CHAPTER 1: October 1957

"I was at my ranch in Texas," Lyndon Baines Johnson recalled, "when news of Sputnik flashed across the globe . . . and simultaneously a new era of history dawned over the world." Only a few months earlier, in a speech delivered on June 8, Senator Johnson had declared that an intercontinental ballistic missile with a hydrogen warhead was just over the horizon. "It is no longer the disorderly dream of some science fiction writer. We must assume that our country will have no monopoly on this weapon. The Soviets have not matched our achievements in democracy and prosperity; but they have kept pace with us in building the tools of destruction."[1] But those were only words, and Sputnik was a new reality.

Shock, disbelief, denial, and some real consternation became epidemic. The impact of the successful launching of the Soviet satellite on October 4, 1957, on the American psyche was not dissimilar to the news of Pearl Harbor on December 7, 1941. Happily, the consequences of Sputnik were peaceable, but no less far-reaching. The United States had lost the lead in science and technology, its world leadership and preeminence had been brought into question, and even national security appeared to be in jeopardy.

"This is a grim business," Walter Lippman said, not because "the Soviets have such a lead in the armaments business that we may soon be at their mercy," but rather because American society was at a moment of crisis and decision. If it lost "the momentum of its own progress, it will deteriorate and decline, lacking purpose and losing confidence in itself."[2]

According to the U.S. Information Agency's Office of Research and Intelligence, Sputnik's repercussions extended far beyond the United States. Throughout western Europe the "Russian launching of an Earth-satellite was an attention-seizing event of the first magnitude." Within weeks there was a perceptible decline in enthusiasm among the public in West Germany, France and Italy for "siding with the west" and the North Atlantic Treaty Organization (NATO). British-American ties grew perceptibly stronger.[3] Some Americans began to think seriously about building backyard bomb shelters.

That evening after receiving the news, Senator Johnson began calling his aides and colleagues and deliberated a call for the Preparedness Investigating Subcommittee of the Senate Committee on Armed Services to begin an inquiry into American satellite and missile programs. Politically, it was a matter of some delicacy for the Democratic Senate Majority Leader.[4]

Dwight D. Eisenhower was an enormously popular Republican president who had presided over a distinctly prospering nation. He was the warrior president, the victor over the Nazis, and a "father" figure for many Americans. Moreover, race, not space, seemed at the time to be uppermost in the American mind. Governor Orval Faubus of Arkansas had only days before precipitated a confrontation between the Arkansas National Guard and federal authority.

When, at President Eisenhower's personal interdiction, Governor Faubus was reminded that in a confrontation between the state and federal authority there could be only one outcome, the Governor withdrew the Guard only to have extremist mobs prevent the entry of black children into Little Rock High School. Eisenhower thereupon nationalized the National Guard and enforced the decision of the Supreme Court admitting all children, irrespective of race, creed or color, to the public schools.

Finally, Eisenhower had ended the Korean War; he had restored peace in the Middle East following the Israeli invasion of the Sinai peninsula; and in 1955 he had announced the target to launch a man-made satellite into space in celebration of the International Geophysical Year (IGY). And in 1957 the Eisenhower-sponsored interstate highway system was just beginning to have a measurable impact on the lifestyle of Americans.[5] Automobiles were now big, chrome-laden, and sometimes came with air-conditioning and power steering. Homes, too, tended to be big, brick, and sometimes came with air-conditioning and television. There was, however, no question but that the great Eisenhower aura of well-being had been shattered first by recession, then by the confrontations at Little Rock, Arkansas, and now by Sputnik.

The White House commented on October 6, that the launching of Sputnik "did not come as a surprise." Press Secretary James C. Hagerty indicated that the achievement was of great scientific interest and that the American satellite program geared to the IGY "is proceeding satisfactorily according to its scientific objectives"—while President Eisenhower relaxed at his farm. Two days later the Department of Defense concurred that there should be no alarm and that the American scientific satellite program need not be accelerated simply because of the Soviets' initial success. On the ninth, retiring Secretary of Defense Charles E. Wilson termed the Soviet Sputnik "a neat scientific trick" and discounted its military significance.[6]

And that day President Eisenhower announced that the Naval Research Laboratory's Vanguard rocket program, which would launch the IGY satellite into orbit, had been deliberately separated from the military's ballistic missile program in order to accent the scientific nature of the satellite and to avoid interference with top priority missile programs. Had the two programs been combined, he said, the United States could have already orbited a satellite.[7]

Lyndon Johnson, with the approval of Senator Richard B. Russell, Chairman of the Senate Armed Forces Committee, directed the staff of the Preparedness Subcommittee, which he chaired, to begin a preliminary inquiry into the handling of the missile program by the Department of Defense. Independently, Eisenhower met with top military, scientific, and diplomatic advisors and called the National Security Council into session before convening the full cabinet to discuss what could be done to accelerate the United States satellite and guided missile program. The *New York Times* observed that more scientists visited Eisenhower during the 10 days following Sputnik than in the previous 10 months. Neil H. McElroy, who was replacing Charles E. Wilson as Secretary of Defense, and assorted military aides doubted that a speedup of the satellite or missile programs would be feasible given existing technological and monetary limitations. The President for the time concurred that defense spending should be maintained at its then current levels of about $38 billion.[8]

Solis Horwitz, Subcommittee Counsel, reported to Johnson on the 11th that at the preliminary briefing held by the Preparedness Subcommittee staff, Pentagon representatives explained that the Vanguard IGY project and the United States missile program were separate and distinct projects, and that it would be several weeks before they could give an accurate picture of the military significance of the Russian satellite. Moreover, almost everyone had believed the United States would be the first to put up a satellite, and "none of them had given much thought to the military and political repercussions in the event the Soviets were first." At a meeting of the Eighth International Astronautical Federation Congress, the commander and deputy commander of the Redstone Arsenal stated flatly that the United States could have beaten the Russians to space by a year if delays (attributed to the Navy) had not been ordered. McElroy promised to see to it that "bottlenecks" were removed. And retiring Secretary of Defense Charles E. Wilson responded to criticisms that appeals for a faster flow of money for the Vanguard project made between 1955 and 1957 had been "bottled up" in the Secretary's office. Earlier, the press reported that Wilson had an unsympathetic attitude toward basic research, about which he is supposed to have commented: "Basic research is when you don't know what you are doing."[9]

Lyndon Johnson told a Texas audience on October 14 that, "The mere fact that the Soviets can put a satellite into the sky . . . does not alter the world balance of power. But it does mean that they are in a position to alter the balance of power." And Vice President Richard M. Nixon, in his first public address on the subject, told a San Francisco audience that the satellite, by itself, did not make the Soviets "one bit stronger," but it would be a terrible mistake to think of it as a stunt.[10] Sputnik demanded an intelligent and strong response, he said.

The *New York Times* blamed "false economies" by the administration for the Russian technological lead. It reported that the Bureau of the Budget had refused to allow the Atomic Energy Commission to spend $18 million appropriated by Congress on "Project Rover," a nuclear powered rocket research and development program, which "would postpone the time when nuclear power can be used to propel rockets huge distances."[11]

There were scoffers and skeptics, but precious few. The President's advisor on foreign economic affairs called the Soviet satellite "a silly bauble." But by the end of October, the reaction to Sputnik was beginning to take a distinctly different tone. The problem went beyond missiles and defense. It was far more basic. Alan Waterman, Director of the National Science Foundation, submitted a special report to President Eisenhower which indicated that basic research in the United States was seriously underemphasized. The federal government must assume "active leadership" in encouraging and supporting basic research. That same evening Secretary McElroy restored budgetary cuts previously made in arms research. Educators began to insist on greater emphasis on mathematics, physics and chemistry in all levels. Secretary of Health, Education and Welfare Marion Folsom responded that while "more and better science must be taught to all students in secondary schools and colleges," attempts to imitate Soviet education would be "tragic for mankind." Nixon believed that Soviet scientific achievements underscored the need for racial integration in the public schools and elsewhere in the United States. On November 3, a second Soviet triumph in space sorely delimited Folsom's appeal to preserve the tradition of a broad, liberal education. A second much larger and heavier satellite, carrying aboard it a dog named Laika, began Earth orbit.[12]

The next day Johnson, with Richard Russell and Styles Bridges, and all of the Armed Services Committee were briefed at the Pentagon. As Johnson said, "The facts which were brought before us during that briefing gave us no comfort." The next day Johnson decided that the Preparedness Subcommittee should initiate "a full, complete and exhaustive inquiry" into the state of national defenses.[13]

President Eisenhower addressed the Nation on the 7th, telling the people that his scientific friends believed that "one of our greatest and most glaring deficiencies is the failure of us in this country to give high enough priority to scientific education and to the place of science in our national life." He announced the appointment of James Killian, Jr., president of the Massachusetts Institute of Technology, as Special Assistant to the President for Science and Technology, and he elevated the prestigious Science Advisory Committee from Defense to the Executive Office, enlarging its membership from 13 to 18 members. He announced that within the Department of Defense a single individual would receive full authority (over all services) for missile development. Congress, he said, would be presented legislative proposals removing barriers to the exchange of scientific information with friendly nations. The Secretary of State would appoint a science advisor and create science attachés in overseas diplomatic posts. More pointedly, he directed the Secretary of Defense to give the "Army and its German-born rocket experts permission to launch a satellite with a military rocket." Secretary Neil McElroy issued those instructions on November 8.[14]

Eisenhower's initial response to Sputnik emphasized scientific education, basic research, the free exchange of ideas, and the centralization of authority for satellite and missile development outside the prerogative of any single branch of the military services. Although still quite some distance from the conceptualization and organic legislation creating the National Aeronautics and Space Administration, certain parameters for such an organization had become evident in the political and scientific communities by the end of October 1957.[15] But some Americans who had been thinking about bomb shelters began building them.

It was perhaps not inappropriate that Lyndon Johnson compared the Sputnik crisis to Pearl Harbor in his opening remarks for the Preparedness Subcommittee Hearings on November 25:

> A lost battle is not a defeat. It is, instead, a challenge, a call for Americans to respond with the best that is within them. There were no Republicans or Democrats in this country the day after Pearl Harbor. There were no isolationists or internationalists. And, above all, there were no defeatists of any stripe.

But he suggested that Sputnik is an even greater challenge than Pearl Harbor. "In my opinion we do not have as much time as we had after Pearl Harbor," he said.[16] But the subcommittee took the rest of November, December, and most of January to conduct hearings and take counsel on satellite and missile programs.

Distinguished scientists, administrators, and soldiers such as Dr. Edward Teller, "father" of the hydrogen bomb; Dr. Vannevar Bush, president of MIT; General James H. Doolittle, who led the first daring bombing raid over Japan and now presided over the National Advisory Committee for Aeronautics; General Maxwell Taylor, Army Chief of Staff; Dr. Wernher von Braun, Director of the Operations Division of the Army Ballistic Missile Program; Defense Secretary McElroy; dozens of corporate presidents such as Donald W. Douglas with Douglas Aircraft, Robert E. Gross with Lockheed, Roy T. Hurley with Curtis-Wright, Lawrence Hyland (Hughes Aircraft), E. Eugene Root (vice president of Lockheed), S.O. Perry (the chief engineer for Chance-Vought missile program); and flag officers from every service participated in the subcommittee hearings. While "the newspapers have been filled with columns about satellites and guided missiles," Johnson said, "nowhere is there a record that brings together in one place precisely what these things are and exactly what they mean to us."[17] That was the purpose and, to a considerable extent, the accomplishment of Lyndon B. Johnson's hearings. In this, Johnson made a significant contribution to the configuration of the American space program and, at the time unknowingly, to the creation of a space center in Houston, Texas, that would one day bear his name.

Johnson, a Democrat from a then almost overwhelmingly Democratic State, was born near Stonewall, Texas, and received a degree from Southwest Texas State Teachers College in 1933 after teaching at a small Mexican-American school in Cotulla, Texas, and teaching public speaking in the Houston schools. He served as a secretary to Representative Robert M. Kleberg (1932-35), and in 1937 won an election for a vacant seat in Congress caused by the death of the incumbent. In 1938, he was reelected and served four terms in the House before winning his Senate seat in 1948 and again in 1954. He had been a strong partisan of the New Deal and of Franklin Roosevelt and Harry Truman. His elevation to the post of Senate Democratic leader in 1953 and key committee assignments, not to mention his close personal and political relationship with Speaker Sam Rayburn of Texas, afforded Johnson unusual clout and visibility in the Senate. The subcommittee hearings, not wholly innocently it might be added, gave Johnson much greater national visibility. But the truth was that Lyndon Johnson, even in 1957, when it came to satellites and missiles and defense, literally, as he put it in his memoirs, "knew every mile of the road we had traveled."[18]

The subcommittee's first witness, Edward Teller, was born in Budapest, Hungary, in 1908 and educated in Germany, before coming to America in 1935 to serve as professor of physics at George Washington University. He moved to the University of Chicago in 1941, before joining the Los Alamos Scientific Laboratory team, and in 1952 moved to the University of California Radiation Laboratory. Teller attributed America's "missile-gap" to both specific and general situations. Specifically, he said, the United States did not concentrate on missile development because after the war it was not clear how such a missile could be used. More generally, the United States had not committed its money or its talent to the sciences, as had the Soviets. The Soviet achievements, he said, contrary to the popular notion that "their" German scientists are doing the job, must be attributed to the Soviet people and the Soviet scientists. And after considerable discussion and response to questions about national defense, security, and so forth, Teller raised the question: "Shall I tell you why I want to go to the Moon?" And after the laughter subsided he said, "I don't really know. I am just curious."[19]

Vannevar Bush, who received both the bachelor and master of science degrees from Tufts University in 1913 and a doctorate of engineering from Massachusetts Institute of Technology and Harvard University in 1916, was president of the Carnegie Institution before becoming chairman of the corporation of MIT. "Dr. Bush," Johnson addressed him, "for many years Americans have been in the habit of turning to you for good advice and good counsel. It has been a wise habit, and we members of this committee turn to you once again in time of crisis."[20]

In response to questions from Chief Counsel Edwin L. Weisl, Bush explained that the technical problems of the satellite and the ballistic missile are similar. To launch a satellite, very high velocity and effective guidance into orbit are required, and in the case of the intercontinental missile both are necessary, except that one must do “the second one very much better” in order to solve the reentry problem. He advised scattering Strategic Air Command units to make them less vulnerable, and suggested that there was nothing wrong with American scientists, engineers and production. The only problems with the missile and satellite programs, he believed, were organization, planning and past complacency. “We have had a rude awakening,” he said, “and now must divest ourselves of our smugness and complacency and get to work.” He urged the establishment of a central planning board acting as an advisor to the president and indicated that such an agency had been recommended by the Rockefeller Board in 1953, had received the approval of the Joint Chiefs of Staff, but then had never been implemented.[21]

General James Doolittle received a master and a doctorate of science degree from MIT, and now chaired both the Air Force Scientific Advisory Board and the National Advisory Committee for Aeronautics (NACA). He attributed the current crisis to the fact that the Soviet Union began working intensively on missile development in 1946, while the United States did not begin until 1953. He also said that Soviets worked harder. They had a double incentive system. One is rewarded for excellence—and destroyed if the job was not good, he said. He did not advocate that system. Moreover, he said, the Soviet Union had an “arms” economy and the United States a “butter” economy. About one-fourth of the Soviet Union’s gross national product went into the military, while about one-twelfth of America’s spending was for defense. And he suggested that the first order in catching up with the Soviet Union would be an overhaul of America’s educational system. We need more classrooms and more and better science teachers. Doolittle said that in the Soviet Union the science professor earned roughly 50 times that of the day-laborer, while in the United States “in many cases they do not get as much.” We “must give more kudos, more encouragement, more praise, more honor, if you will, to the science students.” He believed that Sputnik was a good thing because it alerted Americans to the threat, and the real basis of the threat was Soviet excellence in science and technology.[22]

Undoubtedly one of the witnesses most knowledgeable of missile development was Wernher von Braun. Von Braun began his experiments with liquid fuel rockets in Germany in 1930 as a member of the German Society for Space Travel. It was there that he first encountered one of the three great pioneers in rocketry and space—Hermann J. Oberth.

Oberth was born in 1894 in what is now Hermanstadt, Rumania. When he was 12 years old, his mother gave him a copy of Jules Verne’s *De la Terre a la Lune* (From the Earth to the Moon) first published in 1865. That book seems to have provided the common inspiration for the disparate pioneers of space: Robert H. Goddard of the United States, Konstantin E. Tsiolkovsky of Russia, and Oberth of Germany. Oberth designed a long-range liquid fuel rocket in 1917 and completed his doctorate in 1922 with a thesis which became a classic book on the subject of rocketry and space: *Die Rakete zu den Planetenraumen* (The Rocket into Interplanetary Space) published in 1923. The book discussed orbiting space stations, space food, space walks, and possible space missions. He later received a letter from a young German fan who complained that he could not understand Oberth’s equations in the book. That young man was Wernher von Braun. Oberth joined the German Rocket Society in 1927, and in 1930 was in Berlin as an advisor for the production of a film entitled *Frau im Mond* (Woman in the Moon). The rocket he constructed for the production never got off the ground, and Oberth turned his talents to the more practical skills of a mechanic and locksmith. Many, many years later in 1955, Oberth joined Von Braun's rocket team at the Redstone Arsenal in Huntsville, Alabama, and so in a sense closed a historic loop that had begun almost 50 years earlier.[23] As early as 1919, Oberth had become aware that a counterpart in the United States was working with rocketry.

The American, Robert H. Goddard, born in 1882, received a doctorate from Clark University and taught physics, but lived and breathed rocketry. Goddard wrote America's first scientific paper on the subject, published by the Smithsonian Institute in 1922 and entitled "A Method of Reaching Extreme Altitudes." It became the subject of some derision in the American press, which labeled Goddard "the Moon rocket man." But Goddard, a technician and tinkerer as well as a theorist, launched the world's first liquid fueled rocket (oxygen and gasoline) from his aunt's homestead in Auburn, Massachusetts, on March 16, 1926. By 1940, Goddard had moved to a ranch in New Mexico and was building rockets 22 feet long, propelled by 250 pounds of liquid oxygen and gasoline and which developed a thrust of 825 pounds. But he worked independently, almost in secret, and without government or institutional support other than for private subsidies from Charles Lindbergh and grants from the Guggenheim fund. Although he died in 1945, long before Sputnik and the reality of space, he had no doubts that space was a part of humanity's future: "for 'aiming at the stars,' " he said, "both literally and figuratively, is a problem to occupy generations, so that no matter how much progress one makes, there is always the thrill of just beginning."[24]

Although recognized only long after his contributions to the theory of space travel, Konstantin E. Tsiolkovsky (1857-1935) was the first to develop the basic theory of rocketry. He prepared an article entitled "Exploration of Cosmic Space by Means of Reaction Devices" in 1898, which was published in 1903. But there seems to have been little application of his theories until much later, and Tsiolkovsky lived most of his life as a deaf and impoverished school teacher. Nevertheless, long after his death he provided inspiration to the Soviet rocket scientists who produced Sputnik.[25] In that moment, German, Russian, and American theory and history joined hands, and they did so perhaps with the metaphysicists and writers of the western world including the ancients who contemplated both their celestial universe and their gods who traversed both the Earth and the heavens, and those more modern dreamers from Leonardo da Vinci to Jules Verne through Edgar Rice Burroughs, Ray Bradbury and Isaac Asimov who made the scientific revolution and man in space a meaningful and popular human experience.

Von Braun's space odyssey began with the production of experimental missiles for the German army's Weapons Department in a program headed by Dr. Ing. H.C. Dornberger, in 1932, prior to Adolf Hitler's elevation to the chancellery. Germany's rejection of the Treaty of Versailles and the rearmament of Germany included the establishment of a permanent missile center at Peenemünde, where the V-2 was developed. It was successfully fired in October of 1942 and began military use in 1944. Finally, by this time some official interest in rocketry was developing in the United States.

A group of scientists at California Institute of Technology, headed by Hungarian-born Dr. Theodore von Karman and including Frank J. Malina, organized a Rocket Research Project in 1939 that focused on design fundamentals of high altitude rockets. In 1944, with military financial support, CalTech reorganized the project as the Jet Propulsion Laboratory which concentrated on jet-assisted aircraft take-off units (JATO). The laboratory also received authorization from Major General G.M. Barnes to proceed with a high altitude rocket project, known officially as Project ORDCIT.[26] As the war's end began to become a reality, military interest in the acquisition of German scientific knowledge, and particularly of V-1 and V-2 weaponry, grew and provided the incentive for what became "Operation Paperclip."

Major General H.J. Knerr, with the Strategic Air Forces, urged General Carl Spaatz to secure established German facilities and personnel before they could be destroyed or dispersed. In early 1945, he also urged Robert A. Lovett, the Assistant Secretary of War for Air, to push for the capture of German war technology, and to allow captured German scientists and their families to immigrate to the United States. Subsequently, on April 26, 1945, the Joint Chiefs of Staff issued an order directing General Dwight Eisenhower to "preserve from destruction and take under your control records, plans, documents, papers, files and scientific, industrial and other information and data belonging to . . . German organizations engaged in military research."[27]

Operation Paperclip, as it was called, became one of the unique finales in the defeat of Nazi Germany. Colonel H.N. Toftoy and Major James P. Hamill masterminded the rocket and missile segment of the project. Toftoy made early contact with a group of scientists, including Von Braun, who opted for capture by the Americans rather than the Russians. Von Braun told the Preparedness Subcommittee that as the Russian Army approached from the east, he and his associates took a vote and unanimously cast their lot with the west. They then somewhat perilously made their way out of Peenemünde and convinced the German navy that they had orders to evacuate with their equipment to a more central location. The group ended up in Bavaria where the American armies found them. During the confusion of Germany's collapse, Colonel Toftoy was unable to get a response from Washington to his request to transfer some 300 German rocket scientists and their families to the United States, and quickly flew to Washington to push his request through. There he secured permission to admit 127 scientists and technicians. The families were to be housed and cared for by United States authorities until they could be transferred at a later date.[28] Von Braun, who had been technical director of the Peenemünde Rocket Center, was one of those 127.

Hamill did more. The Nordhausen V-2 plant, which manufactured the German rockets, was designated to fall within the Soviet occupation zone, and all plans and equipment were to be left for the Soviets. "These orders," Hamill said, "originated at a very high level." But unofficially and off the record, "I was told to remove as much material as I could, without making it obvious we had looted the place." The net result of Operation Paperclip was to bring 300 boxcar loads of materials including plans, manuals, and documents and 100 V-2 rockets to the United States.[29] During his interrogation at Partenkirchen, Germany, in 1945, Von Braun closed with a comment about Moon travel and atomic energy (before the United States dropped its atomic bomb):

> When the art of rockets is developed further, it will be possible to go to other planets, first of all to the Moon. The scientific importance of such trips is obvious. In this connection, we see possibilities in the combination of the work done all over the world in connection with the harnessing of atomic energy together with the development of rockets, the consequence of which cannot yet be fully predicted.[30]

The first contingent of German scientists, including Von Braun and six of his associates, arrived at Fort Strong, Massachusetts, on September 20, 1945. They soon transferred to the Aberdeen Proving Ground in Maryland where they helped process the German guided missile documents. In December, 55 other German rocket specialists were given work at Fort Bliss, Texas, and White Sands Proving Grounds, New Mexico. Von Braun and the men at Aberdeen soon joined the rest at Fort Bliss, and eventually all of the rocket group moved there. Tests with V-2 rockets began in January 1946, and advanced to high altitude experimental tests using V-2 rockets for the Hermes II program. Improved designs and successes led to the search for improved facilities. In 1949, the decision was made to adapt the Huntsville (Alabama) Arsenal, which manufactured chemical mortar and howitzer shells during the war, and the Redstone Ordnance Plant located there, which produced the assembled shells, for the use of the missile team. The Army created the Ordnance Guided Missile Center there in April 1950, at which time Von Braun and about 130 of his associates arrived. The Army team created the Redstone, Jupiter and Juno missiles at the Redstone Arsenal—prior to the launch of Sputnik.[31] In 1951, Von Braun began work on the Army's Redstone missile under the direction of K.T. Keller (who later became president and chairman of the board of Chrysler Corporation). Initially planned for a 400- to 500-mile range, the Redstone soon was adapted to carry a heavier payload over an approximately 175-mile range. In 1955, the longer-range Jupiter rocket program began with the Ballistic Missile Agency under the command of Major General John B. Medaris. The project at first stressed the development of a land-based and sea-based 1500-mile range missile, and the Army Ballistic Missile Agency cooperated with the Navy until the Navy withdrew to develop its own submarine-launched Polaris missile. A single-stage, liquid fueled Jupiter intermediate range ballistic missile (IRBM) was fired on May 31, 1957.[32] Indeed, the Redstone-Jupiter-Juno program and the Polaris program comprised only two of the missile efforts that had been under way in the United States since the close of World War II.

Since 1949, the Naval Research Laboratory had been involved in high altitude rocket research for atmospheric and astrophysics research using liquid and solid rocket propellants in the Viking program. In 1955, the solid fueled Viking held the world altitude record for single-stage rockets. It was from a proposal of the Naval Research Laboratory, in cooperation with the Glenn L. Martin Company, that the launching of the International Geophysical Year satellite was selected by a special advisory board headed by Homer Stewart of the Jet Propulsion Laboratory. The decision, made in August 1955, as Walter McDougall pointed out in *. . . the Heavens and the Earth: A Political History of the Space Age*, stressed both the civilian and the scientific bent of the advisory board and of the project. The decision was supported by the Department of Defense and the administration despite the consensus that the Redstone rocket developed by the Von Braun team "promised a satellite soonest."[33]

Paralleling the missile developments by the Army and Navy, the National Advisory Committee for Aeronautics (NACA) in 1945 began designs for a ramjet-powered aircraft in cooperation (sometimes) with the Army Air Forces and variously Bell and Douglas Aircraft Corporations. Bell began work on the Bell XS-1, while Douglas, working on a proposal for the Navy, began developing the D-558 turbojet. By the mid-1950's, a contract had been awarded to North American Aviation for the X-15, and plans were developing for Project HYWARDS, a successor to the X-15 and a predecessor to the Dyna-Soar, which became a conceptual model for the space shuttle. NACA's Langley Aeronautical Laboratory, specifically the flight research section headed by Robert R. Gilruth, and later the Pilotless Aircraft Research Division (PARD) supported the design efforts of these experimental, rocket-powered aircraft.[34]

Congress founded NACA in 1915, "to supervise and direct the scientific study of the problems of flight with a view to their practical solution." The American Aeronautical Society, founded in 1911, urged the creation of a national aeronautics laboratory, somewhat similar to an earlier but now defunct Langley Aerodynamical Laboratory administered for a few years by the Smithsonian Institution. The proposal generated more controversy and competition than real support, until the outbreak of war in Europe in 1914, and the evident role of aircraft in modern warfare began to stimulate interest in "aeroplanes."[35] The role of aircraft in World War I, before the entry of the United States into that war, captured the attention of the American public much as Sputnik did in 1957. And, as in World War I, the response to the "crisis" was to create a civilian, rather than a military oriented, governmental advisory board. In 1915 the board was NACA. In 1958 the board was a reconstituted NACA, called the National Aeronautics and Space Administration (NASA).

The analogy extended even further. NACA's first chairman, Brigadier General George P. Scriven, explained in the Annual Report for 1915, that while military preparedness seemed to dictate present needs, "when the war is over, there will be found available classes of aircraft and trained personnel for their operation, which will rapidly force aeronautics into commercial fields, involving developments of which today we barely dream."[36] NACA urged and, in August 1916, secured congressional funding for a national civilian aeronautical laboratory. In July 1917, NACA broke ground for the construction of the Langley Aeronautical Laboratory (and a week later Congress approved a $640-million aviation bill).[37]

Just as a reconstituted NACA became the heart of NASA, so Langley's PARD, in a reconstituted form, as the Strategic Task Group, became the nucleus of NASA's man-in-space program. Ultimately, the Strategic Task Group, joined by engineers and specialists from the Canadian subsidiary of Britain's A.V. Roe Corporation, the military services (especially the Air Force) and private industry provided the human resources for the composition of the Manned Spacecraft Center or Lyndon B. Johnson Space Center in Houston, Texas. Among those associated with the Langley Aeronautical Laboratory were Robert R. Gilruth, who became the first director of the Manned Spacecraft Center; Maxime A. Faget, head of the Performance Aerodynamics Branch of PARD and Assistant Director for Research and Development at the Manned Spacecraft Center; and Walter C. Williams, a Langley engineer assigned to supervise flight tests of the Bell XS-1. On a 1947 test flight supervised by Williams, Air Force pilot Charles E. "Chuck" Yeager flew the first manned supersonic flight in history.[38] Williams and Yeager both became key members of the Manned Spacecraft Center team, as did Paul Purser from PARD.

Purser, who worked with Faget on the HYWARDS project and collaborated in the design of the "Little Joe" launch vehicle used in Project Mercury, was an original member of the Strategic Task Group assembled by Gilruth at Langley for the development of a man-in-space program. He served as special assistant to Gilruth during the formative years of the man-in-space program. Christopher C. Kraft, Jr., joined the Langley Laboratory in 1945 and was an original member of Gilruth's Space Task Group (STG), as was Charles W. Mathews who joined the Langley Laboratory in 1943 and had worked on the XS-1 transonic tests. Joseph G. Thibodaux began work at Langley in 1946 heading variously the Materials, Rocket and Model Propulsion Branches. Kenneth S. Kleinknecht joined Gilruth's group at Langley in 1959, after work on the X-15 at the Flight Research Center in California.[39] Thus, variously NACA, the Langley Aeronautical Laboratory, and specifically PARD housed to a considerable extent the people, projects, and aspirations for what would within a year of Sputnik become a defined and institutionalized man-in-space program.

Robert Rowe Gilruth, a 35-year-old aeronautical engineer from Nashwauk, Minnesota, began flight research work at Langley shortly after his graduation with a master of science degree from the University of Minnesota in 1936. In 1945, he organized a research group and conducted transonic and supersonic flight experiments with rocket-powered models, which led to the establishment of PARD. In 1952, Gilruth became Assistant Director of the Langley Aeronautical Laboratory, and in 1958 became director of a new STG organized as a result of the National Aeronautics and Space Act. The early STG, as Paul Purser recalled years later, was something of an ad hoc arrangement, without any official directives or titles established. By 1959, for example, the STG "had never received even as much as a piece of paper from Headquarters establishing the group, and . . . the closest thing to an official pronouncement was the memo that Gilruth himself had written. . . ." Gilruth himself had no official title.[40]

The reality in 1957 was that the United States had diverse and reasonably sophisticated space and missile programs with a relatively long history. The people were in place and had relatively long associations with each other. Moreover, by 1957, the conceptual framework, much of the design, and some of the hardware that would comprise the essential components of America's man-in-space efforts for the next several decades were in place. This analysis, however, was not imminently clear at the conclusion of the extensive hearings conducted by the Preparedness Subcommittee. Other than for Wernher von Braun, relatively few "hands-on" engineers associated with missile or rocket plane development appeared before Congress, although to be sure there were a large number of generals, admirals, and corporate presidents associated with such developments. The hearings were conducted at a much "higher" level and, to an extent, were much more political than technical as might be expected.

The fact that the hearings were political rather than technical, and that the media and the public were truly shocked by that tiny spinning Soviet globe in the sky, led to the institutionalization of an American space program. Senator Johnson released public comments about the hearings from time to time and summarized the work (2313 pages) of the Preparedness Subcommittee after its 3 months of hearings closed. Early in the course of the hearings, one of Johnson's aides commented in a memorandum to Senator Johnson on November 26, 1957, that one clear pattern that emerged from the testimony was the extreme difficulty in pinning down lines of authority for missile and satellite programs. On December 16, Johnson issued a press release saying that "it is apparent that we have the technical skill, the resources and the necessary enthusiasm among our technicians to build any missile that we need and to build it on time. What we have been lacking are hard, firm decisions at high levels."[41] What Johnson was saying was that Sputnik created a chink in Republican political armor and now offered an opportunity for Democratic party leaders.

In December, the Naval Research Laboratory attempted to launch a Vanguard rocket carrying a satellite, but an explosion on the launch pad in front of the press proved only embarrassing. (A second attempt in February 1958 did no better.) The nod then went to Von Braun to launch a Jupiter C (Juno I) carrying a satellite. The successful launch on January 31, 1958, of the Explorer I satellite (weighing 81 pounds) to a maximum altitude of 984 miles considerably bolstered American spirits, but even more significantly the scientific experiments on the Explorer discovered the Van Allen radiation belts surrounding the Earth's atmosphere.[42]

With national confidence bolstered, Congress began moving toward decisions about missiles and space. The Senate approved the creation of a Special Committee on Space and Astronautics (S.R. 256) on February 6, and Senator Carl Hayden as president pro tempore of the Senate called a meeting into session on February 20, where Lyndon Johnson was quickly elected chairman. The committee considered briefly the feasibility of establishing a joint committee with the House but no action was taken. And Johnson outlined what he thought was the primary business of the committee, that being to define who in the executive and legislative branches should have jurisdiction over specific aspects of space and astronautics, how these organizations should be established, and how to deal with the international aspects of space. The committee briefly considered Senator Clinton P. Anderson's memorandum urging a decision on U.S. space objectives as variously a stunt, having to do with military preparedness, or relating to the peacetime uses of space. And he listed options as being to (a) hit the Moon, (b) put a man into space, (c) put an animal into space, or (d) conceivably start thinking about a Mars mission, manned or otherwise.[43] Judging by Senator Anderson's memorandum and the daily press stories relating to space, the country's mood was both feisty and impatient.

It would take a firm hand at the tiller to keep a reasoned course and avoid the pitfalls of unduly hasty decisions. There were a number of such hands, but in retrospect, Lyndon Johnson knew intuitively that space was not simply something "out there," but something intimately associated with the quality of life on Earth. He believed space was the first new physical frontier to be opened since the American West. The Preparedness Subcommittee Hearings continued, and the Special Committee on Space and Astronautics began hearings and independent study. The House of Representatives created a Select Committee on Astronautics and Space Exploration on March 5, under the leadership of John W. McCormack, and began hearings and staff studies. Both the work of the Preparedness Subcommittee and the simple creation as well as the work of the House and Senate Select Committees, "emphasized the importance of a national space program and an agency—preferably independent and civilian—to administer it." Moreover, Johnson's initiative on the Preparedness Subcommittee helped ensure that the decisions relating to space and missile development would occur "in a broad political arena."[44]

Perhaps the strongest incentives and direction leading to the establishment of a national space program under civilian authority came directly from President Eisenhower. Two advisory bodies made similar recommendations to the President. Nelson Rockefeller, who chaired the Rockefeller Brothers Fund which was completing a study of national security, testified before the Preparedness Subcommittee in January that the question as to where the authority for the development of outer space should be housed should be decided by the Secretary of Defense; but by March 5, Lyndon Johnson recalled that: "He changed his mind and recommended to President Eisenhower the establishment of a civilian space agency. The President endorsed his recommendation." Johnson said that in the beginning he had "no firm conviction either way" but by the time the hearings were over, he had been persuaded that the "best hope for peaceful development of outer space rested with a civilian agency."[45] On March 26, President Eisenhower released a document from his Science Advisory Committee entitled "Introduction to Outer Space, An Explanatory Statement. . . ." under his introductory statement which read:

> This is not science fiction. This is a sober, realistic presentation prepared by leading scientists. . . . I have found this statement so informative and interesting that I wish to share it with all the people of America and indeed with all the people of the Earth. . . .These opportunities reinforce my conviction that we and other nations have a great responsibility to promote the peaceful use of space and to utilize the new knowledge obtainable from space science and technology for the benefit of all mankind.
>
> Dwight D. Eisenhower[46]

The Advisory Committee explained that four factors gave "importance, urgency, and inevitability" to the advancement of space technology. Those were "the compelling urge of man to explore and discover" and the necessities of defense, national prestige, and scientific observation and experiment. In very simple language, the report briefly discussed satellites, a manned and unmanned Moon landing, an instrument landing on Mars, a satellite radio network, military applications of space (primarily communications and reconnaissance, specifically rejecting satellites as bomb carriers), costs versus benefits, and finally, a space timetable that concluded with "Human Lunar Exploration and Return" and "much later still" Human Planetary Exploration.[47] To a remarkable extent, the report provided a blueprint for the American space mission over the next several decades.

On April 2, Eisenhower presented a special message and legislation to Congress recommending the creation of the National Aeronautics and Space Agency:

> The new Agency will be based on the present National Advisory Committee for Aeronautics and will continue that agency's well-established programs of aeronautical research. In addition, the new Agency will be responsible for programs concerned with problems of civil spaceflight, space science and space technology.
>
> . . . it is appropriate that a civilian agency of the Government take the lead in those activities related to space which extend beyond the responsibilities customarily considered to be those of a military organization.[48]

The President then instructed the NACA to present full explanations of the proposed legislation to both houses of Congress, and to plan for reorganization as may be required by the legislation. NACA and the Department of Defense were to review programs to decide under which agency they should be placed and what the Department of Defense would need in the future to maintain its military requirements; and NACA was to ensure the participation of the scientific community through discussions with the National Science Foundation and the National Academy of Sciences.[49]

Congress began hearings and study of the proposed legislation immediately, and on July 29 received the President's endorsement of the "National Aeronautics and Space Act of 1958." The act declared that "it is the policy of the United States that activities in space should be devoted to peaceful purposes for the benefit of all mankind." Objectives of American space efforts were to expand human knowledge, to improve the efficiency of aeronautical and space vehicles, and to develop vehicles capable of carrying instruments, equipment and supplies, and living organisms through space. Congress authorized the creation of the National Aeronautics and Space Council (including the Vice President, Secretary of State, Secretary of Defense, the Administrator of NASA, and the Chairman of the Atomic Energy Commission) and NASA which would assume all of the responsibilities, properties, and authority of NACA.[50]

During the deliberations of the proposed legislation, Dr. Hugh L. Dryden, Director of NACA, explained to the House Select Committee that NACA "formally initiated studies of the problems associated with unmanned and manned flight at altitudes from 50 miles up, and at speeds from Mach 10 to the velocity of escape from the Earth's gravity," in 1952. The primary mission of NACA, he stressed, was scientific research for all departments of the government. "In this technological age," he said, "the country that advances most rapidly in science will have the greatest influence on the emotions and imagination of man," and will enjoy the most rapid growth, the highest standard of living, the greatest military potential, and the "respect of the world." There were, in April 1958, 17 unpaid members of NACA appointed by the President who reported directly to the President. The committee established policy and planned research programs conducted by the 8000 scientists, engineers, and supporting personnel who comprised the staff of the agency. NACA's research centers at the time included Langley Aeronautical Laboratory and its associated Pilotless Aircraft Research Station on Wallops Island (with a combined staff of about 3300); Ames Aeronautical Laboratory, California, staffed with 1450 persons; Lewis Flight Propulsion Laboratory, Ohio, with a staff of some 2690; and the High Speed Flight Station at Edwards, California, with a staff of 312.[51]

After the conclusion of the House Select Committee hearings in May, Dryden brought Robert R. Gilruth to Washington to plan a man-in-space program. "There," according to James R. Hansen, "working less than 90 days in one large room on the sixth floor of the NACA building, a small task group of less than 10 men, assembled by Gilruth over the telephone from the staffs of Langley and Lewis laboratories, came up with all of the basic principles of what would become Project Mercury." The plan closely paralleled proposals made by Gilruth's associate, Maxime A. Faget, at a NACA conference on high-speed aerodynamics in March.[52] Thus, before the passage of the act creating NASA, or what became the Johnson Space Center, the United States had a plan and a project group directed toward putting a man in space. It may have been that the creation of the plan by Dryden was consciously or subconsciously directed toward the goal both of preserving a NACA hegemony over space-related activities while at the same time attempting to preserve the essential scientific integrity of NACA programs. It was clear, however, that the new governmental agency for aeronautics and space would be much more operations oriented than had been NACA.

The National Aeronautics and Space Act of 1958 attempted to harness the energies, talents and aspirations of a nation in a bold and exciting new enterprise. The act reflected a remarkable unanimity and commitment by the American people that had perhaps been unmatched in times of peace since the days of Theodore Roosevelt and the construction of the Panama Canal. To be sure, in the minds of many, despite the language of the act, this was not an act of peace but of war, albeit a cold war. Certainly Sputnik was instrumental in the inception and the speedy approval of the Space Act of 1958. America, to be sure, was well on the way to space before Sputnik, and would have been there with or without Soviet competition, but it is most unlikely that the United States would have made the level of commitment to space, in terms of talent, money, organization or popular support, without Sputnik. That extended far beyond space for the United States, and indeed most of the world's peoples began to emerge from Sputnik with a new sense of identity and purpose. Humans were no longer earthbound.

October 1957 was one of those milliseconds in the human experience that marked the beginning of a "giant leap" for all mankind, a leap that might properly be equated to such other moments in history as the discovery of fire, agriculture, the New World, flight, and atomic energy . . . and a leap, to be sure, that is a perilous, difficult, and uneasy one. October 1957 and that October of a year later when NASA officially began functioning were also fundamental to the inception and organization of the Lyndon B. Johnson Space Center in Houston, Texas.

Administrator Thomas Keith Glennan announced that NASA would officially begin functioning on October 1, 1958. On November 3, Robert R. Gilruth, Assistant Director of the Langley Aeronautical Laboratory, announced the formation of a Space Task Group, including himself and 34 other Langley employees. Over the next 3 years this group, which worked together in a seemingly unstructured and almost formless fashion, grew and expanded and developed personal and professional relationships such that when the decision was made to create a NASA "Manned Spacecraft Center," the organization, the experienced personnel and, to a considerable extent, the programs were already in place at Langley and within the NASA community. Thus, October 1957 and October a year later when NASA officially began functioning were critical moments in the inception and organization of what became, after his death, the Lyndon B. Johnson Space Center in Houston, Texas. Johnson helped write and enact the legislation which created NASA. He knew, indeed, every mile of the road America has traveled to space, and he knew intuitively that space was not simply something "out there," but something intimately associated with the quality of life on Earth.[53]