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THE THRESHOLD OF SPACE:

THE AIR FORCE IN THE NATIONAL SPACE PROGRAM  
1945-1959

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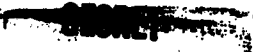
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Ah, but a man's reach should exceed  
his grasp,  
Or what's a heaven for?

- Robert Browning

## FOREWORD

The Threshold of Space is a brief study of the national space program from 1954 through 1959 with emphasis on the role of the Air Force. It was originally prepared as a chapter for inclusion in the History of Headquarters USAF, Fiscal Year 1959. Because of the importance and timeliness of the subject, the chapter is being issued as a separate study to make it more quickly available throughout the Air Force.

Based chiefly on official documents, The Threshold of Space is a precis of a much more detailed history on the space program currently being prepared. Rather than confining itself to fiscal year 1959, the present study reaches back to the beginnings of space research in the 1940's and carries the story forward to January 1960. This was necessary to provide the proper perspective for an understanding and appreciation of this vital area of national activity.

It was impossible in a study of this length to cover all facets of the space program, whether national or Air Force. There had to be a choice of topics such as policy, the selection of projects for development, and the widespread distribution by the Department of Defense of systems and subsystems among the three services for research and tests. Other topics almost equally important had to be excluded. Among the latter there were such subjects as interservice rivalry for control of the satellite-detection fence and the Navy-Air Force dispute about the Pacific Missile Range. It was also necessary to omit coverage of the valuable work done by the Air Force in the field of space medicine and in the establishment of international agreements for the construction of bases outside the United States. These and other subjects will receive thorough treatment in the more comprehensive history now under way.

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**THE THRESHOLD OF SPACE  
(THE AIR FORCE IN THE NATIONAL SPACE PROGRAM, 1945-1959)**

In October 1957 the Soviet Union staked out for itself historical primacy in space by launching Sputnik I--the first man-made satellite to orbit the Earth. This triumph went to Russia by default, for the United States could have been first to place a satellite in orbit. To many Americans, it seemed that, more than anything else, our failure was the result of national complacency. And there is much in the record to support this explanation of events.

Space Work Prior to Sputnik

The will to trespass upon space is as old as mythology, but it remained a fantasy until the Germans dramatized the power of rocketry with the V-2 in World War II. It seemed clear that this propulsion, if properly developed, could break the restrictions of Earth's gravity and reach both orbital and escape velocities. Equally important for a space vehicle was the rocket's independence of the atmosphere. Structurally free of aerodynamic requirements--unless needed for controlled reentry--and breathing the oxygen of its own fuels, the rocket could travel to literally unlimited distances in the near vacuum of space. At first it seemed that to increase the size of the rocket engine would be to increase the thrust proportionately. However, it was soon apparent that combustion flames behave differently in chambers of different dimensions,

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and there was no easy ratio between the size and thrust of engines.<sup>1</sup> Consequently, rocket engineering took its place among the rigidly established propulsion sciences, and the long years of patient research continued.

Immediately after the war the Army, Navy, and Air Force, moved both by the German success with the V-2 at Peenemünde and the less impressive results of American endeavors, carried forward experiments at White Sands Proving Ground and Holloman AFB. They used left-over V-2's as well as new, inexpensive, and specially designed small missiles for scientific exploration of the upper atmosphere. Progress was swift. At the same time the military services, and especially the Air Force, turned to industrial contractors for the rocket-propelled ballistic missiles that they could already foresee as great weapons of the future. As far as the proposed intercontinental and intermediate-range ballistic missiles (ICBM's and IREM's) were concerned, progress was slow because of slim budgets and the cost of current military requirements. The ICBM's and IREM's were too costly to serve as carriers of high explosive bombs, and fission bombs were too costly to risk the inaccuracies of unmanned delivery. Consequently, in 1947, Air Force hopes for a program of long-range ballistic missiles had to be suspended<sup>2</sup> and could not be resumed for a number of years. Even the early fusion bomb models of 1951 and 1952 were of no help. Though their great radii of destruction could be reconciled with the circular probable error (CEP) of missiles, the bomb designs did not fit missile configurations.

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The great change came in 1953 when Los Alamos Scientific Laboratory, after prolonged thermonuclear research, promised a fusion bomb of small size and high yield. This warhead could justify ICBM and IRBM delivery, and the Air Force was free at last to undertake, with the consent of the Administration, an all-out ballistic missile program. The Air Research and Development Command (ARDC) entrusted the work to its Western Development Division (WDD), activated especially for that purpose in 1954 and subsequently redesignated Air Force Ballistic Missile Division (AFBMD). The program soon came to include the Atlas and Titan ICBM's and the Thor IRBM.

Even before 1954 there could have been plans for a space program utilizing the Army Redstone missile as booster in a multi-stage combination with small missiles. By 1954, or 1955 at the latest, there was an inventory of at least 11 missiles in service or development suitable for multi-stage vehicles. The Army Redstone and Jupiter and the Air Force Atlas, Titan, and Thor were 5 possible boosters to be combined with any of the 6 small missiles then available\*--1 belonging to the Air Force and 5

\*The characteristics and 1957 status of these 11 missiles:

<u>Missile</u>	<u>Max Thrust</u> (in lbs)	<u>Velocity</u> (mph)	<u>Alt/Range</u> (in miles)	<u>1957 Status</u>	<u>Sv Origin</u>
Corporal	20,000	1,800	100 ma	In service	Army
Aerobee	4,000	3,000	70 ma	In service	Navy
Aerobee H1	4,000	3,000	120 ma	In service	Air Force
Aerobee H1	5,000	4,500	160 ma	In service	Navy
Viking	20,000	4,500	100 ma	In service	Navy
Sergeant	70,000	1,900	100 ma	Dev & Pdn	Army
Redstone	75,000	10,000	250 mr	Pdn & Sv	Army
Jupiter	165,000	15,000	1,500 mr	Pdn & Sv	Army
Atlas	300,000	15,000	5,500 mr	Dev & Pdn	Air Force
Titan	300,000	15,000	5,500 mr	Dev & Pdn	Air Force
Thor	165,000	15,000	1,500 mr	Dev & Pdn	Air Force

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belonging to the Army and Navy. Yet not 1 of the 11 had been designed specifically for space purposes. This fact, not infrequently charged to a hit-or-miss policy followed by the Department of Defense, constricted the American space payloads for a long time after the space program began.

The Russians followed a quite different policy. It seems certain that they pursued atomic and missile programs simultaneously. Assuming that sooner or later there would be a breakthrough to relatively small thermonuclear weapons, the Soviets produced a rocket engine that was tailored neither as a carrier of thermonuclear warheads nor as a booster of space vehicles but one that could serve both purposes. The policy may indicate poor planning as far as the optimum ICBM is concerned, but in 1957 it gave the Soviets a fine space vehicle. The Russian rocket engine possessed a thrust beyond anything then being planned for the American arsenal, including the Atlas and Titan, and permitted the use of large payloads.

The failure of the Americans to develop either a high-thrust booster or one specially designed for space vehicles did not mean that the military departments had had no interest in space. In 1945 the Navy began a study of satellite feasibility. The project moved slowly, however, and its completion was anticipated by a similar Air Force undertaking. Early in 1946, Headquarters USAF directed RAND to investigate the feasibility of man-made satellites. In accordance with instructions, RAND completed a basic study in May 1946, and in February 1947 released

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12 additional studies suggesting a space program that was largely of scientific interest.<sup>3</sup>

In December 1947 the Engineering Division of the Air Materiel Command (AMC) evaluated the RAND 13 studies, concluded that a satellite was technically possible, and recommended establishment of an Air Force satellite project. Headquarters USAF was sympathetic but could do little in the way of support during the decade 1947-57. Distraction was attributable in part to limited funds throughout the postwar years of recovery and retrenchment, to operational emphasis and requirements during the Korean War, and, after 1953, to an Administration-Defense Department policy that discouraged extensive investments in basic research. Although there was no written directive against research, public statements by high officials served to deter the military services from pursuing research and development work as actively as they desired.<sup>4</sup>

*Should be modified*

Yet no policy could hide from discerning minds that a technological revolution was under way. The air-breathing aircraft was approaching the limit of its potentialities; the ballistic missile offered new orders of velocity and range; and space--though only reluctantly recognized by some--was opening up as a new world of adventure. Russia boastfully pursued advanced technology, and there were frequent and verifiable reports of Soviet space plans. Some American voices warned against the passivity of the United States, but they had little effect. In June 1955, Lt. Gen. Donald L. Putt, DCS/Development, protested against the "small size of our national effort in basic research." Two months later, Trevor Gardner, Assistant Secretary of the Air Force (Research and Development), said that

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the research and development budget for fiscal year 1957 and beyond should be doubled "to maintain our technological superiority." In December, Gardner declared that \$200,000,000 more was needed if the Air Force was to meet the Soviet challenge.<sup>5</sup>

The warnings remained unheeded, and Headquarters USAF was caught between the high cost of defense and limited budgets. In this same period, however, the Administration afforded a small measure of relief by making no sharp distinction between "basic research" and "development." Occasionally, the latter term could be used to cover work that was essentially research, as was done with new engines and new fuels needed for navigation and communication satellites.<sup>6</sup>

In a more specific area of space planning high policy was less lenient. On 15 March 1955, Headquarters USAF issued General Operational Requirement (GOR) No. 80 calling for a satellite weapon system. By this time RAND had long since abandoned its 1946-47 thesis that the space venture would be chiefly of scientific value. In 1956, RAND proposed three feasible projects of military significance--the Advanced Reconnaissance System (ARS); the Man-in-Space (MIS) Project, and the Ballistic Weapons Research and Supporting System (BALWARDS). The latter, using Atlas, Aero-bee, and Sergeant missiles, looked toward landings on the moon and flights in the vicinity of Venus and Mars. Both ARS and MIS were approved as possible projects. The Air Staff also approved BALWARDS, but in May 1957 the Office of the Secretary of the Air Force required the deletion of the interplanetary missions. In its new and shrunken version BALWARDS became the near-space project known as the Ballistic Research and Test System (BRATS).<sup>7</sup>

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The change of BALWARDS into BRATS did not discourage RAND. In September 1957 the corporation recommended a "missile-space program" of 10 projects. Among these were five projects that pertained solely to space: reconnaissance satellites; cislunar systems; interplanetary systems; navigation satellites; and communication satellites.<sup>8</sup>

During these same two or three years before Sputnik, when Headquarters USAF was thinking in terms of GOR No. 80 and RAND was proposing military space projects, many Air Force officers in widely scattered field units, and without coordinated plans, were likewise concerning themselves with the same problem. Small groups at Headquarters ARDC, at the Ballistic Missile Division, at Holloman AFB, and at Wright Air Development Center (WADC) sensed danger in the Government's unwillingness to give the new technology the urgent support they felt it deserved. Acting independently of Headquarters USAF, the groups separately prepared a number of papers advocating research plans that might span the next 15 or 20 years. Among other things, the proposed programs called for organized space experiments "at the earliest practicable date." There were discussions also of expendable and recoverable Earth orbiters, the latter to be both of the manned and unmanned variety, a manned space station, and an expendable vehicle for lunar landing.<sup>9</sup>

Thus, prior to the launching of Sputnik in October 1957, Headquarters USAF, together with RAND, AMC, ARDC, AFMD, WADC, and other field units, had evidenced a widespread interest in astronautics and a sophisticated grasp of its technology. On the other hand, at no level within the Air Force, the Department of Defense, or the Administration had there been a

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clear statement of the ultimate objective of a space program or a systematic evaluation of the disparate aims of the suggested projects.

The basic goal of any national space program, civilian or military, must inescapably be the establishment of habitable stations in space. But to think of going beyond the limits of interplanetary areas with mid-twentieth century knowledge and techniques would be unrealistic and verging on the fantastic. Even the small-scale enterprise beyond the Earth would take man into an unknown realm of danger and adventure. It could not be attempted without costly and carefully prepared exploratory projects to discover the nature of the space environment and to test the feasibility of using space immediately for practical purposes. This idea was doubtless present in many minds long before Sputnik, but it had seldom been expressed specifically before 1957. Its absence as a guiding principle in space policy may have contributed to the undisciplined efforts to counter the Russian success with a frugal program.

Evolution of a National Space Policy, 1954-58

Top-level indifference to the importance of space was of long standing. In December 1948, James Forrestal, Secretary of Defense, passingly referred to a "military interest in a possible Earth satellite," but the Department of Defense took no concrete actions in the years that followed. In December 1954, another Secretary of Defense, Charles E. Wilson, was told that the Russians might place a satellite in orbit before the Americans could do so, and he replied, "I wouldn't care if they did."<sup>10</sup> Between 1954 and 1957 there were innumerable warnings, official and unofficial, that the Soviets would attempt to launch a satellite before the

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end of 1957. Sputnik I therefore did not come as a surprise to informed people in or outside of the Government. In his State of the Union Message delivered to Congress on 9 January 1958, the President himself reflected the general indifference that had previously prevailed when he admitted that "most of us did not anticipate the intensity of the psychological impact upon the world of the launching of the first satellite."<sup>11</sup>

The failure to appreciate the importance of being first in space is all the more unfortunate because the United States had already undertaken to place a satellite in orbit in the near future. By 1955 the three services were all thinking of a possible satellite, and the Army and Navy even requested official approval of their joint project, known as Orbiter, to use a Redstone missile as a booster for a small payload. At the same time the Administration determined to develop a scientific satellite as an American contribution to the International Geophysical Year (IGY), scheduled for 1 July 1957-31 December 1958. This decision prompted the Secretary of Defense to disapprove Orbiter "in the interest of IGY policies." He then directed the three services to submit proposals for a scientific satellite that was dedicated wholly to peaceful ends.<sup>12</sup>

The Army and Navy united in proposing a modified version of Orbiter, but once again this was ruled out. The use of Redstone, a military missile, would create security problems and might suggest a motive that was not purely scientific. Because of these objections the Navy proposed on its own a backup vehicle that would utilize a modified version

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of the Viking, long ago produced by Glenn L. Martin for naval participation in the White Sands experiments. The Air Force, with no adequate nonmilitary missile at its disposal, could do only one of two things-- recommend the production of a new rocket engine, an undertaking that might interfere with the ballistic missile program, or suggest the use of an Atlas ICBM, which would be as objectionable as a Redstone. Unwilling to risk interferences with the missile program, the Air Force proposed an Atlas-boosted satellite, knowing that the project would go by default to the Navy.<sup>13</sup>

On 29 July 1955 the President announced that the United States, as part of its IGY contributions, would attempt to launch a number of 21-pound satellites without the use of military missiles. The project, known as Vanguard, although organized in the Department of Defense under Navy management, would be divorced from military significance.<sup>14</sup>

The U.S. decision to exclude the use of a military booster became a significant factor in the 1957 Soviet space victory. There were two reasons: first, the Navy turned to Martin for the Vanguard modification at a time when that company was engaged in a reorganization of the Viking development team; second, the Office of the Secretary of Defense caused further delays because it had little enthusiasm for the space program, withheld "first importance" status from the project, granted "dribbling" support, and released funds at an inadequate rate.<sup>15</sup>

The day after the President announced Vanguard, the New York Times noted that "the United States and Russia now appear to be in a race for

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the glory of making the first major step toward interplanetary flight. . . . Soviet determination to achieve this objective was announced last 15 April.<sup>16</sup> Most Americans, however, were impervious to the Russian threat, inexplicably skeptical of Soviet technology. The United States ran no race. When time passed and Vanguard obviously slipped from its schedule, there was deep concern among space protagonists. One periodical commented in July 1957:<sup>17</sup>

Eulogized and advertized ad nauseum as mankind's greatest adventure, there is still no assurance that any of the VANGUARD attempts will be successful during the 18 months of the IGY. It's the nature of the still-young state of the rocket art. Even if VANGUARD is ready it still may not be first. Reports point to a Russian try within ten weeks. And to the south the . . . [Army Ballistic Missile Agency or ABMA] team [which] everybody tries to ignore may beat even that date.

In truth, as early as April 1956, ABMA had begged for permission to employ its Jupiter C\* missile to launch a satellite, in view of Vanguard delays and increasing evidence that the Soviets would be first in space-- an event certain to inflict "serious damage" to the prestige of the United States. The Army's proposals were rejected by the Department of Defense, presumably with the approbation of the Administration, still devoted as it was to the policy of exploration for demonstrably peaceful purposes.<sup>18</sup>

Coincidentally with the rejection of ABMA's plan, the Far Side project, directed by Col. William O. Davis and nurtured quietly within the

\*The Jupiter C was an experimental stage-rocket device consisting of a Redstone booster and two stages of solid-propellant rockets. When fired in September 1956 it reputedly traveled 3,300 miles, with a peak altitude of 650-680 miles, and could have brought its payload into orbit if the final stage trajectory had been preset for that purpose.

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Air Force Office of Scientific Research (OSR), ARDC, almost succeeded. It involved launching a missile from a balloon at an altitude of 100,000 feet to penetrate space for a distance of 4,000 miles with the purported purpose of gathering information of vital interest to the Air Force. Despite charges of inadequate coordination, subterfuge, mismanagement, and "utter misdirection of basic research funds," Colonel Davis persevered with his plans. In the spring of 1957 he obtained permission from the Air Force, the Department of Defense, and the Atomic Energy Commission to conduct the operations from the Eniwetok Pacific Proving Ground. In September 1957 the first shot failed. There were five others to be made. On 4 October the second missile tangled with the collapsing balloon at 70,000 feet, escaped from the wreckage, and reached a known altitude of 370 miles.<sup>19</sup>

The next morning, newspapers of the world bannerlined the 184-pound Russian Sputnik. National and international comments on the Soviet victory were not complimentary to the United States. Throughout the American press there was general condemnation of the "partial measures, hit or miss planning and confused organization that have marked our . . . work in this field."<sup>20</sup>

A number of high-ranking U.S. officials attempted to belittle the Russian satellite. Sputnik was unimportant because it was no surprise; it was a "neat scientific trick"; it was an "outerspace basketball game,"<sup>21</sup> The same thought appeared to be implied in the White House announcement of 9 October that the United States would not become engaged in a space race with other nations and that Project Vanguard would not be accelerated.<sup>22</sup> This meant that Vanguard would keep to its unhurried schedule.

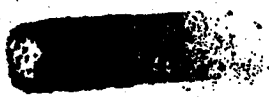
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Much of the press and public interpreted this belittlement of the Russian achievement as a sign of nervousness, and there was evidence to support the interpretation. Between 8 and 15 October there took place a number of high-level Government conferences to reevaluate the whole missile program. In late October, when there was a report that the third shot of the Far Side project had penetrated 4,000 miles into space, the Department of Defense hailed the erroneous claim as proof of a vigorous program in basic research. And yet again, on 3 November the 1,120-pound Sputnik II, complete with dog, was "no surprise to the President," who nevertheless directed further conferences on rocketry.<sup>23</sup>

In these uneasy days the Secretary of the Air Force, James H. Douglas, called upon a committee of distinguished scientists and USAF officers headed by Dr. Edward Teller to propose a line of positive action. The committee's report was completed 22 October 1957. Though the report went to high levels of the Government, its recommendation for a closely unified program was disregarded in favor of a divided program that, in the opinion of many, tended to dissipate rather than concentrate the expanded effort.<sup>24</sup>


The first major organizational development came on 7 November 1957 when the President added to the existing structure by appointing Dr. James R. Killian as Special Assistant for Science and Technology. On 12 November, Neil McElroy, the new Secretary of Defense, issued Defense Directive 3210.1 emphasizing basic research. About the same time, McElroy decided "to correct previous errors" by creating a new agency to

  
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control, direct, and relate the missile and space programs. It was the belief of some highly placed officials that the Department of Defense already had the capabilities to do this work. The need was for firm guidance rather than a complication of the organizational framework. The Secretary of Defense was not convinced. After some delay, while considering the need for congressional approval, McElroy established the Advanced Research Projects Agency (ARPA) on 7 February 1958. The new office was headed by Roy W. Johnson and, contrary to the wishes of the Joint Chiefs of Staff (JCS), was authorized to direct the research and development projects within the Department of Defense that the Secretary might assign to it.<sup>25</sup> In practice ARPA would then reassign the projects on a contractual basis to the military departments, other Government agencies, or civilian institutions.

Although the White House and Department of Defense statements showed that the Administration saw the need for a space program, there was as yet no basic policy pronouncement to that effect. Then, on 26 March, the President's Science Advisory Committee affirmed that "space technology" was required by human curiosity, scientific knowledge, the maintenance of national prestige, and the defense of the United States.<sup>26</sup> This was the first official declaration by the Government that space was of military significance, but there was still no evaluation of space as a realm of military operations.

On 2 April the President asked Congress to approve the establishment of a National Aeronautics and Space Administration (NASA) to conduct

  
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all space activities "except those projects primarily associated with military requirements." Though he did not say what these requirements were, it was clear that the military program would be less important than the civilian program. <sup>27</sup>

Congress acted with dispatch. On 29 July, the President signed the National Aeronautics and Space Act (Public Law 85-568) creating NASA. It had the effect of bisecting the space program into military and civilian segments. The same law brought into being a National Aeronautics and Space Council (NASC), to advise the President on space matters, and a Civilian-Military Liaison Committee (C-MLC) as a bridge between the military and civilian space agencies. <sup>28</sup>

Meanwhile, on 3 July 1958 the National Security Council (NSC) submitted to the President a policy statement on outer space. The Council stated that Russian superiority in astronautics would create an imbalance of power in favor of the Communist bloc. Moreover, there were immediate military requirements for weather, communication, and electronic counter-measure satellites. In the more distant future the armed forces might require satellites as bombardment vehicles, as maintenance and supply depots for outer space vehicles, and as reconnaissance stations. The President signed this paper on 18 August. <sup>29</sup>

By midsummer 1958 the Administration had established a space policy that called for dual programs, civilian and military. But the lines of demarcation were not sharp and there were certain to be wide areas of overlap, as well as competition for prestige and money.

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The expression of policy is not limited to policy statements. It is present too, at least by implication, in many decisions of an operational nature. Certainly the Air Force was moved by a policy of careful investigation in 1946 when it directed RAND to study the feasibility of satellites and in 1947 when it instructed AMC to evaluate the studies. But there was no doctrine at the time to define the role that the Air Force should play in space. In December 1947, AMC's approval of the RAND studies and recommendation that the Air Force initiate a satellite project impelled Lt. Gen. Howard A. Craig, DCS/Materiel, to urge the Chief of Staff to define the Air Force position on space.<sup>30</sup> On 15 January 1948, Gen. Hoyt S. Vandenberg, Vice Chief of Staff, signed the following Space Policy Statement:

The USAF, as the Service dealing primarily with air weapons--especially strategic--has logical responsibility for the satellite. Research and development will be pursued as rapidly as progress in the guided missiles art justifies and requirements dictate. To this end the problem will be continually studied with a view to keeping an optimum design abreast of the art, to determine the military worth of the vehicle--considering its utility and probable cost--to insure development in critical components, if indicated, and to recommend initiation of the development phases of the project at the proper time.

*But how to put*

In the next nine years, 1948-57, the Air Force had no formally approved space program, but it never lost interest in the possibility of such a program and never rescinded the policy statement of 15 January 1948. Consequently when the nation's reaction to Sputnik made a national space program inevitable, the Air Force was in a position to develop from Vandenberg's statement a policy on space missions.

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Air Force space policy came to consist of four major assumptions. First, any space program would depend upon a mushrooming space technology, and that in turn required extensive research and development. Second, because of its role in all operations above the surface of the Earth, the Air Force held an inherent right to a dominant role in space operations. Third, for the sake of clarity in military plans it was necessary to define the Air Force mission in space operations. And fourth, space would become more and more critical for the military security of the nation. This last point had been the heart of the 1955 GOR No. 80 that first called for a satellite weapon system.<sup>31</sup> Gradually the Department of Defense, and many members of Congress too, came to accept this same view.<sup>32</sup>

The Air Force naturally sought leadership in space military operations. In March 1958, Gen. Thomas D. White, Chief of Staff, USAF, reverting to Vandenberg's theme of 1948, wrote:<sup>33</sup>

For all practical purposes air and space merge, form a continuous and indivisible field of operations. Just as in the past, when our capability to control the air permitted our freedom of movement in the land and seas beneath, so, in the future, will the capability to control space permit our freedom of movement on the surface of the earth and through the atmosphere.

Neither the Army nor the Navy admitted the Air Force claim to primacy in space, but Headquarters USAF constantly reaffirmed the doctrine. As a compact expression of air-space relationship, the Office of the Chief of Staff introduced the term "aerospace."<sup>34</sup> The meaning of the word was not understood immediately either within the Air Force or elsewhere.<sup>35</sup> Confusion led the Air Staff to seek a definition, and

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the meaning of the term was expressed officially in AFM 1-2 in December 1959:<sup>36</sup>

The aerospace is an operationally indivisible medium consisting of the total expanse beyond the earth's surface. The forces of the Air Force comprise a family of operating systems--air systems, ballistic missiles, and space vehicle systems. These are the fundamental aerospace forces of the nation.

Logically the doctrine of aerospace expressed the thought that air-power and space power are the same thing and should be vested in a single service which, whatever its official title, would be the aerospace force. Space vehicles would be another category of vehicles to be employed in the regions above the surface of the Earth to help deter war or, failing that, to help win the war.

Late in 1958 the Air Force attempted to specify its exact role in space for the sake of long-range planning and development, and Headquarters listed 15 projects pertinent to space missions that should be Air Force responsibilities.<sup>\*37</sup> The problem was to have the missions assigned. As the time approached for the first session of the 86th Congress in January 1959, the Air Staff prepared a policy statement that emphasized reconnaissance, offensive, and defensive space operations as

\*The 15 missions were: military reconnaissance with satellites utilizing optical sensors; the use of military satellites utilizing infrared sensors; the employment of military satellites for communications; military reconnaissance with electronic sensors; weather observation by military satellites; a satellite defense system; a manned maintenance and supply system for outer-space vehicles; manned defensive outer-space vehicles; manned bombardment space vehicles; manned satellites for a system of detection, warning, and reconnaissance; bombardment satellites; lunar bases; target drone satellites; satellites for electronic countermeasures; satellites as navigation aids.

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essential to USAF space activities. Of course the Army and Navy too had space aspirations, and there developed a triservice struggle before the congressional committees. A further complication was the role of ARPA in shaping military space projects to meet the desires of the Department of Defense and the Administration. In March 1959 the Air Force arguments before the congressional committees were blunted by Roy S. Johnson, ARPA's director. He admitted a "possible" military need for lunar and planetary bases, but only in the distant future, "not in the span we are working in now." Johnson wanted current developments limited to communication satellites of 5,000 pounds at altitudes of 22,000 miles and military vehicles with maneuverability to altitudes of only 600 miles.<sup>38</sup>

Even in trying to establish a research and development program to overcome the lost opportunities of 1953-57 the Air Force encountered difficulties. Not only did the rapidity of technological breakthroughs preclude the assurance that any budget would be sufficient for the coming year, but the Air Force was not a free agent in such matters. The Bureau of the Budget itself could arbitrarily impose ceilings. Moreover, after February 1958, authority for space projects was centralized in ARPA. The Air Force therefore could do little more than urge funds for long-term projects; work to accelerate the production of Atlas, Titan, and Thor; proceed as swiftly as possible with near-space projects; and fight for favorable policies at high levels.<sup>39</sup>

USAF Plans and Projects, 1957-59

Within a matter of weeks after Sputnik the Air Force was engaged in two major undertakings related to space. The first was to establish a

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Headquarters USAF agency to supervise the various projects already existing on paper. The second was to place the previously proposed projects in a formal program to be sanctioned by highest authority.<sup>40</sup> In neither effort was the Air Force successful. There came to be a paradox: the more attempted the less accomplished.

#### Directorate of Advanced Technology

In November 1957, Col. V. Y. Adduci, Assistant Director, Office of Legislative Liaison, urged the Air Force "to jump the gun on the problem of astronautics by appointing either a Director or Assistant Chief of Staff for Astronautics." In view of the growing opposition within Headquarters USAF to the further creation of assistant chiefs of staff there was little probability of placing the space agency at that level. Conceivably, it could have been located in the Office of the Assistant Chief of Staff for Guided Missiles, where there was already some capability for the work. The Chief of Staff decided, however, to place the agency under the Deputy Chief of Staff/Development. On 10 December, General Putt announced the establishment in the DCS/Development of the Directorate of Astronautics, to be headed by Brig. Gen. Homer A. Boushey.<sup>41</sup>

The Department of Defense reacted adversely to this action. William Holaday, Defense Director of Guided Missiles, publicly stated that the Air Force "wanted to grab the limelight and establish a position." The Secretary of Defense expressed his opposition to use of the term "astronautics," which seemed to him an Air Force bid for popular support. Strong pressure on Headquarters USAF from above, verbal rather than written, made it advisable on 13 December for General Putt to cancel his memorandum of 10 December.<sup>42</sup>

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