2) Exploration of the Solar System, through a series of missions into the late 1990s; (3) Outpost on the Moon, beginning with robotic exploration in the 1990s such that by the year 2010, up to 30 people would live and work on the moon's surface; and (4) Humans to Mars, from exploration to habitation. (31:25)

The four select missions form the basis of the report but Ms. Ride cautions against viewing missions as the total answer to U.S. space efforts. She endorses the attention required to concentrate on a number of areas that will keep U.S. options open: launch capability, rebuilding the nation's technology base, and life science research. (11:117)

The concepts expressed in the Ride Report are sound in that

they provide the framework for truly long-range planning for the civil space program. The concepts envisioned by Ride are closely related to the ideas expressed by the National Commission of Space in 1986. The commission suggested a three-fold concept including: (1) Advancing our understanding of our Planet, our Solar System, and Universe; (2) Exploring, prospecting, and settling the Solar System; and (3) Stimulating space enterprises for the direct benefit of the people on Earth. (30 :5)

Ride clearly places scientific and applications goals as the centerpiece of the American space program. Specific time-tables outlined in the report may require adjustments. Additionally, scientists, rather than NASA engineers and administrators, should rank high in the decision-making process regarding these adjustments.

The Ride Report is an ambitious strategy that promises success for the U.S. However, it does not alleviate the American space leadership problem. It only relates to a portion of the space program equation, because it does not embrace the military use of space and the national security interests of the United States. To complete the equation, this review concurs with the concepts of Donald Latham, past Assistant Secretary of Defense for Command,

Control, Communications and Intelligence. Latham recommends a long-term strategy is required based on: (1) clearly defined and realistic national goals and objectives; (2) a realistic assessment of Soviet military space programs; (3) civil space requirements of the Free World; and (4) U.S. national security requirements.

(18:42)

This review suggests then, that an effective U.S. National Space policy should encompass the four principles prescribed by Mr. Latham to include the principles of the Ride Report. A comparison between these concepts and Reagan's National Space Policy statement released in February, 1988, follows.

The goals and objectives of President Reagan's national space policy are for the most part adequate and a significant improvement when compared to past space policy statements. Prior to the new space policy release, President Reagan had received ample criticism from various fronts concerning the policy void. Goals and objectives are important. Rick Hauck, scheduled to command the next post-Challenger mission had expressed concern stating, "We must decide what we really want to do. We need to be clear about our goals." (13:72)

Reagan's goals are clearly defined but fall short of the mark in

the human exploration area of the civil space program. Similar to the Ride Report, Reagan calls for manned and unmanned exploration "within and beyond the solar system." Ride specifically outlines plans for the Moon and Mars with habitation the aim. Reagan leaves the specifics of the civil space goals to a technology program called Pathfinder with a future presidential decision to be made. This "manana" decision by Reagan will most certainly draw criticism from not only Ride, but the scientific community as a whole. Scientists have criticized NASA and Reagan throughout his eight-year tenure. NASA's solar system exploration committee chairman, David Morrison, says we have taken two steps forward and three steps back. He focuses on the FY 1988 planetary science budget which is a fourth of what it was in early 1970. (3:16)

The new national space policy appears to have considered in its conception, the Soviet military space program. The U.S.S.R. has devoted tremendous resources toward their military space effort. Over 90 per cent of their space systems are military or military related, to include their manned space station and space-based SDI program. (Latham:44) The most thorough six-page coverage of the Soviet military space program comes from a recent Time cover story. (37:64-69) To counter that Soviet threat, Reagan's space

policy directs the DOD to "develop, operate, and maintain enduring space systems...[which] requires an integrated combination of antisatellite, survivability, and surveillance capabilities." The DOD is to develop an antisatellite capability "at the earliest possible date." Additionally, the DOD is to, "provide for the survivability of selected, critical national security space assets (including associated terrestrial components) to a degree commensurate with the value and utility of the support they provide to national-level decision functions, and military operational forces across the spectrum of conflict."

In terms of U.S. national security requirements, Reagan's policy is also clear. It states that "the United States will pursue activities in space in support of its inherent right of self-defense and its defense commitments to its allies." Reagan's policy also "rejects claims to sovereignty by any nation over outer space, celestial bodies, or portions thereof, and rejects any limitations...to acquire data from space."

Reagan's space policy also states that arms control negotiations governing space activities will only be conducted when such measures are, "equitable, effectively verifiable, and enhance the security of the United States and its allies. In

addition, the policy provides technology transfer guidelines designed to protect the national security interests of the U.S.

The president's new space policy measures up very well against the yardstick of this review with the exception of specific human exploration goals for the civil space program. In addition to the fulfillment of concepts expressed by Ride and Latham, the new space policy addresses space commercialization and appoints a coordinating agency for the president regarding space issues.

The policy provides clear guidelines for multiple governmental agencies regarding the national encouragement of commercial efforts in the space industry. The use of governmental launch and launch related facilities and services is designed to stimulate free market competition within the private sector. Pricing guidelines are provided.

The president directed that the Senior Interagency Group on Space (SIG Space) will continue to convene. They will review policy, proposed changes to policy, and provide referral to the president for decisions. To work effectively for the chief executive however, the president must insure the level of power for SIG Space is commensurate with the task. Can SIG Space resolve inter and intra-agency disputes such as the recent flap

between Science Advisor to the President Graham, and NASA Administrator Fletcher? (12:9) It is too early to forecast the effectiveness and level of support SIG Space will provide the president.

CHAPTER III

THE FUTURE

The United States awaits yet a new era of space endeavors. Eight years of the Reagan administration rapidly draws to a close. Who will be the new chief executive, and what programs will the new administration champion? The time may be drawing nigh for resolutions to some of the issues which have fostered heated debate in American society and the aerospace industry. President Reagan has specifically provided guidance in his new space policy on the Shuttle, the Space Station, and the Strategic Defense Initiatives. Nevertheless, these three issues stand at the center stage of the American space program for the forthcoming administration.

The Shuttle

President Reagan's policy directs the continued use of the Shuttle. The controversy over the requirement for the Shuttle has been a long-enduring one. In the post-Challenger era it is easy to find critics who blame NASA and a series of three presidents for their decisions resulting in a Shuttle-only access to space

philosophy. There are those who defend NASA, stating that NASA was forced into a Shuttle-only position by those who would kill the program altogether. (21:176) Others criticize NASA severely, stating that NASA realized as the Shuttle approached its first flight, that projected scientific programs, manufacturing ventures, and commercial opportunities simply didn't exist. Nevertheless, critics say, NASA explained to President Carter that he would preside over the STS demise unless future defense requirements went to the Shuttle as additional program justification. (14:171)

Some aerospace observers neither defended nor criticized the decision process resulting in the STS program. Their position is that the planning and developing of the STS took place at a time when the U.S. economic objectives were drastically changing. With the aftermath of international and national economic disruption, there was a natural tendency to hold back on the expenditure for additional space activities. Such attitudes led to a single-minded policy wherein alternate modes of launch were precluded. (6:156)

In the post-Challenger era, the U.S. fully understands the predicament the Shuttle-only policy created, and has taken steps by way of policy and practice in providing a variety of lift capabilities to support the various requirements.

Once the idea that the Shuttle can do everything is abandoned, the U.S. must determine the best use of the STS. Since the Shuttle can carry people, it can accomplish missions that no other vehicles can perform. The capture and return to service of the \$235 million Solar Max in 1984 by Challenger is one example of the flexibility of the STS. The repair of Leasat in 1985 is another example. Other unique applications for STS will present themselves. Additionally, satellites that are too heavy or too large to fly on existing rockets should also be scheduled against STS use. A third priority should be to include missions like Skylab, where the STS performs as a coupled carrier for manned experiments. (43:143) The Shuttle is a valuable national asset that, when added to the developing arsenal of ELVs, gives the United States the flexibility in low-Earth orbit to regain space leadership.

The Space Station

The Space Station has also been a contested development program which according to the president's policy, is to be operational by the mid-1990s. There are three distinct camps involving the space station: those that definitely want it; those that definitely don't want it; and those that want it, but not now.

Among those in favor of the Space Station is Dr. Hans Mark, former Secretary of the U.S. Air Force and Deputy Administrator of NASA. Dr. Mark believes in the Space Station requirement. His personal regret while working at the highest levels within the U.S. establishment was the cancellation of the Manned Orbiting Laboratory which would have paved the way for the Space Station which in the absence of the MQL, is just getting underway. (21:175)

Other advocates of the Space Station agree to the national security interests that the Space Station represents, but believe it should not be directly linked to the STS program. Nevertheless, until other vehicles can prove their capability in providing space access, the Space Station and Shuttle are inexplicably tied to one another. (6:161)

The DOD has obvious interest in the Space Station. Before stepping down as the Secretary of Defense, Casper Weinberger was extremely vocal in his position that foreign participation must not preclude the DOD from facility use in military experiments. (42:32)

Positions against the Space Station are voiced with equal clarity in the media. Some opponents against the development of the Space Station simply believe the project will cost too much money. Others are opposed because the concept calls for

near-Earth orbit placement, and they question the practical application of its positioning. Near-Earth orbit allows cheaper launching cost to get the Space Station into orbit, and cheaper operating cost once it is in place. However, it is the polar orbits which cover the entire surface of the Earth providing the predominant national security field. (14:168)

A significant number of opponents of the Space Station argue pointedly against the president's rationale for the Space Station as disclosed in his State of the Union address on 25 January 1984. In his address President Reagan stated, "A Space Station will permit quantum leaps in our research in science, communications, and in metals and life-saving medicines which can be manufactured only in space." Despite the president's claims, the only proven commercial space application thus far has been in the communications satellite and associated industries. Materials-processing is yet in the infancy stage and Earth sensing, navigation, reconnaissance, surveillance, and military applications have been, and will continue to be accomplished by unmanned spacecraft. The majority of these spacecraft have been launched by ELVs at a cost far below the Shuttle. (41:164)

In 1983, the Space Science Board of the National Academy of

Sciences conducted an evaluation on the usefulness of a manned Space Station for scientific reasons. Their assessment was not supportive in that their report stated, "The Board...found...no scientific need for this space station during the next 20 years." A follow-on study conducted over a two-year period by the Space Station Board entitled, "Space Science in The Twenty-First Century: Imperatives for Two Decades (1995-2015)," found few first-order scientific objectives requiring man's presence, much less a permanently manned space station. (41:185)

Other opponents of the Space Station conclude that NASA believes in the Space Station as a goal in its own right. Opponents disagree, and suggest that the functional utility of the Space Station has never experienced national debate, nor has the U.S. determined the significance of the Soviet MIR Space Station capability. (23:180)

Many of the Space Station skeptics are 100 per cent in favor of the development and fielding of an operational Space Station; they simply don't believe the time is right for such a complex and expensive program. These manned space program proponents desire a gradual investment in manned facilities aimed at facilitating exploration rather than short-term goals. (43:149)

Strategic Defense Initiative

As reported earlier in this review, SDI seems to most to be either all good, or all bad, without varying shades of gray. The major arguments against SDI fall into either a fear of tremendous expense, a fear that the concept will destroy treaty negotiations with the Soviets, or legal considerations.

Costs, as related earlier, are certainly not overwhelming considering other social programs, as long as the current estimates are within reason.

Even in the absence of the ABM Treaty, SDI affects the on-going arms negotiations with the U.S.S.R. SDI opponents contend that nuclear and conventional negotiations will be dashed by SDI. (34:35) There are many observers, on the other hand, who believe the affects of SDI on the Soviet Union vis-a-vis the negotiations tables are positive rather than negative. Prior to President Reagan's SDI announcement, there was an alarming void at the Soviet side of the table. SDI appears to have changed that situation.

The legal issue, in terms of the Anti-Ballistic Missile Treaty of 1972, allows an easy dismissal of the program if the next

president elects to cut SDI; he can simply use the "narrow" interpretation of the treaty for justification. If the next president decided to halt SDI, the bargaining chip concept would be the most logical tool.

Additional Considerations

President Reagan's successor will be forced to come to grips with the Shuttle, the Space Station, and SDI. He will have, in addition, a full plate of other space related issues with which he must deal. Reagan has left behind the most comprehensive space policy to date. How the next president uses that policy, or changes that policy will affect every American and the world as well. Many believe that the second 30 years in space will not be as spectacular as the first 30 years. (22:22) Policy will be an important element in determining just how spectacular the U.S. space effort will be.

It is clear from the history of the national space program that individuals and agencies play an ever-important role in the outcome of the U.S. space ventures. The president, of course, holds the single most important cards in the development of space activities. American space history has witnessed the caution and constraint of Eisenhower and Nixon contrasted against the commitment of

Kennedy. His dream of national prestige and accomplishment in space may reappear.

Congress and the OMB will continue to hold the purse strings to the space program. Future administrations must resist the temptation to become caught up in the fight for annual budget decisions rather than developing long-range policy decisions.

The leadership at NASA and the DOD will affect tomorrow's space program. What will their goals, concepts, and programs consist of in the future? Their ability to maneuver within executive and legislative circles will play an important role in future U.S. space development.

And finally, there is the American public. National opinion on such topics as space flight, exploration, space defense, and the amount of resources required for these activities will be decisive in the final analysis.

And, also in the final analysis, could the answer to American success or failure revolve around money? NASA administrator James C. Fletcher expressed concern over space expenditures when he addressed the National Academy of Engineering in 1975. Dr. Fletcher said:

...The grave problems that confront our times should not

force us to hang a price tag on everything we do and then haggle over the prices as though we were shopping in some ancient Eastern bazaar. The danger of this mercenary approach is that we may lose sight of the incalculable rewards beyond the innermost fringe of our space goals... It was narrow vision that prompted the Vikings to overlook the potential of America five hundred years before Columbus... Space offers us an alternative for the future. Our race can squander its potential and continue our unchecked momentum down the slopes of time toward the shore of the primeval sea to join the great reptiles and Nature's other unsuccessful experiments. Or, can we accept the challenge of the great spaces between the worlds and establish our citadels among the stars...The choice, as the historian Wells once said: 'It's the Universe or nothing.' (10:116)

Contrast these thoughts with a quote from a Russian worker in

Pravda who said:

What do Sputniks give to a person like me? So much money is spent on Sputniks it makes people gasp. If there were no Sputniks the Government could cut the cost of cloth for an overcoat in half and put a few electric flat-irons in the stores. Rockets, rockets, rockets. Who needs them now? (40:6)

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