The Heavens and the Earth Study Guide

The Heavens and the Earth by Walter A. McDougall

BOOKRAGS

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Plot Summary

The Heavens and the Earth by Walter A. McDougall is a history of the space age. McDougall looks at the space age not only from the development of the technology, but also within the context of the Cold War. It is not how the technology came into being but the international political events that led to the different events in space history. The book begins in Russia where Tsar Alexander is assassinated by students who made a bomb in the chemistry lab that Alexander's father financed. Science was being funded in Russia in the Tsarist days when the twenty-four year old Konstantin Tsiolkovsky was already dreaming of and working out the physics for rockets. Tsiolkovsky wasn't the only Russian with these dreams in pre-Revolutionary Russia. After the Revolution, science and technology had to find its place in the new hierarchy until World War I pushed the issue to the forefront and forced Stalin to recognize its importance.

McDougall traces the development of R & D in both the United States and Russia in order to construct the history of the space age. The development of science and technology do not take place without money, and the space programs in both countries did not take place without huge amounts of government spending and promotion of research and development activities, both in and out of the military sectors. In the United States the commitment to the space program resulted in the biggest commitment of resources in history. Eisenhower made the commitment because the post-World War II world was in the throes of the Cold War, of which the weapons and space races were a part. For the United States, the commitment of the federal resources to science, education, industry, etc. was contrary to the prevailing economic thinking of the time. The role for government in capitalism was not to interfere in the private sector and finance R & D, leading to a successful space program. This is why Eisenhower tried to keep down spending.

The space race began when the Russians launched Sputnik and put a satellite into space ahead of the Americans. Eisenhower downplayed the situation, but the Russians got as much mileage out of it as possible. They had the prestige of being first and were using it to their advantage, saying that the U.S. lagged behind Russia in science and technology. This was also being used to prove the superiority of the Soviet system over capitalism which the Russians tried to use to their advantage in the Third World and in Europe. Most of the world believed in the Soviet superiority. It wasn't until years later that the magnitude of Khrushchev's bluff became known.

But this set the stage for the American entry into the space program with all of its emphasis on R & D and all of its spending. It also set the stage for all of the events involving treaties and agreements at the United Nations and why most of them were window dressing: the United Sates didn't want to give away any of its secrets and the Russians didn't want anyone to know how far behind they actually were. McDougall does a good job of presenting the history of the space age in its proper political framework and shows how various international events led to various events in the space race.

Part 1: Chapter 1, The Human Seed and Social Soil: Rocketry and Revolution

Part 1: Chapter 1, The Human Seed and Social Soil: Rocketry and Revolution Summary and Analysis

Part I begins with the death of Tsar Alexander II, blown up by a bomb from the chemistry lab of the St. Petersburg Technological Institute that his own father had founded. At this time, Konstantin Tsiolkovsky was already writing about rocketry and gravity and trying to design rocket ships. He is known as the father of modern cosmonautics. Even backward Russia was active in work on aviation and rocketry in the years before World War I and the Russian Revolution.

The book opens with the name of the pioneers of rocketry: Tsiolkovsky, Goddard, Oberth, Korolev, and von Braun. Tsiolkovsky is the Russian boy genius that designed a space ship powered by centrifugal force at the age of sixteen and also discovered the flow in his work, but he always dreamed of space travel. As a teacher in Kaluga he began to publish scientific papers and specialized in theory and design, since he did not receive that much grant money. He also foresaw the use of solar energy as a power source.

The Bolshevik revolution occurred in 1917 and the regime of Stalin was one of terror. The Russians were known to be backwards in science and technology and had to raise her level of technology to be on a level with Europe and the rest of the world. The Tsarist state tried to make up for this technological backwardness by emphasizing pure science. By the time of World War I, they were known not as poor engineers but brilliant theoreticians. The Tsarist government directed scholars towards science and mathematics. Graduates of technical schools also received certain tax breaks and other perks. They still had to recruit engineers from abroad at this time.

The proper role of science and technology was a subject of debate in the Soviet regime right from the beginning. They supported science but not the free exchange of ideas which more or less precludes scientific progress. The government had to foster the growth and development of science and technology but at the same time had to insulate the areas of ideology and power from their effects. When the first wave of terror was experienced in 1918, many scientists and technicians fled. Igor Sikorsky, developer of the helicopter, and George Kistiakowski, who was instrumental in shaping U.S. space policy, were among those who fled. They were known as bourgeois scientists.

There was a debate over the proper role of science in the new society in the Soviet regime. There were two schools of thought. The Mechanists believed that dialectical materialism was active in scientific knowledge which meant that Western scientific knowledge had to be repositioned in the Marxist society. The other school of thought, the Deborinites, believed that Western science had to be avoided and Marxists science

pursued. The purges and massive flights of scientists and technicians did away with the need for a decision on the two schools of thought. The First World War taught Lenin that those with the best technology come out on top.

Lenin ordered all scientists to be tolerated. They were needed too badly by the regime. He also ordered the establishment of new research institutions to promote the technological progress which the country sorely needed. Everything was geared toward rapid technological progress. In 1919, the Central Aerodynamics Institute (TsAGI) was founded and Tsiolkovsky was elected to its ranks. In the mid 1920s, the Central Bureau for the Study of the Problems of Rockets (TsBIRP) was formed to join all Soviets working on the problem and to find out what the West was doing in the area. They would publish information and encourage research in the area of the military application of rockets.

This made the Soviets the first government to support space flight. Other organizations formed in this area in Russia and in other countries as they all began to hold conferences. By the end of the decade there had been ten years of education in the area and by the mid-1930s, rocket research was a part of the state, not to be left to private organizations. Technological progress was a vital part of history in the Soviet view of things. The industry was so important that they had to seal off their country from foreigners in order to protect their industry.

The years 1922 to 1928 are referred to as the Golden Years of Soviet science since this is the period when the Soviets were most open to foreign influence and private organizations. Most of the aviation industry was still staffed by those who preceded the war so there were not many ideological pressures in the industry. The inquisitiveness and freedom of the technical sector was short-lived. Stalin appointed technical managers who were loyal to him and his regime and five-year plans for industrialization were put into effect. Electrical factories from the West were built with the assistance of Western technicians. Eventually a group was arrested and accused of sabotage, leading to the Industrial Party Affair and trial in 1930.

This brought the freedom experienced by science to an end as the Academy of Sciences was taken over by the state and membership grew, along with massive expenditures by the state. During the years of the Great Depression, the Soviet economy was expanding R&D facilities while the West was shutting their's down. During this time the Soviet backwardness was being overcome by imports. By 1939 the Soviets were holding their own in airplane production and Soviet pilots were capturing records. The Germans began to catch up in 1940, leading to another purge. In 1941, the Russian air force was destroyed when it was caught on the ground.

Work was taking place in the field of rocketry while aviation was growing. Sergei P. Korolev, a test pilot and designer, became the deputy-director of RNII, the Jet Scientific Research Institute, and developed the basis for the Soviet jets. He did work in rocketry, experiencing many breakthroughs, and did the first two-stage rocket test in 1939, along with missile tests. From 1938 on he was in the Gulag as the result of a purge of the aircraft industry. They carried on their aircraft design work in the sharagas, or work

camps, and the Soviets caught up to the Luftwaffe. "The seeds of spaceflight disappeared into the soil of Stalinist technocracy, but by 1941, the soil was sufficiently fertilized - at great human cost, to be sure - for germination to occur. Perhaps Stalinist rule then inhibited the growth of rocketry by its contribution to the outbreak and disastrous defeats of the war. But the course of that same war, by ridding Russia of the invader and saying the technocratic Soviet state, by winning a share of the German technical inheritance for the Soviet engineers, and by blowing in a new international storm in which long-range rocketry took on surpassing importance, also put the Soviet drive for spaceflight back on schedule" (40).

Part 1: Chapter 2, Political Rains and First Fruit: The Cold War and Sputnik

Part 1: Chapter 2, Political Rains and First Fruit: The Cold War and Sputnik Summary and Analysis

A week after the beginning of the Allied invasion at Normandy, Germany began using the Vergeltungswaffe -1, or V1, against the British. This was an unmanned missile carrying a ton of explosive and an early ancestor of the missiles that would be used in the 1980s. The V2, also known as the A4, succeeded the V1 and was much more expensive even though it was almost invulnerable. These were the products of the German rocket program, which ended in 1945. The V2 technology was not unknown to the Soviets and it probably resulted in pushing the U.S. into the rocket program earlier than they would have entered if it hadn't been for the V2. This was the predecessor of the Cold War which was yet to come.

The V2 was made near Harz Mountain near Nordhausen in a plant staffed by slave labor. The plant was producing 900 V2s per month. The Gestapo arrested von Braun in 1944 due to the plans of his team who were designing versions of the A4 that were multi-stage long range rockets, some of which were capable of orbiting. The Gestapo felt that von Braun's plans were not in the best interests of the Fatherland. Soviet intelligence was aware of the V2 productions facilities and wanted to capture them and the Baltic test site, but when the Russian Army arrived there they found the facilities deserted. Von Braun and his group found and had surrendered to the Americans. This was the Mittelwerk and one hundred of its rockets were sent to the New Mexico testing grounds along with the von Braun team before the Soviets took over the sector. They also recovered all of the documentation that was hidden in a mine shaft, so everything was gone before the Soviets arrived.

The Americans recruited one hundred fifteen of the German scientists and sent them to the United States with their families to follow. The German scientific works were already being divided up and carted off before the peace conference. The V2 scientists were being looked for by the Russians. They offered good wages and guaranteed their safety. All that remained were a few low level technicians and one major designer named Grottrup. Grottrup worked with a then-freed Korolev to develop a more powerful V2. This work showed the Soviets that they were not behind the Germans as they had thought and their own Soviet engineers were as good as the Germans. They only lagged the Germans in the area of the V2 type of rocketry. The emphasis of the war now shifted to Japan.

The Americans used the atomic bomb, and the end of the war more or less ended the war time alliance between the United States and the Soviet Union as the Cold War began. Whether the United States realized it or not, they were in a weapons race with the Russians, who were determined to develop their own atomic bomb. They already

had their own work going on in fission and chain reactions and had a cyclotron in Leningrad. The atomic bomb was seen as a counterbalance to the power of the Red Army in Europe and the Russians did not feel safe. They sped up their work and exploded their first atomic bomb in August 1949.

A new Five Year Plan was being discussed in 1945, just as the Soviets were considering whether or not to apply for reconstruction loans from the Americans. The Soviets were debating how open their economy should be: should there be cooperation with the West during the era of reconstruction or should they return to their position of autarky? Stalin called on the Soviet scientists to do better than they had in the past so their country could be protected against any kind of emergency. The new Five Year Plan called for massive expenditures on R&D. Stalin eventually went his own way without Marshall Aid funds, which divided the post-war world into two distinct camps with a race to be first in all areas. This is the beginning of the Cold War.

The Russians also shipped German technology and personnel to Russia to help develop their rocketry industry. They were looking to develop long-range weapons and missiles that could cross oceans for the post-war era. The approval for the project, known as the Sanger Project, came from the Politburo. They worked on various phases of the project until 1953 when they were told to pack for their return to their homes. Most of the work took place at the Tyuratam rocket oasis where the T-1 or Pobeda was developed as a Russian version of the V-2. It was here that Korolev designed the ICBM that launched the Sputnik.

The arms race was on between East and West. The Russian development of the atomic bomb led to increased spending on defense by the United States which developed more new weapons. The Soviets responded by increasing the size of their army and developing more weapons. The arms race continued as the Soviets directed resources into their military-industrial sectors at the expense of their consumer sector. After Stalin's death in 1953, the arms race continued under the reign of Nikita Khrushchev, as was evident at the 1956 Party Congress where Khrushchev reported of their own recovery without any aid from the Americans and their Marshall Plan. Russia was totally self-sufficient and portrayed by its leader as interested in peaceful coexistence.

In the 1950s, the Soviets gathered a group of scientists to develop a satellite to be placed into orbit around the Earth, just as the United States had announced. Korolev was carrying on his work of missile development under the Ministry for Medium Machine Building, which was a front for the missile program. Moscow announced its successful testing of an ICBM in August 1957, leading to the successful launch of the satellite several weeks later.

The Russians were the first to launch a satellite and penetrate spaceflight and outer space. The Russians had an interest in rockets and flight during the days of the Tsar. Critics pointed out that putting a satellite into orbit is not the same thing as the precise delivery of a missile to its target. The Soviets were stimulating research without use of the market mechanism. Much of the work on missile development took place in labor camps.

Part 2: Chapter 3, Bashful Behemoth: Technology, the State, and the Birth of Deterrence

Part 2: Chapter 3, Bashful Behemoth: Technology, the State, and the Birth of Deterrence Summary and Analysis

At the end of World War II, news reporters learned what the Germans had been working on. The V-2s were only the beginning as there were plans to launch them from submarines. They were also working on various kinds of guidance systems so missiles could be used against specific targets. There were plans for night vision equipment and a space station with a big mirror which would incinerate targets on the Earth. And the war ended with the United States having atomic weapons. Because there was no control of these weapons, some claimed that the world war never ended for the United States or for Russia. Both Truman and Eisenhower used nuclear deterrence as a way of restraining the Russians, but this action forced both countries into rapid technological development and massive spending programs.

The founding fathers of the United States did not want science and technology to be a function of the federal government. Education also was in the hands of the states and the private sector. The federal government was involved in technology only when federal lands or interstate commerce were involved. The United States was behind Europe in technology at the time of World War I and the gap widened due to the war. One of the few exceptions to the government's approach was the National Advisory Committee for Aeronautics (NACA) which came into being as an attachment to the Naval Appropriations Bill of 1915. It functioned as a provider of information on modern technologies to the field of aviation.

In the 1920 Thorstein Veblen and Herbert Hoover promoted technology and supported efforts for federal support. The United States, in the years before the Second World War, spent a pittance on R & D compared to the Russians. The government did not use public funds for scholarship or the funding of private enterprise, as the Soviets did. This ended with the beginning of World War II but explains why the Americans were so far behind the Germans in the area of rocketry.

One scientist who was interested in rocketry and liquid rocket fuels was Robert Goddard. Originally working as faculty at Clark University, he received funding and moved to New Mexico and did experimental work in fuels and rockets at his ranch near Roswell. There were other scientists, like Robert Esnault-Pelterie, who conducted their studies out of their homes, as well. They did not obtain government sponsorship in the 1930s as their Russian and German counterparts did, although the U.S. government did

begin to take an interest in the subject in the mid-1940s. Vannevar Bush talked President Roosevelt into forming the Office for Scientific Research and Development (OSRD) which funded research at universities and firms during the war years. The government facilities at Oak Ridge and Los Alamos came into being as well as many facilities at universities. The federal government doubled its budget for R & D spending during the war.

Once the federal government began funding scientific research everyone knew it would continue after the war. There were basically three issues that had to be resolved regarding the organization of the federally funded research: the control of atomic energy and coordination and unification of the armed services. This resulted in the domination of the military in the regime they ended up creating. During this era different plans were considered and the government finally concluded that control of R & D was too important to be the domain of any one entity. This resulted in the formation of the National Science Foundation in 1950.

The next issue involved atomic energy. Various plans were studied by both the private and public sectors. The plan decided on put most of the R & D for atomic energy in private hands. The United Nations was to ensure that atomic energy would only be used for peaceful purposes. There was talk of disarmament, basically by Andrei A. Gromyko, the Russian who wanted the Americans to disarm. Nothing much came of this since neither side was willing to do what had to be done in the interest of peace. Some people were beginning to see the implications of an arms race between the Soviets and the Americans and what it would mean in the post-war years.

The military is shown to have played a more important role in the years after World War II. Weapons development meant that had to determine who would have control over what. The question involved the air and who would have control there since all services used the air. The question surrounded how the services would be coordinated - would they share the information and weapons or would each develop their own? This changed after V-J Day as all of the services became active in developing missile programs. Since Congress did not create an R & D entity for the armed forces, each service developed their own.

In 1947, in response to the Eberstadt Report, the U.S. defense establishment was reorganized under the National Defense Act of 1947. The National Security Council was formed, along with the Central Intelligence Agency. The Department of Defense was established along with a Joint Chiefs of Staff. In addition to the Army and Navy, there was now an Air Force. "In mid-1947 the crises that sparked the Marshall Plan and Truman Doctrine also inspired the first investigation of American atomic requirements. With the results of the Bikini Atoll tests in hand, the JCS concluded that atomic bombs could indeed nullify any nation's military effort and demolish its social and economic structures. But given the current scarcity of bombs, they must be used against population centers and only in extraordinary circumstances against military targets" (93). The U.S. military decided that 400 atomic bombs as powerful as the Nagasaki bomb would be enough to deter the Soviets. They were ordered and delivered in 1953.

Part 2: Chapter 4, While Waiting for Technocracy: the ICBM and the First American Space Program

Part 2: Chapter 4, While Waiting for Technocracy: the ICBM and the First American Space Program Summary and Analysis

The U.S. rocketry program was limited by Truman's budget control. Truman allocated more funds to the domestic economy than to the rocket program. Even though the military had begun to develop satellite and ICBM missile programs, the funding wasn't there for them so the Soviets leaped ahead of the United States. Some programs involving missiles were cancelled because of the lack of fuel. The U.S. excelled in long-range bombers and was not too concerned with missiles.

There were several reasons for letting the ICBM program slide. Economic interests mean that funding should go for big bombers and jets, due to the American superiority in aviation and the preference of the Air Force as well as the scientific problems that had to be solved. This led to concentrating on strengthening the SAC and not so much as spending the money on R & D. In the late 1940s the German V-2 was being modified and improved by various U.S. military groups.

Satellite programs have a history very similar to that of the ICBM. There was interest at the end of the war that faded due to budget considerations, then a sudden re-interest in the area due to Soviet progress. There was some interest in the coming space age but not much effect on government policy. The problem arose simply due to a lack of interest. In 1946, a report was written that showed that a satellite was possible with the given technology at hand. By 1948, after the excitement of the Defense Act and the unification, there was little interest in satellites and missiles and little funding available.

This changed when it became known that the Soviets had the A-bomb and the Americans began development of the hydrogen bomb. There was fear that the Russians might even be ahead of the Americans in its development. The Korean War caused a massive increase in U.S. military spending as well as spending on R & D and the Air Force began a program for the Atlas missile development in 1951. The U.S. successfully tested its first H-bomb in the Marshall Islands in November of 1952; they called this test MIKE. The problem they had with fuel was solved by Andrei Sakharov with the Joe-4 test in August 1953. The result was a small and light H-bomb. The U.S. caught up in March with Operation CASTLE in the Bikini Atoll.

During this time it was determined that the United States was behind in the race for the ICBM and the Air Force appointed Bernard Schriever to head the program for the

development of the Atlas missile, by naming him head of the Western Development Division. RAND, a think tank, was involved in the study for the ICBM and its political and military implications. "The differing concentrations were crucial, for the developmental lag and the theoretical lead of the United States were responsible both for the United States finishing second in the satellite race and for the fact that the eventual American space program was much more suited to national strategic needs than was the Soviet. The RAND document of October 1950, more than any other, deserves to be considered the birth certificate of American space policy" (108).

Satellites were not just for meteorological purposes but also for reconnaissance purposes; therefore, satellites have a high defense and national security value. The launching of a satellite is also an international event in that it can't be kept a secret for long. The RAND report tried to predict the reaction to an American launch by other nations, including Russia, as they figured out what reconnaissance by satellite means. The Russians, they figured, would view the satellite as a threat. RAND addressed the issue of air space and was a satellite a violation of another nation's air space. How far up did it have to be not to be a violation?

Part 2: Chapter 5, The Satellite Decision

Part 2: Chapter 5, The Satellite Decision Summary and Analysis

Eisenhower became President in 1952 while the Korean War was still in progress. The U.S. was still behind in space age technology due to budget limitations. Eisenhower realized that the Cold War was expensive. It would never break out into a "hot" war, but would require massive amounts of spending, so it was necessary to maintain a balanced economy. This meant that military spending had to be kept in line while the Communist threat was effectively countered. His New Look programs still inherited weapons spending decisions from the previous administration but he realized the need for pushing technology and so did the military.

Eisenhower echoed the usual U.S. position of calling for disarmament and arms limitations along with onsite inspections, which the Soviets opposed. The Soviet quest for secrecy led to increased spying on the part of the United States. Both sides kept the other restrained through stalemate as a study, called the Killian Report, presented to the NSC showed. The study recommended a high priority be given to the ICBM and IRBM programs as well as early warning systems and more science and technology spending to research the ability to detect and destroy missiles. They called for more intelligence. The Russian missile testing facilities were deep inside the country outside of U.S. radar range. This led to the need for a spy plane, thereby leading to the creation of the U-2 which began its surveillance flights over Russia in 1956.

"Blatant violation of Soviet airspace was a risky, hit-and-miss means of espionage. If continuous surveillance of Soviet installations and exact targeting of Soviet bases were to be assured, the solution was to spy from outer space. Camera-toting satellites, circling the earth south to north in a polar orbit, could view the entire surface of the earth as it rotated below, return to any location in a few days' time, home in on suspicious areas, and do it all under the legal cover of freedom of space - if such legal cover could be established" (117). Thus, the development of reconnaissance satellites was given a high priority.

The Eisenhower administration had to face the satellite issue and the issue of its legality. The RAND report had suggested launching a satellite that did not fly over the Soviet Union as a scientific and legal test of the issues. It was felt that the United States could launch a satellite with the existing technology, and that if the United States had the technology then so did other countries. It was considered a matter of prestige that the United States be the first to launch a satellite. This was to be the beginning of the space age and there were three proposals: Project Orbiter, the IGY proposal, and the WS-117L proposal, with the expected test to take place in the 1957-58 period.

The expected launch date was to be a part of the U.S. participation in the International Geophysical Year which is why the program was publicized as being non-military and

for peaceful purposes. The design chosen for the satellite was non-military and did not beat the Soviets. The von Braun team operating out of Hunstville had the Redstone project, which proposed a rocket that was a successor of the German V-2 and was considered to be the technically superior rocket, though it was a part of the military. The military could have pressed the issue and beat the Soviet launch, but at the time, keeping the project in the civilian sector was considered more important. The objective was to clear the way for the legality and acceptance of reconnaissance satellites and there were two ways that this could happen. One way would be if there were no objections to the U.S. satellite billed as launched for the advancement of science, and the other way was if the Soviets launched their satellite first.

Diplomatic efforts of the time were still aimed at trying to bring about arms limitations with onsite inspections which were still opposed by the Soviets. The Eisenhower administration privately held that if the Soviets wouldn't open up with agreed upon inspections, they would be opened up through other means. Meanwhile, work continued on the Atlas and work began on the Titan, both ICBMs. Work on the Jupiter, an IRBM, also began during this period, at Huntsville, and in 1956, work began on the Polaris. The Thor program was also underway by the Air Force with testing beginning in January, 1957, and plans for the Minuteman missile began in 1956.

While missile development was taking place, so was the space program, called Project Vanguard. The contractor for the project was Martin, who was working on the project at their Baltimore facility. By August 1957, the Soviets had tested two ICBMs and were expected to be close to launching their own satellite. There were many U.S. tests during this period, some of which were successful, some of which were not. In October 1957, the U.S. led the Russians in the areas of guidance technology, warhead design and solid-fuel technology and lagged the Russians in ICBM development. The Sputnik was launched in October 1957.

The successful launch of the Sputnik in October 1957 suggested that the Soviets had attained technical and military parity with the West, which undermined Western defense policy. Sputnik handed President Eisenhower his biggest public defeat since it was billed as the loss of the space race. Much of this was attributed to the fact that science and technology were considered to be the domain of the private sector. A growing public sector leads to fears of creeping socialism as there were fears about the huge amount of federal spending. The Killian report predicted that the U.S. had five to eight years to prepare for the missile age. The federal government had to match the Soviet capabilities without losing control over spending. The Russian launch of the Sputnik established the legality of freedom of international space, one of the issues that the U.S. was trying to address.

Part 3: Chapter 6, "A New Era of History" and a Media Riot

Part 3: Chapter 6, "A New Era of History" and a Media Riot Summary and Analysis

In 1959, the economy was strong and in spite of the huge amount of military spending, there was still a budget surplus. Eisenhower was nearing the end of his second term in office and had the domestic economy under control. The biggest problem his Presidency faced was the Sputnik; it undermined U.S. credibility in the battleground of technological competition. The Eisenhower administration was the first to formulate space policy.

Lyndon B. Johnson was Senate Majority Leader in October 1957. He and his family were at their Texas ranch when news of the Sputnik launch reached them. Johnson looked into the possibility of holding hearings on the subject but he was aware of Eisenhower's popularity. The launch of Sputnik II on November 3rd made hearings a certainty. The problem for Johnson and the media was that nobody knew much about space. There was a large outcry from the public and from the Congress about the Soviets being the first into space. The State Department viewed it as a propaganda victory and a way for the Soviets to gain an advantage with the underdeveloped nations. The week after the first launch, the story began to unfold about the problems faced by the American program.

Results of a Gallup Poll the week following the launch showed the American majority feeling that it was a blow to U.S. prestige and surprised that the Russians beat the Americans to the launch. Most thought that satellites would be used for good purposes, not bad. *Life* magazine portrayed the event as a big defeat for the United States and blamed the cause on a lack of spending. If the American space program had been a military venture, the Redstone would have been launched much earlier; further, intelligence reports indicated that the government knew about the Soviet ICMB since August, so it wasn't a total surprise.

Some claimed the Soviet victory was the result of the information they took from Germany after the war, when in actuality, the U.S. received the bulk of the information and most of the top scientists. Most agreed that the majority of the damage was more propaganda in nature. Vice President Richard Nixon proclaimed that Sputnik had no effect on the military balance and that the United States could produce more than the Russians. The Eisenhower administration had a problem with damage control because public confidence was shaken, as Sputnik was equated with Russian superiority.

It was thought that Eisenhower would order an American launch, but he didn't right away, even though many were prepared for such orders. A report known as the Gaither Report claimed that the U.S. could face a threat by 1959 if current trends continued and

recommended acceleration of the programs for missile and defense systems. A CIA report put the U.S. two to three years behind the Russians. Still, Eisenhower refused to authorize a crash program. The Johnson hearings, the Inquiry into Satellite and Missile Program, began on November 25th and were pretty much political in nature since Johnson was trying to capture the Democratic nomination for President in 1960. The hearings, which continued until January 23rd, created interest in the press even though they didn't reveal anything extraordinary. The conclusions of the hearings were that the Soviets were ahead in areas like missile development, submarines, R & D, and space, and were catching up in the area of aircraft. They were training more scientists and engineers than the U.S. was. His report also included a list of seventeen recommendations, all of which required higher levels of spending.

Part 3: Chapter 7, The Birth of NASA

Part 3: Chapter 7, The Birth of NASA Summary and Analysis

Eisenhower had to have some response to the Sputniks; he couldn't just ignore them. Even if it wasn't true that American education, the American satellite program, or the military was inferior, or that there wasn't enough spending by the defense sector or that the spending was wasteful, the administration had to do something. Eisenhower still rejected the impetus for any kind of crash program, opting for sufficiency instead. This basically expanded the Cold War into other areas and resulted in an expanded technocracy.

Eisenhower emphasized the threat of Communist imperialism and downplayed Sputnik in his 1958 State of the Union speech. America was making speedy progress in many of its missile programs but the psychological impact of the Sputniks was not anticipated by the government. The result was new spending in the areas of science and technology and R & D and a speeding up of R & D efforts, in addition to more spending on education. The change came in the view that there should not only be more military research but that the military should sponsor civilian research. The spending bill on education made it through Congress as a seven year program of aid to education. Education probably benefited most from the Russian launch of Sputnik.

The launch of the Sputnik also led to a reorganization of the Department of Defense. This was also a major goal of Eisenhower's in 1958; he felt the reorganization was necessary to the changes in technology. The bill made the Secretary of Defense responsible for operations commands instead of having them spread among the services. The same was true for funding. A Director of Defense Research and Engineering would handle all R & D activities. A third major feature involved an integrated staff for the JCS. This passed and became law on August 6th. Eisenhower was still trying to keep a reign on federal expenditures.

There was competition between the services for funds and for who could do what first. They each had their different programs and there was duplication of effort. Each group, and these weren't just the services but also other governmental agencies, felt that they were specially equipped to handle space. The space program was eventually put into the DoD. In January of 1958, the U.S. launched the Explorer, which put a satellite into orbit. In the following days and weeks there was much investigative work going on, in addition to a new Senate committee. This committee was headed by Senator Johnson. A PSAC (President's Science Advisory Committee) report named two goals for space: exploration and control. Space was important for reasons of communications, surveillance, and meteorology. The report also looked at various legal issues like radio frequency use, over flight issues, and regulation. The Committee also suggested a civilian panel to look into these problems and explained why none of the existing

agencies was adequate. They also concluded that the major goals of the space program should be scientific and political.

On March 5th a memorandum was sent by the White House proposing the creation of NASA, the National Aeronautics and Space Administration. At the same time the PSAC released a report explaining the four reasons for the importance of space technology: the exploration urge of man; military security; national prestige; and science. It also explained some scientific facts to the public, like what keeps satellites in space and other things about rockets. It also offered a timetable of events in space. In April, the National Aeronautics and Space Act of 1958 was proposed to Congress. "The purposes of space activities were the expansion of human knowledge, improvement of aircraft and organisms through space, preservation of the United States as a leader in space science and applications, cooperation with other nations, and optimal utilization of American scientific and engineering resources" (172). Space activities were split between the DoD and NASA space programs, one military, the other scientific. The bill did not commit the United States to any kind of space race.

Deliberations on the bill continued through the month, with Senator Johnson receiving favorable notice. The deliberations focused on the military-civilian problem and on the national-international problem. They tried to downplay the military aspects of the program. It came down to the House committee stressing civilian control and the Senate committee stressing international cooperation. The two houses finally worked out a compromise bill, trying to downplay the role of the military even though they all knew that defense was the most important government agency at this point. There was no way they could keep the military out of space or the space activities even though they wanted the program to be as open as possible for the world to see. The bill passed both house's committees by mid-June.

They reached a compromise on patents that would belong to the government but gave the administrator the right to waive the rights at his discretion. NASA came into being on October 1, 1958. In 1959 there were two new committees, the Senate Committee on Aeronautical and Space Sciences and the House Committee on Science and Astronautics.

On May 15, 1959, the Soviets launched Sputnik III and Khrushchev bragged about the Soviet superiority in science and technology. Von Braun and the U.S. launched their third satellite the following March.

Part 3: Chapter 8, A Space Strategy for the United States

Part 3: Chapter 8, A Space Strategy for the United States Summary and Analysis

Strategy was not easy to develop. The United States was wealthy in resources but most were in the private sector. If government used too many, that would cause problems in the private sector. This was one of the problems the space age presented to the U.S. government. What is a proper space strategy for America? There were two big questions posed by space. First, how to constrain the arms race that was to take place and second, what to do about areas that are outside of territories like air, Antarctica, and outer space. It seemed to many that there would have to be international treaties to work out these issues.

There were a lot of articles and debate about space law and who owned what in outer space. After Sputnik there was hope that the U.S. could counter the Soviets in space and that weapons would somehow be kept out of space. RAND did a study of the political implications of the space age with the Soviets bragging about their superiority and telling smaller countries to tell the U.S. to remove their bases. Western expectations that Western superiority in science and technology could serve as a balancing agent against the Soviets were well known. The Office of the Secretary of Defense released a study that emphasized that U.S policy and national interest come before space law and commitments, which must be consistent with the policy and national interests of the country.

Eisenhower proposed to the Russian that space be used for peaceful purposes only. The two sides agreed in theory but not on the procedure involved. The NSC was ordered to conduct a study and prepare a report on U.S. space strategy by Eisenhower. It recommended that missile policy be treated as a separate issue than space. This meant that satellites would be the only issue that the United Nations would have a say about. The definition of outer space was still a problem. The U.S. wanted the right to launch its satellites and at the same time it wanted the right to denounce any hostile flights over its own territory.

There was also the issue of future manned space flights that had to be considered, since current flights were unmanned. There was also the question of international cooperation. The U.S. would cooperate for scientific, political, and psychological purposes to ensure its leadership in using space for peaceful purposes. It didn't appear that the Soviets would cooperate. The U.S. still wanted onsite inspections and the Soviets were still remaining secretive as with the weapons issue. As far as the legal questions and issues, they could not be settled at the present time because of the lack of knowledge and ascertained fact. The rules would have to come from experience and those experiences didn't exist yet.

The Russians wouldn't let space rules interfere with its ICBM program. It led the U.S. in orbital payload and would for several more years but the U.S. had the advantage in miniaturization. The NSC published a proposed timetable for when certain events would happen in space. The U.S. needed to use reconnaissance satellites for intelligence purposes and they needed a political and psychological framework that was conducive to this effort while maintaining its stance of using space for peaceful purposes. Although there was a call for a U.N. planning committee, both sides realized that nothing could be accomplished through the United Nations without the cooperation of the U.S. and the U.S.S.R.

It was hoped that the U.N. would help promote a world opinion that equated the U.S. with peaceful use of space for the benefit of mankind and would promote the U.S. military program of providing a deterrent against Soviet aggression. They also hoped the U.N. would promote the progress of the free world in space and would allow for classified space program in certain conditions. Then the U.S. military program would be covered and considered a necessary for deterrence. The U.N. committee was needed for things like rules on orbits, frequency use and bilateral cooperation in space science. The U.S. didn't want them involved in anything more.

The Soviets gave the appearance of having a tremendous lead in space. This wasn't true, though they did what they could to maintain the image. In actuality, their lead was limited to big boosters and possibly to space medicine. They lagged in every other category. Neither side favored bilateral programs that promoted the exchange of scientific information; the U.S. didn't want to give away any of its secrets and the Soviets didn't want anyone to find out how backward they were. The U.S. view prevailed and the U.N. voted to establish the UN Ad Hoc Committee on Peaceful Use of Outer Space, which is where the details of space law would be decided.

Attempts were made to define space after Sputnik, but space eluded a definition that wasn't based on velocity or some other aspect of technology. The military had the biggest interest in a definition of space and protection of spy satellites would always be a concern of policy. Nobody had protested the launching of satellites or their flight. They also had to face the issue of who owned outer space. Could territorial claims be made or was space owned by mankind? Could they even make rules or a code before the facts were known?

Neither superpower wanted rules in the space game. If space was demilitarized or truly international, none of the super powers would spend any money on it. Nor would they have any interest in it. The U.S. and U.S.S.R. needed the practical aspects of space exploration defined, like orbits and frequency uses and other managerial kinds of functions. Neither wanted much more than that, in spite of what they publicly stated. Even though there was talk of a missile ban, this would end most space programs and therefore was not actively sought. This basically meant that the race for space would continue just as the arms race had. This is the result of the fact that there were not ways to have controls or cooperation.

On October 11, 1958, the U.S. launched the Pioneer I. The satellite was supposed to orbit the moon but missed; however, it did provide important information on the Van Allen belts. The next two, Pioneer II and III, also missed. The U.S. launched the four-ton Atlas satellite on December 18th and Project Score was the first communications satellite successfully launched. A few weeks later, in January, the Soviets launched the Luna I, which also missed the moon but escaped the Earth's gravitational field. The USAF launched Discover I in February 1959, followed by the launches of Discover II, III, and IV in the next few months.

Part 3: Chapter 9, Sparrow in the Falcon's Nest

Part 3: Chapter 9, Sparrow in the Falcon's Nest Summary and Analysis

NASA was a civilian agency, not a military agency. It more or less had to be sheltered from the military. No one at the DoD was in favor of the civilian space agency. Once the space agency was created, it had to be staffed, which meant they had to find an administrator. T. Keith Glennan was selected as administrator and Hugh Dryden as his deputy. Glennan's philosophy was based on five points: government was too big so NASA work would be out-sourced; the agency should build a program suitable for large launch vehicles instead of concentrating on the missiles; they were to ignore the propaganda value of space flight; the structure of programs should be based long-term goals; and the NASA program should be based on providing the capabilities and options for space flight, not fulfilling certain goals. NASA inherited many existing facilities and also a new one, the Goddard Space Flight Center in Beltsville, Maryland, which opened in May 1959. The Saturn rocket with its F-1 engine was turned over to NASA for development.

Not only was the U.S. engaged in a race for space with the Russians, each of the services was involved in competition with the others. The USAF had plans for manned space flights along with moon landings. Von Braun and his team eventually became a part of NASA and the moon project as NASA acquired part of the Huntsville installation, the George C. Marshall Space Flight Center. This basically removed the Army from the space business. The Air Force didn't like the idea of a divided space program. Even NASA agreed that the divided program created some problems. For political purposes the space program had to remain in civilian control. This was Eisenhower's point of view as he ruled in favor of NASA over the Air Force.

Project Mercury was the name given to the project for the manned space flight with the goal being to beat the Russians. Eisenhower was trying to hold costs and spending down and not engaging in a space race, but Congress was always willing to give out money. Basically Eisenhower gave Glennan three goals for the space program. They were to be sure that the needs of the military were met. Eisenhower also wanted real advances in science and technology so the United States would not be ashamed. The third goal was that there was to be an orderly program.

The decision was made to go ahead with the plans for the Saturn rocket with the F-1 engine. Anything bigger had to wait until they received a decision on whether or not they were going to join the space race. They needed the Saturn for moon flights and manned flights since these were the true objectives. The United States was committed to the space program whether they were racing against the Soviets or not.

There were only two ways of avoiding a space race with the Soviets. One way was arms control, which required onsite inspections which went against the Soviet desire for secrecy. The other way was through cooperation which neither side seemed inclined to do. There was a propaganda value in cooperation plus the possibility of obtaining the resources of allies. Arnold Frutkin was hired to handle international affairs and negotiate agreements with other nations that led to tracking stations, launching other nation's satellites, etc. over the years. The French, under de Gaulle, established their own programs but the British decided not to.

"An 'honest' space program might have been one single, coordinated effort run by the DoD and pursued in outspoken competition against an 'inferior, flawed Communist rival.' This would have been candid, but would also have been a mirror image of the Soviet posture. U.S. space institutions at least reflected the elevation of the human spirit, even if deeds did not always measure up. The United States under Eisenhower traveled far on the road to technocracy, but it still sheltered the memory of goals loftier than those of the power-state" (209).

Part 3: Chapter 10, The Shape of Things to Come

Part 3: Chapter 10, The Shape of Things to Come Summary and Analysis

Under Eisenhower, big government was still considered to be undesirable, so there were still attempts to hold down spending. Most Democrats called for increased federal activity in various parts of the economy. In the post-Sputnik era there was an alliance between the social activists and the military that lasted until the Vietnam War. New theories; these were applied to various situations to develop strategy. During the 1950s there were calls for rearmament by Kissinger and others who were looking at deterrence. Much strategy came from the civilian sector at this point.

The 1950s represented a period of change. Most people felt that some kind of space strategy had to be formulated. They couldn't just wait to see what developed. They wanted the military free of the budget constraint so it could do what it must to meet the Soviet threat. There were calls to do away with the constraints that limited the growth of government. At this time there was the problem of the underdeveloped countries and the threat of Communism. It cost money to sway the have-nots into one camp or the other. RAND was not the only think tank calling for increased spending. There was a great deal of debate during this period.

James Gavin, the ex-chief of Army R & D, presented his views about the space age and the changing world. Military satellites would soon become common place as would other kinds of satellites. Gavin felt that there had to be coordination between scientists, business, and the military, but that U.S. policy prevented this from taking place. Walt Rostow was a member of the media who also expressed his views on the topic. He was well-accepted by the public. The West had to find a way to compete with the promises of the Soviets to the underdeveloped countries. Instead of capitalism being the aberration, Rostow felt that communism *was* the aberration. The U.S. must counter the Soviet threat by helping nations develop their economies and infrastructures. The way to help backward nations develop was to invest in them. High levels of investment were needed in the United States to prove to other countries that the investment model worked. This would require more federal spending.

These views were echoed in the Rockefeller Panel reports. These reports covered defense, social policy, foreign policy, economics, education, and the future of democracy. The panels consisted of citizens from different areas who discussed the various issues. The panels called for increased government spending or arms, investment, and domestic social programs. They felt that all of the necessary programs could be financed with a real growth rate of four percent or better.

In 1960 there was a PSAC committee headed by Glenn Seaborg to study science education. The study, headed by the chancellor of the University of California at Berkeley, confirmed that there was massive federal intervention in the area of education. The Seaborg report concluded that because science and technology were so important a change in educational policy in this area was required. Government funding of science was referred to as investment and it was desirable that government associate with universities for purposes of research. Eisenhower did not give in to these calls for massive federal spending as his successors did.

The issues in the coming Presidential campaign would focus on the missile gap. In May 1960 the Russians shot down the U-2 spy plane piloted by Francis Gary Powers. The U.S. said the plane was a NASA weather plane until the Russians produced the pilot. The Congressional hearings on the incident were secret. They found that the Soviet ICBMs did not pose the threat that had been attributed to them. There weren't that many of them and the U.S. had more than enough B52s to counter them. The information that they thought came from guesses had been coming from spy plane reconnaissance. Eisenhower was questioned by the press about the urgency of the situation. He didn't see any urgency. The U.S. space program was one to be proud of from his point of view.

The Kennedy-Johnson program, the New Frontier, was based on space exploration. Kennedy portrayed America as being behind since the Russians were first with the Sputnik, they were first to the moon and they were the first to put dogs into space. Nixon tried to counter this by saying that the Americans were actually ahead of the Russians since the vast majority of orbiting satellites were American and would have manned space flights and manned space stations soon. Nixon disagreed with Kennedy over the fact that the Americans were losing the space race. The United States introduced the first seven astronauts in the middle of 1959, confirming its commitment to manned space flights.

NASA published its long-range plan, which predicted manned flights by the mid-1960s and a moon landing around 1970 and said the Russians would continue to have some firsts but that they were satisfied with the situation. The Apollo moon program was proposed at this time. It was eventually vetoed by Eisenhower due to the proposed costs. But Eisenhower approved the program for Saint, or satellite interceptor, to protect spy satellites.

During this period the U.S. launched many new satellites. The Tiros 1 was the first of ten weather satellites to be launched over the next five years. The data from these satellites was shared with the world. The Transit 1B was the first navigation satellite which allowed ships to calculate their own positions. In May 1960 the Soviets launched Korabl Sputnik I which was a test for a manned space flight. It wasn't completely successful but their next launch, three months later, of Korabl Sputnik II was successful, with two dogs parachuting to the ground after the flight. The U.S. Echo communications satellites also were approved at this time.

The U-2 incident was embarrassing for the U.S. but it did not bring spy planes or spy satellites to a halt. The Midas 2 spy satellite was launched three weeks after the crash of the U-2. This allowed the U.S. to detect all missile launches. Discovery 13 was the first U.S. ship to obit and re-enter and land.

Part 4: Parabolic Ballad: Khrushchev and the Setting of Soviet Space Policy

Part 4: Parabolic Ballad: Khrushchev and the Setting of Soviet Space Policy Summary and Analysis

The two terms of Eisenhower were years of peace, the only peace the Americans had since 1941. The economy experienced growth without inflation as good economic conditions prevailed in America. Sputnik changed things for everyone as the world entered a new era. Sputnik gave the Russians a credibility that they did not have before the launch. It called for a U.S. response to the technocracy and the U.S. shaped its policy in terms of defense: its spy satellites and other military systems had to be protected. The U.S. space program was portrayed as open as opposed to the secrecy of the Soviet program. The U.S. program wasn't as open as it was portrayed to be because the military program was separate from the civilian program. In spite of his goals to limit the growth of government, Eisenhower laid the foundation for many of the big spending programs to come in the future. Education is an example.

The U.S. made a distinction between civilian and military; the Russians did not. Khrushchev set the pace for the Soviet space strategy. There was a lot of propaganda value in Sputnik but propaganda doesn't provide resources. A military state depends on controls and coercion and this is what was taking place in the Soviet Union under Khrushchev. There were still many variables that Khrushchev couldn't control like the West, the Chinese, his own opponents, etc. The new set of variables introduced by the space age was treated differently in the U.S. and the U.S.S.R. Eisenhower tried to preserve American traditions and customs while accommodating the new variables of the space age. Khrushchev used the situation to introduce new sweeping reforms. He found that the Soviet society wasn't in a position to deliver everything that he wanted which led to a series of bluffs on his part. He didn't have the base that he needed for resources or technology. His bluffs kept Russia safe from attack since the world thought they had much more than they really did. The Russians weren't as strong as Khrushchev led the world to think they were.

Part 4: Chapter 11, Party Line

Part 4: Chapter 11, Party Line Summary and Analysis

Sputnik gave the Russians tremendous propaganda value. The satellite gave the Soviets the ICBM that they claimed to have and gave them superiority in that area of science. Sputnik also showed that their interests in space were peaceful under the leadership of Khrushchev. The Soviets proved that they had the science and technology and that they could use it. The Soviets relied heavily on misinformation following the launch of Sputnik. They had the Americans believing that there was really a shift in the balance of power. The propaganda value of the launch was evident in the Soviets using the launch to claim that socialism was superior to capitalism. All of the science and technology required for the launch were the products of socialism.

The Soviets claimed they were countering the American nuclear monopoly. A month after the Sputnik launch, Khrushchev renounced the Potsdam agreement's power control of Berlin and was tempted to acknowledge East Germany's claim to the city. He claimed that they were mass producing ICBMs and could accurately land a hydrogen bomb anywhere in the world. Much of the Soviet propaganda efforts were aimed at Europe. By November of 1957, a majority of Europeans thought that the Soviet were stronger than the Americans and the West and these numbers increased by 1960. Even the British believed that the Soviets launched more satellites than the Americans had, even though it wasn't true.

The Soviets could pull this propaganda campaign off because of the secrecy. The Soviets wouldn't allow any onsite inspections, had travel restrictions, and fueled Western imagination and their own misinformation because nobody could disprove them. Until the U-2 was brought down, it was believed that the Americans and the West were guessing when they said the Soviets weren't as strong as they claimed they were. All of the Soviet facilities were hidden throughout their country with no advance announcements of launches.

Korolev was still the Russian Chief Designer and he was given an old aircraft factory that became his manned spaceflight center as he went to work of this project. The Soviets were competing with the American Project Mercury. They began to recruit their cosmonauts in 1959 and worked under the constraint that the space capsules could not land in the sea but had to land on Soviet land. These were the Korabl Sputniks that were tested in 1960, with two dogs landing safely in August. They tried to keep their failures a secret. In 1959 they put Yuri Gagarin into flight in a Lunik called the Vostok I, three weeks ahead of the Americans.

The Russians kept Korolev a secret. They were afraid he would be kidnapped or assassinated. He was only acknowledged for his work in private. Even the Soviet launch complex in Kazakhstan was a secret and not on the maps. The propaganda value is what the secrecy was feeding. Even after the American's Shepherd's flight in

May, the Russians were still considered to be superior in space by the Europeans. Most of the underdeveloped world believed in Russian superiority. The Soviet launches gained respect for the Soviet system. They tried to use their space shots as proof of the existence of technology throughout the Russian economy. In actuality, resources were diverted from other industries and into the space industry to give this appearance of a technology adequate society on a level with the U.S. Nothing could have been further from the truth at the time.

In spite of Khrushchev's claims, he never attended a launch and was never interested in any of the scientific gains of space flight. Korolev helped Khrushchev maintain the fazade of Soviet superiority in missiles and space. In July of 1961, Khrushchev informed Korolev that he had a month to ready his next manned space flight and it must be better than that of Gagarin. As it turned out, it was timed with the building of the Berlin Wall on August 13th.

Part 4: Chapter 12, The Missile Bluff

Part 4: Chapter 12, The Missile Bluff Summary and Analysis

Khrushchev was bluffing the whole time he was talking about the U.S. lagging behind Russia. The Soviet rocket was inefficient since they were using a cluster of smaller engines which gave it a shorter range. This actually inhibited their efforts in the 1960s and put them behind more and more. The Soviet SS-6 was more than ten years behind the American minuteman missile which was already being designed. But the Soviets played the propaganda for all it was worth. The SS-6 had a twenty percent failure rate which meant that at the time of the Cuban missile crisis, there were thirty-five missiles that could be launched successfully. This is not the mass production that they were leading the world to believe.

The U.S. had its own stockpile of missiles. There were one hundred twenty-six Atlas missiles by the time of the Cuban missile crisis. The Titan 1, which was first used in 1962, was replaced with the Titan 2, which remained active until the 1980s. The 150 Minutemen that were in silos in 1962 grew to over 1,000 by 1967. After Khrushchev's death, the SS-9, SS-11, and SS-13 came into use, letting the Russians pull even in 1969. Khrushchev's whole regime represented the era of the missile bluff with Russia behind the United States and the West. The sheer number of missiles doesn't tell the whole story of superiority since there is more that goes into it, but the U.S. had a more than two to one lead in 1962 in terms of sheer numbers. In addition, the U.S. had missiles on their submarines and also a large lead in manned bombers at this time.

In 1958 the Russians shifted their resources into the R & D and production of military rockets instead of the ICBMs which put them at least five more years behind the Americans. Sputnik gave the Soviets prestige which they would have been stupid to downplay. The Chinese also supported the Soviets in their propaganda and in their claim to have surpassed the United States in science and technology. The Chinese wanted a war against capitalism but then found out that the Russians wouldn't share the technology with them or supply them with nuclear devices. By 1958 the two countries weren't very friendly as the Sino-Soviet rift continued to widen. Within months, the Chinese began their own programs to develop nuclear bombs missiles and to enter space.

The Russians decided right from the beginning to use the missile program as a form of deception. They weren't doing much with the ICBM but waiting for technology to improve. There were various reasons for their decision to do this. They wanted the prestige and diplomatic gains from being the leaders in the missile gap, even though it wasn't real. They also wanted some kind of deterrence against NATO and they wanted to put the U.S. on the defensive. This gave more strength to Russian programs in Europe and other countries and in spite of all of their bluffing, the United States didn't

fall for the bluff during the Berlin crisis. The spy satellite represented the biggest threat there was to the Soviet bluff.

The Soviets blamed the U.S. for lack of disarmament saying that they refused to dismantle their overseas basis. They didn't mention that they, the Soviets, wouldn't consent to inspections. They conducted all of their research and testing in secrecy. The Soviets were more interested in secrecy and disinformation than they were in disarmament. Cooperation with the Americans was out of the questions because it would reveal Soviet weaknesses which might lead to an attack on them. The Soviets viewed space law in terms of freedom of space which they had no choice to promote since they were the first to launch a satellite. The satellite didn't fly over the other countries; the Earth rotated beneath the satellite. Basically, space was beyond the control of governments.

The Soviets were worried about American spy satellites when the U-2 was shot down. The film from the plane showed airfields and factories. Khrushchev pointed out that there were no ICBM bases on film. He did not say that they didn't have any. But the incident showed that the Soviets had the capacity to bring down the U-2. And as Georgi Zhukov warned, shooting down the U-2 would lead to more intensive use of spy satellites, which are harder to defend against. The Americans were the first to put this kind of technology to use because they were ahead of the Russians in that area.

Like the United States, the Russians didn't want a definition of space and where it began. They adopted the U.S. approach of claiming that if something is in orbit, then it is in space. They didn't want many constraints on space and agreed that there is no such thing as claiming any celestial bodies for any country. For the most part, the Russians and the Americans were in agreement in this area and didn't want the United Nations interfering.

Part 4: Chapter 13, Hammers or Sickles in Space?

Part 4: Chapter 13, Hammers or Sickles in Space? Summary and Analysis

By now Americans were realizing that the Soviets had some better technology but none of which gave them a lead or totally destructive capabilities. Sputnik meant they had to make choices since they didn't have the resources of the know-how to do all they wanted. And they functioned under a cloak of secrecy. As McDougall points out, it is not easy to find or to construct Soviet expenditures in these areas. In many cases the figures were hidden in different categories. "To be sure, Soviet strategy can be presumed to derive in part from geography, economy and technology. But all three are in flux (for the third can alter the other two). Soviet strategy is also a function of ideology, which helps to determine the perception of the enemy and the definition of national interest. Similarly, 'bureaucratic rivalry' also exists in the U.S.S.R., but is itself subsumed in the larger context of military-party relations" (263).

The military and the Soviet government had a relationship that went in cycles. The military must support the government but at the same time is apt to be purged by the government. It is not completely autonomous. When Zhukov served as defense minister the military gained prestige and authority. It had long-range bombers and the hydrogen bomb but these are not the only weapons that win wars, wrote Zhukov. Zhukov went overseas on a military trip and returned to find that he had been replaced. These weapons allowed for a smaller army which Khrushchev took advantage of many times in the coming years.

The Soviets, like the Americans, gained from the policy of deterrence, especially when it came to nuclear weapons. The goals of foreign policy of both sides were met without war. The Soviets could gain more from deterrence than the Americans could. Khrushchev had his Strategic Rocket Forces and the military wasn't happy. They knew it was a bluff and the decrease in the army weakened the ability to function as a deterrent. There was less money for the services due to the ability to have a second strike capability. Finally, the whole idea of nuclear deterrent was to hold the population as hostages.

Khrushchev basically used Sputnik as an excuse to reorganize the whole Soviet military. The Soviet economy did not have the same high growth rate at the end of the 1950s as it had at the beginning of the decade. Increased spending on missiles results in cuts in spending in other areas in the military budget. Deterrence on the Soviet's part was part of the bluff, not an attempt to capitalize on superiority, which it was for the Americans. It gave Khrushchev greater control over the military and allowed a shift of labor into the civilian sector. The result was higher spending during the Khrushchev years as the Russians also sought the potential of space weapons.

The Soviets protested the U.S. spy satellites the most in the years 1961-1963. The Russians criticized the U.S. for spy satellites yet stressed the strategic value of space satellite systems for themselves. When Khrushchev tried to put MRBMs, or medium range missiles, in Cuba in October 1962, along the route to settlement, the Russians admitted their inferiority. There was another call in Russia for the development of space weapons and this led to higher spending in 1962-63. The Space Age was all of four years old in 1962. The U.S. already had sixty-three launches, with more than half of them military, whereas the Soviets only had fifteen.

The Russians began launching the Kosmos satellites in 1962 with the launches continuing in 1963-65. They were also putting second generation spy satellites into orbit and navigations satellite systems into orbit. The space race was now not only for prestige, as with Sputnik, but also for military exploration. There were some agreements between the Americans and Russians at this time. They agreed not to place nuclear weapons in space and agreed to a free outer space for terms of exploration. They agreed to a code of space law offered through COPOUS of the United Nations.

Part 4: Chapter 14, Space Age Communism: The Khrushchevian Synthesis

Part 4: Chapter 14, Space Age Communism: The Khrushchevian Synthesis Summary and Analysis

The Soviet system was very much taken with science and technology or what is called the S-T Revolution. The Russians put aside some of their theories of Soviet administration, capitalism and international relations in favor of theories that consider science and technology. This was very important for Russia because the conflicts eventually caused Khrushchev to fall from power. Technology opened up all of the techniques involved in data processing, management and methods of research. Bukharin and others claimed that socialism resulted in faster technology since it freed up the creative energies of the people. Technological innovation was accompanied by a social revolution and was a manifestation of that social revolution. Soviet theorists had a problem explaining the role of technological innovation in capitalism.

Soviet theorist defined the beginning of the S-T Revolution as being in 1953. The Korean War had caused changes in government R & D, economic controls and integration of science, industry and government and these things were the essence of the S-T Revolution. The United States ended up adopting the methods that were part of the Socialist methodology. This led to the vast changes known as Soviet revisionism. Khrushchev's rationale was that there was nothing in the atomic bomb that fit the class principle and that the inevitability of war didn't exist. This meant that the policies of the capitalist and socialist countries were being shaped by weapons technology and that these were independent variables that didn't depend on class principles. He also felt that there had to be some reason for the differences in foreign policies and some way of explaining those differences. Khrushchev was looking at a situation that didn't fit the existing theory and was trying to explain it.

This stimulated many papers and research in Soviet schools. The starting point for them were the objective forces of history, the fact that Soviet weapons brought about peaceful coexistence and led to the third crisis of capitalism (the first two were the world wars). This third crisis would begin in the mid-1950s and would not involve a war but would result from Soviet technology that began with Sputnik. Influences on the U.S. government were now exogenous and not endogenous. Technology could evolve in the West with interdependence between the capitalist elites and the state. The S-T Revolution was expected to result in high growth rates for capitalism. The principles of Leninism were not operative because there wouldn't be a war. The war grounds would be technology and growth and either the west would not be able to survive the contradictions brought about by technology or there would be convergence between the

East and the West. For this reason, there was a lot of Communist support for the S-T Revolution.

There was rapid expansion of Soviet R & D expenditures during the 1950s and growth of labor involved in the R & D sectors as the Soviets shifted resources into these areas. The Russians opened communications barriers between scientists that had been closed for decades. Ten new scientific cities were created in the Soviet Union and the size of university graduate programs in these areas was doubled. But this technological revolution didn't do what the Soviets had hoped. The Soviet growth rates leveled off just as the Western growth rates began to expand, delaying the time at which the Soviets would equal the West in terms of per capita output. Other failures had to do with agriculture and food production with the Russians having to import grain. Khrushchev also made political changes in the structure of the Soviet regime at this time, including a shift of resources into the production of consumer goods. He also attempted to modernize the Army.

Soviet technology never reached the level that Khrushchev and others had hoped. Western products and technology still had to be duplicated. The Soviets did not develop their own. The Soviet dissidents like Sakharov came into being as Soviet methods were protested. Khrushchev's support waned which eventually led to his overthrow since he identified himself with the S-T Revolution and tried to take credit for it and brought about so many changes in the Soviet society and regime because of it.

The Soviet space program under Khrushchev had no real long-tem planning since Khrushchev was more interested in upstaging the Americans that in taking a real lead. Korlev is said to have drafted long-range plan but couldn't win approval from Khrushchev. The Soviet Vostok program, even though it put the first man into space, added little to technological knowledge and did not lead to second generation space craft. The Soviets refused to take the bait and say they had dropped out of the moon race.

The Soviets were engaged in a great technological push during the 1950s and 1960s and Khrushchev was identified with it. It was a way of proving the superiority of socialism. The S-T Revolution was the way in which Khrushchev hoped Russia would catch up with the West. "Buoyed by triumphs in space, he went so far as to espy the Promised Land on the horizon and declare himself not another communist Moses but Joshua. In time it became clear that Khrushchev had not the wit, not the USSR the resources, to fulfill the hopes, given the many demerits of militarized social management. Nor did Khrushchev have the iron grip of Stalin to survive failure. That Khrushchev blundered repeatedly is beyond doubt; that he was a victim of the disaffections attending an era of explosive technological change is also true" (295).

Khrushchev thought that everything that Communism promised would happen because of the S-T Revolution. Even though he more or less mishandled the situation, it didn't bring about the changes that he thought it would. In the post- Khrushchev era, the new leaders, Brezhnev, Kosygin and Podgorny stopped claiming that the Russian would

overtake the West in any area. They knew that the S-T Revolution would continue but there would be no more bluffs as Khrushchev had done.

Part 5: Chapter 15, Destination Moon

Part 5: Chapter 15, Destination Moon Summary and Analysis

Jack and Bobby Kennedy were first introduced to rocketry at the Men's Clam and Oyster Bar when the owner introduced them to Charles Stark Draper of MIT. Both remained skeptics until years later. On May 25, 1961, President Kennedy asked Congress for funding to put men on the moon and to return them to Earth. Kennedy wanted Americans to project a positive image to the world. Kennedy brought about the largest commitment in resources to the moon program and the missile program, one being peaceful, the other being military.

Kennedy felt that the world was different than it had been even under Eisenhower. America, which had been used to the thrifty ways of the Eisenhower administration, was now facing the big spending of the Kennedy Administration. The new approach, from an economic point, was to stimulate the economy to the point where it could support the higher levels of spending. Kennedy put his Vice President, Lyndon Johnson, in charge of the space program within the administration, and Johnson would use the National Aeronautics and Space Council that his bill had created to do so. Kennedy was warned by his advisors that manned space flight could cause public relations problems for the President if there was failure. This is why there was hesitation during the early months of the new administration.

Glennan resigned as administrator of NASA and Dryden acted as acting administrator during the transition period. James E. Webb was named the new administrator. The first hurdle they faced was debate over a divided space program. The military still was not happy with civilian control and NASA, even though they helped in every way they could. An Air Force Space Study Committee was appointed to look into the problem. Their report concluded that it would take three to five years to catch up to the Russians. The control still remained with NASA, in spite of this report. Webb set out to work with the military and they reached agreement on a number of issues. All of the impetus of the early days of the administration was to lead to a vastly expanded the space program.

Yuri Gagarin's successful mission caused a shift in U.S. policy as Kennedy wanted a way to catch up to the Russians. The trend of the embarrassments suffered in Laos, the Congo, with Gagarin and the Bay of Pigs must be countered in some way. Kennedy asked Johnson to find an area in space where the Americans could beat the Russians. The result was support for a moon landing program which was proposed by Johnson. The U.S. would gain in lost prestige, would catch up or surpass the Soviets, and would gain in world opinion. But it all hinged on the United States being the first to have a successful moon landing mission.

McNamara, the Secretary of Defense, also supported the moon landing program. He felt it would be good for American prestige and also would take some of the financial

burden off of some of the defense contractors who were experiencing some financial difficulties. They suffered from too much manpower, a situation that would have to be corrected without the expanded space program. Kennedy was told that spending on the space program would stimulate the economy. Kennedy approved the program that Johnson had proposed with few changes. The Apollo program was a go.

Part 5: Chapter 16, Hooded Falcons: Space Technology and Assured Destruction

Part 5: Chapter 16, Hooded Falcons: Space Technology and Assured Destruction Summary and Analysis

The decisions made by Kennedy and his advisors in the first few months of the new administration shaped American space policy for years. The result was a rapid buildup of missiles causing the Soviets to be the ones with the missile gap. The military and civilian aspects were blended in that much of the military was controlled by civilians and the civilian part was partially militarized. The last chance to stop the missile race was passed and the Secretary of Defense wanted a coherent national policy to come from the highest level so that missions and cost-effectiveness could be defined for various forms of competing weapons systems.

McNamara revolutionized how defense requests were processed during this period by performing an overall comparison of projects from the competing services in terms of cost-effectiveness. The result over the next two budget cycles was an increase in weapons and missiles, as well as bombers and other planes and equipment. The myth of the missile gap was laid to rest by this administration that made their estimates based on what they thought the Soviets could have in five years. By the time the Soviets increased their interest and production, it was 1967 and the U.S. had a comfortable lead to fall back on.

The U.S. had to have bigger and better missiles in order to threaten Soviet launch sites and other military targets as a way of guaranteeing that neither side ever used their weapons. This was the 'no cities' policy of the American administration that the purpose of any war was not to destroy the enemy population but to destroy the enemy's military to try to keep them from destroying our cities. This was known as counterforce and the purpose was to give the enemy every incentive not to attack. By the end of McNamara's tenure, he came to believe in MAD, or mutual assured destruction, which resulted from the second strike capability of both sides.

The Pentagon became computerized under McNamara and Kennedy. They had a new planning system implemented called the Planning-Programming-Budget System (PPBS) which balanced all aspects of defense. This led to the use of five year plans which were also important management tools. There was also the issue of what kinds of military space programs there should be. The thinking was that the U.S. must be in a position to prevent other nation's domination and they didn't know what was ten or fifteen years in the future or what to expect then.

By the 1960s, NASA was doing all of the primary research. Civilian management required that any research have a stated end result which was not the way in which the military was used to doing things. The big question asked in regards to new systems was its affect of deterrence. Would the new system add to or detract from deterrence? This became the guiding principle on systems during the Kennedy years. During this period the satellites were improved. The Discoverer and Samos satellites were reconnaissance satellites with greatly improved photographic resolution. The Agena D could move its orbit to different places so suspicious areas could be investigated. Various test projects were undertaken by the different services and agencies. Different comsats were developed and put into orbit. Space weapons programs were cancelled by the Americans as the Soviets cancelled various programs that did away with the need for certain kinds of weapons.

Part 5: Chapter 17, Benign Hypocrisy: American Space Diplomacy

Part 5: Chapter 17, Benign Hypocrisy: American Space Diplomacy Summary and Analysis

U.S. supremacy in space was required if the coming world was to be based on U.S. views and values. It was the way to keep socialism from spreading and being accepted by underdeveloped nations. The power to do so came from the technology itself. Communications and weather satellites linked places that were previously hard to link. "These hopes, by no means mysterious in a world beset by fears of nuclear war, poverty, and strife, nevertheless smacked of millenarianism. For a television in every hut could be a vehicle for education and understanding, or just as easily (and more likely) a tool of propaganda and hatred. But recognition of the damage done if new technology 'fell into the wrong hands' made it all the more incumbent on the United States to take the lead and exert a telling influence over its use" (345). This could cause problems unless the U.S. would allow the transfer of technology to allow other countries to benefit from technology.

This whole American strategy and response was based on the assumption that the Soviets had the lead in the space race. If not, or if they engaged in cooperation, how could NASA keep receiving the big budget it had? If there was a U.S. cutback, then that would give everyone else the opportunity to catch up. It all hinged on the fact that the U.S. maintain its superior position which is accepted by other nations and the technology would be transferred to others.

The 1960s were marked with a space program that continued for four reasons. First, the civilian space program was protection for the military space program, even though the two were separate. There was also the issue of cooperation with the Russians and our Allies in the areas of arms control and space science, as well as the organization required for communications satellites. Reconnaissance satellites were very active and a sore subject with the Russians. This led to a news blackout on any military launches of spy satellites and the only entity kept in the dark was the American public. The U.N. required registration of all satellites and the U.S. took to leaving parts of the form blank in order to protect their spy satellites. When the Russians began to launch their own spy satellites in 1963, the problem ended.

The U.S. and the Soviets cooperated on arms control and science in space. They both opposed the orbiting of bombs mainly due to the cost and the problems involved. When dytente began, so did the grounds for further cooperation. The United States needed this stance for its own image even though some of it ran counter to U.S. interests. They didn't want to be sharing their space secrets with the Russians but agreed to share space/science type of information. It would be cheaper for both sides because it would eliminate the massive spending programs that come out of competition. RAND defined

ten areas as goals for cooperation. They include the areas of tracking stations, data collection, cost sharing on expensive missions, sharing prestige, proof of peaceful intentions, international forums for dissemination of information about intentions, providing a model for cooperation, avoiding restrictive controls on individual nation's activity, helping developing countries, and a way into the Communist bloc. They never ventured past weather satellites and some communications functions.

The third and fourth goals involved Western Europe who would receive cooperation from the U.S. if they had something to contribute. It ended up being based on cooperation in science. The U.S. was not opting for massive dissemination of its own engineering technology to help European aerospace firms even though they would provide launch services for them. Comsat systems were international with use by different governments. Comsat systems were cheaper than transatlantic cable and Kennedy ordered the development of one Comsat system with all nations joining in. This led to studies regarding how it would be set up. The Communications Satellite Act of 1962 was one of the most debated bills and issues of the Kennedy administration. Many nations balked at being a part of it on U.S. terms. The U.S. would always maintain a 50.6% share and the agreement would last for five years. INTELSAT was launched in April 1965.

Part 5: Chapter 18, Big Operator: James Webb's Space Age America

Part 5: Chapter 18, Big Operator: James Webb's Space Age America Summary and Analysis

Webb, as NASA administrator, was charged with organizing the moon program, called the Apollo program. He had a staff of 6,000 in 1961 but this number was to grow more than tenfold due to the Apollo mission; this number would represent only ten percent of the total number of people working on the space program. The remainders were in the private sector. In order to undertake Apollo, NASA would need a manned flight center and the different directors would report to Associate Administrator Robert Seamans instead of their own center directors. Seamans' role was to promote functional integration of the different aspects of the project and the teams.

NASA received approval for its manned flight center and construction began in Houston. A little after this, Cape Canaveral was chosen as a permanent launch site and expanded. A new facility in Louisiana was for the Saturn rocket and its contractors, and the Mississippi Test Facilities came into being to test the rocket engines. Apollo was the largest civilian project in history and there was much national interest. Webb had to figure out how to coordinate the many tasks associated with Apollo so that any problem received immediate attention. Systems integration was also a big factor since each of the pieces must fit in with and work with all of the others. They implemented PERT, Program Evaluation and Review Technique, which allowed for the analysis of variables used in the completion of projects.

The biggest prospect NASA faced was selecting the mode for the moon shot. How were the astronauts supposed to reach the moon? Should they land on the moon after blasting off from the Earth or should they have an EOR, Earth Orbit Rendezvous? Once they decided they were using the Saturn 5 rocket, the question became what was the best way to get there. They studied a third option, the LOR, or Lunar Orbit Rendezvous, where the astronauts would use a lunar module to descend to the moon from their ship. Eventually, the LOR won out.

The Gemini program came after the Mercury program and provided experience in flights with more than one man, spacewalks, rendezvous, and ground control. There was still a lot of opposition to the LOR as the chosen mode. Kennedy favored a 1966 moon landing date which NASA thought was too soon. The space program required a large mobilization of resources on par with a war situation, only the nation was at peace. Webb appreciated the magnanimity of the task he was being asked to perform. He also realized that technological advances were changing the ways that governments and universities did things. He also expected the space program to result in growth and stability for the overall economy, so vast was it as many universities and private firms benefited from it.

On October 3, 1962, the Sigma 7 was launched with Walter Schirra aboard for a six-orbit, nine-hour trip through space. Gordon Cooper's flight on May 15, 1963, was the last of the Mercury series. Cooper made twenty-two orbits on his voyage. The Russian's Vostok III made sixty-four orbits and Vostok V made eighty-one orbits.

Part 5: Chapter 19, Second Thoughts

Part 5: Chapter 19, Second Thoughts Summary and Analysis

In 1963 NASA began to have budget problems. There were three views competing for support: the pro-Apollo technocratic, anti-Apollo technocratic, and anti-technocratic views. It basically broke down to those for or against the moon landing program. Most people accepted the technocracy by this time so that left just the moon shot as the source of discussion. Many scientists felt that the Apollo program had grown too large and costly and that the funds could be put to a better use. Some wondered how to measure the public worth of the space program.

Eisenhower wanted to know why they were in such a hurry to reach the moon. The Republicans were against the Apollo program and said Kennedy should concentrate on building a strong military presence in space instead. They, including Barry Goldwater, wanted to see the emphasis shift from the civilian to the military. Other critics were blaming the moon program for unemployment and inflation. Some wanted the money reallocated to other uses. Priorities were a big issue. Many deemed education and employment to be more important than space. Kennedy said that the country was wealthy enough to afford both, that it wasn't an "either/or" situation. Kennedy made a speech at the United Nations inviting the Russians to join them in the shot to the moon and Khrushchev responded that the Russians weren't working on a moon landing. Budget cuts delayed the program to 1968-69 and the Senate enacted a rider to prevent any teaming with another country on the project unless Congress consented. This guaranteed the existence of the Apollo program.

Johnson assumed the Presidency upon Kennedy's death and won the 1964 election. The War on Poverty became a reality in the Great Society program and Johnson promised to see the Apollo program through to its conclusion. In a poll taken in October, 77% of Americans said they wanted the Apollo program to continue.

In the 1950s the belief in and practice of limited government was still a fact. The growth of the federal government expanded greatly with the Kennedy administration. By the mid-1960s, liberals were looking for more in the way of social engineering since Kennedy insisted that the U.S. could afford both moon shots and education programs, which is where Johnson's Great Society took America. Americans adopted the posture of cooperating in matters of science and competing in matters of engineering which didn't make the Europeans very happy.

Part 6: Chapter 20, Voyages to Tsiolkovskia

Part 6: Chapter 20, Voyages to Tsiolkovskia Summary and Analysis

The flight of Apollo 8 took place in 1968 after a twenty-three month stand down following the deaths of Virgil Grissom, Edward White, and Roger Chaffee. The Soviets had also suffered fatalities in their space program when their Soyuz crashed, killing Vladimir M. Komarov. They were also launching Zond rockets and circling the moon. Thomas O. Paine was now heading NASA and on December 21, Frank Borman, James Lovell, and William Anders made the historic trip in Apollo 8. Soon, Neil Armstrong and Buzz Aldrin walked on the surface. The moon shot was pretty much of a dead end mission. Its purpose was science and prestige while most of space was about reconnaissance and communications satellites.

Johnson also believed that space exploration should only be for peaceful purposes and made plans for a U.N. treaty supporting such principles. Some people didn't see any point in such a treaty. They already had agreement banning nuclear weapons in space so there was not much to be gained from a treaty except to make the signatories look good. The Soviet draft called for a ban on all weapons tests and maneuvers in all of space; this was what the Americans didn't want. The U.S. would allow the coverage of all of outer space but not the terminology about the military activity. The Outer Space Treaty came into being in 1967 after a great deal of compromise between the U.S., the Russians, and other countries.

The language of the treaty was debated in the Senate. Why only prohibit weapons of mass destruction? Why demilitarize the moon and not the rest of space? In spite of the debate and the questions, the treaty was ratified in April. It did not add much substance to what already existed. The U.S. military did not want all of space demilitarized and neither, apparently, did the Russians. The Americans would not be happy with any plan that forced them to give away their technology. It laid down some of the principles of space law. The treaty established the only conditions under which space flights could occur and it was appropriate for the technology at hand.

Planning of the post-Apollo period began in 1964. The next five years were characterized by vagueness. Webb said he didn't favor long-range planning. They looked at flights to Mars and space stations. Nixon, then President-elect, had a task-force look into the question of long-range space planning. They came up with three proposals: a manned flight to Mars, a space station, and an Earth orbiting station for fifty people with a shuttle. Nixon opted for the third plan and then postponed it until they had a shuttle. Eventually the program shrank to Skylab.

Once the moon shot was achieved, many lost interest in space. To many, the space program had achieved what it set out to achieve when it put men on the moon. Nixon approved the Space Transportation System (STS) in 1972 when faced with the political prospects of unemployment in the aerospace industry. This led to the Space Shuttle. The return of de Gaulle to power in France led to France developing its own A-bomb, missiles, nuclear submarines, jets, and their own space program. France would have a place as an active competitor in the marketplace for any of these products. The Europeans had to enter these areas in order to keep up with technology and the United States refused to give away its technology to France. The Europeans eventually carved niches for themselves in the Comsat markets.

The Russian's satellite launches began to increase in 1967 and continued to rise. In 1973 they averaged one launch every third day and eventually surpassed the U.S. in the number of spacecraft in orbit, even though they don't have the same capabilities as the U.S. hardware does. They had their first docking in space in 1969 and launched their space station, the Salyut, in 1971. The Russians had their own INTERSPUTNIK system and did not take part in INTELSAT. Even during the years of dytente, Soviet spending continued to escalate, as did their weapons development.

Part 6: Chapter 21, The Quest for a G.O.D.

Part 6: Chapter 21, The Quest for a G.O.D. Summary and Analysis

It is hard to value public programs because they involve some immeasurable aspects, or non-market factors. These are things like quality of life or the value of life or other variables that can't be measured by the market. These can also be considered the adjustments that people must make to the various programs. During this time new management procedures were adopted at NASA and at the Pentagon which were recommended for other government programs. They all decided that R & D was important to the economy but by the end of the 1960s, seven out of every eight scientists were either working on R & D projects or with the funding.

Was there a return to the economy due to the increased government spending in R & D? That is what McDougall discusses in the beginning of this chapter. One study claimed a 43% return, but the General Accounting Office found the figure to be a little high. Most of what NASA did was at too high a level to have effects on the population but they did have higher levels of technology in some industries. There were changes in the aerospace industry but these did not necessarily affect the overall economy. Aerospace firms are not the run-of-the-mill firms in the economy. They have no incentive to be efficient because they are covered by government contracts for highly specialized products. The firm has to maintain its excess capacity in between projects for security reasons. Defense and aerospace contractors are not in the same position as other firms.

Approximately one third of all R & D monies went to universities. They built expensive facilities in physics, engineering and other areas with the funds. Government funds accounted for 50-80% of some university's budgets. Universities became very dependent on these government funds. This caused some internal strife at some institutions of higher learning in that the social sciences and other departments were not benefiting from these funds until the Johnson years and the Great Society.

Eventually the method of systems analysis came under attack as did other technocratic methods. There were pressures to shift the resources and the attention to the various social problems of the country. This slowed down the resources dedicated to R & D to almost one quarter of their high level by the 1980s. There was a backlash against the spending on R & D and against the traditional curricula on campuses. Planning didn't work well in a capitalistic economy. Systems need something that is outside of them to make sure that all managers and other economic agents are doing what they are supposed to do and achieving their goals. This is what is called a Guarantor of Decisions or Guarantor of Destiny, or G.O.D.

Part 6: Chapter 22, A Fire in the Sun

Part 6: Chapter 22, A Fire in the Sun Summary and Analysis

McDougall reiterates the purpose of his book - to trace the development of space technology. There are various ambiguities associated with the space age. The launch of Sputnik and the Cold War brought about a situation where technology was financed and pushed by government. The more backward a society is, the more needed is the push by government. The advanced nations justify their push for technology to maintain their security. Some, like Pope Pius VII, view technology to be a tool that humans use and the tool should be used for morally neutral purposes. Does science and technology present a problem between religion and science? Pope Pius VII didn't seem to think so.

"My instinct tells me that our science and technology, feeble as they are in controlling Nature, are so acute in studying it that they will soon reveal their limits. It is then that man must confess the mortality of his works, without turning on them or himself with contumely. It is then that the orthodox message is a sure guide: God made us, is disappointed in us, but loves us anyway, by which we are redeemed. Technology is our subcreation" (460).

Characters

Konstantin Tsiolkovsky

Robert Goddard

Hermann Oberth

F.A. Tsander

Sergei P. Korolev

Grigory Tokady

Wernher von Braun

Bernard A. Schriever

T. Keith Glennan

Groegi Zhukov

Dwight D. Eisenhower

Nikita S. Khrushchev

John F. Kennedy

James E. Webb

Lyndon B. Johnson

Thomas O. Paine

Objects/Places

Tsarist Russia

Tsarist Russia is where the book opens, with Tsar Alexander being killed by a bomb. This is the era and the place where some of the greats in the name of rocket science lived and worked.

Soviet Russia

Post-revolutionary Russia had its Bolshevik government with its state control under Stalin. The sciences and technology were given a top priority and benefited from the influx of resources.

Germany

The Germans were the first to use rockets during World War II and the rocket production plants were hidden on German soil.

Sharagas

Sharagas were Soviet work camps, part of what is known as the Gulag. Many Soviet scientists worked in these labor camps, including those who worked on missile development.

The United States

The United States became a world power after World War II and was the counter-balance to the growth of Soviet power. This involved the spending on defense and R & D and the development of new weapons to counter and deter the Soviet threat.

Kazakhstan

Kazakhstan was a republic in the Asian part of the U.S.S.R. and home of the Tyuratam, which became an ICBM test facility.

Turkey

Turkey is where American radar base at Samsun monitored Soviet flights. The Soviet ICBM test facilities in Kazakhstan were outside the range of this facility which led to the development and use of the U-2 spy plane.

Cape Canaveral

Cape Canaveral is the American rocket launching site located in Florida.

Space or Outer Space

Space and *outer space* are terms that can't be defined without the use of velocity or other aspects of technology.

Great Britain

Great Britain decided not to enter the arms race of the space race, preferring instead to be protected by the United States. They did not see the need to spend the massive amounts that such programs would require and they did not see any need to be self-sufficient in these areas.

Themes

The Cold War

The most dominant theme of the book is the Cold War and how it affected decision making in the post-World War II era. The Cold War was a conflict between ideologies and a struggle to categorize nations into the Eastern or Western blocks with socialism struggling to prove it was better than capitalism and vice-versa. The result of this was the arms race and accumulation of weapons. The U.S. built up its weapons and made new weapons as a form of deterrence, especially once the Soviets had nuclear capability. It was believed that a strong second strike capability would deter the enemy from attacking because they knew the retaliation would destroy them. The Cold War meant that everyone lived under the threat of the bomb and the outbreak of war, even though both Russian and the U.S. knew enough not to engage in a hot war because there would be no overall winner.

The Cold War meant that there was intense competition between East and West and this competition was intensified by the Russian launch of Sputnik. The U.S. had plans for their own satellite launch and Eisenhower wasn't too concerned about the Russians being first. The Russians went on to claim superiority in science and technology and to claim that they led the United States and the West. Khrushchev began a bluff that continued for the entire time of his regime and most of the world believed it. The U.S. kept "guesstimating" the strength of Soviet missiles and claimed they weren't as strong as they claimed they were. It wasn't until the U-2 was shot down that some people realized that the U.S. wasn't totally guessing.

In some ways, the Cold War is responsible for the space program and the American rush to the moon. The Americans had to somehow show that they were stronger in science and technology, even though the Soviets kept achieving firsts. They didn't do things first because of superior technology; they basically made do. The U.S. led the way in communications and reconnaissance satellites that the Russians didn't begin to catch up to until the 1970s.

Deception

Deception is another big theme of the book and the deception was on both sides. After the launch of the Sputnik, Khrushchev and the Russians were riding high on the wave of prestige from being the first to launch a satellite. It didn't matter that the technology used by the Americans when they launched theirs just weeks later was superior. Khrushchev and the Russians were claiming the Russians to be the leaders in science and technology and using this to prove that socialism was superior to capitalism. This was important during the 1950s, when the Cold War was in existence. This gave the Russians and socialism some credibility with the underdeveloped countries of the world.

Khrushchev kept the Russian program shrouded in secrecy. When it came to weapons and missiles, they wouldn't agree to the onsite inspections that the Americans wanted. They kept all of their programs very quiet and built facilities in cities that were off limits to foreigners and too far inland for the Americans to track from their bases in Turkey. This way, the Americans didn't know what or if they were launching, until they began using U-2 spy planes to fly over the country. Khrushchev began a bluff with the Sputnik launch that lasted for his entire regime. The Soviets didn't have the missiles that they claimed they had and they weren't as advanced as they claimed to be. Onsite inspections would have proven this.

Deception was also a part of international treaties. Neither the United States nor Russia wanted space defined. The U.S. based its image on a space for peace program when it actually had its space program divided into civilian and military programs. Neither country wanted too many constrains on the use of space. Cooperation was eschewed by both because the U.S. didn't want to give away its technology and the Russians didn't want them to know how backward they were. Deception was a major theme of this era.

The Role of Choice

Another theme of the book is the role of choice. Choices have to be made by every society. There are not enough resources for every society to have more of all goods. There aren't enough resources for more of both space goods and consumer goods. This was particularly true in the Soviet Union, where rapid technological development was achieved by duplication of Western technology and by the direction of goods into the targeted sectors and away from the consumer sectors. Growth in Soviet science and technology stopped when Khrushchev increased the production of consumer goods. There weren't enough resources for both.

The United States had problems in this area but not as severe as the Russians did. The U.S. had the resources to increase spending in both areas. There was money for the space program and money for education and poverty. The federal involvement in these areas went against the prevailing economic practices of the time but Kennedy and Johnson turned it around. This increased spending eventually led to the budget and other problems experienced by the U.S. economy in the 1970s and 1980s.

But each society, whether it was socialistic or capitalistic, had to make its choices. They both had to make the political and economic decisions that came out of the Cold War and the desire to lead the way into the space age. They both paid a price for these decisions.

Style

Perspective

The author, Walter A. McDougall, is an academic and historian and has the background and expertise to write a book of this kind, especially by putting the space race into a political perspective. This makes the book very interesting to see how the events in the space arena are tied to political events. The author does a good job of explaining the events of the space race with the political context of the Cold War. McDougall was interested in international relations in the area of things like oceans and other non-territorial areas and how international rivalry affects technology and the rate of change of technology. Both of these areas come together in the space race. Space is not owned by any one country or entity and certainly involves a lot of technology to investigate.

McDougall's intended audience is anyone with an interest in the subject. His book is well written and easy to read for all levels of audience. The audience does not have to have any prior knowledge of the events of the time or any knowledge of science and technology. McDougall provides the required background information, although for readers with personal memories of the events makes it more interesting and meaningful for the reader.

Readers of all ages and levels will benefit from this book because it tells them how and where the space program came from.

Tone

The book is written in an objective and factual tone. It is historical in nature and therefore is presented chronologically for the most part. This makes it easy to follow for the reader, who doesn't have to do any backtracking. There are a lot of names mentioned and it is somewhat of a challenge to pick out the important ones. The third person style of writing adds to the objectivity of the book.

The author does not make value judgments about the different economic and political systems or about the space program and the levels of spending to which it led. He remains objective and presents the facts in an historical and academic fashion. The reader does not feel like he is reading about history although that is precisely what he is reading about.

The presentation style of the author keeps the book interesting for the audience. The reader has to appreciate the breadth and scope of McDougall's research as indicated by the Notes sections. Finding information on the Soviet Union is not always easy, especially when it is in this area, yet McDougall does a thorough job.

Structure

The book is divided into six smaller books. Each book has its own theme and its own section of history to cover, and does so with a number of chapters devoted to different topics. Each of the books has a titled section with the book number and a conclusion section, each of which are separate from the chapters. This makes the structure of the book a little unusual, though it works as a whole for this particular subject. The book is for the most part chronological, and the author is quite thorough in all realying of information.

There are a lot of names given in the book. Some of them are mentioned only once or twice; some of them are recurring. Part of the challenge is to figure out which ones are the most important, but the number of people cited or referred to shows the scope of the author's research. The book is well written and well researched. The author presents a log of information that was difficult to obtain during the years of the Soviet era.

The book also contains boxed information about the different space flights, which makes them easy to find and emphasizes them in the mind of the reader. There is also a list of abbreviations that are used throughout the book presented to the reader at the beginning of the book; this is a very useful reference list for readers. The author also uses cartoon jokes and illustrations throughout the book. This information is also presented as a list at the beginning of the book. These lists make it easy for the reader to look up information, especially about the different space shots by both the Americans and the Russians.

Quotes

"He parodied himself in an essay called 'The Gravity Hater' about a 'friend' who took gravity to be 'his personal, bitterest enemy. He delivered threatening, abusive speeches about it and convincingly, so he imagined, set out to prove its entire worthlessness and the bliss that "would come to pass" through its abolition." Gravity pressed us down like worms, but a gravity-free environment 'would make the poor equal to the rich" (18).

"To be sure, technological superiority was to be a primary legitimizer of Communist authority, but in order to whip the nation to the necessary efforts, the regime constantly had to invoke the threat from more developed, hostile states abroad" (29).

"In this way the Cold War for 'intellectual reparations' in the form of Nazi scientists and their secret weapons began before the political Cold War was apparent. At Potsdam in July the Big Three powers agreed to share German scientific facilities, but it was a sham. The soviets were already carting off entire laboratories, while the German racketeers, a wind tunnel, and other spoils were en route to the United States. What Winston Churchill called the Wizard War in technical one-upmanship and espionage did not stop on V - E Day" (45).

"The handling of the Grottrup team is illustrative of Soviet borrowing. Always behind, the Soviets are constantly tempted to tap foreign hardware and talent. Always prone to secrecy, in part to cover their own backwardness, they are discreet and anxious to patriate foreign skills as rapidly as possible" (54).

"Sputnik was a famous victory, an expression of much that is good in Russian culture. It was also an expression of much that must be labeled bad in Soviet practice - the distortion of technology, purchased at such a price, into a cold tool of the state. And this observation already suggests part of the answer to the next questions we must consider: why the supremely technological, but not yet technocratic, United States was second into outer space" (65).

"The American pattern of privately funded and executed R & D distinguished American ideology from the Soviet. It was also a luxury, bestowed by the strategic isolation and natural wealth of North America and the inventiveness and vigor of its people, business, and universities, American economic and military needs were met for 150 years without centralized mobilization of intellectual resources. But the international imperative, imposing a nondiscretionary, continuous involvement in the global struggle for power and security, broke the pattern. In December 1941 the United States suddenly lost its luxury to dispense with policy for science and technology, and the postwar period, this time, brought no respite. The history of policy for science ever since has been one of struggle to reconcile abiding American values with the need to meet the real and perceived challenges from abroad" (76).

"But the very next year new changes were in the works; the postwar lull was ending. For the Soviet A-bomb forced an immediate reassessment of American strategy that split

the government and physics community and climaxed in another technical breakthrough - the hydrogen bomb - that restored in a flash the glitter of long-range rocketry" (103).

"The New Look followed logically from weapons decisions made under Truman. In fact, Truman's cabinet planned a similar trend as soon as the fighting could be stopped in Korea. But the New Look obviously increased American dependence on technological leadership at a time when the USSR had already demonstrated a thermonuclear potential and was proceeding rapidly with transcontinental bombers and missiles" (114).

"A new age was dawning, in which organized brainpower for military and civilian science and technology was the dearest national asset. Eisenhower, however, rejected the demands of generals and congressional 'hawks' for a crash buildup and opted instead for sufficiency. But 'sufficiency' implied mutual deterrence, and that only meant that the Cold War would be expanded beyond nuclear weapons and espionage into a competition of entire systems, each claiming to be better at inventing the future. Hence Sputnik posed an insoluble dilemma for Eisenhower's United States: either it must race headlong for strategic superiority, compromising fiscal integrity and militarizing much of the private sector, or it must accept strategic parity, in which case all aspects of national endeavor, including conventional weaponry, economic growth, 'social justice,' and the hearts and minds of Third World peoples became yardsticks of Cold War competition. Either way Sputnik invited another American lurch toward technocracy. The Eisenhower response that addressed the Sputnik Challenge head-on, but that also expressed his ambivalence to the new age, was the National Aeronautics and space Administration (NASA), another federal agency devoted to the conduct of a specific technological revolution" (157).

"The dual space program and the space policy derived from it in the first years of the Space Age reflected this complexity. Hence U.S. space strategy aimed at the establishment of a legal regime in space that complemented the American freedom to pursue such military missions in space as were needed to protect and perfect the nuclear deterrent. But the dual thrust of American space strategy also opened the United States to charges of hypocrisy from Moscow and Western critics, which only increased as hopeful rhetoric found little echo in deeds" (178).

"International cooperation also appeared desirable from scientific, political, and psychological standpoints. The United States should cooperate in space so as to enhance its position as a leader in the peaceful uses of space, conserve American resources, speed up space progress by pooling talent, open up the Soviet bloc, and achieve international regulation. But genuine U.S./Soviet collaboration appeared unlikely" (181).

"Conventional wisdom portrays Eisenhower as skeptical and tight-fisted regarding space, in contrast to his enthusiastic successors. This is part of the picture, to be sure, the 'rearguard' aspect. But it obscures the fact that Eisenhower also secured NASA's place as a growing technocratic enterprise. Ike founded the civilian agency, nurtured it, gave it the major missions, and the tools it needed, and linked it to national prestige. Once the critical judgment had been made that the United States should promote its

space program as open, peaceful, and scientific - but still in competition with the Soviet - the future of was assured" (208).

"Academic strategists, disgruntled generals, ambitious economists and scientists, social reformers, and politicians - all contributed to the new consensus in an enlightened United States. Common to all was the perception of need for vastly increased federal spending and power, a perception singularly favorable to an alliance between defense and space 'hawks' and social 'doves' built on the presumed realization that state investment in science, technology, and education would refill the coffers of a generous Treasury. Ike alone did not buy the new orthodoxy and was hooted down. His successors bought it" (218).

"In his memoirs Khrushchev confessed, 'Of course, we tried to derive the maximum political advantage from the fact that we were first to launch our rockets into space. We wanted to exert pressure on the American militarists - and also influence the minds of more reasonable politicians - so that the United States would start treating us better.' But the quest for 'maximum political advantage' led to the espousal of a 'party line' that not only hindered rapid and rational development of space technology but encouraged a dangerous deception in military policy as well" (249).

"It would also be a grave embarrassment for the Soviets to undercut their own prestige by downplaying Sputnik. Indeed, Sputnik offered them a chance to retire once and for all the Soviet reputation for backwardness and replace it with an image of dangerous and inestimable strength. If your opponent always things you weaker than you are, you can profit from this misconception only by surprising him in a clash of arms. But if the enemy always thinks you stronger than you are, you can exploit his error through a diplomacy of intimidation. What was more, the risks involved in a bluff were reduced by secrecy and by the American unwillingness, evident since 1945, to use its nuclear superiority in preemption. A strategy of deception, therefore, capitalized on Soviet strengths and cloaked Soviet weaknesses" (252).

"But the phenomenon was special in Soviet history in this way: for the first time the regime, committed as always to pushing new technology, did not simultaneously seek to isolate the power structure from the second-order consequences of such technology. Rather, Khrushchev embraced the social and political consequences of the S-T Revolution, even glorified them, and called it all the fulfillment of communism. Finally, his tinkering reached Party organization itself, including mandatory turnover of committee memberships and culminating in rumors of a special session of the Central Committee at which there were to be 'many changes at the top.' That may indeed have been 'the last straw'" (284).

"'The generation that fought the war' - these were the Kennedy men. Convinced of their brilliance in comparison to the men who surrounded Ike, they extolled vigor, intellection, and movement. Behind the clichys about 'company commanders' replacing the generals was the truth that World War II was the formative experience of their lives. They remembered the biter fruits of appeasement, but above all the way war had galvanized

science, industry, and government, and showed what Americans could do with technology, the proper leadership, and the inspiration of a mighty cause " (307).

"Under the strategy of assured destruction, passive military satellites suddenly emerged as 'good' systems and active space weapons as 'bad' ones. Military applications satellites had already proved their worth and were stabilizing. To throw away their tacit safety in order to play with unproven, destabilizing, and expensive weapons seemed foolish. Better to use diplomacy to educate the Soviets to that effect" (339).

"Whether the Soviets ever accepted assured destruction as anything other than a convenient encouragement to the United States to stand down while they pressed ahead is a live question. But for the time being, given their inferior resources and need to catch up with the United States in missile forces, the Soviets, too, might have been pleased to place space weaponry on the back burner. The American decisions of 1963 did seem to preserve outer space as a sanctuary well into the 1980s. But the wisdom of those decisions will hang on the ultimate efficacy of the civilians' strategy, second-strike deterrence and assured destruction: the balance of terror" (343).

"By late 1963 the hand-wringing ended. As has been seen, the Soviets began launching their own spy satellites, called off their diplomatic offensive, and agreed to principles of behavior in space that, by neglecting offensive, and agreed to principles of behavior in space that, by neglecting to ban military activities, legitimized observation from space. The United States achieved a great deal in having military space systems treated not as a special category but as any other military systems, to be promoted or discouraged not because of the medium in which they operated but because of their contribution to security and stability. And yet, to the uninformed, the United States appeared to be the dangerous power that openly advocated 'militarization' of the cosmos" (348).

"In space policy Johnson benefited in the campaign from the aftereffect of Kennedy's joint moon proposal. He, too, pledged to seek cooperation with the Soviets, but otherwise he would see Apollo through to the end" (400).

"The USSR, on the other hand, was a people's state ... and in any case would soon catch up. Now the United States was saying that the Soviet Union might be ahead for the moment but was run as a slave state in which resources could be mobilized to serve militaristic ambitions. The United State, on the other hand, was a free country ... and in any case would soon catch up. In so saying and doing, American leaders bought the communist list that technology was both a symbol of social superiority and the main agency for making one's own preferred image real" (404).

"But the first irony of Apollo was that over time, the means had become more important than the end, even though that means - technocracy - was to prove inapplicable to most of the items on the new national agenda. Going to the moon was an engineering problem; eliminating discrimination or poverty or even urban blight was not. By the 1980s Americans could ponder two decades of federally managed change an wonder if the tangible benefits outweighed the intangible costs, and how to fashion a balance scale to make such judgments at all" (413).

"All in all, aerospace was a hard business in which to make an honest dollar. Aviation firms had to 'bet the farm' every time they designed a new airplane for the civilian market and play politics on every government contract. To escape this, firms seized the rare moments when they had available cash to diversify (North American with Rockwell Standard and Martin with Marietta cement) or merge (McDonnell and Douglas) or both (General Dynamics out of Convair and Material Services). The restructuring of the industry proceeded with federal approval for it meant a cushion against fluctuations in government spending" (439).

"The United States, and the world, is caught in a *Flucht mach vorn*, a flight into the future. What do we fear most, that technocracy will be perfected, or that it won't be? Americans delight in such futurist epics as *Star Trek* and *Star Wars* precisely because the human qualities of a Captain Kirk or Han Solo are always victorious over the very technological mega-systems that make their adventures possible. We want to believe that we can subsume our individualism into the rationality of systems yet retain our humanity still" (449).

Topics for Discussion

Why is Tsiolkovsky known as the great pioneer of modern rocketry?

What were the events that occurred near the end of World War II when German facilities were being entered or found by the Allies? How did America and Russia benefit?

The United States lagged behind both Russia and Germany in missile development during World War II. How did this happen? What measures were taken during the war years to increase funding of R & D?

Eisenhower correctly foresaw that the Cold War would not turn into a Hot War. What were the implications of this? How did they affect spending and technology?

Which nation was first to launch a satellite? What factors led to this situation and what were the implications for the United States and Russia?

How did the S-T Revolution bring about changes in Soviet theory?

What was Khrushchev's bluff? Why was it important?

What effect did the space program and the increased R & D spending have on universities?