

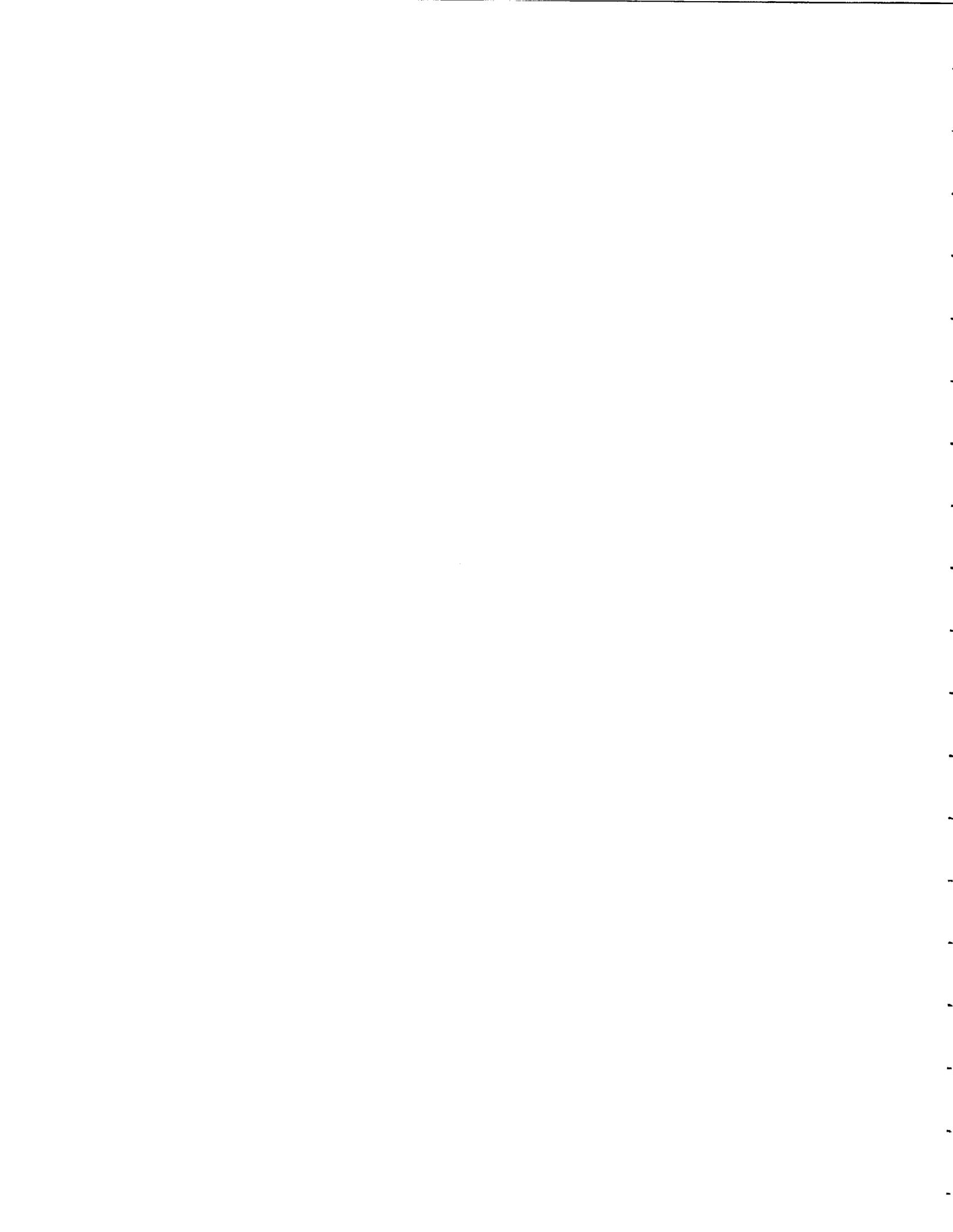
NASA/TM-113448

RECONSIDERING SPUTNIK

FORTY YEARS SINCE THE SOVIET SATELLITE

WASHINGTON, D.C.
SEPTEMBER 30–OCTOBER 1, 1997





**Reconsidering Sputnik:
Forty Years Since the Soviet Satellite**

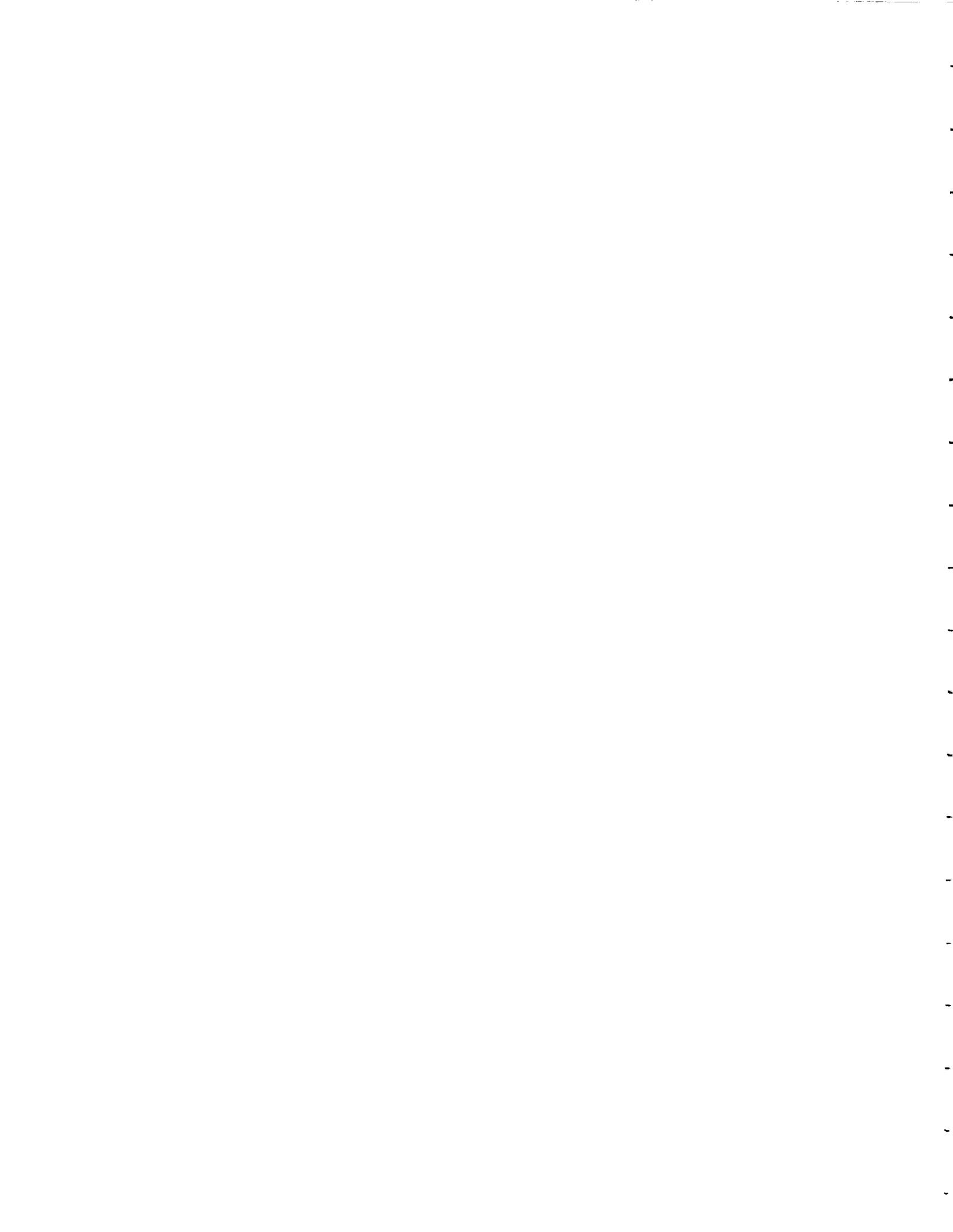
S. Dillon Ripley Center Auditorium
Smithsonian Institution
1100 Jefferson Drive S.W.
Washington, D.C.
September 30 - October 1, 1997

NASA History Office, NASA Headquarters Office of Policy and Plans
National Air and Space Museum, Smithsonian Institution
Space Policy Institute, The George Washington University
Kennan Institute for Advanced Russian Studies, Woodrow Wilson Center for International
Scholars

On October 4, 1957 the Soviet Union lofted the first artificial satellite, *Sputnik I*, into Earth orbit. This 184-pound, basketball-sized sphere ushered in the era of the space race. At the height of the Cold War and several months into the International Geophysical Year, the Soviet Union had beaten the United States into space, a symbolically significant achievement. In the immediate aftermath, the American public was greatly distressed and the National Aeronautics and Space Administration was created within a year. The real significance of the *Sputnik I* launch can be seen over the long term, however, as the race for human exploration of the Moon began in the early 1960s, global satellite communications became a reality, and new generations of scientific spacecraft began exploring the universe.

The NASA Office of Policy and Plans/History Office, the National Air and Space Museum, the George Washington University Space Policy Institute, and the Kennan Institute for Advanced Russian Studies are proud to sponsor a symposium on the impact of Sputnik. Separate panels will address Soviet and American activities prior to Sputnik, immediate ramifications of the launch in the United States and around the world, and some of the long-term consequences.

The symposium will take place in the auditorium of the S. Dillon Ripley Center of the Smithsonian Institution at 1000 Jefferson Drive SW, Washington, DC. Attendance at the symposium is open to the public, but seating is limited so early registration is strongly encouraged. There is a \$30 registration fee for breakfast, lunch, and refreshments.



AGENDA

Tuesday, September 30

9:00 a.m. Welcome, Announcements, and Introduction by Alan M. Ladwig, NASA Associate Administrator for Policy and Plans; Roger D. Launius, NASA Chief Historian; and John M. Logsdon, Director of the Space Policy Institute at George Washington University

9:15 a.m. Keynote Speech: "Was Sputnik Really a Saltation?" by Walter A. McDougall, Professor of History and International Relations, University of Pennsylvania

9:45 a.m. The Soviet Union and Sputnik

Chair: Marcia S. Smith, Science Policy Research Division, Congressional Research Service

"Rising from the Cradle: Soviet Public Perceptions of Spaceflight Before Sputnik," by Peter A. Gorin

"Korolev, Sputnik, and the International Geophysical Year," by Asif A. Siddiqi, Department of History, Carnegie Mellon University

"Korolev's Triple Play: Sputniks 1, 2, and 3" by James J. Harford, Executive Director Emeritus, American Institute of Aeronautics and Astronautics

"State Program, Bureaucratic Entrepreneurship, or Scientific Autonomy? Policymaking Processes and Structures Behind the Launch of Sputnik" by Andrew J. Aldrin, TRW Components International and Department of Political Science, California State University at Long Beach

11:00 a.m. Break

11:15 a.m. Space and the International Geophysical Year

Chair: Derek Elliott, Department of History, Geography, and Political Science, Tennessee State University

"Before Sputnik: National Security and the Formation of U.S. Outer Space Policy, 1953-1957," by Kenneth A. Osgood, Department of History, University of California at Santa Barbara

"A Strategy for Space," by Dwayne A. Day, Guggenheim Fellow, National Air and Space Museum

"Sputnik and the IGY," by Rip Bulkeley, Oxford, England

12:30 p.m. Lunch (catered box)

1:30 p.m. Immediate Ramifications of Sputnik in the United States

Chair: John M. Logsdon, Director of the Space Policy Institute at George Washington University

“Sputnik, the Gaither Committee, and the Escalation of the Cold War,” by David L. Snead,
Richmond, VA

“Organizing the U.S. Government for Outer Space: 1957-1958,” by Eilene Galloway, Honorary
Director, International Institute of Space Law and Trustee Emeritus, International Academy of
Astronautics

“Sputnik: A Political Symbol and Tool in 1960 Campaign Politics,” by Gretchen J. Van Dyke,
Department of Political Science, University of Scranton

“Opening the Space Age: A Legacy of the International Geophysical Year,” by J.A. Simpson,
Enrico Fermi Institute and Department of Physics, University of Chicago

3:00 p.m. Break

3:15 p.m. Immediate Ramifications of Sputnik - International Perspectives

Chair: Steven J. Dick, U.S. Naval Observatory

“Building a Third Space Power: Western European Reactions to Sputnik at the Dawn of the
Space Age,” by John Krige, Director, Centre de Recherche en Histoire des Sciences et des
Techniques, Paris

“Sputnik and France: A ‘Mission to Civilize?’,” by Guillaume de Syon, History Department,
Albright College

“The Impact of Sputnik on American Foreign Policy,” by Lawrence S. Kaplan, Director Emeritus,
Lemnitzer Center for NATO and European Community Studies, Kent State University

4:30 p.m. General Discussion

5:00 p.m. Adjourn

Wednesday, October 1

7:45 am Breakfast at National Air and Space Museum

9:00 a.m. Welcome and Announcements by Roger D. Launius, NASA Chief Historian, and Blair D. Ruble, Director, Kennan Institute for Advanced Russian Studies, Woodrow Wilson Center for International Scholars

9:15 a.m. Keynote Address: "The Long Term Consequences of the Soviet Union's Investment in Space Exploration," by Sergei Khrushchev, Watson Institute, Brown University

9:45 a.m. Long-term Consequences of Sputnik:

Chair: Robert W. Smith, Chair, Space History Department, National Air and Space Museum

"Reflections on Sputnik," by Roald Sagdeev, East-West Space Science Center, University of Maryland

"Artifacts or Facts?: Soviet Space Historiography in the Last Forty Years," by Cathleen S. Lewis, Department of Space History, National Air and Space Museum

Break

"Sputnik and the Creation of the Soviet Space Industry," by William P. Barry, Department of Political Science, U.S. Air Force Academy

"A Certain Future: American Higher Education and the Survival of a Nation," by John A. Douglass, University California at Santa Barbara and Berkeley Center for Studies in Higher Education

"Sputnik and Technological Surprise," by Glenn P. Hastedt, Department of Political Science, James Madison University

12:00 p.m. Adjourn



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History Symposium *Reconsidering Sputnik: Forty Years Since the Soviet Satellite*

Paper Proposal

March 25, 1997

*The Earth is a cradle of human intellect,
but one cannot live in a cradle forever...*
Konstantin E. Tsiolkovsky

RISING FROM A CRADLE...

Soviet Public Perception of Spaceflight Before Sputnik

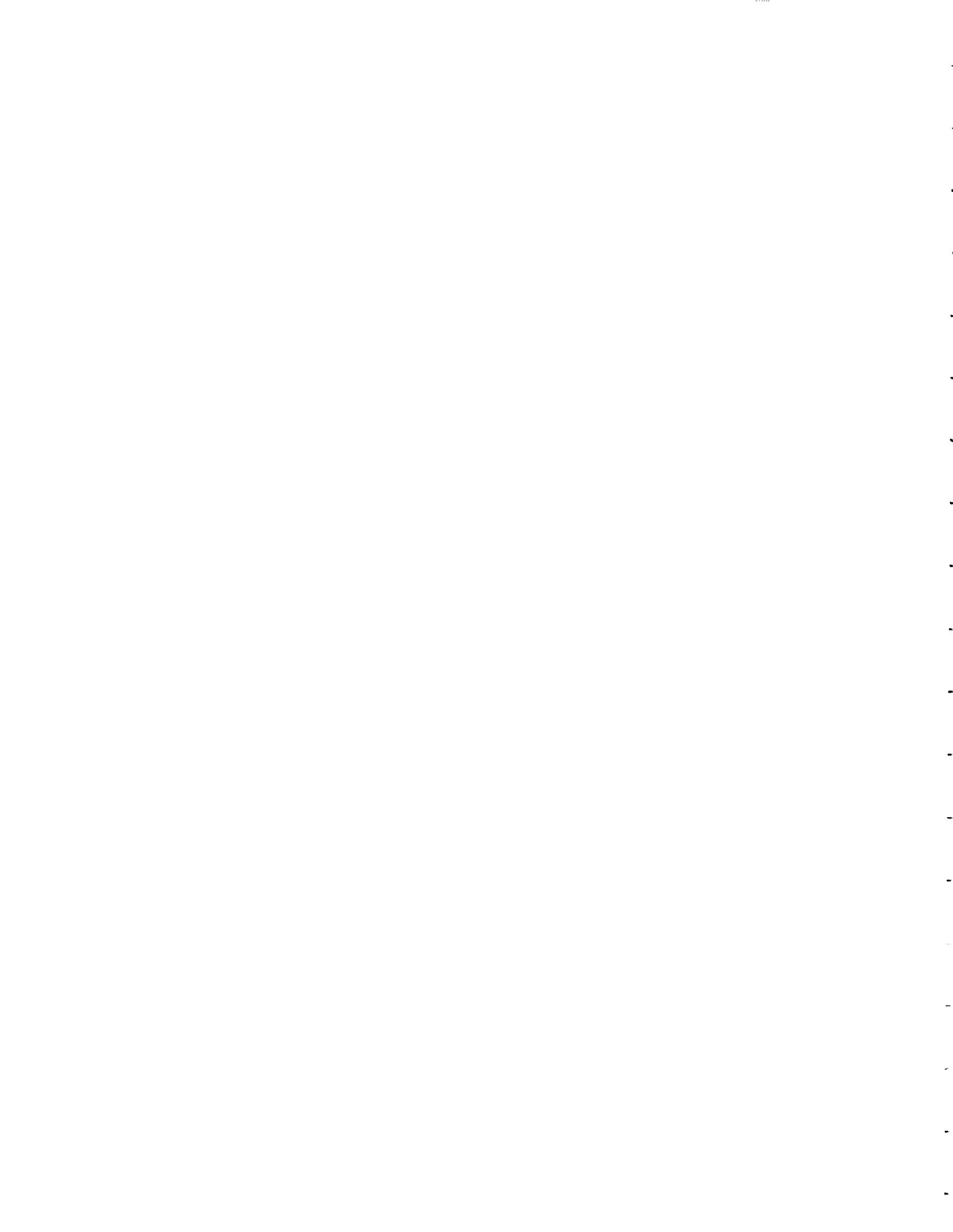
The paper is intended to describe Russian/Soviet public perception of spaceflight in the first half of the 20th century, prior to the launch of the first satellite (1900 - 1957). The purpose of this research is to show that despite the secrecy around Soviet rocket program the public in the USSR was prepared to understand and accept the beginning of the space era. The paper will address the following subjects:

- Early proponents of a spaceflight ideas in Russia and the USSR;
- Descriptions of future space explorations in Russian/Soviet popular science and science fiction literature;
- Knowledge and response of the general public to a possibility of a spaceflight;
- Public spaceflight societies in the USSR;
- Political exploitation of the spaceflight idea in the 1920s - 1950s.

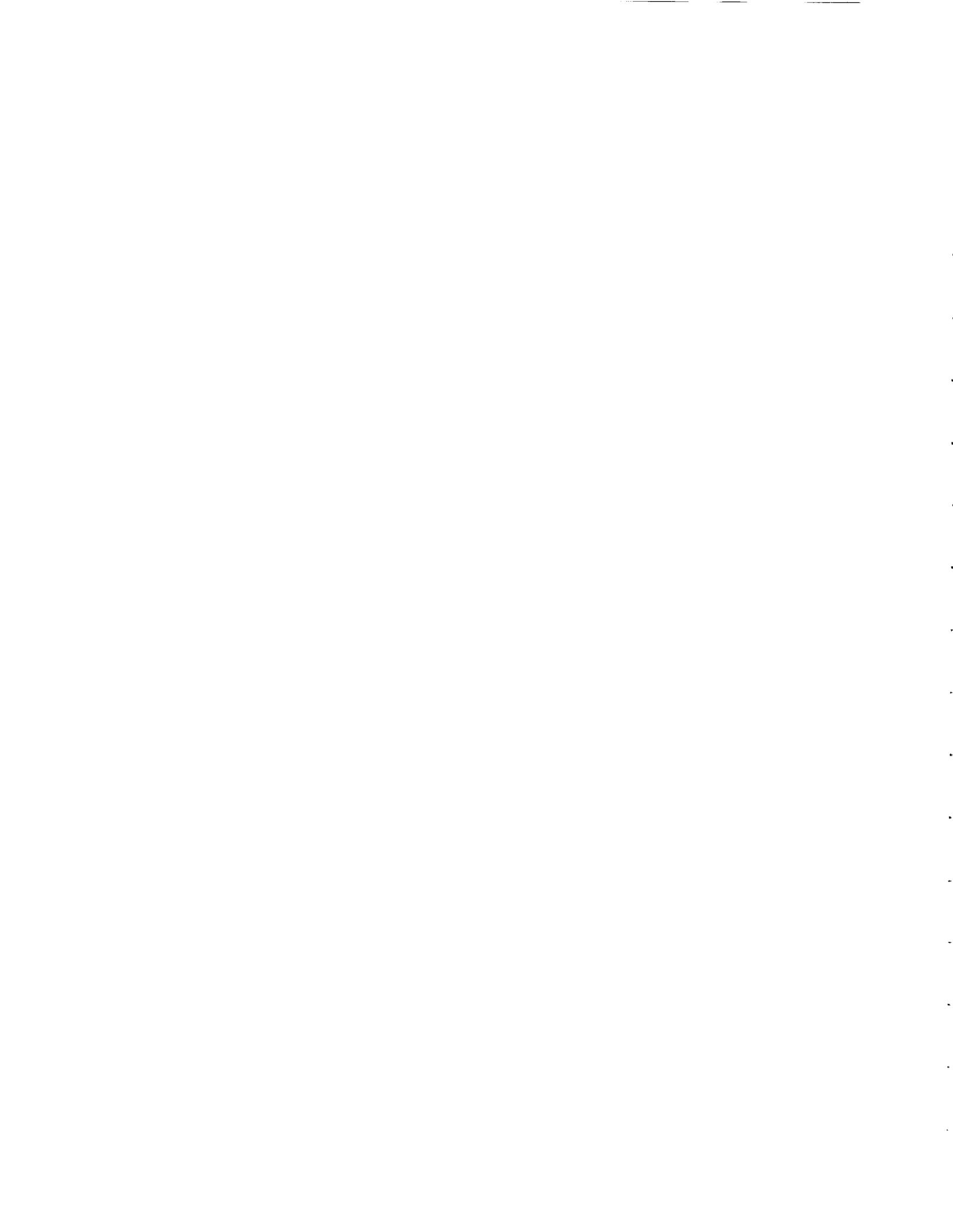
The author will deliberately avoid detailed description of professional rocket research organizations: GDL, MosGIRD and RNII. Although those organizations in many respects created a scientific foundation for the rocket technology in the USSR, their work is more or less known today in the West. They also worked in secrecy, thus having only a marginal impact on a public opinion. Instead, the author will concentrate on activities of the early spaceflight proponents who appealed directly to the public. Apart from the works of the spaceflight pioneer Konstantin Tsiolkovsky, the paper will provide short accounts on activities of lesser-known Soviet scientists and writers, such as: Yuri Kondratiuk, Friedreich Tsander, Yakov Perelman, Ari Schternfeld, Nikolay Rynin, Alexander Beliyaev and others. It will show how popular science and science fiction literature deeply influenced public awareness of a possibility of a spaceflight. The author will describe and demonstrate samples of such literature of the 1930s - 1950s. The paper also intend to analyze the origin and trends of how Soviet political leadership exploited spaceflight idea for political propaganda purposes. It will be shown in the paper, that such political exploitation did not start with a launch of Sputnik but goes back to the 1920s.

In author's opinion, the research subject of this proposed paper is new for the US public and historians alike. The paper will be based mostly on Russian original materials.

The author intends to illustrate his presentation by view-graphs with rare images of how Soviet scientists envisaged space activities before the launch of Sputnik.







Korolev, Sputnik, and The International Geophysical Year

Asif A. Siddiqi

From the point of historical inquiry, the institutional and political machinations behind the genesis of Sputnik have remained a largely ignored area of scholarship. Embellished by speculation and fueled by Soviet secrecy, the story behind Sputnik has assumed the form of a parable, cobbled together from rumors and mythology, and colored by an eagerness to fill in the blanks of what we did not know. Thus, while the post-mortem effects of Sputnik have been the subject of much scholarly debate, the origins and motivations that led to the launch of the first artificial satellite have remained, to a large degree, in the realm of conjecture. In recent years, with the dissolution of the Soviet state in 1991, mythology came into confrontation with reality. Declassified primary documents have provided a rich resource and incentive to look back again at an event which had such a profound impact on the course of events in the latter part of the twentieth century.

Conception

Sputnik would not have been possible without the combined contributions of two men who had consistently advocated a commitment for a space program to a reluctant Soviet government. Sergey Pavlovich Korolev, the younger of the two, had become absorbed in dreams of space exploration during his short tenure as a member and eventual leader of an amateur Soviet rocketry group in the early 1930s.¹ It was there that he befriended Mikhail Klavdiyevich Tikhonravov, another former glider pilot. Their paths diverged during World War II and in its aftermath they were working in different institutions, both contributing to the new long-range ballistic missile effort. Korolev had the auspicious title of 'Chief Designer,' by dint of his official title as head of the Department No. 3 of the Specialized Design Bureau at the Scientific Research Institute No. 88 ('NII-88' in its Russian abbreviation).² Stalin had established the NII-88 (pronounced 'nee-88') in 1946 to serve as the leading engineering organization in Soviet industry to develop long-range missiles.

During the following decade, Korolev's department, which eventually became an independent organization, the Experimental Design Bureau No. 1 (OKB-1), focused efforts on a series of ballistic missiles for the Soviet armed forces. Since the primary thematic thrust of Korolev's group was military missiles, there was negligible work on projects which had purely scientific utility. Dedicated wholly to the grand ideals of space exploration, Korolev did make a few spurious efforts to interest the leadership in artificial satellites in the late 1940s, but none of these ever proved to have any results until he combined his lobbying with Tikhonravov's independent work at the NII-4, an unrelated military institution dedicated to research on applications of ballistic missiles. After authoring several important R&D reports on the possibility of space launch vehicles and artificial satellites in the late 1940s and early 1950s, Tikhonravov emerged in 1954 with a detailed technical exposition entitled "Report on an Artificial Satellite of the Earth."³ It was at the same time, on 20 May 1954, that the Soviet government formally tasked Korolev's Design Bureau to develop the first Soviet intercontinental ballistic missile (ICBM), the R-7. Korolev did not waste time. Just six days later, he sent Tikhonravov's satellite report to the Soviet government with an attached cover letter stating:

I draw your attention to the memorandum of Comrade M. K. Tikhonravov,

1. For a detailed look at Korolev's scientific activities in the 1930s see G. S. Vetrov, *S. P. Korolev i kosmonavtika: pervye shagi* (Moscow: Nauka, 1994).

2. Yu. P. Semenov, ed., *Raketno-Kosmicheskaya Korporatsiya "Energiya" imeni S. P. Koroleva* (Korolev: RKK Energiya named after S. P. Korolev, 1996), 22.

3. For an English language summary of the details of Tikhonravov's research during the 1940s and early 1950s as well as the famous 1954 report itself, see Asif A. Siddiqi, "Before Sputnik: Early Satellite Studies in the Soviet Union, 1947-1957," forthcoming in two parts in *Spaceflight*, October and November 1997. Tikhonravov's document has been reproduced as M. Tikhonravov, "Report on an Artificial Satellite of the Earth" (in Russian) in B. V. Raushenbakh, ed., *Materialy po istorii kosmicheskogo korabl' 'vostok'* (Moscow: Nauka, 1991), 5-15.

"Report on an Artificial Satellite of the Earth," and also to the forwarded materials from the U.S.A. on work being carried out in this field. The current development of a new product [the R-7 ICBM] makes it possible for us to speak of the possibility of developing in the near future an artificial satellite...It seems to me that in the present time there is the opportunity...for carrying out the initial exploratory work on a satellite and more detailed work on complex problems involved with this goal. We await your decision.⁴

If Korolev's goal was to elicit a formal decree for his proposal, his appeal was not very successful. However, his request appears to have been passed on through various levels of the government and reached the office of missile and nuclear industry chief Vyacheslav A. Malyshev, officially the Minister of Medium Machine Building. Prompted by Korolev's persuasive arguments, Malyshev, along with three other top defense industry officials, submitted a proposal to Soviet leader Georgiy M. Malenkov asking permission to carry out "work on the scientific-theoretical questions associated with space flight."⁵ No doubt interested in the military applications of Tikhonravov's satellite, Malenkov approved the idea. Armed with a modicum of support, Korolev commenced a modest research project at his Design Bureau coordinated with Tikhonravov's own work at the NII-4. Incredibly, as this research was ongoing, the satellite issue remained divorced from further governmental involvement, as Korolev was diverted to more important matters relating to work on military missiles such as the R-7 ICBM. It was, however, the very first intervention by the Soviet government on an issue related to space exploration.

Korolev's satellite work may have continued at a leisurely pace through the mid-1950s with lukewarm governmental support were it not for some surprising and well-publicized events outside of the USSR. In the spring of 1950, a group of American scientists led by James van Allen met in Silver Springs, Maryland to discuss the possibility of an international scientific program to study the upper atmosphere and outer space via sounding rockets, balloons, and ground observations. Strong support from Western European scientists allowed the idea to expand into a worldwide program timed to coincide with a period of intense solar activity, 1 July 1957 to 31 December 1958. The participants named this period the International Geophysical Year (IGY) and created the *Comité speciale de l'année géophysique internationale* (the 'Special Committee for the International Geophysical Year' or 'CSAGI') to establish an agenda for the program. Soviet representatives, including Academy of Sciences Vice-President Academician Ivan P. Bardin, served on the Committee, but do not appear to have had any significant contribution to its proceedings. In fact, the May 1954 deadline for submissions for participation in the IGY passed without any word from Soviet authorities. At a subsequent meeting in Rome on 4 October 1954, Soviet scientists silently witnessed the approval of a historic U.S.-sponsored plan to orbit artificial satellites during the IGY.⁶ The satellite proposal clearly surprised the Soviet delegation, and perhaps had repercussions within the USSR Academy of Sciences. In the fall of 1954, the Academy established the Interdepartmental Commission for the Coordination and Control of Work in the Field of Organization and Accomplishment of Interplanetary Communications, a typically longwinded title which obscured its primary role, a forum for Soviet scientists to discuss space exploration in abstract terms, both in secret and in public.⁷

The existence of the Commission was announced on 16 April 1955 in an article in a Moscow evening newspaper; Academician Leonid I. Sedov, a relatively well-known gas dynamics expert was listed as the Chairman of the Commission.⁸ Unlike the title of the body, the primary duty of the Commission was stated with unusual

⁴ The text of this letter in a censored version has been published as S. P. Korolev, "On the Possibility of Work on an Artificial Satellite of the Earth" (in Russian), M. V. Keldysh, ed., *Tvorcheskoye naslediyе Akademika Sergeya Pavlovicha Koroleva: izbrannyye trudy i dokumenty* (Moscow: Nauka, 1980), 343.

⁵ Semenov, 1996, 86. The co-authors of the proposal were: B. L. Vannikov (First Deputy Minister of Medium Machine Building), M. V. Khrunichev (First Deputy Minister of Medium Machine Building), and K. N. Rudnev (Deputy Minister of Defense Industries). Of interest is the fact that Malyshev, Vannikov, and Khrunichev were all high officials in the nuclear weapons industry. Rudnev was the only one from the missile industry.

⁶ Edward Clinton Ezell and Linda Neumann Ezell, *The Partnership: A History of the Apollo-Soyuz Test Project* (Washington, D.C.: NASA SP-4209, 1978), 16; Nicholas Daniloff, *The Kremlin and the Cosmos* (New York: Alfred A. Knopf, 1972), 54.

⁷ A. Yu. Ishlinskiy, ed., *Akademik S. P. Korolev: ucheniy, inzhener, chelovek* (Moscow: Nauka, 1986), 453; Boris Kononov, "The Genealogy of Sputnik" (in Russian), in V. Shcherbakov, ed., *Zagadki zvezdnykh ostrovov* (Moscow: Molodaya gvardiya, 1989), 115.

⁸ "Commission on Interplanetary Communications" (in Russian), *Vechernaya moskva* (April 16, 1955), 1. An English translation of the announcement is included in F. J. Krieger, *Behind The Sputniks: A Survey of Soviet Space Science* (Washington, D.C.: Public Affairs Press, 1958), 328-330. The names of only four other members were announced at the time:

explicitness: "One of the immediate tasks of the Commission is to organize work concerning building an automatic laboratory for scientific research in space."⁹ In hindsight, it is clear that the Commission, a part of the Astronomy Council in the Academy, had very little input or influence over *de facto* decision-making in the Soviet space program, although one of its functions was to collect proposals from various scientists on possible scientific experiments which could be mounted on future satellites. Sedov himself played a major role as Chairman by appearing at numerous international conferences talking in very general terms on the future of space exploration. None of its members had any direct connection or contact with the missile and space program, although they were clearly aware of the broad nature of Korolev's work. The latter appears to have had little to do with the formation or work of the Commission. He evidently attended one meeting in 1954 to inquire about the group's work.¹⁰

While this Commission had little real authority, its Chairman Sedov may have played a crucial role in connecting Korolev's satellite efforts with the International Geophysical Year. The chain of events was set off on 29 July 1955 by U.S. President Dwight D. Eisenhower's Press Secretary James C. Hagerty who announced at the White House that the United States would launch "small Earth-circling satellites" as part of its participation in the IGY.¹¹ It was at this same time that the International Astronautical Federation was holding its Sixth International Astronautical Congress at Copenhagen, Denmark. Heading the Soviet delegation was Sedov and Kirill F. Ogorodnikov, the editor of a respected astronomy journal in the USSR. The two were called into action by an announcement on 2 August by Fred C. Durant III, the President of the Congress, who reported the Eisenhower Administration's intentions of launching a satellite during the IGY. Not to be outdone, Sedov convened a press conference the same day at the Soviet embassy in Copenhagen for about 50 journalists during which he announced that "In my opinion, it will be possible to launch an artificial Earth satellite within the next two years." He added that "The realization of the Soviet project can be expected in the near future."¹²

It is quite unlikely that Sedov was speaking on his own authority, and possibly had taken cues from highly-placed Party officials who were aware of the government's approval in August 1954 of exploratory research on space issues. Perhaps a Party or Academy of Sciences official back in Moscow had decreed that Durant's statement warranted a response from Sedov. Certainly, there had been much discussion on the possibility of Soviet satellites by that time, although no single project had received approval. What is known is that the two pronouncements, one by the Eisenhower Administration, and the one by Sedov, were the subject of relatively intense scrutiny by the press all over the world. This response appears to have been critical for Korolev.

By coincidence, it was on 16 July 1955 that Tikhonravov, along with OKB-1 engineer Ilya V. Lavrov as co-author, finished his latest study on artificial satellites.¹³ Based on work originating from the May 1954 document, the two suggested a reduced mass of 1,000-1,400 kilograms for an automated satellite. They also proposed the formation of a group of 70-80 people to carry out the task of designing and building the satellite and to work on future piloted spacecraft (Korolev wrote in the margins: "Too many, 30-35 people."). The Chief Designer, more attuned to the political reality of such a project, also added that "the creation of [a satellite] would have enormous political significance as evidence of the high development level of our country's technology."¹⁴ In a move symptomatic of Korolev's relentless perseverance of the space issue since the early 1950s, Korolev also had one of his sector chiefs at the OKB-1 prepare a technical report on the possibility of sending a probe to the Moon using modified versions of the R-7 ICBM.

V. A. Ambartsumyan, P. L. Kapitsa, B. V. Kukarin, and P. P. Parenago. A larger 27 member list was submitted to the International Astronautical Federation in October 1957.

⁹. "Commission on Interplanetary Communications," 1955.

¹⁰. Of the 27 Commission members listed in 1957, only two individuals, A. A. Blagonravov and D. Ye. Okhotsimskiy, were directly involved in the ballistic missile and space programs. The former headed the Commission for Upper Atmosphere Research of the Academy of Sciences which oversaw all scientific suborbital launches, while the latter was one of the leading mathematicians at the Department of Applied Mathematics of the V. A. Steklov Mathematics Institute of the Academy of Sciences (OPM MIAN) who was involved in the early design of the R-7 ICBM. See also Ishlinskiy, 1986, 453.

¹¹. Ezell and Ezell, 1978, 18.

¹². Robert W. Buchheim and the Staff of the Rand Corporation, *Space Handbook: Astronautics and its Applications* (New York: Random House, 1959), 277; "We'll Launch 1st Moon, and Bigger, Says Russ," *Los Angeles Examiner* (August 3, 1955); John Hillary, "Soviets Planning Early Satellite," *The New York Times* (August 3, 1955).

¹³. Ishlinskiy, 1986, 445; Yaroslav Golovanov, "The Beginning of the Space Era" (in Russian), *Pravda* (October 4, 1987), 3. Note that in Semenov, 1996, 86, it is stated that the report was authored only by Lavrov and it was completed on 16 June 1955, not 16 July 1955. Tikhonravov himself has, however, claimed they *both* authored the report.

¹⁴. Semenov, 1996, 87.

The activity on the space front reached its zenith on 30 August 1955 when Korolev attended two different meetings, one with the defense community, and one with the scientific community, to discuss the new satellite report. The former was at the offices of the powerful Military-Industrial Commission, the coordinating mechanism for management of the entire Soviet defense industry. Presiding over the meeting was the Commission's new Chairman Vasilii M. Ryabikov. Also in attendance were Academician Mstislav V. Keldysh, a noted scientist involved in research and development on several high profile military programs, and Col.-Engineer Aleksandr G. Mrykin, a senior artillery officer responsible for overseeing the procurement of new ballistic missiles for the Soviet armed forces.¹⁵ At the meeting Korolev spoke of both his satellites and lunar probes. Notorious for his legendary short temper and larger-than-life personality, Mrykin was not receptive to Korolev's old arguments of the possibly great political importance of a Soviet satellite. The artillery officer told Korolev in no uncertain terms that only when the R-7 had completed its flight testing would they consider a satellite. Fortunately for Korolev, he had Keldysh's support, and that may have tipped the scales. While details of the deliberations remain extremely sketchy, it appears that Ryabikov approved the use of an R-7 ICBM for a modest satellite program. Lunar probes were not considered. There were probably two factors working in Korolev's favor: the possible use of a satellite for military purposes; and the demonstration of Soviet science and technology during the IGY.

Armed with Ryabikov's approval, Korolev attended a second secret meeting the same day at the offices of the 'chief scholarly secretary' of the Academy of Sciences Gennadiy V. Topchiyev. Many other scientists and designers including Keldysh, Tikhonravov, and rocket engine specialist Valentin P. Glushko were present. Korolev reported to the distinguished assemblage that the Council of Chief Designers at a recent meeting had conducted a detailed examination on modifying the original R-7 into a vehicle capable of launching a satellite into orbit. No doubt, he also spoke of the government's interest on the matter. At the end of his speech he formally proposed to build and launch a series of satellites into space, including one with animals, and for the Academy to establish a formal commission to carry out this goal. The Chief Designer had a specific timetable in mind. He told his audience, "As for the booster rocket, we hope to begin the first launches in April-July 1957...before the start of the International Geophysical Year."¹⁶ If earlier, Korolev's satellite plans had been timed for the indefinite future, the Eisenhower Administration's announcement in July 1955 completely changed the direction of Korolev's attack. Not only did it imbue Korolev's satellite proposal with a new sense of urgency, but it also gave him a specific timetable to aim for. If the United States was planning to launch during the IGY, then the Soviets would launch one a few months *before* the beginning of the International Geophysical Year, guaranteeing a first place finish. The attending scientists at the meeting accepted the new proposal, and at Korolev's recommendation Keldysh was designated the Chairman of the commission. Korolev and Tikhonravov would serve as his deputies.

The following day, on 31 August, a smaller group, including Korolev, Tikhonravov, and Keldysh met to discuss some of the proposals for satellite instruments which many scientists had submitted to Sedov's Commission in the past year. A few days later Tikhonravov and Keldysh convened with some prominent Soviet scientific scholars to explain details of the satellite design and how their instruments were being considered. Korolev himself approved a preliminary scientific program in September 1955, a program which included the study of the ionosphere, cosmic rays, the Earth's magnetic fields, luminescence in the upper atmosphere, the Sun, and its influence on the Earth, and other natural phenomena. The detailed development of a scientific program was left in the hands of the two existing commissions of the Academy headed by Anatolii A. Blagonravov and Leonid I. Sedov.¹⁷

The approval by the Academy to conduct a purely scientific research program accelerated matters considerably. In the ensuing months, several important meetings were held, both by Keldysh's commission and by the Council of Chief Designers, which elaborated the details of the project. Between December 1955 and March 1956, Keldysh consulted a huge number of distinguished scholars to refine the scientific experiments package. They included numerous famous Soviet scientists, many of whose names were public knowledge unlike those who

¹⁵ Semenov, 1996, 87. Keldysh's official posts were: Director of the NII-1 and Chief of the OPM MIAN. Mrykin's official post was First Deputy Commander of the Directorate of the Chief of Reactive Armaments (UNRV). The UNRV was subordinate to the Chief Artillery Directorate (GAU) of the General Staff of the Ministry of Defense.

¹⁶ Ishlinskiy, 1986, 455; Yaroslav Golovanov, *Korolev: fakty i mify* (Moscow: Nauka, 1994), 523-524; Golovanov, 1987. Others present at this meeting were M. A. Lavrentiyev and G. A. Skuridin.

¹⁷ Ishlinskiy, 1986, 455-456; Christian Lardier, *L'Astronautique Soviétique* (Paris: Armand Colin, 1992), 107; Golovanov, 1987. Blagonravov's commission was at the time directing the scientific investigations on board suborbital rockets, while Sedov's commission had recently been established as a public forum for Soviet scientists to discuss space exploration.

were actually developing the spacecraft.¹⁸ It was a large-scale operation with a single coordinating mechanism which, because of its 'civilian' nature, had little precedent. Korolev himself was very conscious of the fact that an official decree on the project had yet to be issued, which meant that a rocket was still not officially available for the project. The magnitude of the immediate tasks, however, obscured that important issue for the time being. There were continuous problems with the program, especially since many who were cooperating did not share Korolev's enthusiasm for the project.

It took about four months for Ryabikov's spoken approval in August 1955 to translate into a formal decree of the Soviet government. As a purely scientific project managed by the Academy of Sciences, it was not considered a top priority. In fact, the Soviet government probably viewed the satellite project in much the same manner as they viewed the continuing series of scientific rocket flights into the upper atmosphere which also used military missiles for 'civilian' purposes. They were relatively inexpensive, unobtrusive, and ignored by the political leadership. Consequently, the USSR Council of Ministers issued a decree, number 149-88ss, on 30 January 1956, calling for the creation of an unoriented artificial satellite. The document approved the launch of a satellite, designated the 'Object D,' in 1957 in time for the International Geophysical Year. As per Tikhonravov's previous computations, the mass of the satellite was limited to 1,000 to 1,400 kilograms of which 200 to 300 kilograms would be scientific instruments. Apart from the Academy of Sciences, five industrial ministries would be involved in the project. The responsibility for preparing a Draft Plan for the Object D fell on the shoulders of Sergey S. Kryukov, at the time a Department Chief at the OKB-1. Tikhonravov served as the 'chief scientific consultant.'¹⁹ Korolev had his promise. It was now too late to turn back.

Labor

The Object D (or D-1) was so named since it would be the fifth type of payload to be carried on an R-7, Objects A, B, V, and G being designations for different nuclear warhead containers.²⁰ The satellite was a complex scientific laboratory, far more sophisticated than any other IGY proposal from the period. While Kryukov's engineers depended a great deal on Tikhonravov's early work on satellites, much of the actual design was a journey into uncharted territory for the OKB-1. There was little precedent for creating pressurized containers and instrumentation for work in Earth orbit, while long-range communications systems had to be designed without the benefit of prior experience. The engineers were aware of the trajectory tracking and support capabilities for the R-7 missile, and this provided a context for determining the levels of contact with the vehicle. The fact that the object would be out of contact with the ground for long periods of time (unlike sounding rockets) meant that new self-switching automated systems would have to be used. The selection of metals to construct the satellite also presented problems to the engineers, since the effects of continuous exposure to the space environment was still in the realm of conjecture. The experiments and experience from sounding rocket tests provided a database for the final selection.

Technical work on the vehicle officially began on 25 February 1956 with actual construction beginning on 5 March. Tikhonravov's group at the NII-4 and Korolev's Design Bureau at the NII-88 were the two most active participants in this process, but numerous other organizations provided various elements of the complete satellite. By 14 June, Korolev finalized the necessary changes to the basic version of the R-7 ICBM in order to use it for a satellite launch. The new booster would incorporate a number of major changes including the use of uprated main engines, deletion of the central radio package on the booster, and a new payload fairing replacing the old one used for a nuclear warhead.²¹ A month later, on 24 July 1956, Korolev formally approved the initial Draft Plan for the

¹⁸. These included: atmospheric specialists V. I. Krasovskiy, L. V. Kurnosovaya, and S. N. Vernov, the young mathematicians from the OPM MIAN T. M. Eneyev, M. L. Lidov, D. Ye. Okhotsimskiy, and V. A. Yegorov, solar battery expert N. S. Lidorenko, and the more famous Academicians L. A. Artsimovich, V. L. Ginsburg, A. F. Ioffe, P. L. Kapitsa, B. P. Konstantinov, and V. A. Kotelnikov. See Ishlinskiy, 446, 456; Golovanov, 1987.

¹⁹. Keldysh, 1980, 362; Ishlinskiy, 1986, 445; Konovalov, 1989, 116-117; Golovanov, 1994, 529; Semenov, 1996, 87. B. Konovalov, "Dash to the Stars" (in Russian), *Izvestiya* (October 1, 1987), 3. The five industrial ministries were: the Ministry of Defense Industries, the Ministry of Radiotechnical Industry, the Ministry of Ship Building Industry, the Ministry of Machine Building, and the Ministry of Defense.

²⁰. Raushenbakh, 1991, 209. A, B, V, G, and D are the first five letters of the Russian cyrillic alphabet.

²¹. Ishlinskiy, 1986, 446; Golovanov, 1994, 530; Timothy Varfolomeyev, "Soviet Rocketry that Conquered Space: Part 1: From First ICBM to Sputnik Launcher," *Spaceflight* (August 1995), 260-263.

Object D. The document was co-signed by his senior associates Tikhonravov, Konstantin D. Bushuyev, Sergey O. Okhupkin, and Leonid A. Voskresenskiy.²²

By mid-1956 the Object D project was beginning to fall significantly behind schedule. Some subcontractors were particularly lackadaisical in their assignments, and parts were often delivered which did not fit the original specifications. On 14 September, Keldysh made a personal plea at a meeting of the Academy of Sciences Presidium for speeding up work, invoking a threat all would understand: "we all want our satellite to fly earlier than the Americans."²³ Events in the satellite program took an abrupt turn in the waning months of 1956. Actual test models of the Object D, expected to be ready by October, remained unfinished. By the end of November, Korolev began to suffer from great anxiety, no doubt compounded by his extraordinarily busy plans, traveling from Kaliningrad to Kapustin Yar to Tyura-Tam to Molotovsk and back several times to oversee various projects.²⁴ Part of this anxiety was due to serious concerns that his project would be suddenly preempted with a satellite launch from the United States. He had been informed of a September 1956 launch of a missile from Patrick Air Force Base at Cape Canaveral, Florida which, according to his erroneous information, was a failed attempt to launch a satellite into orbit.²⁵ A second concern were the results of static testing of the R-7 engines on the ground. Instead of the projected specific impulse of 309-310 seconds, the R-7 engines would not produce more than 304 seconds, too low for the heavy Object D satellite. He realized that perhaps he was making this effort too complicated. Why not attempt to launch something simpler on the first orbital attempt instead of a sophisticated one-and-a-half-ton scientific observatory?

At the end of November Tikhonravov was perceptive enough to detect Korolev's anxiety and verbalized it: "What if we make the satellite a little lighter? Thirty kilograms or so, or even lighter?"²⁶ Keldysh was at first opposed to the idea, but eventually ceded to the strong-willed Korolev. This time Korolev would not depend on dozens of other subcontractors: he made sure that the smaller satellite would be designed and manufactured completely in his own Design Bureau with the help of only two outside organizations: the Scientific Research Institute of Current Sources under Nikolay S. Lidorenko for the design of the on board batteries, and the NII-885 under Chief Designer Mikhail S. Ryazanskiy for the radio-transmitters. On 5 January 1957, Korolev sent off a letter to the government which described his revised plan. He asked that permission be given to launch two small satellites, each with masses of 40-50 kilograms, in the period April-June 1957 immediately *prior* to the beginning of the IGY. This plan would be contingent upon the timetable for the R-7 program which Korolev admitted was behind schedule; the first launch of the missile was set for March 1957 at the earliest. Each satellite would orbit the Earth at altitudes of 225 X 500 kilometers and contain a simple shortwave transmitter with a power source sufficient for 10 days operation. Korolev did not obscure the reasons for the abrupt change in plans:

...the United States is conducting very intensive plans for launching an artificial Earth satellite. The most well-known project under the name "Vanguard" uses a three-stage missile...the satellite proposed is a spherical container of 50 centimeters diameter and a mass of approximately 10 kilograms. In September 1956, the U.S.A. attempted to launch a three-stage missile with a satellite from Patrick Base [sic] in the state of Florida which was kept secret. The Americans failed to launch the satellite...and the payload flew about 3,000 miles or approximately 4,800 kilometers. This flight was then publicized in the press as a national record. They emphasized that U.S. rockets can fly higher and farther than all the rockets in the world, including Soviet rockets. From separate printed reports, it is known that the U.S.A. is preparing in the nearest months a new attempt to launch an artificial Earth satellite and

²² Golovanov, 1994, 530; Lardier, 1992, 107. Tikhonravov was officially an employee of the NII-4 but was temporarily working as the Chief Consultant to the NII-88 OKB-1.

²³ An edited version of Keldysh's speech has been published as M. V. Keldysh, "On Artificial Satellites of the Earth" (in Russian), V. S. Avduyevskiy and T. M. Eneyev, eds. *M. V. Keldysh: izbrannyye trudy: raketnaya tekhnika i kosmonavtika* (Moscow: Nauka, 1988), 235-240; See also Golovanov, 1994, 530.

²⁴ Kaliningrad was the location of the OKB-1, while sea trials of the R-11FM were carried out near Molotovsk. Kapustin Yar and Tyura-Tam were the two missile launch ranges.

²⁵ This was a Jupiter C missile (no. RTV-1) which flew a distance of 5,300 kilometers on 20 September 1956 during a re-entry test. A live third stage could have put a small payload into orbit, but this was not the intended goal.

²⁶ Golovanov, 1987; Golovanov, 1994, 532.

is willing to pay any price to achieve this priority.²⁷

While Korolev's information on U.S. plans may have been in error, his instincts were not that far off. The United States could have launched a satellite by early 1957, but various institutional and political obstacles precluded such an attempt.

By 25 January 1957, the Chief Designer approved the initial design details of the satellite, now officially designated Simple Satellite No. 1 (PS-1).²⁸ Although there was some token resistance to Korolev's revised plan, primarily from Keldysh, his letter appeared to have adequately invoked the specter of U.S. eminence in the field of military technology. On 15 February, the USSR Council of Ministers formally signed a decree (no. 171-83ss) entitled "On Measures to Carry Out in the International Geophysical Year," approving the new proposal.²⁹ The two new satellites, PS-1 and PS-2, would weigh approximately 100 kilograms and be launched in April-May 1957 after one or two fully successful R-7 launches. Eisenhower's plan to launch an American satellite during IGY was *the* deciding factor on a launch date. The Object D launch, meanwhile was pushed back to April 1958. Focused on a more modest objective, Korolev wasted little time. He quickly sent out technical specifications for the initial satellite PS-1 to the two subcontractors. By this time there was an impressive sight at the Tyura-Tam launch base in Soviet Central Asia: the first flight article of the magnificent R-7 was on the launch pad.

The first three launches of the R-7 ICBM in May-July 1957 were all failures, completely disrupting Korolev's schedule to launch a satellite before the beginning of the IGY. The days following the last failure were the lowest point for Korolev and his associates. Suddenly everything they had labored for over three years had been put into doubt. There was severe criticism from higher officials and even talk of curtailing the entire program. For Korolev, the headaches were compounded by the cumulative delays of his Simple Satellite project. It was now a month *into* the IGY and the R-7 itself had not flown a successful mission. His dreams, his position, his status were all in jeopardy, and this began to affect his temperament. In mid-June he had written to his wife from the launch site, "Things are not going very well again," adding with a note of optimism, "...right here and now, we must strive for the solution we need!" By July things began to deteriorate. On the 8th he wrote "We are working very hard," but after the second launch failure, he wrote on the 23rd "Things are very, very bad."³⁰ Korolev's biographer wrote in 1987, "In all the postwar years, no days were more painful, difficult, or tense for Sergey Pavlovich Korolev than those of that hot summer of 1957."³¹

Apart from competition from the United States, Korolev had to unexpectedly deal with a different kind of threat at the time, one from within the USSR in the person of Chief Designer Mikhail K. Yangel of the Experimental Design Bureau No. 586 (OKB-586). In the first quarter of 1957, Yangel's Design Bureau at Dnepropetrovsk in Ukraine, on orders from ministerial boss Dmitriy F. Ustinov, had begun to explore the possibility of modifying their R-12 intermediate range ballistic missile into a satellite launch vehicle.³² The missile itself, fueled by storable hypergolic propellants unlike the R-7, was the subject of a five year long development program, at first under Korolev's tutelage, but later transferred to Dnepropetrovsk. Prodded by the unending delays in the R-7 program, Yangel evaluated "the possibility of the *immediate* launch of a similar satellite [as Korolev's] using the simplest of booster rockets based on the strategic R-12 missile."³³ Although analysis proved that a hastily modified two-stage R-12 could be used for this goal, it did not seem likely that a first launch could be carried out prior to either the R-7 or the Americans. To Korolev's relief, the plan was shelved.

Back at the launch range of Tyura-Tam, the fourth R-7 launch on 21 August 1957 was successful. The missile and its payload flew 6,500 kilometers, the warhead finally entering the atmosphere over the target point at Kamchatka. Korolev was so subsumed by euphoria that he stayed awake until three in the morning speaking to his

27. The complete text of Korolev's letter is reproduced as S. P. Korolev, "Proposal on the First Launch of an Artificial Satellite of the Earth Before the Start of the International Geophysical Year" (in Russian) in Keldysh, 1980, 369-370.

28. Ishlinskiy, 1986, 447.

29. Semenov, 1996, 88, 632.

30. Golovanov, 1987.

31. Golovanov, 1987.

32. V. Pappo-Korystin, V. Platonov, and V. Pashchenko, *Dneprovskiy raketno-kosmicheskii tsentr* (Dnepropetrovsk: PO YuMZ/KBYu, 1994), 60; S. N. Konyukhov and V. A. Pashchenko, "History of Space Launch Vehicles Development," presented at the 46th International Astronautical Congress, October 2-6, 1995, Oslo, Norway, IAA-95-IAA 2.2.09. The range of the missile was about 2,000 kilometers.

33. Yu. Biryukov, "From the History of Space Science: The Price of Decision—First Place (The First Satellites)" (in Russian), *Aviatsiya i kosmonavtika* (October 1991), no. 10: 37-39. Author's emphasis.

deputies and aides about the great possibilities that had opened up, the future, and mostly about his artificial satellite.³⁴ It was extremely unusual for the Soviets to publicize successes in any military field, so it was all the more odd when six days after the R-7 launch, the official news agency TASS released a brief communiqué:

A few days ago a super-long-range, intercontinental multistage ballistic missile was launched. The tests of the missile were successful; they fully confirmed the correctness of the calculations and the selected design. The flight of the missile took place at a very great, hitherto unattained, altitude. Covering an enormous distance in a short time, the missile hit the assigned region. The results obtained show that there is the possibility of launching missiles into any region of the terrestrial globe. The solution of the problem of creating intercontinental ballistic missiles will make it possible to reach remote regions without resorting to strategic aviation, which at the present time is vulnerable to modern means of antiaircraft defense.³⁵

Clearly it did not have the intended effect on the U.S. public or media, since for the most part, little attention was given it. Those that did pay lip service to the announcement spoke only to dismiss the claim, a stance justified partly by the black hole of information on Soviet ballistic missiles. It would take 38 more days before the entire world would take notice that a new age had arrived, heralded by that same intercontinental ballistic missile.

Birth

Work on the 'simple satellite' PS-1 had continued at an uneven pace since development of the object began in January 1957. Between March and August, engineers carried out computations to select and refine the trajectory of the launch vehicle and the satellite during launch. These enormously complicated computations for the R-7 program were initially done by hand using electrical arithrometers and six-digit trigonometric tables. When more complex calculations were required, engineers at the OKB-1 were offered the use of a 'real' computer recently installed at the premises of the Academy of Sciences at Keldysh's request. The gigantic machine filled up a huge room at the department and may have been the fastest computer in the USSR in the late 1950s: it could perform ten thousand operations per second, a high-end capability for Soviet computing machines of the time.³⁶

There were many debates on the shape of the first satellite, with most senior OKB-1 designers preferring a conical form since it fit well with the nose cone of the rocket. At a meeting early in the year, Korolev had a change-of-heart and suggested a metal sphere at least one meter in diameter.³⁷ There were six major guidelines followed in the construction of PS-1:

- the satellite would have to be of maximum simplicity and reliability while keeping in mind that methods used for the spacecraft would be used in future projects;
- the body of the satellite was to be spherical in order to determine atmospheric density in its path;
- the satellite was to be equipped with radio equipment working on at least two wavelengths of sufficient power to be tracked by amateurs and to obtain data on the propagation of radio waves through the atmosphere;
- the antennae were to be designed so as to not affect the intensity of the radio signals due to spinning;
- the power sources were to be onboard batteries ensuring work for two to three weeks; and
- the attachment of the satellite to the core stage would be such that there would be no failure to separate.

The five primary scientific objectives of the mission were:

- to test the method of placing an artificial satellite into Earth orbit;

³⁴ Golovanov, 1987; Golovanov, 1994, 514; Council of Veterans of the Baykonur Cosmodrome, *Proryv v kosmos: ocherki ob ispitatelyakh spetsialistakh i stroitelyakh kosmodroma Baykonur* (Moscow: TOO Veles, 1994), 25, 174

³⁵ "Report on Intercontinental Ballistic Missile" (in Russian), *Pravda* (August 27, 1957). A complete English translation of the press release is included in Krieger, 1958, 233-234.

³⁶ Ishlinskiy, 1986, 447; V. Lysenko, ed., *Three Paces Beyond the Horizon* (Moscow: Mir Publishers, 1989), 58.

³⁷ I. Minyuk and G. Vetrov, "Fantasy and Reality" (in Russian), *Aviatsiya i kosmonavtika* (September 1987), no. 9: 46-47.

- to provide information on the density of the atmosphere by calculating its lifetime in orbit;
- to test radio and optical methods of orbital tracking;
- to determine the effects of radio wave propagation through the atmosphere; and
- to check principles of pressurization used on the satellite.³⁸

The satellite as it eventually emerged was a pressurized sphere, 58 centimeters in diameter made of an aluminum alloy. The sphere was constructed by combining two hemispherical casings together. The pressurized internal volume of the sphere was filled with nitrogen at 1.3 atmospheres which maintained an electro-chemical source of power (three silver-zinc batteries), two D-200 radio-transmitters, a DTK-34 thermo-regulation system, a ventilation system, a communications system, temperature and pressure transmitters, and associated wiring. The two radio transmitters operated at frequencies of 20.005 and 40.002 megacycles at wavelengths of 1.5 and 7.5 meters. The signals on both the frequencies were spurts lasting 0.2 to 0.6 seconds, providing the famous 'beep-beep' sound to the transmissions. The antennae system comprised four rods, two with a length of 2.4 meters each and the remaining two with a length of 2.9 meters each. Tests of this radio system were completed as early as 5 May 1957 using a helicopter and a ground station.³⁹ The total mass of the satellite was 83.6 kilograms of which 51.0 kilograms was simply the power source. The lead designer for PS-1 was Mikhail S. Khomyakov. Oleg G. Ivanovskiy was his deputy.⁴⁰

Korolev, of course, kept close tabs on the development of PS-1 and continuously saw to it that the spherical satellite was kept spotlessly clean and shiny not only for its reflective qualities, but perhaps also for its overall aesthetic beauty. On one occasion he flew into a rage at a junior assembly shop worker for doing a poor job on the outer surface of a *mockup* of the satellite. "This ball will be exhibited in museums!", he shouted.⁴¹ An aide from Moscow telephoned Korolev at Tyura-Tam on 24 June to inform him that he had just signed the document specifying the final configuration of the satellite. The launch vehicle earmarked for the satellite was a slightly updated version of the basic R-7 ICBM variant. The modifications included: the omission of a 300 kilogram radio-package from the top of the core booster; the changing of burn times of the main engines; the removal of a vibration measurement system; the use of a special nozzle system to separate the booster from the satellite installed at the top of the core stage; and the installation of a completely new payload shroud and container replacing the warhead configuration.⁴² The length of the booster with the new shroud was 29.167 meters, almost four meters shorter than the ICBM version.

The Council of Ministers had formally approved the simple satellite program in February 1957. With one R-7 success under his belt, Korolev now needed final permission from the State Commission to proceed with an orbital launch after a second successful launch. Despite the *official governmental sanction*, this process appears to have been fraught with difficulty, suggesting that even at this late stage, there were individuals on the Commission who were not interested in the satellite attempt. At a State Commission meeting soon after the August launch, Korolev formally asked for permission to launch a satellite if a second R-7 successfully flew in early September. Convincing the Commission proved to be much harder than expected and the meeting ended in fierce arguments and recriminations. Not easily turned away, Korolev tried again at a second session soon after, this time using a political ploy: "I propose let us put the question of national priority in launching the world's first artificial Earth satellite to the Presidium of the Central Committee of the Communist Party. Let them settle it."⁴³ It worked. None of the members wanted to take the blame for a potential miscalculation, and Korolev got what he wanted. A final document for launch, "The Program for Carrying Out a Test Launch of a Simple Unoriented ISZ (the Object PS) Using the Product 8K71PS," was later signed by:

- Vasiliy F. Ryabikov (Military-Industrial Commission);
- Mitrofan I. Nedelin (Ministry of Defense);

³⁸ M. K. Tikhonravov, "The Creation of the First Artificial Earth Satellite: Some Historical Details," *Journal of the British Interplanetary Society* (May 1994), V. 47, no. 5: 191-194.

³⁹ Tikhonravov, 1995; G. A. Kustova, *Ot pervogo Sputnika do "Energii" - "Burana" i "Mir"* (Kaliningrad: RKK Energiya, 1994), 37; Jacques Villain, ed., *Baïkonour: la porte des étoiles* (Paris: Armand Colin, 1994), 26; Golovanov, 1994, 537.

⁴⁰ O. G. Ivanovskiy, *Naperekor zemnomy prityazheniyu* (Moscow: Politicheskoy literatury, 1988), 167-169.

⁴¹ Mikhail Florianskiy, "October 4 – For the First Time in the World," *Moscow News Supplement* (1987), no. 40.

⁴² Varfolomeyev, 1995; Keldysh, 1980, 365; Yu. A. Mozzhorin et al., eds., *Nachalo kosmicheskoy ery: vospominaniya veteranov raketno-kosmicheskoy tekhniki i kosmonavtiki: vypusk vtoroy* (Moscow: RNTSKD, 1994), 60-61.

⁴³ Council of Veterans of the Baykonur Cosmodrome, 1994, 29-30.

- Dmitriy F. Ustinov (Ministry of Defense Industries);
- Valeriy D. Kalmykov (Ministry of Radio-Technical Industry); and
- Aleksandr N. Nesmeyanov (Academy of Sciences).⁴⁴

The subsequent launch of the R-7 on 7 September was as successful as the one in August, and the R-7 ICBM flew across the Soviet Union before depositing its dummy warhead over the Kamchatka peninsula.⁴⁵ In the summer, Korolev and the other Chief Designers began to informally target the satellite launch for the one hundredth anniversary of spaceflight visionary Tsiolkovskiy's birth on 17 September, but achieving this date proved increasingly unrealistic. Instead of being at Tyura-Tam for a space launch on that day, Korolev and R-7 rocket engine designer Glushko were both in attendance at the Pillard Hall of the Palace of Unions in Moscow for a special celebration of the great visionary's birthday. In a long speech to the distinguished audience, Korolev, whose real job was not revealed, prophesized that, "in the nearest future the first test launches of artificial satellites of the Earth with scientific goals will take place in the USSR and the USA."⁴⁶ The audience had little idea of the accuracy of the prediction.

On 20 September Korolev was at Moscow for a meeting of the State Commission for the PS-1 launch.⁴⁷ Chairman Ryabikov, Korolev, Keldysh, and Marshall Nedelin were the principle participants and established 6 October as the target date of the launch based on the pace of preparations. At the same meeting, the Commission decided to publicly announce the launch of PS-1 only after completion of the first orbit. A communiqué to this effect was written up by Ryabikov himself on 23 September.⁴⁸ The frequencies for tracking by amateurs had already been announced earlier in the year in the issues of the journal *Radio* although details of the program had obviously been omitted. Korolev himself flew into Tyura-Tam on 29 September staying in a small house close to the primary activity area near site two.

The preparations for launching were for the most part uneventful save for the last minute replacement of one of the batteries on the flight version of PS-1. Still apprehensive over a last minute U.S. launch, Korolev abruptly proposed to the State Commission that the launch be brought forward two days. His concerns were apparently prompted by plans for a conference in Washington, D.C. in early October as part of IGY proceedings. On the 6th, the day of PS-1's scheduled launch, a paper entitled "Satellite Over the Planet" was to be presented by the American delegation. He believed that the presentation was to be timed to coincide with a hitherto unannounced launch of a U.S. satellite.⁴⁹ Local KGB representatives assured Korolev that this was not so, but Korolev was convinced that a launch of Army Jupiter C might be attempted. In the end, the schedule for PS-1's

⁴⁴ Semenov, 1996, 90. 'ISZ' is the Russian abbreviation for Artificial Satellite of the Earth. The 8K71PS was the industrial designation for the modified version of the R-7 used for the satellite launch.

⁴⁵ Yu. V. Biryukov, "Materials from the Biographical Chronicles of Sergey Pavlovich Korolev" (in Russian), in B. V. Raushenbakh, ed., *Iz istorii sovetskoy kosmonavtiki* (Moscow: Nauka, 1983), 238; Lardier, 1992, 93; Golovanov, 1994, 517. Soviet leader Khrushchev is said to have been present at this launch, but this is unconfirmed by Soviet or Russian sources.

⁴⁶ S. P. Korolev, "On the Practical Significance of K. E. Tsiolkovskiy's Proposals in the Field of Rocket Technology" (in Russian), in B. V. Raushenbakh, ed., *Issledovaniya po istorii i teorii razvitiya aviatsionnoy i raketno-kosmicheskoy nauki i tekhniki* (Moscow: Nauka, 1981), 40. This is a complete version of his speech. An abridged English translation has been reproduced in Institute of the History of Natural Sciences and Technology, *History of the USSR: New Research. 5: Yuri Gagarin: To Mark the 25th Anniversary of the First Manned Space Flight* (Moscow: Social Sciences Today, 1986), 48-63. Note that the latter does not include the above quote.

⁴⁷ The State Commission for the Launch of the Object PS-1 comprised the following members: Chairman V. M. Ryabikov (Chairman of the VPK); V. P. Barmin (Chief Designer of GKSB SpetsMash); I. T. Bulychev (Deputy Chief of Military Communications of the Ministry of Defense' General Staff); V. P. Glushko (Chief Designer of OKB-456); S. P. Korolev (Chief Designer of OKB-1); V. I. Kuznetsov (Chief Designer of NII-944); A. A. Maksimov (from the UNRV); A. G. Mrykin (First Deputy Chief of the UNRV); M. I. Nedelin (Deputy Minister of Defense for Reactive Armaments); A. I. Nesterenko (Commander of the NIIP-5); G. N. Pashkov (Deputy Chairman of the VPK); N. A. Pilyugin (Chief Designer of NII-885); M. S. Ryazanskiy (Chief Designer and Director of NII-885); S. P. Shishkin (Chief Designer at Arzamas-16). Others involved were: A. F. Bogolomov (Chief Designer of the OKB-MEI); M. V. Keldysh (Director of NII-1 and Chief of the OPM MIAN); I. T. Peresyupkin (Minister of Communications); K. N. Rudnev (Deputy Minister of Defense Industries); G. R. Udarov (Deputy Chairman of the State Committee for Defense Technology); and S. M. Vladimirovskiy (Deputy Chairman of the State Committee for Radio Electronics). See Yu. A. Skopinskiy, "State Acceptance of the Space Program: Thirty Years of Work" (in Russian), *Zemlya i vseleennaya* (September-October 1988), 73-79; Lardier, 1992, 285.

⁴⁸ Ishlinskiy, 1986, 447; Lardier, 108-109; Kononov, 1989, 122-123.

⁴⁹ Golovanov, 1994, 537-538.

launch was moved forward two days to the 4th; Korolev signed the final order for launch at four in the afternoon on the 2nd and sent it to Moscow for approval.⁵⁰

The R-7 was transported and installed on the launch pad in the early morning of 3 October escorted on foot by Korolev, Ryabikov, and other members of the State Commission. Fueling began early the following morning at 0545 hours local time.⁵¹ Korolev, under a great amount of pressure, remained cautious throughout the proceedings. He told his engineers, "Nobody will hurry us. If you have even the tiniest doubt, we will stop the testing and make the corrections on the satellite. There is still time..."⁵² Most of the engineers, understandably enough, did not have time to ponder over the historical value or importance of the upcoming event. PS-1's deputy designer Ivanovskiy recalled "...Nobody back then was thinking about the magnitude of what was going on: everyone did his own job, living through its disappointments and joys."⁵³

On the night of the 4th, huge flood lights illuminated the launchpad as the engineers in their blockhouse checked off all the systems. In the command bunker accompanying Korolev were some of the senior members of the State Commission. All launch operations for Sputnik were handled by two men, a civilian and a military officer. Representing the civilians was Korolev's deputy Leonid A. Voskresenskiy, one of the most colorful characters in the history of the Soviet space program. A daredevil motorcyclist with a legendary penchant for taking risks, he had been with the program since the early days in 1945 when the Soviets had scoured Germany for the remains of the A-4 missile. Lt.-Col. Aleksandr I. Nosov represented the military. Both men were 44 years old at the time. The actual command for launch was entrusted to the hands of Boris S. Chekunov, a young artillery forces lieutenant. He later recalled the final moments as the clock ticked past midnight local time: "When only a few minutes remained until lift-off, Korolev nodded to his deputy Voskresenskiy. The operators froze, awaiting the final order. Nosov, the chief of the launch control team, stood at the periscope. He could see the whole pad. 'One minute to go!,' he called."⁵⁴ Another senior engineer in the bunker recalled:

With the exception of the operators, everybody was standing. Only N. A. Pilyugin and S. P. Korolev were allowed to sit down. The launch director [Nosov] began issuing commands. I kept an eye on S. P. Korolev. He seemed nervous although he tried to conceal it. He was carefully examining the readings of the various instruments without missing any nuance of our body language and tone of voice. If anybody raised their voice or showed signs of nervousness, Korolev was instantly on the alert to see what was going on.⁵⁵

The seconds counted down to zero and Nosov shouted the command for lift-off. Chekunov immediately pressed the lift-off button. At exactly 2228 hours 34 seconds Moscow Time on 4 October, the engines ignited and the 272,830 kilogram booster lifted off the pad in a blaze of light and smoke. The five engines of the R-7 generated about 398 tons of thrust at launch. Although the rocket lifted off gracefully, there were problems. Delays in the firing of several engines almost resulted in a launch abort. Additionally, at T+16 seconds, the System for the Simultaneous Emptying of the Tanks (SOBIS) failed, which resulted in higher than normal kerosene consumption. A turbine failure due to this resulted in main engine cut-off one second prior to the planned moment.⁵⁶ Separation from the core stage, however, occurred successfully at T+324.5 seconds, and the 83.6 kilogram PS-1 successfully flew into a free-fall elliptical trajectory. The first human-made object entered orbit around the Earth inaugurating a new era in exploration.

With most State Commission members still in the bunker, engineers at Tyura-Tam awaited confirmation of orbit insertion from the satellite in a van set up about 800 meters from the launch pad. As a huge crowd waited outside the van, radio operator Vyecheslav I. Lappo from the NII-885, who had personally designed the onboard transmitters, sat expectantly for the first signal. The Kamchatka station picked up signals from the satellite and there was cheering but Korolev cut everybody off: "Hold off on the celebrations. The station people could be

⁵⁰. This document was not actually signed until the morning of the launch. See Ishlinskiy, 1986, 448.

⁵¹. Mozzhorin, 1994, 63.

⁵². Golovanov, 1987.

⁵³. Golovanov, 1987.

⁵⁴. Ivan Borisenko and Alexander Romanov, *Where All Roads Lead to Space Begin* (Moscow: Progress Publishers, 1982), 66.

⁵⁵. Mozzhorin, 1994, 63. The author of this quote is (at the time) OKB-1 engineer Ye. V. Shabarov.

⁵⁶. Ishlinskiy, 1986, 448, 464; B. Ye. Chertok, *Rakety i lyudi: Fili Podliptki Tyuratam* (Moscow: Mashinostroyeniye, 1996), 197.

mistaken. Let's judge the signals for ourselves when the satellite comes back after its first orbit around the Earth."⁵⁷ Eventually the distinct 'beep-beep-beep' of the craft came in clearly over the radio waves and the crowd began to celebrate. Chief Designer Ryazanskiy who was at the van immediately telephoned Korolev in the bunker. The ballistics experts at the Coordination-Computation Center in Moscow had determined that the satellite was in an orbit with a perigee of 228 kilometers and an apogee of 947 kilometers, the latter about 80 kilometers lower than planned due to the early engine cut-off. Inclination of the orbit to the Earth's equator was 65.6 degrees while orbital period was 96.17 minutes.⁵⁸ Experts at the Moscow Center also ascertained that the satellite was slowly losing altitude, but State Commission Chairman Ryabikov waited until the second orbit was over prior to telephoning Soviet leader Nikita S. Khrushchev.

Khrushchev's reaction to the launch was unusually subdued for an event of such magnitude and perhaps indicates that he, like many others, had not grasped the true propaganda effect of such a historic occurrence. He later related:

When the satellite was launched, they phoned me that the rocket had taken the right course and that the satellite was already revolving around the earth. I congratulated the entire group of engineers and technicians on this outstanding achievement and calmly went to bed.⁵⁹

The official Soviet news agency TASS released the communiqué Ryabikov had authored on the morning of 5 October. Published in the morning edition of *Pravda*, it was exceptionally low-key and was not the headline of the day:

For several years scientific research and experimental design work have been conducted in the Soviet Union on the creation of artificial satellites. As has already been reported in the press, the first launching of the satellites in the USSR were planned for realization in accordance with the scientific research program of the International Geophysical Year. As a result of very intensive work by scientific research institutes and design bureaus the first artificial satellite in the world has been created. On October 4, 1957, this first satellite was successfully launched in the USSR. According to preliminary data, the carrier rocket has imparted to the satellite the required orbital velocity of about 8,000 meters per second. At the present time the satellite is describing elliptical trajectories around the Earth, and its flight can be observed in the rays of the rising and setting Sun with the aid of very simple optical instruments (binoculars, telescopes, etc.).⁶⁰

The Soviet media did not ascribe a specific name for the satellite, generally referring to it as 'Sputnik,' the Russian word for 'satellite,' often also loosely translated as 'fellow traveler.'

As the media tumult over Sputnik began to mount in the West, the Soviet leadership began to capitalize on the utter pandemonium pervading the discourse on the satellite in the United States. On 9 October, *Pravda* published a long report anonymously authored by Korolev and other designers detailing the construction and design of the satellite.⁶¹ The parties responsible for this great deed were, of course, not named. Having been involved in the defense industry, the real job titles of the members of the Council of Chief Designers had always remained secret, although Tikhonravov and others had freely published under their own names through the 1950s on topics of general interest. This suddenly changed as their names disappeared from official histories. Beginning with the launch of Sputnik, of the four major contributors to the success of Sputnik, Korolev, Glushko, and Keldysh were referred in the open press as the Chief Designer of Rocket-Space Systems, the Chief Designer of

⁵⁷. Mozzhorin, 1994, 64.

⁵⁸. Ishlinskiy, 1986, 464;

⁵⁹. Daniloff, 1972, 65-66.

⁶⁰. "Announcement of the First Satellite" (in Russian), *Pravda* (October 5, 1957). A complete English translation of this announcement is included in Krieger, 1958, 311-312.

⁶¹. "Report on the First Satellite" (in Russian), *Pravda* (October 9, 1957). A complete English translation of this article is included in Krieger, 1958, 313-325.

Rocket Engines, and the Chief Theoretician of Cosmonautics respectively. The fourth, Tikhonravov, did not even have a pseudonym for himself.

The titles not only hid their identities, but also added an element of attraction and enigma to the men behind the world's first space program. New editions of histories of Soviet rocketry published prior to 1957 ceased to carry Korolev's name, and Soviet encyclopedias now merely listed him as heading a laboratory in an unspecified 'machine building' institute in the USSR. Glushko meanwhile was now said to be laboratory chief at the Moscow Institute of Mineral Fuels.⁶² Korolev, certainly in recognition of the key role he played, was allowed to write in no less an important newspaper as *Pravda*, but under the pseudonym 'Professor K. Sergeyev.' His first article titled "Research into Cosmic Space" was published on 12 December 1957. Khrushchev claimed at the time that as the years went by "the photographs and names of these illustrious people will be made public," but that for the moment "in order to ensure the country's security and the lives of these scientists, engineers, technicians, and other specialists, we cannot yet make known their names or publish their photographs."⁶³

Conclusion

The timing of the Sputnik launch was motivated by a single reasoning: Korolev's drive to preempt a U.S. satellite launch attempt during the International Geophysical Year. At first, it was a competition with Vanguard. Spurred by the July 1955 announcement of U.S. satellite plans for the IGY, Korolev, joined by Tikhonravov and Keldysh, convinced both the government and the Academy of Sciences within a month to proffer support for a complex Soviet satellite project timed for launch before the IGY. A second jolt came as a result of miscommunication about a U.S. Army missile launch in September 1956. Putting the heavy scientific satellite on the backburner, Korolev's engineers put together a much simpler satellite to beat any American attempt. Once again, they timed it for launch before the start of the IGY. This 84 kilogram ball, although delayed several months, lifted off into orbit on 4 October 1957 and opened a new era.

The political and cultural shock bequeathed by Sputnik set events in motion that eventually gave rise to Apollo, perhaps the central artifact of the so-called 'space race' of the Cold War. Conventional wisdom suggests that the race began on 4 October 1957 and ended on 20 July 1969 with the Moon landing. But as we begin to dig deeper into the origins of the space race, it is clear that that race began long before the launch of Sputnik, in 1955, with the Eisenhower Administration's famous announcement on satellites. And perhaps fortunately for the Soviet Union, it was a race in which one of the participants, the United States, did not even know it was running until it was too late.

62. *Soviet Space Programs, 1962-65; Goals and Purposes, Achievements, Plans, and International Implications*, Prepared for the Committee on Aeronautical and Space Sciences, U.S. Senate, 89th Cong., 2nd Sess. (Washington, D.C.: U.S. Government Printing Office, December 1966), 149-150.

63. *Soviet Space Programs, 1962-65*, 1966, 71-72.

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Korolev's Triple Play: Sputniks 1, 2 and 3

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Abstract

The paper deals with the politics, planning and technology of the period 1946-1958, spanning the development of the R-7 ICBM technology which made possible the launching of an artificial satellite; the strategy used by Sergei Pavlovich Korolev, with the support of Mystislav Keldysh, in bringing the satellite from conceptualization by Mikhail Tikhonravov to actuality; the early work on Sputnik 3, which was planned to be Sputnik 1; the hurried development of Sputnik 1 when Sputnik 3 was not ready; the even more hurried development of Sputnik 2 (the Laika carrier) at Khrushchev's behest; the actual launches; the failure to map the radiation belts; the casual reaction, at first, by Kremlin officialdom to Sputnik 1's success; and then the quick switch to braggadocio when the world impact was realized.¹

Initial Soviet Reaction to Sputnik 1 Launch

While it jolted the rest of the world, the successful launch of Sputnik 1 on October 4, 1957, received casual treatment, at first, in Moscow. Korolev's former colleague, Academician Boris Rauschenbakh, told me, some 35 years later, "Look up the pages of Pravda for the first day after the launch. It got only a few paragraphs. Then look at the next day's issue, when the Kremlin realized what the world impact was."²

The article in the October 5 Pravda was, indeed, tersely phrased. Positioned modestly in a right hand column part way down on the first page, it did not even mention the satellite in its head. Titled routinely, "Tass Report," it gave the facts of the launch clinically, and the editors apparently felt obliged from the very first sentence to educate the readers on what it was all about:

In the course of the last years in the Soviet Union scientific research and experimental construction work on the creation of artificial satellites of the Earth has been going on.

As already reported in the press, the first launches of satellites in the USSR were planned for implementation in accordance with the program of scientific research for the International Geophysical Year.

As the result of a large, dedicated effort by scientific-research institutes and construction bureaus the **world's first artificial satellite of the Earth** has been created. On 4 October, 1957 in the USSR the first successful satellite launch has been achieved. According to preliminary data, the rocket launcher carried the satellite to the necessary orbital speed of about 8,000 meters per second. At the present time the satellite is moving in an elliptical trajectory around the Earth and its flight can be observed in the

¹ Adapted from *KOROLEV How One Man Masterminded the Soviet Drive to Beat America to the Moon*, James Harford, John Wiley & Sons, New York, 1997, pp. 121-137

² Rauschenbakh comment to author at 41st International Astronautical Congress, Montreal, Oct. 11, 1991

rays of the eastern and western Sun with the help of simple optical instruments (binoculars, spyglasses, etc.).³

The article went on to give the basic information--size, weight, orbital inclination, radio frequency on which the beep could be heard--and it credited the great Tsiolkovsky with having established the feasibility of artificial Earth satellites decades earlier.⁴

The Next Day's Turnabout

The next day's Pravda was something else.⁵ "World's First Artificial Satellite of Earth Created in Soviet Nation" stretched across the top of page one, which was devoted almost entirely to the achievement. But the lead story in the right hand column did not recount the feat itself, with first hand reports from the Soviet protagonists--their names were top secret, after all, so they could not even be contacted. Instead, the column was datelined New York, and it quoted in detail the congratulations of Russia's fiercest Cold War rival, the USA. The words, generous in their praise, were from Joseph Kaplan, chairman of the U.S. National Committee for the International Geophysical Year. Both the Soviet and American satellite programs were carried out under IGY auspices, with the results available to the world's scientists. Below the Kaplan item were congratulatory bulletins from A. C. B. Lovell, the British astronomer, and from a member of the USSR's political family, Pavel Novatsky of the Polish Academy of Sciences--the latter headed "Big Victory."

Big victory it certainly was. Poems lyricized the event, like "Leap into the Future" and "Scouting the Celestial Deep." An ephemeris, showing the times when the carrier rocket would be visible over cities in the USSR, as well as Detroit and Washington, was printed like a train timetable. It was the moment to cash in on the performance of a feat that Nikita Khrushchev could never have dreamed would have so powerful an effect. He, after all, had been apathetic about "just another Korolev rocket launch," as Rauschenbakh described the attitude of the Soviet premier and his clique on first hearing the news.

In the days to come, though, Pravda was delighted to print the praises of friends and enemies. Reactions from Peking and Shanghai (that friendship would dissolve only a few years hence), Warsaw, Paris, Vienna, Rome, London, and an especially long one from New York, ran under a big headline that ran across the page, "Russians Won the Competition."⁶

The US Muffed the Chance to be First

It was a competition which the Americans should have won hands down. The concept of putting up a satellite had been known to the world's space enthusiasts for many years. In America serious proposals to launch a spacecraft into Earth orbit had been discussed since the mid-1940's. Robert P. Haviland recalls that when he was working in the Navy's Bureau of Aeronautics in 1945, motivated by a report on space rockets in a document captured from the Peenemunde Germans, he "wrote a 4-5 page memo proposing a Navy satellite development but it was scorned."⁷

In February, 1946, the US Army Air Corps asked the major air frame companies to submit secret proposals for the design of an "earth orbiting satellite." Douglas Aircraft was notified on July 1 that its

³ Pravda, Oct. 5, 1957, p. 1

⁴ In *Rockets and Cosmic Space*, a monograph published by Tsiolkovsky in 1903.

⁵ Pravda, Oct. 6, 1957, pp. 1-2

⁶ Pravda, Oct. 8, 1957, p. 3

⁷ Haviland telephone interview with author, May 22, 1995

design was judged the winner. Today's aerospace companies will find it hard to believe that the Air Corps evaluation was completed in less than four months! What's more, Douglas was funded for the study at the "unheard of amount in those days" of \$1 million but their contract was switched to the newly-formed Project RAND (for Research and Development) in Santa Monica, California.⁸ RAND's eventual report on "Preliminary Design of an Experimental World-Circling Spaceship" predicted, with keen perception, that "The achievement of a satellite craft by the United States would inflame the imagination of mankind, and would probably produce repercussions in the world comparable to the explosion of the atomic bomb."⁹ Alas, nothing followed the study, and so it would not be a US satellite that would generate those repercussions.

Tsiolkovsky Showed in 1903 That a Satellite Could be Orbited

In Russia, as mentioned earlier, Konstantin Tsiolkovsky had shown mathematically in 1903 how a device launched at a certain velocity would achieve Earth orbit. Then in 1948, forty-five years later, the visionary Mikhail Tikhonravov had made the case to Korolev for developing just such a device. At first he was unable to get support for the concept. His presentation to a meeting of the Academy of Artillery Sciences was treated skeptically. Golovanov quotes the remarks of the Academy president, Anatoli Blagonravov, at the meeting: "The topic is interesting. But we cannot include your report. Nobody would understand why...They would accuse us of getting involved in things we do not need to get involved in..." However, what Blagonravov said officially was not what he thought instinctively. This courteous, mild-mannered, chain-smoking, white-haired former general, who would become in later years one of the chief spokesmen for the Soviet Union in the United Nations Committee on the Peaceful Uses of Outer Space, was bothered by the wary reception of Tikhonravov's ideas. "There was no way he could escape the thought that this ridiculous report was in fact not very ridiculous at all." Blagonravov, risking the derision of his colleagues, put the report back on the agenda, thereby giving Tikhonravov--and Korolev--license to study possible satellite designs.¹⁰

The R-7 ICBM Carrier Made a Sputnik Launch Feasible

Some five years later, towards the end of 1953, having redesigned the R-7 rocket to carry a heavier payload, Korolev had drafted a proposed decree for the Central Committee of the Communist Party which included the possibility of using the vehicle to launch a satellite. However, while the draft "was making its way to the top" mention of the satellite was struck out.¹¹ Not until May 26, 1954 did Korolev formally propose the satellite launch to Dimitri Ustinov, Minister of Armaments.¹² By then the R-7 was capable of propelling an H-bomb warhead of 5 tons--the actual size had not yet been determined--over an intercontinental ballistic trajectory. It could easily orbit a satellite of some 1.5 tons. According to Korolev's deputy, Vassily Mishin, Korolev had to propose a Sputnik launch as part of the test program of the ICBM

⁸ Brill, Yvonne, one of the participants in the Rand study, letter to the author, June 15, 1995

⁹ Project RAND Report SM-11827, May 2, 1946, from Rand 25th Anniversary Volume, Rand Corp., Santa Monica, CA, 1973, p. 3

¹⁰ Golovanov, Yaroslav, *The Beginning of the Space Era*, Pravda, Oct. 4, 1987, p. 3, translated into English in JPRS-USP-88-001, Feb. 26, 1988, p. 48

¹¹ Vetrov, Gyorgi, private communication, June 13, 1995

¹² Keldysh and Vetrov, *Creative Legacy...*, p. 343, and Tarasenko, Maxim, *Military Aspects of Soviet Cosmonautics*, Nikol, Moscow, 1992, p. 16. Tarasenko reports that the recommendation called for "development of a 2-3 ton satellite, a recoverable satellite, a satellite for a long orbital stay of 1-2 people and an orbital station with regular Earth ferry communication."

program.¹³ In any case, Korolev's proposal to Ustinov is so delicately phrased that R-7 is not mentioned at all, but merely referred to as the

...new article which permits speaking about the possibility of designing an artificial Earth satellite within the next few years. By a certain reduction of the weight of the payload it will be possible for the satellite to achieve the necessary velocity of 8,000 m/sec.¹⁴

As Roald Sagdeev, longtime head of the USSR Space Research Institute, put it, "Korolev and his colleagues could have only had a vague idea of how heavy the final reentry vehicle (for the ICBM warhead) should be. Sakharov <Andrei> was still far from knowing how to make this deadly weapon relatively compact and easily portable. Since rapid progress was required, rocket designers adopted a worst-case strategy and started to develop an ICBM that, as it was discovered later, had a substantial excess of launch capability, or throw weight."¹⁵

US Vanguard Chosen Over Project Orbiter

Meanwhile more substantive thinking on possible satellite designs had been resumed in the U.S. The most expedient design approach came from Von Braun's team at the Army's Redstone Arsenal in Huntsville, Alabama. Starting with a meeting in early 1954 with George Hoover of the Office of Naval Research, von Braun and his colleagues eventually came up with Project Orbiter, which would have been an Army-Navy-Air Force design using already-developed Army Ordnance weapons technology to put a small satellite into orbit.¹⁶ But the Eisenhower administration had reasons to choose a different approach. Eisenhower wanted to keep the military out of the IGY program, which was dedicated to scientific purposes. That was the surface reason. The other one, more telling, was--ironically--based on military strategy. He wanted to be consistent with his well-publicized "Open Skies" stance at a time when U-2's and spy satellites were being developed to begin reconnoitering the USSR. Eisenhower reasoned that a satellite put up as part of the IGY program would strengthen the freedom of the skies policy and would be less likely to disturb Nikita Khrushchev's sensibilities about overflight than one sponsored by three military services. Also, Soviets were likely to launch an IGY satellite themselves. And so a project named Vanguard--which proved to be an embarrassing choice of names--was chosen to carry the US banner into the space age. Based on a sounding rocket developed by the Naval Research Laboratory, but under the auspices of the National Science Foundation, it was going to be a riskier venture than Orbiter because it called for substantially modified first and second stages, a new third stage, and new rocket engines and guidance technology.

Sedov Reveals Soviet Satellite Plan at IAF

On July 29, 1955, the Eisenhower Administration announced that the U.S. would launch Vanguard for scientific purposes during the 1957-58 IGY. A few days later, at the Sixth Congress of the International Astronautical Federation in Copenhagen, a delegation of Soviet scientists, appearing at IAF for the first time, revealed at a press conference that the USSR, too, might be in the game. Leonid Sedov,

¹³ Mishin interview with author, Sept. 2, 1992

¹⁴ Keldysh and Vetrov, *Creative Legacy*...

¹⁵ Sagdeev, Roald, *The Making of a Soviet Scientist*, John Wiley, New York, 1994, p. 155

¹⁶ For a detailed account of the genesis of Project Orbiter see Stuhlinger, Ernst, and Ordway, Frederick I. III, in *Wernher von Braun Crusader for Space*, Krieger Publishing, Malabar FL, 1994, pp. 123-131

head of the Soviet delegation, and the newly appointed chairman of an Academy of Sciences Commission on Interplanetary Communications,¹⁷ choosing his words carefully, said:

From a technical point of view, it is possible to create a satellite of larger dimensions than that reported in the newspapers which we had the opportunity of scanning today. The realization of the Soviet project can be expected in the comparatively near future. I won't take it upon myself to name the date more precisely.¹⁸

But, Sedov, it seems, was speculating, since no official decision had yet been made that there would be a Soviet satellite in IGY. In fact, not until January 30, 1956 would the Council of Ministers issue a decree authorizing its development.

Tikhonravov Transferred to Korolev Bureau

It was at this time that Korolev was able to arrange for Mikhail Tikhonravov and his team, which had been working on a satellite concept at Special Design Bureau #385 in the Ural Mountains, to join him. One of the members of that team, Konstantin Feoktistov, recalled:

We wanted to build a satellite but Korolev had that responsibility. Tikhonravov was transferred to Korolev's bureau in early 1956 after the Party and the Government had authorized Korolev to proceed with the development of a satellite. But the rest of us in the group had to apply to Korolev individually. However, Korolev relied on the advice of Tikhonravov, his old friend and, by the end of 1957 I was chosen, although it was difficult to leave #385.¹⁹

Sputnik Plans Lag, Keldysh Criticizes Industry

Even the January decision, however, was not followed by sufficiently aggressive support for the satellite development in the opinion of Korolev and his close ally, Mstislav Keldysh. Time to beat the Americans had flown by and the Soviet establishment was not yet revved up. Nine months later, on September 14, in what must have been exasperation, and probably with Korolev's prodding, Keldysh appeared before the presidium of the Soviet Academy of Sciences to state his case.²⁰ He first reviewed patiently, like a good teacher, the physics of placing a satellite in orbit. Then he covered the pioneering scientific measurements which the Soviet satellite would make--the Earth's magnetic fields, the "ionic composition of the upper layers of the atmosphere," the "corpuscular radiation of the Sun," cosmic radiation, possible micrometeorites.

¹⁷ The full name seems a satire on Soviet bureaucracy. It was the Interdepartmental Commission for the Coordination and Control of Scientific-Theoretical Work in the Field of Organization and Accomplishment of Interplanetary Communications of the Astronomical Council of the USSR Academy of Sciences

¹⁸ Krieger, F. J., *Behind the Sputniks*, Public Affairs Press, Washington, 1958, p. 330

¹⁹ Feoktistov interview with author, Moscow, Dec. 12, 1991

²⁰ Avduyevsky, V. S., *M. V. Keldysh Selected Works Rocket Technology and Cosmonautics*, (Russian), Nauka, Moscow, 1988, p. 235

He must have caused eyes to widen a bit when he said "...we are considering placing a live organism in the satellite--a dog. It turns out that the perception of a dog is the most similar to the perception of a man--biologists so consider it. The dog will live there in the absence of a gravitational field, in conditions of irradiation, of cosmic radiation. The dog will be undergoing all sorts of dangers, because if the satellite is hit by a large meteoric particle, it will broach the satellite..."

By then he surely had their full attention, but he went on. "We, of course, can't stop at the task of creating an Earth satellite. We, naturally, are thinking of further tasks--of space flight. The first project along these lines, I believe, will be to fly around the Moon and photograph it from the side which is always hidden to us." Then came hard criticism: "We have come up short in a whole series of tasks in the Academy of Sciences, and are lagging now. Back in August we were to turn in the dimensions of the equipment and their mode of attachment to the rocket...We delayed this work, which resulted in a notable delay in the planning and development of the satellite itself."

He called out specific industry laggards: "In general, the radiotechnological industry isn't helping us enough...They are sluggishly regarding the creation of this satellite...We have already committed one breach in delaying the delivery of size specifications and other information to the Korolev Design Bureau." Finally, the ultimate motivation came out baldly: "...it would be good if the Presidium were to turn the serious attention of all its institutions to the necessity of doing this work on time...we all want our satellite to fly earlier than the Americans'."²¹

Keldysh and Korolev had not only the Academy of Sciences and industry to motivate, they had to deal with the objections of the military generals, who feared that the satellite project would slow down the development of the R-7 ICBM. The fear was understandable since R-7's first five launch attempts had failed.²² But foot-dragging by the support institutions was only one of Korolev's problems. In spite of Keldysh's speech, the satellite which was supposed to have the honor of being first continued to fall behind schedule. In fact, it would lag so badly that it would become Sputnik 3--a huge, sophisticated satellite, eventually launched on May 15, 1958. Sputnik 3's 1,327 kg payload included virtually all of the instruments called out in Keldysh's speech.

"Simplest" Sputnik Moves Ahead of Big Science Satellite

"But," said Gyorgi Grechko, one of the engineers who worked at the Korolev design bureau during those days, and who later became a cosmonaut, "these devices were not reliable enough so the scientists who created them asked us to delay the launch month by month. We thought that if we postponed and postponed we would be second to the US in the space race so we made the simplest satellite, called just that--Prostreishiy Sputnik, or 'PS'. We made it in one month, with only one reason, to be first in space."²³

It was at this time, on August 21, 1957, that the R-7, in its sixth attempt, propelled a dummy H-bomb warhead all the way to Kamchatka, some 6,000 km. With that success the confident Korolev made his move to beat the Americans with his PS. His next obstacle was a skeptical State Commission for the R-7 ICBM. Discussion of Korolev's satellite proposal before that body, according to a 1992 report by a journalist in a Moscow magazine, was "sharp, the opponents arguing primarily about the tight timing," and "complete agreement was not achieved." Korolev had to go back to the Commission a second time. This time he tried a different ploy. Why not, he challenged the members, put the question of authorization to the Presidium of the Central Committee of the Communist Party--in the context of whether or not the

²¹ Ibid., pp 235-240

²³ Grechko interview with author, Moscow, May 16, 1993

USSR should try to be the first country in the world to launch a satellite? The Commission blanched. "Nobody wanted to be scapegoat." And so the project proceeded.²⁴

With the Commission's nervous acquiescence, Korolev bulldozed the development, in a little more than a month, of a plain, polished 83.6 kg sphere containing only a radio transmitter, batteries and temperature measuring instruments, with the intent to place it in orbit on a rocket which had failed in five of its first six launch attempts. It was a very hectic month, and while the satellite was simple, the attention given to its manufacture was unsparing, especially by Korolev, himself.

"I coordinated the production, testing, launch preparations and the launch itself," recalled Oleg Ivanovsky, looking back 36 years during a 1993 interview. Ivanovsky had been deputy to Mikhail Khomyakov, Sputnik 1's principal designer. He recalled that there were problems:

For example, there were two peculiarities which satellites had that missiles did not. One was that the satellite required precise thermal control and the other was that vacuum sealing was used to assure reliable performance. We had to find new techniques of manufacturing the surfaces in order to achieve the necessary optical and thermal qualities. We had no experience in this work. We needed vacuum chambers. I recall one episode when we had to persuade the production shop that the satellite was a new item, not a missile.

Korolev, with his iron character, was able to influence the attitude of people. The Party directed that new paint be put on the factory walls. Korolev put the satellite on a special stand, draped in velvet, in order that the workers would show reverence towards it. He supervised the carrying out of the production schedule every day personally.²⁵

One of the metalworkers who was assigned to the Sputnik 1 manufacture was Gennadi Strekalov, later to become a cosmonaut. "My teacher in metalworking did the finishing," he told me. "Two half spheres were stamped, then machined, then the masters did the finishing."²⁶ Strekalov, who, in 1995, flew to the Mir space station with American astronaut Norman Thagard and then participated in the first Mir-Shuttle rendezvous, is as proud of his work on Sputnik 1 as he is of his four orbital flights.²⁷

"Korolev came over to the shop and insisted that both halves of the sputnik's metallic sphere be polished until they shone, that they be spotlessly clean," recalled Konstantin Feoktistov, who would be the first engineer-cosmonaut to go into orbit in the three-man Voskhod 1 seven years later. "The people who developed the radio equipment were actually the ones demanding this. They were afraid of the system overheating, and they wanted the orbiting sphere to reflect as many rays of the Sun as possible."²⁸

²⁴ K. Gerchik, *Proryv v Kosmos (Breakthrough into the Cosmos)*, Central Council of Veterans of Baikonur Cosmodrome, Moscow, 1992, pp. 77-78. The State Commission was chaired by Vassily Ryabikov. It included, besides Korolev himself, Marshal Mitrofan Nedelin, Giorgi Pashkov, Valentin Glushko, Nikolai Pilyugin, Viktor Kuznetsov, Mikhail Ryazanski, Vladimir Barmin, Alexander Mrykin, S. Shishkin, I. Bulychev, Alexei Nesterenko, and A. Maksimov.

²⁵ Ivanovsky interview with author, Moscow, Jan. 26, 1993

²⁶ Strekalov interview with author, Moscow, Jan. 28, 1993

²⁷ The Mir-Shuttle rendezvous was Strekalov's fourth orbital flight, although his fifth space launch. He and Vladimir Titov were successfully ejected by the launch escape system when their Soyuz T-10 spacecraft was engulfed by flames in 1983.

²⁸ Zheleznov, Nikolai, *Hello---(Bip-Bip) Scientist, Designer and Cosmonaut Speaking*, Soviet Life, October, 1982, p. 35

An idea of how intense were the preparations for the launch of the "simplest satellite," and how sensitive Korolev was to the event's historical importance, comes from the recollections, on the 30th anniversary of the launch, of one of the design team, Mikhail Floriansky:

The jettisoning of the nose cone and the process of separation of the sputnik from its carrier was being tested at the assembly shop late in August, 1957. It is not a complex procedure, but fraught with possible surprises. Everything was going on normally--or so it seemed--when Korolev all of a sudden subjected the plant's chief engineer to a terrible dressing down. Korolev was berating him--what for!--for the poor quality of the surface of the **mockup** of the sputnik! The quality of the surface is really important in flight because the heat conditions of the sputnik depend on it, but why the dressing down now, when quite a different process was being tested?

Korolev said angrily:

"This ball will be exhibited in museums!"²⁹

It was Korolev's aesthetic as well as engineering sense that had led him to insist on the ball shape for Sputnik 1, although one of the early designs proposed was for a cone-shaped structure. "Today, after decades have passed," recalled colleague Mark Gallai in a 1980's interview, "we simply cannot imagine the first sputnik to be anything other than what it was: an elegant ball...with an antenna thrown back like a galloping horse."³⁰ There were two flight-ready spheres built, one for the launch and another one for ground testing, developing the welding and other fabrication techniques. The second one would later be launched too, with the carrier for the dog Laika on Sputnik 2.

Rebrov Recalls the Launch Preparations

A recollection of the preparations for Sputnik 1, and the launch itself from Baikonur, comes from Colonel Mikhail Rebrov:

People in the "space room" worked in white smocks, performing each operation with the greatest thoroughness. The rocket was assembled in the big hangar. Silence fell when the Chief Designer appeared. At the time Sergei Korolev was exacting and more strict than ever...

Only two days were left. The carrier rocket was rolled out to the launch pad in the early morning of October 2, 1957. Korolev walked in front, together with all the other chief designers. They walked in silence the entire 1.5 km long way from the assembly-testing building to the pad. No one will ever know what was going through Sergei Korolev's mind at the time. Later on, when the sputnik was installed in orbit, and its call sign was heard over the globe, he said:

"I've been waiting all my life for this day!"

The moment of the blast-off has been described many times. Then the rocket got out of the radio zone. The communication with the sputnik ended. The small room where the radio receivers were was overcrowded. Time dragged on

²⁹ Floriansky, Mikhail, *October 4--For the First Time in the World*, Moscow News Supplement, No. 40 (3288), 1987

³⁰ Ishlinsky, *Academician S. P. Korolev...*p. 62

slowly. Waiting built up the stress. Everyone stopped talking. There was absolute silence. All that could be heard was the breathing of the people and the quiet static in the loudspeaker...And then from very far-off there appeared, at first very quietly and then louder and louder, those "bleep-bleeps" which confirmed that it was in orbit and in operation.

Once again everyone rejoiced. There were kisses, hugs and cries of "Hurrah!" The austere men, who were greeted out of space by the messenger they had made, had tears in their eyes.³¹

Americans Shocked But Determined to Respond

Hardly tearful, more like rueful, was the reaction of the American space community. Even though the possibility that the Soviets had been making plans for launching a satellite was known in the US, and not only to government insiders, the fact of the launch was a deep jolt to the space professionals.³²

At that time, I was Executive Secretary of the professional society for space engineers--the American Rocket Society (ARS). *Astronautics* magazine, the main ARS publication, could not resist reminding its readers that, "A little over two years ago, when the government's guided missile policy committee decided against the Von Braun-Medaris³³ satellite proposal in favor of Project Vanguard, there were four dissenters who voted to send the idea on to the National Security Council for further consideration. One of them was the 'Lone Eagle,' Charles A. Lindbergh, the last one to make aviation headlines of the same magnitude as 'Sputnik.'"³⁴

Grim determination characterized the American rocketeers. "They <the Russians> must not be allowed to win this game--a game with far-reaching political, social and economic consequences," *Astronautics* editorialized.³⁵

In the same issue, a very insightful interpretation of the technological significance of the Russian feat by Martin Summerfield of Princeton University had an upbeat aspect, but was somber in its reflection on the advanced state of Soviet space technology.

The success of the Russian "Sputnik" was convincing and dramatic proof to people around the world of the real prospects of space travel in the not distant future. The fact that a 23-in. sphere weighing 184 lb has been placed in an almost precise circular orbit indicates that a number of important technological problems such as high thrust rocket engines, lightweight missile structures, accurate guidance, stable autopilot control, and large scale launching methods have been solved, at least to the degree required for a satellite project.³⁶

³¹ Rebrov, Col. Mikhail, *Sputnik No. 1*, Moscow News Supplement, No. 40 (3288), 1987, p. 3

³² US IGY officials had known of the Soviet plans since 1955 when Pravda had alerted its readers, and the delegates to the 1955 International Astronautical Congress in Copenhagen were informed as well. In June, 1957, an article appeared in the Soviet journal *Radio*, by one V. Vakhnin, alerting radio specialists on how to tune in on an orbiting satellite's signal.

³³ Major General John B. Medaris, Von Braun's boss at the Army Ballistic Missile Agency.

³⁴ *Astronautics*, Nov. 1957, p. 6

³⁵ *Ibid.*, p. 17

³⁶ Summerfield, Martin, *Problems of launching an earth satellite*, *Astronautics*, Nov., 1957, pp. 18-21, 86-88

I got a phone call at my home in Princeton about 7:00PM on Friday evening, October 4, from the *New York Times* aeronautics reporter, Richard Witkin. Had I heard? What is the reaction of the US rocket community? My response is not even in my memory. But the impact of the launch on the US, as well as on my own career, would be powerful, indeed. ARS at the time had a membership of about 5,000 engineers and scientists, most of them working on missile programs, although a few dozen were on Project Vanguard. By 1962, just seven years later, the membership quadrupled to 20,000, a growth so rapid that industry and government pressures caused a merger of ARS with the Institute of Aeronautical Sciences, the society for aeronautical engineers, into what is today the 40,000 member American Institute of Aeronautics and Astronautics (AIAA).

World Reaction

The news of the launch in the world's leading newspapers got Second Coming treatment. The *New York Times*, receiving the story in the late afternoon of Friday, October 4, printed the next morning a rarely used three-line head in half-inch capital letters, running full length across the front page:

SOVIET FIRES EARTH SATELLITE INTO SPACE;
IT IS CIRCLING THE GLOBE AT 18,000 M.P.H.;
SPHERE TRACKED IN 4 CROSSINGS OVER U.S.

Other world newspapers gave the event similar play. Then the interpretation began. The *Manchester Guardian* needed only a couple of days to begin to speculate apocalyptically on what the Russians might now do. An October 7 editorial titled "Next Stop Mars?" read, "The achievement is immense. It demands a psychological adjustment on our part towards Soviet society, Soviet military capabilities and--perhaps most of all--to the relationship of the world with what is beyond." Some of the *Guardian's* speculation was downright clairvoyant. "We must be prepared to be told what the other side of the Moon looks like <Lunik 3 produced the photos only two years later>, or how thick the cloud on Venus may be <revealed by the Soviet Venera and US Mariner series starting in the '60's>. Accurately, the *Guardian* pointed out that, "The Russians can now build ballistic missiles capable of hitting any chosen target anywhere in the world." That, certainly, was true, but it would be some years before improvements in guidance technology made the capability an actuality. It certainly did not follow, as the *Guardian* stated a few sentences later, that "Clearly they have established a great lead in missile technology." This was one of the earliest inaccurate predictions of a missile gap.

French reaction was equally ebullient. "Myth has become reality: Earth's gravity conquered," bannered *Le Figaro*, and went on to report the "disillusion and bitter reflections" of "The Americans (who) have had little experience with humiliation in the technical domain."³⁷ For three weeks the world could hear the beeping of Sputnik 1 before the radio died out, and it orbited more than 1,400 times before burning up in the atmosphere after three months in space.

Much has been written about the effect of the Sputnik 1 launch on the world scene. Many American space enthusiasts, stricken with gloom at the time, now reflect that it might have been the best thing that could have happened to awaken the need for an aggressive space program. Only four years later President Kennedy would call for what became the Apollo program. An enormous infrastructure of space research and development centers, test and launch facilities and supporting industry and university programs, would come into being.

Some Negative Western Reaction to Space Buildup

³⁷ *Le Figaro*, Paris, October 7, 1957, pp 4-5

There were those who reacted negatively to the surge in space technology and its consequent spurring of the growth of high tech weapons. As former Ambassador to the Soviet Union George Kennan put it in his memoirs, "It <Sputnik> caused Western alarmists, such as my friend Joe Alsop, to demand the immediate subordination of all other national interests to the launching of immensely expensive crash programs to outdo the Russians in this competition. It gave effective arguments to the various enthusiasts for nuclear armament in the American military-industrial complex. That the dangerousness and expensiveness of this competition should be raised to a new and higher order just at the time when the prospects for negotiation in this field were being worsened by the introduction of nuclear weapons into the armed forces of the Continental NATO powers was a development that brought alarm and dismay to many people besides myself."³⁸

Sputnik 2, Pushed by Khrushchev. Readied in One Month

While all this introspection was taking place in the West, the creators of Sputnik were unable to be interviewed, take bows, be photographed, get medals. Sergei Korolev was literally back at the office, because Khrushchev, realizing what a hot property he had, gave him new orders. Do something bold, Sergei Pavlovich, to celebrate the upcoming 40th anniversary of the Revolution! It's only a month away. Cosmonaut Grechko tells the story.

I heard this from Korolev himself with my own ears. After Sputnik 1 Korolev went to the Kremlin and Khrushchev said to him,

"We never thought that you would launch a Sputnik before the Americans. But you did it. Now please launch something new in space for the next anniversary of our revolution."

The anniversary would be in one month! I'll bet that even with today's computers nobody would launch something into space in one month. It was, I think, the happiest month of his <Korolev's> life. He told his staff, and his workers, that there would be no special drawings, no quality check, everyone would have to be guided by his own conscience. The engineers would make drawings and give them directly to the workers. And we launched on November 3, 1957, in time for the celebration of the Revolution.³⁹

The payload of Sputnik 2 weighed 508 kg, more than six times the weight of Sputnik 1. A shroud housed a carrier containing the world's first space passenger, the mongrel dog Laika, plus a duplicate of the Sputnik 1 sphere. Laika is reported to have barked and eaten food during his lonely sojourn but, alas, he died when the capsule overheated after failing to separate from its booster, thereby rendering the thermal control system inoperative. Animal groups protested, but the Soviets made Laika into a martyr for a noble cause. Veterans of the Sputnik 2 project regard it as an even more significant achievement than Sputnik 1. Not a single engineering task had been performed on it until after Sputnik 1 went up.

With the new triumph Khrushchev could not resist escalating his needling of the Americans. In a speech at the 40th anniversary of the Revolution, on November 6, he said, "It appears that the name Vanguard reflected the confidence of the Americans that their satellite would be the first in the world. But...it was the Soviet satellites which proved to be ahead, to be in the vanguard...In orbiting our earth,

³⁸ Kennan, George F., *George F. Kennan Memoirs 1950-1963*, Pantheon Books, New York, 1972, p. 140

³⁹ Grechko interview

the Soviet sputniks proclaim the heights of the development of science and technology and of the entire economy of the Soviet Union, whose people are building a new life under the banner of Marxism-Leninism."

Vanguard. Rushed to Launch. Explodes on Pad

Those derisive comments proved even more galling to the Americans a month later when, on December 6, the first attempt to launch the Vanguard satellite was an ignominious failure before the world's television cameras. The three stage rocket was designated TV-3, for Test Vehicle 3, and it had been originally scheduled to be just that, a test. But under Sputnik pressure, the "test" was moved up several months, and made into a full-fledged attempt at a satellite launch. But the vehicle got only a few feet off the ground before sagging back, buckling, bursting into a huge conflagration and tossing its tiny 1.47 kg payload, still transmitting, some yards away.

Pravda delightedly reproduced the front page of the London Daily Herald which showed a photo of the Vanguard being readied on the launch pad next to one of the explosion. Superimposed above the immense Herald headline, which read, "OH, WHAT A FLOPNIK!" was Pravda's comment, "Reklama and Deistvitelnost," or "Publicity and Reality."

US Explorer Authorized. Launched. Discovers Van Allen Belts

Following the Sputnik 2 launch, a team composed of the Von Braun group from the Army Ballistic Missile Agency--for the launch vehicle--and one from the Jet Propulsion Laboratory in California--for the space capsule --the latter headed by William H. Pickering, was given the nod to put up the first US satellite. On its initial try the team launched the 14 kg Explorer 1, on January 31, 1958. Fortunately, Pickering and Ernst Stuhlinger, one of Von Braun's staff chiefs, conscious of the odds against Vanguard's success, had persuaded James Van Allen of the University of Iowa to make the package of scientific instruments being readied for Vanguard compatible with Explorer 1's Jupiter C launch vehicle.⁴⁰ This turned out to be particularly fortuitous because Explorer 1, with only one sixth the payload weight of Sputnik 1, scored a major scientific coup when its instruments sensed a pattern of radiation around the Earth leading to the discovery of the now famous Van Allen Belts. It is an interesting footnote on scientific history that Sputnik 1 could have made the discovery if it had installed simple instruments. Sputnik 2, in fact, did have the instruments, wrote Van Allen: "a pair of Geiger-Mueller tubes...which operated properly and yielded data for seven days"⁴¹ but the Soviet scientists failed to develop the data necessary to interpret the discovery.

Sputnik 3 Finally Orbited, NASA Established

Oleg Ivanovsky, who worked on Sputniks 1, 2, and 3, speaks with deserved satisfaction of the Soviet achievements of those months in late 1957 and early 1958. But there was trouble too. "We had our first space failure," he told me, with the difficult Sputnik 3. "It was April 27, 1958, and it was caused by a rocket engine failure. The rocket went up about 12-15 km and the satellite fell separately. There was a

⁴⁰ Van Allen, James A., *Origins of Magnetospheric Physics*, Smithsonian Institution Press, Washington, 1983, p. 49. Stuhlinger and Van Allen had begun discussions on the use of a satellite to investigate cosmic rays above the atmosphere more than three years earlier, in 1954, when Van Allen was at Princeton University. Also, Pickering communication with author, Mar. 18, 1996

⁴¹ Ibid., p. 93

search for the satellite. I remember that the pilots conducting the search were not allowed to know what they were looking for. 'Just search the area for anything unusual,' they were told, 'and don't attract the camels.' It was crazy secrecy. Finally one pilot came back and said he had seen something that sounded to us like the satellite. We sent out a rescue team in an armored vehicle. When we got it back some of the instruments could still operate." Ivanovsky then showed me proudly a copper wire which he had recovered from one of the instruments which kept the satellite beeper from operating prematurely.

When the 1.5 ton Sputnik 3 was launched successfully, on May 15, 1958, it caused even more anxiety in the West. Any doubt that the Russians would soon have the capability to send an ICBM to the United States was demolished. Lyndon Johnson, then Senate Majority Leader, had demanded a Congressional investigation of the impact of Sputnik 1 only a few days after its launch. On the Senate floor in January he had made recommendations originating in his Preparedness Subcommittee to "Start work at once on the development of a rocket motor with a million pound thrust," "Put more effort in the development of manned missiles (satellites)," and "Accelerate and expand research and development programs, provide funding on a long-term basis, and improve control and administration within the Department of Defense or through the establishment of an independent agency."

During the same months in early 1958 President Eisenhower, with his science adviser, James Killian, also concluded that a civilian space agency was needed, and directed Hugh Dryden, head of the National Advisory Committee for Aeronautics (NACA), to prepare legislation which would create such an agency on that relatively small organization's structure. The result was Public Law 85-568, signed on July 29, 1958 by the President, calling for the creation of the National Aeronautics and Space Administration (NASA). It was quite an about-face for a president whose staff members had belittled Sputnik 1 as "a silly bauble" and "a neat scientific trick" and who, himself, had said that it had not bothered him "one iota."⁴²

Sputnik 3's large load of scientific instruments was designed to measure micrometeorites, density of the upper atmosphere, cosmic rays, solar radiation, the presence and effect of high energy particles and the Earth's own radiation environment.⁴³ It could have performed a tour de force of scientific research in virgin territory. The *Manchester Guardian* reported that "This impressive list (of instruments) is a telling demonstration of the fact that the latest Russian sputnik has been launched for strictly scientific purposes."

Sputnik 3 Misses Chance to Map Van Allen Belts

Unfortunately, to the great embarrassment of the Soviets, the huge vehicle missed one more chance at what would have been its most significant achievement--mapping the radiation belts. Explorer 1's instruments, which had revealed the existence of the radiation from the belts, had at first been overwhelmed by its intensity, and it took some time for the Van Allen analysis team to understand what it had measured. Sputnik 3 could have mapped the belts systematically, but failed to do so because of a defective tape recorder. The recorder, designed to store and transmit to Earth the information collected by the instruments when it was out of direct radio contact, had failed utterly to transmit the necessary data. Roald Sagdeev recounts what happened:

A scientific team landed at the Baikonur Cosmodrome for the final integration and testing of hardware on Sputnik 3. Korolev invited everyone for the last briefing before the final okay was to be given and the countdown started...It

⁴² Wilson, Glen P., *Prologue*, Quarterly of the National Archives, Winter, 1993, pp 364-70

⁴³ These objectives are virtually the same as those developed at a conference at the University of Michigan on January 27, 1956, the results of which were published in *Scientific Uses of Earth Satellites*, University of Michigan Press, 1956

was the first impressive collection of scientific instruments, each of which was reported to be functioning normally.

However, trouble was soon discovered in some of the supporting hardware. The problem was with the more or less routine tape recorder, whose function was to accumulate data from the different experiments and to prepare messages for the ground station. The spacecraft, revolving around the globe, would only be in contact with the ground station during periods of "direct radio visibility." Simply speaking, the ground station would be unable to sense the signals from the spacecraft when it was behind the horizon... With such a crucial role, members of the scientific team were extremely worried about the troubled tape recorder and they recommended postponing the actual launch to give the technicians a chance to fix it. However, the tape recorder's ambitious engineer, Alexei Bogomolov <"I too often had to depend on his hardware," Sagdeev footnotes acidly> did not want to be considered a loser in the company of winners. He suggested that the testing failure was simply caused by electromagnetic interference from the multiplicity of different electrical circuits in the test room. He boldly proposed to launch Sputnik 3 on time.

To the great disappointment of the scientific team, Korolev accepted Bogomolov's suggestion... During the flight, however, it was confirmed that Bogomolov had been dead wrong. His tape recorder did not work. Consequently, the scientific information gathered was limited by the area of direct radio visibility... Each scientific group had results, but because of the recorder failure they had to guess whether the phenomena discovered were of local or planetary significance.⁴⁴

The most disappointed scientist, says Sagdeev, was Sergei Vernov, a renowned physicist. The detectors on Sputnik 3 sensed extremely high levels of radiation, but was it local or did it exist around the Earth? Some six weeks earlier, on March 26, Explorer 3 had been launched (Explorer 2 had failed to orbit), carrying the first tape recorder ever launched on a satellite. As Van Allen wrote, it "functioned beautifully in response to ground command and fulfilled our plan of providing complete orbital coverage of radiation intensity data."⁴⁵

The Soviets, without tape recorded data, were hogtied. As Van Allen recalled, the team was at first puzzled that they "were encountering a mysterious physical effect of a real nature."⁴⁶ They "worked feverishly in analyzing the data from Explorers 1 and 3 (by primitive hand reduction of pen-and-ink recordings) and organizing them on an altitude, latitude and longitude basis."⁴⁷ In an interesting sidelight on the whole episode, at first there was suspicion that the intense radiation was coming from a Soviet nuclear test. Subsequent analysis, however, proved that it was "geomagnetically trapped corpuscular radiation" distributed in a "belt" around the Earth. At a conference in the summer of 1958, the name "Van Allen radiation belt" was applied for the first time.⁴⁸ More confirmation of the origin of the radiation, as well as the discovery that there was also an outer belt, came two months later--again from the Americans--when Explorer 4 mapped the belts from July 26 to September 19, 1958.

⁴⁴ Sagdeev, *The Making...* pp. 156-57

⁴⁵ Van Allen, *Origins...* p. 82

⁴⁶ *Ibid.*, p. 66

⁴⁷ *Ibid.*

⁴⁸ *Ibid.*, p. 72. Van Allen reports that it was physicist Robert Jastrow who first used the term at a meeting of the International Atomic Energy Agency in Europe

"On a purely observational basis," wrote Van Allen, "the Sputnik 3 data actually represented discovery of the earth's *outer* radiation belt inasmuch as they were acquired before those of Explorer 4 and Pioneer 3."⁴⁹ However, Vernov and colleagues had not yet interpreted the observational finding, although in what seems to have been hindsight, Vernov published a photo of what is now known as the Van Allen belts in Pravda on March 6, 1959, alleging that the data were based on findings that he had reported at an IGY conference in August, 1958. However, colleagues of Van Allen who heard the paper maintain that the fragmentary data available at that time from Sputniks 1, 2 and 3 could not have formed the basis for such a finding, and, what's more, no such finding was reported in the paper.⁵⁰

Afterwards, a Russian joke circulated that the belts were to be called the Van Allen-Vernov radiation belts. "What did Vernov do? He discovered the Van Allen belts."

The Sputnik/Vanguard/Explorer Race 1957-58

October 4, 1957	USSR: Sputnik 1 (83.6 kg) launched
November 3	USSR: Spuntik 2 (508.3 kg), with dog Laika as passenger, launched
December 6	USA: Vanguard TV-3 explodes on launch pad
January 31, 1958	USA: Explorer 1 (14 kg), America's first satellite, discovers the Van Allen radiation belts
February 3	USSR: First try to launch Sputnik 3 fails
February 5	USA: A second Vanguard try fails
March 5	USA: Explorer 2 fails to orbit
March 17	USA: Vanguard 1 (1.47 kg) successfully orbits, establishes the pear-shapedness of the Earth
March 26	USA: Explorer 3 orbits, collects radiation and micrometeoroid data
April 28	USA: Another Vanguard fails to orbit (third failure)
May 15	USSR: Sputnik 3 (1,327 kg) orbits, carrying large array of scientific instruments, but tape recorder fails, so it can't map Van Allen belts
May 27	USA Vanguard fails for the fourth time
June 26	USA Vanguard fails for fifth time
July 26	USA Explorer 4 orbits and maps Van Allen radiation belts for 2 1/2 months
August 24	USA Explorer 5 fails to orbit
September 26	USA Vanguard fails for the sixth time

⁴⁹ Pioneers 1,2,3 and 4 were attempted lunar probes launched in 1958 and early 1959.

⁵⁰ Van Allen, *Origins...* pp. 129-130. Letter from Van Allen to Robert Toth, New York Herald Tribune, Mar. 13, 1959

*“Ministers come and ministers go, but we remain, a unified collective
performing our own work.”*

Sergei Korolev’s last words to his First Deputy, Vasiliy Mishin

GOVERNMENT STRUCTURES, POLICY WINDOWS AND SPUTNIK

At 10:28 p.m., Moscow time, October 4, 1957 another rocket was launched from the steppes of Kazakhstan. But unlike any rocket launched before it, a part of this rocket would not return to Earth. The 80 kg. sphere atop Korolev’s R-7 rocket continued to orbit around the Earth for several years, a small radio transmitter inside emitting a “beep beep” heard round the world. The launch of Sputnik was a defining moment in history. For historians and philosophers, it marked the beginning of the “Space Age.” Mankind took his first tentative step into the cosmos, where surely the greatest of wonders awaited in the years to come. For political leaders and policy makers, this date was of less noble significance, but far more important. It underscored the first Soviet victory in its technological competition with the United States which characterized the Cold War. US technological hegemony had been cracked. U.S. Secretary of State Averell Harriman found it as “shocking: that a backward nation like the USSR could perform such a feat.” Senator Henry Jackson called it “a devastating blow to US scientific, industrial and technological prestige” which plunged the US into “a week of shame and danger.”¹ The shock of Sputnik reverberated with the launch of the first man into space, a Russian, Yuri Gagarin. Like Harriman, policy makers, pundits, and people everywhere puzzled over how a technological backwater like the Soviet Union won the early heats of the space race.

For political scientists and public administrators, the question was almost rhetorical. The answer, they assumed, was that Soviet political and military leadership focused a sizable portion of the nations’ scientific and technological effort on the single goal of beating America into space.² The Soviets began running early and hard, and beat the Americans into space in order to demonstrate the superiority of a centrally-planned

¹ See *New York Times*, October 8, 9, 10, 1957.

² See in particular William Schaeur, *The Politics of Space: A Comparison of the Soviet and American Space Programs*, (New York: Holmes and Meier, 1976).

socialist system. Political scientists examining this program concluded that it was a top-down effort.³ For 25 years this view persisted. Holloway noted that

a crucial feature of the ICBM program is that ever since the decisions to undertake development of the atomic bomb and long-range rockets it has enjoyed the highest priority. The top party leaders have placed great importance on the creation of strategic power, and have devoted time, energy and resources to ensuring the success of ICBM development.⁴

Speilman and Evangelista are among others concluding that the ICBM case was consistent with a leadership driven program.⁵

However, much has changed in the former Soviet Union since these authors examined the subject. Now the assumption can be tested, and subjected to empirical warrant and validation. History has literally been brought out of the safe. Data, previously considered to be unimaginably secret is now openly discussed in journals, at historical conferences, and even in popular newspapers published in Russia. Engineers, policy makers and scientists, whose very existence was kept secret, now openly discuss past Soviet military programs with Western researchers. This newfound wealth of information paints a very different picture of the Soviet space program's development.

There is no question that Stalin provided necessary support for the development of long-range ballistic missiles. But the evidence suggests that rockets were not a high priority. Greater attention was devoted to developing long-range aviation, cruise missiles, and anti-aircraft missiles. The Soviet military was openly hostile to missiles, and was dragged, kicking and screaming, into the space age. Recently released information reveals that the mutation of the missile program into a space program was even more interesting.

³ For an historical interpretation of the sputnik launch see in particular, Walter A. McDougall, *The Heavens and the Earth: a Political History of the Space Age*, (New York: Basic Books, 1985); For interpretations of the program by political scientists see David Holloway, "Innovation in the Defense Sector: Battle Tanks and ICBMs," in Ronald Amann and Julian Cooper, *Industrial Innovation in the Soviet Union*, (New Haven: Yale University Press, 1982); Karl F. Spielmann, *Analyzing Soviet Strategic Arms Decisions*, (Boulder: Westview Press, 1978); and Matthew Evangelista, *Innovation and the Arms Race: How the United States and the Soviet Union Develop New Military Technologies*, (Ithaca NY: Cornell, 1988).

⁴See Holloway, "Innovation in the Defense Sector... p. 401.

⁵See Spielmann, *Analyzing Soviet Strategic Arms Decisions...* pp. 109-145. Evangelista, *Innovation and the Arms Race...* pp. 243-244

The Chief Designer of Long-Range Missiles, Sergei Korolev, kept Stalin and the rest of the political, military, and economic leadership intentionally in the dark regarding the early development of a space program. When the military and economic leadership was made aware of the possibility of a space program, after four years of covert research, they rejected the idea, forcing proponents to sell the program to a reluctant Academy of Sciences. The political leadership ultimately accepted the program, but only after repeated entreaties by Korolev, who finally carried the day by convincing them that there would be a tremendous political payoff to putting a Soviet satellite in space before the Americans.

This explanation of the genesis and success of the Soviet space program departs dramatically from the top-down process typically assumed to be the model for technological development in the Soviet Union.⁶ In fact, development of the Soviet space program closely resembles the classical version of the development of American programs in which ideas "bubble up from the bottom," rendering a case, once a fairly uninteresting to social scientists, significantly more intriguing.⁷

Clearly, the driving force behind this program was its Chief Designer, Sergei Pavlovich Korolev, an observation which has been ably demonstrated elsewhere.⁸ However, in the words of James Q. Wilson, "it is not easy to build a useful social science theory out of [the] 'chance appearance'" of an individual.⁹ This paper will attempt to bridge the gap between the chance appearance of Korolev, the individual, to focus on his specific actions, and the bureaucratic environment with which he interacted. Unlike individuals, which are not easily compared, policy process and bureaucratic structures are the stuff of useful social theory. Ultimately therefore, it is the aim of this paper to transfer Korolev, and the Sputnik program into a format which will be more easily compared with other programs, and lead to a deeper understanding of the significance of Sputnik from the standpoint of social scientists.

The analytic framework of this paper will be built upon the organizational foundations of the early Soviet missile and space program. It is one of the interesting historical paradoxes of Sputnik that the Soviet defense industrial system which was designed to exert airtight control over military R&D, held within its organizational flaws

⁶ See Zbigniew Brzezinski and Samuel P. Huntington, *Political Power: USA/USSR*, (New York, 1972)

⁷ See Brzezinski and Huntington, *Political Power: USA/USSR ...* pp. 228-229.

⁸ For detailed biographies of Korolev see James Harford, *Korolev: How One Man Masterminded the Soviet Drive to Beat America to the Moon*, (New York: Wiley and Sons, 1977); and Iaroslavl Golovanov, *Korolev: Fakti i Mifi*, (Moscow: Nauka, 1994).

⁹ See, James Q. Wilson, *Bureaucracy*, (New York, Basic Books, 1989). It should be noted that there have been attempts to construct useful social theory out of individuals, see for example Jameson W. Doig and Erwin C. Hargrove, *Leadership and Innovation: a Biographical Perspective on Entrepreneurs in Government*, (Baltimore: Johns Hopkins University Press, 1987).

which greatly diminished its capacity to manage a highly innovative program. In part these organizational cracks appeared as the result of historical happenstance. In part they appeared as a result of apparently bad decisions by the Soviet leadership. Whatever the case, Korolev used these organizational soft spots to drive his program through a resistant bureaucracy. For his own part, Korolev did a masterful job of creating a tightly knit organization of rocket scientists and engineers that held and maintained a strong informational advantage over the Soviet leadership.

The paper will then examine how Korolev used his informational advantage to push his agenda forward and move from a purely military missile program to a civilian space program. Sputnik did not occur as the result of a well planned out long-term program, but rather in fits and starts as a result of opportunities which presented themselves to Korolev. It was the ability of Korolev to jump through these “policy windows” that led to the launch of Sputnik. The Soviet leadership was only an observer, and it only played this role for the latter stages of the program. For most of the period that satellite programs were being developed in the Soviet Union, the leadership was completely ignorant. Ultimately, we are led to the question of whether the Soviet leadership was effectively duped by Korolev into supporting a program for which it had no *ex ante* desire.

THE BUREAUCRATIC STRUCTURE OF THE SOVIET MISSILE PROGRAM

The relationship between Korolev and the Soviet leadership in the case of the Sputnik program is well described in terms of the relationship between principals and agents.¹⁰ These theories have been adapted to deal with the problems of political control

¹⁰ Principal-agency theory derives from microeconomic theories of the relationship between owners (principals) and workers (agents). For some the early work applied to behavior in the private sector see Michael C. Jensen, and William Meckling, “Theory of the Firm: Managerial Behavior, Agency Costs, and Ownership Structure,” *Journal of Financial Economics*, Vol. 3 (October, 1976) pp. 305-360; Eugene Fama, “Agency Problems and the Theory of the Firm,” *Journal of Political Economy*, Vol. 88 (April, 1980) pp. 288-307, and Eugene F. Fama and Michael C. Jensen, “Separation of Ownership and Control,” *Journal of Law and Economics*, Vol. 26 (June, 1983) pp. 301-325.

over public bureaucracies.¹¹ In the case of the Soviet missile and space program the principals were the leadership which made decisions on program initiation, cancellation, or significant revisions. The agents were the scientific-technological, and industrial community which designed and built the systems.¹² In most governments, there is a vast gulf between the two sides of government, filled with administrative agencies charged with ensuring that the decisions of the political leadership are faithfully implemented. In the terms of principal-agency these agencies are acting as monitors for the principals. In the Soviet government, the gulf was even broader and the proliferation of government monitoring agencies even greater.¹³

Principal-agency focuses upon informational asymmetries between the political leadership (principals) and the individual bureaus (agents) and the alignment of incentives, in particular, on information available to bureaucrats -- on their true "types" (honesty, personal goals, policy positions) and their true performance -- that politicians do not automatically possess and often can only acquire with much imprecision and expense. It then encourages us to inquire into the monitoring devices and incentive structures -- aspects of institutional design -- that mitigate the asymmetry and thus minimize the problems of adverse selection and moral hazard that will otherwise cause bureaucrats to depart from their political directives.¹⁴

Thus principal-agency theory assumes that there was a fundamental tension between Korolev and the Soviet leadership, and it encourages us to direct our attention on the ability of Korolev to control the flow of potentially adverse information to the leadership, and the ability of the leadership to develop objective means of monitoring the progress of Korolev's program. This framework treats the military service or government agency which ultimately uses the systems produced by Korolev as a principal whose

¹¹ See Terry Moe, "The New Economics of Organization," *American Journal of Political Science*, Vol. 28 (November, 1984) pp. 739-777; Terry Moe, "Politics and the Theory of Organization," *Journal of Law, Economics and Organization*, Vol. 7 (1991 special edition) pp. 106-129; Mathew D. McCubbins and Thomas Schwartz, "Congressional Oversight Overlooked: Police Patrols versus Fire Alarms," *Political Sciences Quarterly*, Vol. 28:1 (1984) pp. 165-179. and Barry Weingast, "The Congressional-Bureaucratic System: A Principal-Agent Perspective," *Public Choice* Vol. 44 (1984) pp. 147-192.

¹² See Jonathan Bendor, Serge Taylor, and Roland Van Gaalen, "Stacking the Deck: Bureaucratic Missions and Policy Design," *American Political Science Review*, Vol. 81, pp. 873-896.

¹³ For a discussion of the Soviet government in terms of principal agency theory see Phillip Roeder, *Red Sunset*, (Princeton: Princeton University Press, 1994).

¹⁴ Moe "The New Economics of Organization..."

interests were consistent with, if not identical to those of the leadership.¹⁵ The leadership will first attempt to establish incentives to encourage the scientists to engage in useful innovation.¹⁶ Since the leadership cannot be certain that the incentives are working perfectly, it will employ monitors to supervise the activities of the scientists.¹⁷ The scientists in turn will use their expertise to manipulate their relationship with the leadership so that the leadership provides them with all of the resources they might need to pursue their research agendas with minimal oversight.¹⁸

The ensuing sections will explore the decision-making structures to identify and assess the actual levels of control. Ultimately, they will conclude that leadership was placed in a very poor position to control the development of the missile and space program.

LEADERSHIP DECISIONMAKING STRUCTURE

Some people say we were technological ignoramuses. Well yes we were that, but we weren't the only ones. There were some other people who didn't know the first thing about missile technology.

¹⁵ As we will see, military often acts as a monitor to a greater degree than it does a principal. This is particularly the case with respect to *programmatic innovation*. For an application of the principal-agency framework to defense procurement see Tracy Lewis, "Defense Procurement and the Theory of Agency," in Jim Leitzel (ed.) *Economics and National Security*, (Boulder CO: Westview Press, 1993) pp. 57-72.

¹⁶ On incentives and risks see in particular David E. M. Sappington, "Incentives in Principal-Agent Relationships," *Journal of Economic Perspectives*, Vol. 5, No. 2, (Spring 1991) pp. 45-66;

¹⁷ See McCubbins and Schwartz, "Congressional Oversight Overlooked..."

¹⁸ See Michael W. Lawless and Linda L. Price, "An Agency Perspective on New Technology Champions," *Organizational Science*, (1992) 3:3 pp. 342-355; see also Jonathan Bendor, Serge Taylor, and Roland Van Gaalen, "Stacking the Deck: Bureaucratic Missions and Policy Design," *American Political Science Review*, Vol. 81 No 3. (September 1987) pp. 873-896.

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When a decision is made to initiate a new program, the leadership *appears* to hold a preponderance of authority. It controls the funding, and must make a positive decision in order for a program to begin formulation. However, for dramatically new technologies, it possesses little understanding of the realistic costs and possibilities for programmatic success. It may not even have a clear understanding of the objectives. Time constraints, imperfect understanding of technology, conflicts over basic goals, and the limited attention the leadership is able to devote to consideration of technically complex issues, are weaknesses of the leadership that scientists may be able to exploit.¹⁹

Joseph Stalin was seemingly capable of exercising complete control over administrative affairs in the Soviet Union from 1944 to 1953. His decision on any issue was final. Through the widespread use of terror, he ostensibly maintained a high level of compliance from his administrators. "Sabotage," or the failure to implement CPSU policies, was the crime for which many R&D managers were shot during the purges of the late 1930s.²⁰ Perceived omnipresence of the secret police created the impression that Stalin was capable of knowing everything. Therefore, once Stalin made a decision, there was a high perceived cost associated with failure to faithfully implement that policy.

However, the gap between potential and actual control was great during the post WW II Soviet Union.²¹ Because of the tremendous concentration of authority in the hands of a single individual, Stalin's ability to control the Soviet Union as a whole was severely circumscribed.²² Therefore, question becomes one of how decision making was actually performed and policies actually monitored under Stalin. Which programs really received his attention?

In the post war years, Stalin's ability to manage affairs was compromised by his ever decreasing attention span. As Stalin aged, and became increasingly incapable of managing such a large bureaucracy, the government settled into a sort of political paralysis. Hough and Fainsod note that "there were very few striking policy innovations taken in these years, and in one policy area after another, one gains the clear impression of petrification."²³ By the end of the war, Stalin was exhausted and increasingly came to rely

¹⁹ See in particular John W. Kingdon, *Agendas, Alternatives, and Public Policies*, (Boston: Little Brown, 1984).

²⁰ See Kendall Bailes, *Technology and Society Under Lenin and Stalin: Origins of the Soviet Technical Intelligentsia, 1917-1941*, (Princeton: Princeton University Press, 1978)

²¹ See Timothy Dunmore, *Soviet Politics 1945-53*, (London: Macmillan, 1984).

²² This is Downs' "Law of Diminishing Control" See Downs, *Inside Bureaucracy...*

²³ See Jerry Hough and Merle Fainsod, *How the Soviet Union is Governed*, (Cambridge: Harvard

upon his colleagues in the Politburo to manage the daily affairs of state. Authority for decision-making on many issues grew unclear in late 1945, and by the end of 1946 the leadership settled into a pattern in which ad hoc groups would gather in the late night and early morning hours over bottles of vodka and snacks to determine the future course of the world's second most powerful nation.²⁴

The political leadership showed little interest in rocketry after the war. Only after repeated prodding by the scientists, it finally responded in 1946 by creating an organizational structure for the development of rocketry. However Stalin's initial decision did not provide for a development program, not even the launch of captured German V-2s.²⁵ The structure of the program itself was ill-suited for development of a new complex technology. Rocketry was put under the management of both an industrial ministry which had little understanding of the technology, and military leaders who were openly hostile toward using missiles as military weapons. Even within the institute charged with the development of rocketry (NII-88), long range rocketry remained a distant second-order priority behind anti-aircraft missiles.

Most analyses to date have argued that these decisions, particularly the 1946 decision to create a missile industry, were conscious efforts to establish a Soviet long range missile program to deliver nuclear weapons to the United States.²⁶ However, at the time these decisions were being made, the Soviet leadership was besieged by a huge number of more pressing issues. It had a very poor understanding of the capabilities of ballistic missiles, and there was no indication that it had any knowledge of the potential use of missiles as nuclear delivery vehicles.

In reality Soviet leadership decision-making closely resembled a "garbage can"

University Press, 1979, p. 363.

²⁴ See Werner Hahn, *Post-War Soviet Politics: The Fall of Zhdanov and the Defeat of Moderation 1946-53*, (Ithaca: Cornell University Press, 1982); Timothy Dunsmore, *Soviet Politics 1941-53*, (London, Macmillan, 1984); Strobe Talbott, N.S. Khrushchev, *Khrushchev Remembers: the Last Testament*, (New York: Little Brown, 1971); Jerry Hough and Merle Fainsod, *How the Soviet Union is Governed*, (Cambridge: Harvard University press, 1979); and Milovan Djilas, *Conversations with Stalin*, (New York: Harcourt, 1962)

²⁵ See Vetrov, *Sekerty Ostrova Gorodomliia...*

²⁶ See David Holloway, "Innovation in the Defense Sector: Battle Tanks and ICBMs," in Ronald Amann and Julian Cooper, *Industrial Innovation in the Soviet Union*, (New Haven: Yale University Press, 1982); Karl F. Spielmann, *Analyzing Soviet Strategic Arms Decisions*, (Boulder: Westview Press, 1978); David Holloway, *The Soviet Union and the Arms Race*, (New Haven: Yale University Press, 1984); and Ronald D. Humble, *The Soviet Space Programme*, (London: Routledge, 1988).

process. The scientists advancing the missile program were a solution looking for a problem and a decision-making opportunity. In the end, they were coupled with a problem (shooting down American aircraft) which had little to do with their solution (ballistic missiles), but the decision-making opportunities created by the end of WW II made it difficult for the leadership to refuse to initiate the program.²⁷

The Decision to Initiate a Rocket Program

On May 9, 1946 (the first anniversary the German surrender -- Victory Day), the Politburo approved the decree on the development of rocketry in the Soviet Union. On May 13 the Council of Ministers issued a broad-ranging decree calling for:

1. priority development of rocketry;
2. established a high level monitoring organization—*Spetskomitet-2*, under the direction of Georgi Malenkov;
3. designated the Ministry of Armaments as the responsible ministry; and,
4. designated the design bureaus and scientific research institutes, from the MV as well as other ministries, which would be participants in the missile development programs.²⁸

The primary design and production organization was designated as NII-88 under the direction of A.D. Kalistratov. Prior to the decree, NII-88 was a poorly equipped factory scheduled for conversion from production of artillery pieces to oil drilling equipment.²⁹ It was far from the best equipped facility in the Soviet Union for for what was purportedly a high profile program.³⁰ Because there were a great many more important issues which the political leadership in late 1945 and early 1946, there were few other details provided for in this decree.

²⁷ See Michael D. Cohen, James G. March and Johan P. Olsen, "A Garbage Can Model of Organizational Choice," *Administrative Sciences Quarterly*, Vol. 17 (1972) pp. 1-25, more recent and detailed accounts appear in James G. March and Johan P. Olsen (eds.), *Ambiguity and Choice in Organizations*, (Bergen Norway: Universitetsforlaget, 1976); and James G. March and Roger Weissinger-Baylon, *Ambiguity and Command: Organizational Perspectives on Military Decision Making*, (Marshfield MA: Pitman Publishing, 1986).

²⁸ Interviews with Chertok, Golovanov.

²⁹ *Progress...*

³⁰ For a mor in depth discussion of the conditions at NII-88 see Chertok, *Raketi i Liudi...*

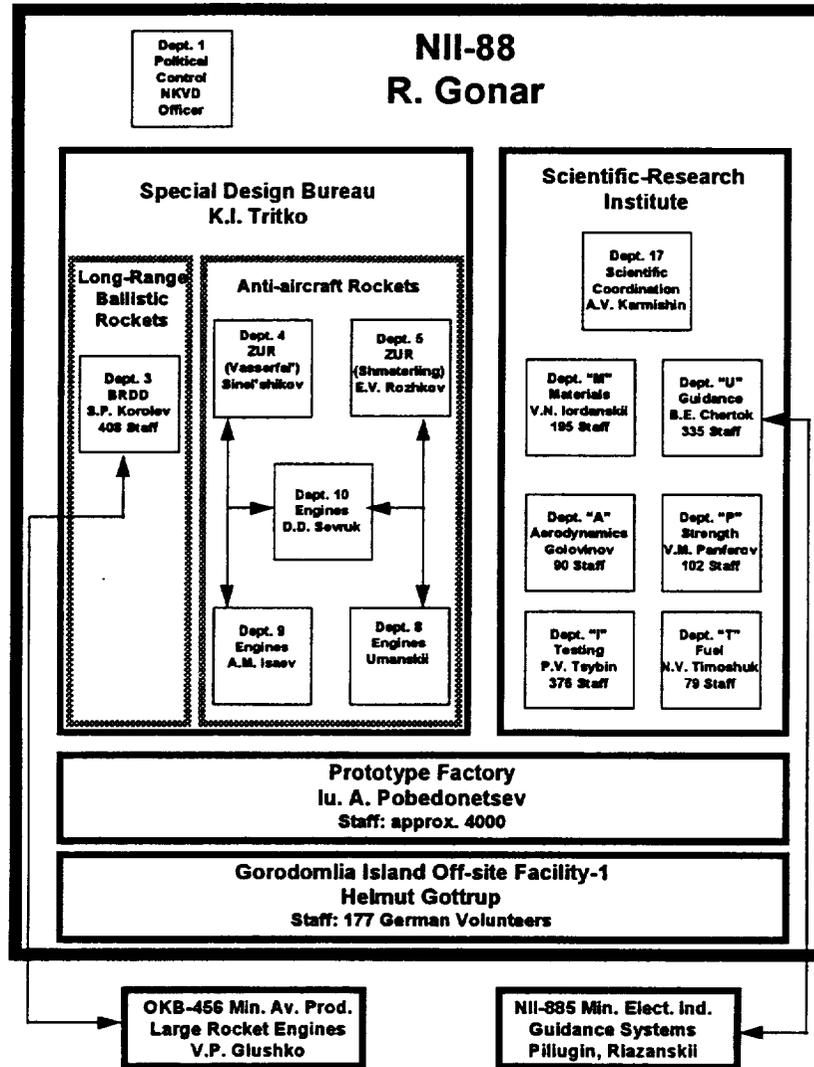


Figure 1 -- The structure of NII-88 circa 1948

There were four rocket programs approved in the 1946 decree. Three of these were for the *Taifun*, *Shmeterling*, and *Vasserfal* anti-aircraft rockets. The fourth was Korolev's long-range ballistic missiles (BRDDs).³¹ Among the rocket programs, anti-aircraft systems were Stalin's highest priority. Even among long-range missiles, it is far from clear that Korolev's program was the most important. There were two other programs for unmanned missiles in the Ministry of Aviation Production (NKAP). The Chelomei Design Bureau was developing primitive cruise missiles based on the captured remnants of V-1 cruise missiles.³² There may have been another rocket-plane project

³¹See Vetrov, *Secrety Gorodomliia...*

³²See "Zhizn' i tvorchestvo Akademika V.N. Chelomeia" *Iz Istorii Aviatsii i Kosmonavtiki*, No. 60 (1990) p. 72.

within NKAP based loosely upon the Sanger space plane concept involving a three stage booster with a winged re-entry vehicle.³³ Given the relatively limited information available on the Tokaev project, and questions over its existence, it is difficult to establish its institutional stability. If it did exist, it was assigned to NKAP. That much is beyond question. However, it is unclear whether Tokaev represented a distinct design bureau or some design group within some other organization, or possibly even the Soviet Air Force (VVS).

In reality, the decree issued by the Central Committee and the Council of Ministers only elaborated on points made in the fourth five year plan (1946-1950). This plan reflected the overall trend to increase the level of defense preparedness after the war. In 1941, the R&D budget was 1.6 billion rubles. By 1945, it increased to 2 billion. In 1946, it shot up to 6.3 billion rubles, and increased to 9 billion by 1950.³⁴ There was also a specific reference to rocketry in the document of the Chairman of Gosplan of the USSR, N.A. Voznesenski. He emphasized that it

is necessary for us to guarantee work on development of new branches of technology and production. To this it is referred...work on development of *reactive technology*, utilizing new types of engines, creating new speeds and capabilities; work on research in the interest of producing and transporting internal atomic

³³Some caution must be used in discussion of the Tokaty project. The existence of this project revolves around the recollections of a single man G.A. Tokaty-Tokaev who defected to England in 1948. In the voluminous literature on the history of Soviet rocketry there is not a single reference to this person and none of the participants who were interviewed for this study have any recollection of his existence or the existence of his project. However, in other respects his accounts of the post-war history of the Soviet rocket program are remarkably consistent with information which was only released some 40 years after his defection. It is entirely possible that his story is correct, but that the project was closed down and all traces removed after his defection. See G.A. Tokaty, "Soviet Space Technology" *Space flight*, Vol. 5, No. 2 (March 1963), pp. 58-64; and G.A. Tokaty, "Foundations of Soviet Cosmonautics," *Space flight*, Vol. 10, No. 10, pp. 335-343.

Gerhardt Sanger was a German rocket engineer who developed a spaceplane concept for delivering a bomb to the United States from Germany. The project was never approved nonetheless he managed to flesh-out the general concept in considerable detail. For a more detailed description see Ordway, *The Rocket Team...*

³⁴Parrott, *Politics and Technology...* pp. 100-101. Reactive technology was the Soviet term for rocket propulsion. Emphasis mine.

energy.³⁵

Similar decrees for the organization of the nuclear and aviation programs were also issued in the same year.³⁶ Viewed in this context, the missile program, which involved no more than hundreds of engineers and technicians, was probably the most trivial of the post-war development programs.

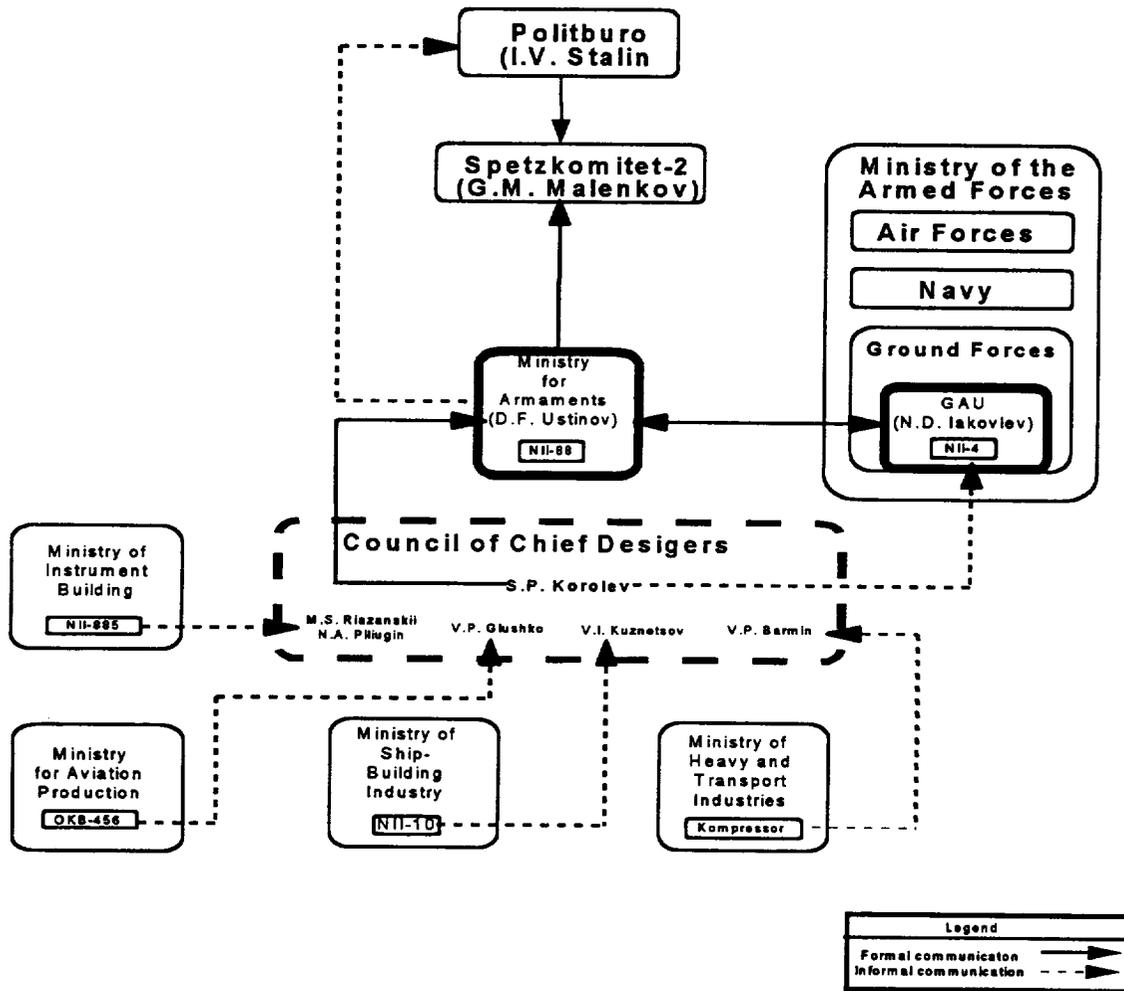


Figure 2 -- The Organization of the Soviet Missile Program in 1950

³⁵A.P. Romanov and V.S. Gubarev, *Konstruktori*, (Moscow: Politizdat, 1989) p. 301. See also, Avduevskii, V.S. and Grishin, S.P., "Razvitie raketnoi tekhniki v SSSR v period 1946--1957 gg." in D'ianenko, S.M., *Issledovaniia po istorii i teorii razvitiia aviatsionnoi i raketno-kosmicheskoi nauki i tekhniki, Vol. III*, (Moscow: Nauka, 1984), p. 9. for a reference to the same information.

³⁶ See Steven J. Zaloga, "The Soviet Nuclear Bomb Programme--The First Decade," *Jane's Soviet Intelligence Review*, April 1991, pp. 174-181.

The basic organizational structure as it existed in 1950 is depicted in figure 2. The most important point illustrated in this diagram is the difference between formal and informal channels. Formally, the program was under the direction of Georgi Malenkov, a leading member of the Politburo, who headed *Spetzkomitiet-2* (Special Committee-2). In practice, Malenkov was seldom involved in decision making. Dmitry Ustinov, the Minister of Armaments, had informal channels of communication with Stalin which circumvented Malenkov. Similarly, the Council of Chief Designers itself was an informal structure. Formally, the institutes were completely separate. Informal coordination between Korolev and the military at NII-4 served to build his constituency in the military from the ground up.

Spetzkomitiet-2

Formally, the programs were under the direction of Georgi Malenkov, a leading member of the Politburo, who headed *Spetzkomitiet-2* (Special Committee-2). The *Spetzkomitiet* system was instituted following the war primarily in order to facilitate the development of nuclear weapons.³⁷ The system was subsequently transferred to the missile, and radar programs and *Spetzkomiteti* were created for each.³⁸ Long range aviation programs also operated under Stalin as an informal special committee.³⁹ However, the missile committee was clearly the lowest priority.

To some extent, the low priority of the committee was due to the weakness of Malekov as an administrator.⁴⁰ Other committees were headed by the Chief of secret police, Lavrenti Beria, and Stalin himself. Both were far more forceful administrators than Malenkov. As already noted above, Malenkov was preoccupied with maintaining his position within the Soviet leadership.⁴¹

Both nuclear weapons and aviation also benefited from the fact that they could

³⁷ See Holloway, *Stalin and the Bomb...*

³⁸ Nuclear weapons fell under *Spetzkomiteti* #1, rocketry under #2, radar under #3. Chertok, *Raketi I Liudi...* The long-range aviation program fell directly under Stalin's guidance, but was may not have been assigned a formal designation.

³⁹ See Zaloga, *Target America...*

⁴⁰ Interview with Boris Chertok, Moscow, August 1994.

⁴¹ See Hahn, *Post War Soviet Politics...* and Khrushchev, *Khrushchev Remembers...*

steal many of the designs from the Americans and therefore could simply order Soviet designers to copy American designs exactly. Such was clearly the case with aviation (the B-29) and the first nuclear weapons.⁴² Since there were no such plans for either anti-aircraft or ballistic missiles in America at the time, Malenkov had no ready design parameters to enforce. When the anti-aircraft program was taken away from Malenkov's committee in 1950 and transferred to the radar program, the priority of Spetskomitet-2 only further diminished.

Malenkov's attention was primarily occupied with political intrigue. For the entire period from the end of the war until his death in 1953, Stalin remained in poor health. For most of this period Malenkov was the heir apparent, if for no other reason than he was the least offensive to other Politburo members. Consequently he often found himself at the center of political battles first with Zhdanov, then with Beria, and finally with Stalin's ultimate successor Khrushchev. There was precious little time for learning even the basics of ballistic missile technology. There were very few recorded instances of meetings between Korolev and his designers and Malenkov.

The Death of Stalin and the transition to new leadership

Stalin died on March 3, 1953. It is difficult to imagine a situation in which a greater power vacuum was created at the pinnacle of national leadership. Moreover, there were no formal mechanisms for political succession, and no less than six contenders for national leadership were removed from positions of power in the next four years. More than four years of political turmoil ensued. The leadership of the Soviet state was not settled until the Summer of 1957. During this time, virtually all of the major decisions regarding the development of ICBMs and the initiation of a space program would be made by a leadership preoccupied by internal struggles.

The Soviet constitution made no explicit arrangements for political succession nor did the political institutions provide any informal arrangements for the succession, of authority, outside of an open competition for assumption of political power. Rush offers the following clarification:

In the last analysis, the chief sanction for the dictator's rule in the Soviet system is the fact that he exercises it, and has placed it beyond the challenge of legitimate political activity. While this sanction may suffice for the incumbent, it has the defect that it provides no principle for establishing the legitimacy of a successor until he too has placed his rule beyond challenge by customary political means.⁴³

⁴² See Zaloga, *Target America...* for a discussion of aviation, and Holloway, *Stalin and the Bomb...* on nuclear weapons.

⁴³ See Myron Rush, *Political Succession in the USSR*, (New York: Columbia University Press, 1965) p. 74.

As a result, several individuals and factions vied for leadership of the Soviet government following Stalin's death. In sequence, Khrushchev and his supporters eliminated each contender to the throne, often using one to eliminate another, then, in turn eliminating the first group. One potential claimant, Lavrenti Beria, was shot, and others such as Georgi Malenkov, Viacheslav Molotov, and Nikolai Bulganin, were dismissed from high positions and relegated to insignificant posts during this four-year power struggle. As a consequence, from 1953 to 1957 lines of authority were extremely unclear, and members of the leadership devoted most of their time to the struggle for succession rather than the business of running the country.⁴⁴

Beyond the general decision-making uncertainty, the Soviet leadership was especially immobilized on topics related to defense technology. Up to his death, Stalin confined information on defense systems to himself and Beria, and to a lesser degree Malenkov. Khrushchev remarked that he had been completely excluded from decisions related to military systems.⁴⁵ Consequently, with the execution of Beria and the exclusion of Malenkov, the Soviet leadership had no one with any experience with military technology in general, let alone defense technology. Khrushchev himself commented on their lack of technological competence with respect to missiles:

Not too long after Stalin's death, Korolev came to a Politburo meeting to report on his work. I don't want to exaggerate, but I'd say we gawked at what he showed us as if we were sheep seeing a new gate for the first time. When he showed us one of his rockets, we thought it looked like nothing but a huge, cigar shaped tube, and we didn't believe it would fly. Korolev took us on a tour of the launching pad and tried to explain to us how a rocket worked. We were like peasants in a marketplace. We walked around and around the rocket, touching it, tapping it to see if it was sturdy enough—we did everything but lick it to see how it tasted.

Some people say we were technological ignoramuses. Well yes, we were that, but we weren't the only ones. There were some other people who didn't know the first thing about missile technology either.⁴⁶

Technological ignorance was complicated by formalized decision making procedures which placed an extremely high burden on leadership, leaving virtually no time for discussion. Weekly Politburo sessions perfunctorily passed through 50 or 60 decisions in the space of a few hours.⁴⁷ Unable to deal with decisions at a high level of detail, the Presidium perforce relied upon the staff of the Soviet bureaucracy for support. This

⁴⁴See Talbot, *Khrushchev Remembers...*

⁴⁵ *Ibid.*

⁴⁶ *Ibid.* p. 46

⁴⁷These were the recollections of Michael Voslensky, in Ra'anana, *Inside the Apparatus...* op. cit. p. 62.

placed a great deal of authority in the hands of the bureaucrats who set the agendas for Presidium meetings, and those who prepared proposals for consideration. But even before Stalin's death, the *Spetskomiteti* system was dismantled, thus severing even this weak connection between the leadership and the missile program. Within the Central Committee, the Department for Defense Industries held no expertise over missiles.⁴⁸ Thus, from 1953 to 1955 there was nothing between the ministries and the leadership to assist in the management of missile technology. In 1955, the Military Industrial Commission was created to oversee all military technology programs. The first Chairman was Dmitry Ustinov.

Leadership Capacity and Decision-Making Uncertainty

Preoccupied with internal struggles, the Khrushchevian leadership was unclear on strategic goals, was totally ignorant of technological means, and was given little time to devote to decisions due to formalistic decision-making processes. As was the case under Stalin, decision-making under these conditions tended to permit perfunctory review of mid-level decisions, but led to avoidance of the most important issues.⁴⁹ It was a leadership extraordinarily ill-equipped to effectively manage missile technology. It would have to rely heavily upon monitoring agencies to provide accurate information regarding missile programs. This was fertile ground for Korolev, who had already developed strong constituencies in both key administrative agencies.

MONITORING/ADMINISTRATIVE AGENCIES

What are you doing?!? You put more than four tons of alcohol in a rocket. If you give my division this alcohol it could take any town. But your rocket could not even hit the town. Who needs it?

Unidentified Red Army Marshal (1948)

Principal agency theory directs attention to several methods of controlling a program which hold relevance to the case of the Soviet missile and space program.

⁴⁸ Interview with Stroganov; see also, Golovanov, *Korolev...*

⁴⁹ See Kingdon, *Agendas, Alternatives and Public Policies...*

Control is particularly problematic in cases of very new technology programs requiring effective monitoring techniques. The most pervasive technique in Soviet society was through what Roeder terms *colonization* a technique that involves population of an organization with personnel which leadership believes it can trust.⁵⁰ A second technique is the creation of competing sources of expertise which can serve as judges, albeit hardly impartial judges, of the progress of their competitors.⁵¹ A third method is to establish independent committees to oversee important milestones.⁵² All three methods were employed by Soviet administrators, but with little success. Ultimately, it was Korolev who was able to colonize his administrative agencies, developing them into strong constituencies.

When the official decision to create a Soviet rocket program was issued in 1946, there were only hollow administrative agencies for monitoring and managing the development of missiles. By the end of 1954, both the Ministry of Armaments (MV) and Ministry of the Armed Forces (MVS) had their own research institutes as well as a variety of administrative organizations to monitor missile development. A directorate for the missile program was formed within the MV (the 7th Directorate) under the direction of Sergei Vetoshkin. During the period from 1949 to 1953, it was staffed primarily by engineers trained by Korolev. Within the MVS, missile programs were assigned to the Main Artillery Directorate (GAU) under Marshal N.D. Iakovlev. General Ivan Nestorenko was put in charge of a research institute (NII-4) created in 1947 with specific responsibility for monitoring the development of ballistic and ZUR missile programs. During the time that the German rocket scientists were involved, the secret police (NKVD) supervised some aspects of the program, but were not nearly as intrusive here as they were with the nuclear program.

The Ministry of Armaments and the the Artillery Troops

Separated by the capriciousness of Stalin's purge of scientists and engineers with ties to the unjustly discredited (and executed) Marshal Tukhachevskii, many of the rocket scientists who had worked with Korolev before the war were reunited in Germany for the purpose of collection of Nazi aviation technology.⁵³ What the rocket scientists found in Germany was by their estimation truly remarkable technology, representing a considerable step toward Tsiolkovkii's dream of space flight. Preoccupied with construction of a post

⁵⁰ See Phillip Roeder, *Red Sunset*, (Princeton, Princeton University Press, 1994).

⁵¹ See Downs, *Inside Bureaucracy...*

⁵² *Ibid.*

⁵³ It is worth noting that Korolev and others were sent to Germany primarily to collect aviation technology, not rocket technology. In fact the leadership showed very little interest in rocket technology. On this point see in particular Chertok, *Raketi i Liudi...*

war order, Stalin was uninterested in German rocket technology. Similarly, administrative agencies saw few prospects. Korolev's rocket program was an organizational orphan.

The search for an administrative home for the missile program predated Korolev's arrival in Germany by almost a year. On September 30, 1944, Korolev wrote to the Deputy Minister of NKAP requesting that the group of rocket specialists from Plant 16 in Kazan (including himself, and Valentin Glushko), recently released from the Peoples Commissariat for Internal Affairs (NKVD) systems of *sharagi*, be transferred to the People's Commissariat for Aviation Production (NKAP).⁵⁴ His proposal was rejected.⁵⁵ Korolev resubmitted the proposal in June 1945, only to be rejected again.⁵⁶ The Ministry of Aviation Production was not merely disinterested in development of rocket technology, it was afraid of it.⁵⁷ The German accomplishments were considerable, and Deputy Peoples Commissar of Aviation Industry, Dementev, justifiably feared that production of Soviet versions of the V-2 would involve considerable technological as well as personal risk.⁵⁸ Failure to successfully assimilate the technologies involved in the V-2 could easily lead to charges of sabotage, and the ministry was already faced with the difficult task of absorbing the technologies involved in reproducing the German V-1, as well as the American B-29.⁵⁹ As events turned, the NKAP was unable to avoid charges of mismanagement. In early 1946, the Peoples Commissar, Novikov, was jailed for his mismanagement of the B-29 program.⁶⁰

Korolev was finally sent to Germany in October 1945 along with a small group of scientists and engineers under the direction of General Gaidukov, who worked within the administrative apparatus of the Central Committee. Rejected by NKAP, Gaidukov's group was in a state of organizational limbo. In order to survive, it had to have a clear affiliation with an industrial ministry. Despite Gaidukov's entreaties to the Central Committee apparatus, there were no takers. Neither Malenkov nor Stalin showed any interest at this point. Clearly, additional persuasive power was needed. To this end, Gaidukov studied the organizational details of pre-war Soviet rocket technology under Korolev's tutelage. The two prepared a sales pitch based on the long Soviet rocket history, and emphasized

⁵⁴Correspondence from Korolev, Archives of the Cosmonautics Memorial Museum/ Memorial of Korolev's house, F.1, ed. xp. kp 135, ll. 16-21.

⁵⁵Vetrov, *Secrets of Gorodomliia Island...*

⁵⁶Georgi Vetrov, *S.P. Korolev i Kosmonavtika: Pervye Shagi*, (Moscow: Nauka, forthcoming) p. 270

⁵⁷Interviews with Chertok, Mishin, and Golovanov.

⁵⁸ Interview with Chertok.

⁵⁹See Steven Zaloga, *Target America: the Soviet Union and the Strategic Arms Race, 1945-1964*, (Navato: Presidio Press, 1993) pp. 69-80.

⁶⁰See *Target America*,... p. 70.

the opportunity provided by the collected German technology for the Soviet Union to advance beyond the rest of the world. Armed with this narrative, Gaidukov and Korolev renewed their search for an administrative home in January 1946, but were greeted with scepticism in Moscow. They went first to the Peoples' Commissar for Aviation Production, Shakyurin, who not only rejected the program again, but also recalled all the specialists from NKAP working on rocketry.⁶¹ The Peoples' Commissar for Munitions, Boris Vannikov, initially accepted Gaidukov's offer, but changed his mind after two weeks, arguing (somewhat disingenuously) that he had *just* been given another program.⁶² Gaidukov and Korolev also paid visits to the Peoples' Commissariats for the Mortar Industry and Heavy Industry only to be rejected there as well.⁶³ Korolev and Gaidukov also considered the idea of setting up an entirely new narkom to manage rocketry.⁶⁴ The scientists favored this option, arguing that rocket technology could not be developed within any of the existing Narkoms (with the exception of the Narkom for Aviation Production.)⁶⁵ As a last resort, Gaidukov went to the Peoples' Commissar for Armaments, Dmitry Ustinov. While Ustinov expressed interest, he refused to accept the program immediately, agreeing only to send his first deputy, Vasilii Riabikov, to examine Gaidukov's rockets.⁶⁶

Riabikov's only industrial experience had been at the Bolshevik naval artillery factory in Leningrad. His work there was in party organization; not design, or even production. He was not suited to judge the value of this new technology. Upon Riabikov's arrival in Germany, Korolev guided him through the captured underground factories at Mittlewerk and Montana, various design bureaus, and finally to the test stands. Riabikov seemed unimpressed. Even the rocket engine tests drew the disheartening response from Riabikov that he thought the one minute test had lasted for hours. A banquet was prepared, offering their best vodka and cognac, but Riabikov was virtually a teetotaler, and remained silent. Finally, however, Riabikov broke his silence and announced to the assembled rocketeers:

Well comrades, everything that you have shown me is very interesting. I believe that our narkom should take up this work. I will speak to Dmitry Fedorovich

⁶¹ Gaidukov was successful in preventing the departure of all but two specialists, rocket engine designer Isaev, and one of his co-workers. See Chertok, *Raketi i Liudi...* p. 139.

⁶² Vannikov was actually tasked with the atomic bomb program several months earlier, but did not disclose this to Gaidukov. Therefore, his excuse was somewhat disingenuous.

⁶³ Interview with Chertok.

⁶⁴ See *Secrets of Gorodomliia...*

⁶⁵ Interview with Chertok...

⁶⁶ See Golovanov, *Korolev..* pp. 361-362..

(Ustinov) about this...⁶⁷

Ustinov considered the program further. He determined that he must go to Stalin with this information in an effort to apprise Stalin before the Chief of the secret police, Beria, had a chance to do the same. This tactic was necessary to diminish the possibility of an inquiry from Stalin as to why Ustinov had not taken up this “promising new technology.”⁶⁸ Ultimately, Ustinov agreed to take responsibility for the program only after an implied threat of reprisal from Stalin. On May 13, the Council of Ministers issued a decree assigning all missile programs to the Narkom for Armaments, but there were no immediate tangible effects of this decree to the rocket scientists in Germany. While Korolev recognized that there were few other possibilities, the other scientists feared that this was a mistake. The Narkom for Armaments knew nothing about missiles. Mishin later proclaimed “that this was the single biggest mistake the Soviet government made in the entire missile program.”⁶⁹

In reality, Mishin was exactly wrong. In Ustinov, Korolev had what should be any program manager’s dream -- a technically ignorant administrator committed to mission success, without a clear idea of what that mission should be. Ustinov was aware that in order to be successful in the Soviet defense industrial bureaucracy, he needed to head an important research program, along with his bread and butter artillery and tank business. Without the technical competence to question Korolev, Ustinov presented only a very loose monitoring structure. For a time at least, Korolev and Ustinov were dependent upon each other. Korolev needed Ustinov’s administrative support with the leadership, and Ustinov’s own career was closely tied to Korolev’s success. A relationship of mutual reciprocity developed which bound the two men’s careers to each other.⁷⁰

The Main Artillery Directorate (GAU)

For a time, relations between Korolev and his other monitoring agent, the Main Artillery Directorate of the Red Army were far more problematic. Marshal Iakovlev, Deputy Chief of the Artillery Troops who were saddled with the rocket program was resistant to the introduction of Korolev’s technology. Iakovlev persistently refused to

⁶⁷ See Golovanov, *Korolev...*, p. 363.

⁶⁸ See Golovanov, *Korolev...*, p. 363. It is also interesting to note that during the late 1930s many R&D managers were accused of stifling inventors’ initiative by rejecting proposals without thorough investigation. See Bailes, *Technology and Society...*

⁶⁹ Interview with Mishin.

⁷⁰ The concept of mutual reciprocity is predicted by Roeder to characterize much of the administrative hierarchy of the Soviet Union. See Roeder, *Red Sunset...*

accept Korolev's original rocket (the R-1) into service in spite of the fact that it had ostensibly met testing requirements. For a time he even openly defied Stalin's orders to accept the missile into service.⁷¹ At one point, Iakovlev refused acceptance because his measurements indicated that the fuselage of Korolev's missile was one millimeter out of specification. While at another he argued that the system should not be accepted because it had not met the testing specification of launch at -50 degrees Celsius.⁷²

The course of events took an abrupt change in 1952 when Iakovlev was arrested and replaced by Marshal M.I. Nedelin as CinC of the Main Artillery Directorate (GAU). Iakovlev had been a constant thorn in Korolev's side from the beginning of the post-war missile development program, refusing to accept any missiles into his services without serious resistance. Ironically, Iakovlev was arrested in 1952 for allegedly allowing the launch of a missile which was ill prepared for testing.⁷³

Korolev and Nedelin immediately established good working relations, in large part because Nedelin was willing to admit his own technological ignorance.⁷⁴ Nedelin's background suggests that he was incapable of independently determining the technical merits of ballistic missiles. His educational training was limited to the political faculties of military academies.⁷⁵ His political training, combined with the arrest of Iakovlev, indicates that he was given responsibility for the artillery program more due to his political reliability than his technical competence.⁷⁶ Not surprisingly, Nedelin did not prove to be a particularly demanding military customer; Korolev aptly described the Marshal as "an experienced and benevolent advisor-consultant."⁷⁷

Since before Nedelin, Korolev pushed for a separate branch of the military devoted to the missile program. Both he and the lower ranking military officers working on the

⁷¹ See Golovanov, *Korolev...*

⁷² Of course both rejections were totally ridiculous. One millimeter may make a great deal of difference in an artillery shell but it is totally inconsequential in a rocket. See Vetrov, *Sekrety Gorodmlia...*

⁷³ This probably involved anti-aircraft missiles, but there is no information to confirm this. See Iaroslav Golovanov, *Korolev: Fakti i Myfi*, (Moscow: Nauka, 1994), p 461.

⁷⁴ See Golovanov, *Korolev...*p 461.

⁷⁵Nedelin's training was first in the Military-political courses in Turkestan (1923), and the Higher Komsomal Faculty (*Komsostav*) of the Dzerzhinskii Artillery Academy.

⁷⁶Nedelin began his military career as a political commissar and only later became a fully fledged artillery commander, after the institution of political commissars was abolished. He had no engineering background.

⁷⁷See V. Tolubko, *Nedelin* (Moscow: Molodaia Gvardiia, 1979) p. 176.

program felt that they were being stifled by the rest of the artillery “ground pounders who refused to acknowledge the significance of the new technology.”⁷⁸ In 1953 the Directorate of the Artillery Command for Special Technology (UZKA) was officially created under Nedelin’s command to supervise the introduction of missiles into the Army. Unofficially, it had the effect of isolating the missile program from the rest of the Artillery program.⁷⁹ In 1955, after the first successful test of a nuclear armed missile, the management of the missile program was brought out of the artillery troops altogether and put under the command of Nedelin as the Deputy Minister of Defense for Special Weapons and Rocket Technology.⁸⁰

Nedelin’s career was therefore also tied inextricably to the success of Korolev’s program. He too was tied into a relationship of reciprocal accountability in which he had little choice but to defend Korolev’s program before the leadership. Consequently, both Korolev’s monitoring agents possessed were seriously compromised.

Competition: The German Rocket Scientists

Korolev did not hold a monopoly over information related to missiles in the immediate post war years. He may not have even been among the most knowledgeable scientists in the Soviet Union. The German scientists who came to the Soviet Union in late 1946 had been working on V-2s for three years, and had developed considerable experience. Even if they were not the most qualified German scientists, they held sufficient expertise in rocketry to provide a critical review of Korolev’s proposals. A critical review was not what Korolev wanted at this time.

The German rocket scientists arrived for their “visit” to the Soviet Union in late October 1946. For a short time, they mingled freely with their Soviet counterparts as they had in Germany, but in spring 1947 almost all were relocated to Gorodomliia Island on Lake Selenger near Moscow. One hundred seventy-seven German specialists came to the Soviet Union, including: 24 Doctors of Science, 88 engineers, and 27 workers.⁸¹ Korolev arranged that the German scientists would labor in relative isolation from Soviet scientists at NII-88, arguing to Ustinov that this move was necessary to insure that the German

⁷⁸ Interview with Kerimov

⁷⁹This was the conclusion of an official history of the military missile program. See Iu. p. Maksimov, *Raketnye Voiska Strategicheskogo Naznacheniiia: Voенno-istoricheskii Trud*, (Moscow: RVSН, 1992) pp. 40-41.

⁸⁰*Ibid.*, p. 41.

⁸¹ The source does not make it clear what specialty the remaining 38 Germans held. See Vetrov, *Sekrety Ostrova Gorodomliia...* p. 48

scientists would have creative independence.⁸² Korolev tasked them with development of an improved version of the V-2, requiring only that the missile have the same basic dimensions as its predecessor. Under Helmut Grottrup's directions, the German scientists began designing what was referred to as the G-1.

There were more sinister, or at least bureaucratically motivated, reasons for the Germans' isolation. Korolev was keenly aware that the Germans presented him with a problem. There was a risk that Grottrup would eventually dominate the Soviet missile program. Korolev wished to be the unquestioned leader. By isolating Grottrup's group Korolev controlled the flow of information regarding their activities.⁸³

Thus, Korolev could not only shape perceptions regarding the quality of the German work, but he could also use German technology without appropriate attribution. Korolev used both to his advantage. The arrangement also gave the Germans little access to the work of the Soviet scientists. Consequently, they could criticize neither Korolev's proposals nor his work.

In September 1947, Grottrup's group completed its preliminary plans for the G-1. As directed by Korolev, Grottrup's plan pushed the technological frontiers in several directions. By using radio guidance in place of an inertial system, Grottrup claimed to increase the accuracy over the V-2 by factor of ten. Through the use of aluminum, the weight was reduced by more than 100 kg. Given the lower weight, only minor improvements in the engine were required to achieve a range of 600 km. Additionally, as with Korolev's R-2 being designed at the time, the most important innovation was the separation of the warhead from the rest of the missile.⁸⁴

Grottrup and his colleagues made their presentation on September 25 at a meeting of the Scientific Technical Council (NTS) of the MV. Before the meeting Korolev made sure that he could control the outcome. The majority of the discussants worked directly under Korolev. Others had close ties to the Chief Designer. After the Germans' presentation, the first discussant, M.K. Tikhonravov, gave a fairly positive assessment of the concepts forwarded by Grottrup. He was one of a minority of discussants without direct institutional ties to Korolev.⁸⁵ But then came Korolev's deputy, Vasiliy Mishin,

⁸² This pattern of isolating the German scientist was consistent with that practiced in the nuclear program. Therefore, Grottrup may have been isolated at the NKVD's urging. However, Chertok and Vetrov make it clear that Korolev at least encouraged this arrangement.

⁸³ See Vetrov, *Sekrety Ostrova Gorodomliia...*; and Chertok, *Raketi i Liudi...*

⁸⁴ Korolev had independently developed a separable warhead during his stay in Germany and intended to use it on the R-2. See Vetrov, *Sekrety Ostrova Gorodomliia...* pp 67-91.

⁸⁵ It should be noted that even Tikhonravov was a longtime friend and colleague of Korolev, going back to their work together at GIRD and RNII in the early 1930's.

who noted that while there were several interesting ideas, Grottrup's project was not realistic, and that it made far more sense to pursue Korolev's plan for the R-2, which had already been approved by the NTS. Mishin was followed by several other members of Korolev's retinue. Glushko criticized the engines' turbo pumps. Riazanski questioned the claims of accuracy, and Piliugin simply announced that "he could never agree with the proposed system." By that time, the feeding frenzy was out of control. V.M. Panferov, the head of the reliability department of the NII, remarked: "It seems to me that the project is of a preliminary character. There are no basic assessments of the materials, and these were not calculated today. At the session we attempted to clarify several questions but were unsuccessful... I can only say the project may present some interesting thoughts for future design developments." Even Boris Chertok, who helped the Germans with their guidance system, criticized the proposal. In the end, Deputy Minister of Armaments E.A. Satel' concluded:

Undoubtedly, this project presents some new technical thoughts... But at the same time, it seems to me that the materials as they are presented here cannot be supported as a draft project. The basic requirement for a draft project -- complete technical assessments, complete scientific analyses of questions are underdeveloped in the design elements. Unfortunately, in the materials presented, as we were able to observe at the concluding section, the defense of the design, sufficient assessments and scientific materials were not present in the proposed project.⁸⁶

The Germans were sent back to the drawing board. Their project would be presented again in another year. Many things would change in the interim. Until then, Korolev could rest assured that the Germans would pose no serious threat to his program. Instead, he would incorporate their technical concepts in his own designs.

Grottrup presented a more refined version of the G-1 to the NTS of NII-88 in November 1948. In spite of the fact that Grottrup had responded to most of the earlier criticisms of insufficient theoretical work, the NTS remained unwilling to accept his design. Again, Korolev's deputies led the attack. Konstantin Bushuev asserted that "for an experimental system the sum of new design elements is too burdensome... all of these ideas cannot be put into a single vehicle at once."⁸⁷ Mishin was not nearly so kind in his assault on the proposal: "It amazed me throughout the proposal. The supplied data appears to be an advertisement. Instead of an engineering approach--a poorly executed essay..."⁸⁸ The Council concluded with the recommendation that further experimentation would be required before the project could be concluded, effectively killing the G-1

⁸⁶ Stenogramma plaenarnogo zacedaniia NTS NII ot 28.12 Archives of TsNIIMash, f. 9, op. I No. 801. As quoted in Vetrov, *Sekrety Ostrova Gorodomiia*, ... p 84.

⁸⁷ *Ibid.* pp. 172-173.

⁸⁸ *Ibid.* pp. 173-174.

project.

Nevertheless, Korolev held a certain interest in seeing that the Germans continued to serve as a source of productive ideas and theoretical work. There were many ideas, such as the separation of the warhead from the fuselage, and the extensive use of aluminum, which Korolev borrowed from the Germans without necessarily providing attribution. However, he did not want the German project to be approved thereby challenging his position as the leader of the long-range missile program. He surely had a hand in the rejection of Grottrup's proposals. Overall, the Germans contributed a great deal to the Soviet missile program, but it was all indirect knowledge.⁸⁹ Despite his attacks, Mishin later remarked in an interview that the Soviet rocket scientists "could not have accomplished anything without the Germans' help."⁹⁰ But that assistance was carefully controlled. Korolev made sure that the Germans did not become competitors.

In the end, however, the German program was a victim of Soviet leadership politics, not Korolev's bureaucratic intrigues. In early 1949, the so-called anti-cosmopolitan campaign began. All foreign science was condemned as "bourgeois science." Soviet scientists were careful to limit their ties with their foreign colleagues. The German scientists became casualties of Soviet politics.⁹¹ In early 1950, the entire research agenda of the German group was closed. The following year, the German scientists began to return to East Germany.

Competing programs provide a powerful source of information for monitors and the political leadership.⁹² They can be used to validate the concepts, cost estimates, or expressed risks of a program. The German rocket scientists presented such a threat to Korolev's autonomy. Their proposal for the G-1 was technically more advanced than those being developed by Korolev's group at the time. Yet Korolev was able to discredit Grottrup's design by stacking the NTS with his own representatives. It was a highly successful technique and effectively eliminated Korolev's primary competition at the time.

Colonization: The struggle for control of NII-88

As a rehabilitated former political prisoner who was not a member of the Communist Party, Korolev was always held some distance away from positions of power. Up until 1950 he was still only the chief of a secondary department within NII-88. In

⁸⁹ See Chertok, *Raketi i Liudi...*; Vetrov, *Sekrety Ostrova Gorodomliia...* and Mishin.

⁹⁰ Interview with Mishin.

⁹¹ Of course this campaign had little effect on the use of foreign intelligence for the development of Soviet systems, particularly in the case of the atomic bomb. See Holloway, *Stalin and the Bomb...* on the "anti-cosmopolitan campaign" see Hahn, *Andrei Zhdanov...*

⁹² See Downs, *Inside Bureaucracy...*; Wilson, *Bureaucracy...*

1950, when the anti-aircraft program was passed on to another institute, he was elevated to the position of chief designer of OKB-1 within NII-88, informally, the third in command. As was the case with any defense industrial facility at the time, the institute's leadership was subjected to intense political scrutiny. In 1950, the institute's first director was replaced for political reasons and replaced by Konstantin Rudnev who had much closer connections with Ustinov.⁹³

At the same time Mikhail Iangel was appointed as chief of the guidance section. From the time Iangel arrived at NII-88 it was clear that he was very well connected politically. Iangel served as the scientific attaché in the Soviet Embassy in the United States during the war, and in Germany prior to that. Only the most politically reliable were permitted such foreign postings, and only the most truly blessed were able to return to successful careers in the Soviet Union. Many were either imprisoned or relegated to insignificant positions following a foreign posting. Iangel was widely seen as Ustinov's man.⁹⁴

At the time of Rudnev's appointment the issue in dispute was the type of rocket fuel to be used in the next generation of missiles. Korolev supported the use of liquid oxygen and kerosene, while the military supported the use of storable propellants. Korolev's missiles promised greater range but were cumbersome on the battlefield because liquid oxygen required refrigeration and could only be loaded immediately prior to launch. Missiles using storable propellants could remain fully fueled in their launchers for weeks prior to launch, but their range remained in question. The military made a powerful case against Korolev, and shortly after his arrival Rudnev declared that storable propellants would be "the main direction of the institute."⁹⁵ In all probability the discussion was as much about control of the institute as it was about technology. Rudnev, despite his proclamations was unable to turn the institute's agenda away from Korolev's about Korolev's direction.

In August 1952 Rudnev was promoted and Iangel became the director of the institute. The appointment of a subordinate to serve as institute director irritated Korolev and the two developed a strong rivalry. The strain in personal relations was exacerbated by Iangel's support of storable propellants, and his opposition to Korolev's report of December 1951 declaring that storable propellants were not sufficiently energetic to

⁹³ See Chertok, *Raketi i Liudi...* and *Progress, gazeta tsentral'nogo issledovskogo instituta mashinostroenoie*, May 23, 1991, p. 1.

⁹⁴ See Chertok, *Raketi i Liudi...*

⁹⁵ Iu. A. Mozhorin, "Istoriia sozdaniia i razvitiia Tsentral'nye nauchno-issledovatel'skii institute mashinostroeniia" (The History of the Creation and Development of the Central Research Institute of Machinebuilding,) *Kosmonavtika i Raketostroenie*, Vol. 1, No. 1 (1993) p. 23.

power a long-range missile.⁹⁶ According to Chertok, the two only spoke to each other when it was absolutely necessary. Routine communications were conducted through intermediaries.⁹⁷ An uncomfortable *modus vivendi* was established while Iangel was director, but it did not last.

Korolev understood it would be possible to achieve intercontinental ranges given further development of storable propellants. But he knew it would be very difficult to make a missile powerful enough to launch a large satellite into orbit using these fuel components given the existing state of technology.⁹⁸ He knew he could get into space using liquid oxygen and kerosene. It was necessary therefore, to stall the development of these systems at least until he could get his space program started.⁹⁹ To support his case, Korolev commissioned a study by M.V. Keldysh, who by then was a close colleague of Korolev, and an informal member of the Council of Chief Designers. Keldysh supported Korolev's position in a late 1953 report asserting that the practical limitation for storable propellants was 1000 km.¹⁰⁰ As a leading member of the Academy of Sciences, Keldysh's position was unassailable. The report was a political victory for Korolev over Iangel. On June 9, 1954, Iangel was sent to Dnepropetrovsk in the Ukraine to head the newly formed design bureau and factory (OKB-586). Their competition would continue from a distance. Ultimately, Iangel would prove Korolev and Keldysh wrong, but by that time Korolev was well on his way to space.¹⁰¹

Korolev's struggle for control over NII-88 seemed unending. But the final battle was fought with Iangel in 1953. To prevail, Korolev capitalized on his developing relationship with Keldysh whose technical competence was unquestioned. While there is no evidence that Keldysh intentionally distorted his report to support Korolev, in 1956, Iangel designed a missile capable of twice the range Korolev predicted using the same storable propellants. At the same time, Korolev and Keldysh were plotting the

⁹⁶ See Korolev, "Tezisy doklad..."; and, interview with Mishin.

⁹⁷ Interview with Chertok; see also Chertok, *Raketi i Liudi*, ..

⁹⁸ Korolev noted that the development of UDMH (hydrazine) as a propellant would greatly increase the range of storable propellants. See Keldysh, *Tvorcheskoe Nasledie...* Interview with Budnik, Dnepropetrovsk, Ukraine, August 19, 1992.

⁹⁹ Interview with Mishin.

¹⁰⁰ See Avduevskii, *M.V. Keldysh Izbrannye Trudy...* pp. 142-144.

¹⁰¹ In 1958 a research institute in Leningrad developed a means of producing hydrazine, a sufficiently energetic storable propellant which would be used in Iangel's missiles. In fairness to Korolev, he had noted that hydrazine would make a useful fuel, but he did not believe it would be developed soon.

Interview with V.S. Budnik, Dnepropetrovsk, Ukraine.

development of a satellite program, in which Keldysh figured prominently.¹⁰² Therefore, he held many of the same incentives as Korolev to see that missiles with higher payload capacities survived long enough to begin a space program. Whatever the motivations, the result of Keldysh's report was clear, NII-88 would focus on Korolev's choice of propellants. The appeal to unquestioned outside experts proved unassailable.¹⁰³ The military, Ustinov, and Iangel had to go elsewhere. Korolev would never again be challenged for control of his design bureau.

Expert Committees: Korolev's control over the State Commission

In the Soviet defense industrial system, no major weapon system could be accepted into service without passing trial as approved by a State Commission comprised of leading military and defense industrial officials. In this respect Korolev's rockets were no exception. The difference was that in the case of most State Commissions, it is not difficult to find sufficient technical expertise among military and industrial administrators to effectively evaluate the system. In particular, expertise is required for failure analysis. In the case of rocketry, however, such officials did not exist within administrative organizations, and the State Commissions relied upon the expertise of Korolev and his scientists. One example of an R-7 failure illustrates the consequences.

In the spring of 1957, the Council, the State Commission, the missiles, and countless technicians proceeded to the new launch range at Tiuratam in Kazakhstan.¹⁰⁴ The first launch attempt ended in failure, when the R-7 blew up early in flight. The problem was traced to dirt in the vernier engines. In response, Ustinov sent one of his deputies to sit in Korolev's design bureau until the problem was corrected. How Karasev, who had no competence in missile technology, would know when the problem was corrected was unclear. Literally all he could do was verify that people were indeed working.¹⁰⁵ The second test on June 7 failed to ignite. A valve had been installed backwards by Korolev's technicians. The third missile launched a month later exploded as the strap-on stages were separating from the core stage. The State Commission temporarily halted the test series after the third failure.

The State Commission created by Ustinov to oversee the launches was headed by

¹⁰² Interview with Eneev.

¹⁰³ On the importance of outside expertise see in particular James D. Thompson, *Organizations in Action*, (New York: McGraw-Hill, 1966);

¹⁰⁴ In 1955 a new launch facility was established at Tiuratam which is now referred to as the Baikonur cosmodrome. For a history of the facility see N.S. Narvolianskii, *Tak Nachinalsia Baikonur*, (Moscow: Promotei, 1991).

¹⁰⁵ See Golovanov, *Korolev...* pp. 503-504.

his deputy for rocketry Vasilii Riabikov.¹⁰⁶ His counterpart on the military side was Deputy Minister of Defense for Special Weapons and Rocket Technology, Marshal Nedelin, who was Deputy Chairman. As was the practice, the State Commission relied upon the technical staff of the Council of Chief Designers to produce reports and analyses.¹⁰⁷ Korolev's deputies drafted the reports. Korolev provided the executive summary, which was the only part of the reports transmitted to the leadership. The results were predictable. Even in the case of the worst failures, his remarks were along the lines of: "It is a complicated business: there may have been some glitches, but these can't be traced to Korolev..." After one failure, Riabikov read Korolev's summary and remarked with a smile: "You're a clever man Sergei Pavlovich. [Korolev] You have resolved all problems with a magic wand, but your shit does not want to become cologne just to avoid offending your nose..."¹⁰⁸ And so it went. The political leadership was, no doubt, aware that there were launch failures, but blissfully ignorant of the depth of the problems, and never casting their suspicions upon Korolev as the culprit.

The Failure of Monitoring Organizations

From the beginning, Soviet administrators were faced with a formidable task. Possessing limited technical competence, they were incapable of understanding either the basic mission of rocketry or the technology involved. Complicating matters, the basic structure of the Soviet system did not offer either Ustinov or Nedelin any alternative to supporting Korolev once the anti-aircraft mission was taken away. For Ustinov and Nedelin Korolev offered them the best opportunity to advance their own careers. Attempts at monitoring Korolev's program proved to be almost complete failures. Within his organization, Korolev defeated competitors, thwarted attempts at colonization, and gained control of technical commissions.

¹⁰⁶ Riabikov left the Ministry of Armaments in 1949 to oversee anti-aircraft systems. He returned to work with Ustinov sometime after Ustinov was appointed as head of the Military Industrial Commission in 1955.

¹⁰⁷ The majority of State Commission members were tied closely to Korolev. See Iu. A. Skopinskii, "Gospriemka kosmicheskoi programy" (State Acceptance of the space program,) *Zemlia i Vselennaiia* No. 5 (September-October) 1988, pp. 73-79.

¹⁰⁸ See Golovanov, *Korolev...* p. 506.

BUILDING THE SCIENTIFIC ORGANIZATION

*The most important thing was not that we learned rocket technology,
but that we closed ranks as a collective.*

S.P. Korolev (1947)

Early creation of a tightly knit organizational structure proved to be a primary source of strength for Korolev's program. But the impetus for this organizational structure came not from Korolev, but from the ideas of the father of Russian space flight, Konstantin Tsiolkovskii. The importance of Tsiolkovskii as an organizing force must be recognized. He provided the basic mathematical calculations demonstrating that space travel was possible. This is the first major step in any new technology. Believing that space travel was an achievable goal was a powerful unifying force in itself. But Tsiolkovskii's work went much further, providing a road map to the stars.¹⁰⁹ Korolev, Glushko, and Tikhonravov found a mission in Tsiolkovskii's words. It was the mission which would unify the emerging cosmic collective through the difficult years of the war, and provide them with a vision of their destination during the test range failures of the limited range R-1. It would commit their conversations regarding space travel to the relative secrecy of their own collective.¹¹⁰

Two factors were key to maintaining the autonomy of Korolev's emerging space program. The first was the ability to conceal Korolev's true intentions to develop a space program at least in parallel with missile technology, if not as his primary priority. The second related factor was Korolev's ability to successfully manage a complex, interdepartmental program without leadership or administrative interference. This section explores Korolev's ability to achieve these goals.

Developing the Technology Underground

Prior to their return to separate organizations in the Soviet Union, the group of Soviet rocketeers in Germany established close working relationships. Those who had not worked with Korolev and Glushko at RNII were quickly brought into the community of space flight advocates. A division of duties was established, and Korolev was accepted as their unquestioned leader.¹¹¹ Most importantly, Korolev devoted a great deal of effort to

¹⁰⁹ A.A. Kosmodemianskiy, *Konstantin Tsiolkovskii -- His Life and Work*, (Moscow, Nauka, 1960) as cited in Daniloff, *The Kremlin and the Cosmos...* p. 20.

¹¹⁰ On the importance of mission to maintaining control over information see Wilson, *Bureaucracy...*

¹¹¹ For a detailed discussion of the rocket scientists' activities in Germany see Chapter 3.

establishing a common set of goals among his workers which far exceeded those of simply launching rockets for use as long-range artillery.

From the time they arrived in Germany, Korolev made it clear to all within the scientific community that his destination was extraterrestrial.¹¹² He extended his vision beyond the scientific community, establishing adherents among the lower ranking military officers, and scientists from the Academy of Sciences.¹¹³ One military engineer, arriving in Germany fresh out of school in 1946, recalled Korolev's response to his question regarding the future of rocketry:

In his answer I first realized that basic idea, you might say his credo, to the realization of which he dedicated his entire life: a rocket—it is the only means to remove a person from his earthly cradle into space, the only means, the help of which might reveal the secrets of the Universe, which is hidden from us by enormous distances. Everything, which in the future would be created in the field of military rocketry, served, by stages in this path to space (including the *semerka*), from which he did not deviate his entire life.¹¹⁴

Korolev was guarded regarding his extraterrestrial ambitions in conversation with his superiors, however. Sergei Vetoshkin, the Deputy Minister of Armaments, noted that Korolev spoke about space “only very rarely, and with great caution. I had the impression that he was probing us: how would we react to such words... We would not react. We were not going into space.”¹¹⁵ Korolev understood that the leadership would not directly support the necessary basic research to develop more detailed theories of space flight. He would have to find more circuitous means of building a research base.

Such an opportunity appeared in 1948. An old colleague from his days at GIRD, Mikhail Tikhonravov, theorized that by combining a number of rockets, virtually any range or speed could be achieved.¹¹⁶ It was a purely theoretical piece of work, but by mid 1948, he came to the conclusion that this concept could be used for propelling an object into outer space. Tikhonravov resolved to present these findings at the first plenary session of the Academy of Artillery Sciences (AAN).¹¹⁷ The AAN was concerned

¹¹² Interviews with Chertok, Mishin, and Mozhorin.

¹¹³ Interview with Kerimov. See also Golovanov, *Korolev...* p. 456.

¹¹⁴ See “Kazanskii, Viktor Vasil’evich,” in *Dorogi v Kosmos...V. 1*, p. 70.

¹¹⁵ See Golovanov, *Korolev...*p. 400.

¹¹⁶ Tikhonravov's ideas were not openly published until 1980, and then in a classified journal of the rocket industry. See M.K. Tikhonravov, “Puti ocushchestvleniia bolshikh dal’nostei strel’by raketami, Doklad v Akademii Artilericheskikh nauk, July 14, 1948)” *Raketaia Tekhnika*, January 1980, pp. 10-19.

¹¹⁷ The Academy of Artillery Sciences was created in the wake of WW II to serve as a forum for

primarily with the application of the experience of WW II to the further development of unguided short range solid fueled rockets such as the Katiusha. Anti-aircraft systems were of secondary concern and the lowest priority was long range rocketry.¹¹⁸ Nevertheless, Tikhonravov and a group of his colleagues approached the President of the AAN with their idea, proposing to present a paper at the upcoming session. Gen. Anatolii Blagonravov initially rejected the proposal, noting that “the topic is interesting. But we cannot include your report. Nobody would understand why...They would accuse us of getting involved in things we do not need to get involved in...” But the rocket scientists were not dissuaded so easily. The next day Tikhonravov returned, and Blagonravov relented, cautioning: “Be prepared. We shall blush together.”¹¹⁹ Blagonravov’s prediction proved prescient. After Tikhonravov’s presentation, one high ranking military official remarked: “The institute must not have much to do. Has it decided to switch to the realm of fantasy?”¹²⁰ This was not isolated criticism. Another participant recalled that “one after another skeptics and critics came up to the lectern” criticizing Tikhonravov’s presentation.¹²¹

One person who took Tikhonravov’s report more seriously was Korolev, who sat on the Presidium of the AAN.¹²² Keenly aware that Tikhonravov’s packets presented the first possibility for putting objects into orbit around the Earth, Korolev was intrigued by Tikhonravov’s report. Following the attacks, Korolev encouraged his old friend but cautioned him that such open discussions of space flight would be unproductive until they could produce a useful missile.¹²³

Tikhonravov was chief of a small research group within a military institute -- NII-4 -- which was hastily created in 1946 as part of the reorganizations necessitated by the decision to create a rocket industry in Russia. The basic mission of the organization was to provide assistance in the utilization of rocketry for the artillery troops.¹²⁴ In the ensuing years, Tikhonravov’s group became a think tank for Korolev’s most ambitious schemes.

discussing future warfare. It was far different from the Academy of Sciences in that it had no permanent institutes attached to it. Its only function, according to participants interviewed for this study was to serve as a meeting place for old Generals to rehash the battles fought in WW II.

¹¹⁸ See K.V. Frolov, *Anatolii Arkad'evich Blagonravov*, (Moscow: Nauka, 1982) pp. 70-72.

¹¹⁹ See Iaroslav Golovanov, “Start kosmicheskii ery,” *Pravda*, October 4, 1987 p.3

¹²⁰ *Ibid.*

¹²¹ See Maksimov and Bazhinov, ...pp. 16-17.

¹²² *Ibid.*

¹²³ See Golovanov, “Start kosmicheskii ery”...

¹²⁴ The structure, personnel and purpose of NII-4 are discussed in greater detail in Chapter 5.

Ironically, the group was partially shielded by the fact that they were under military control. The Director of the institute, Gen. Nestorenko, was not entirely cognizant of the work that was taking place within his own institute. According to one participant, he came to the position of director only “because after the war there were many military generals without jobs, and they had to receive suitably high positions.”¹²⁵ Nestorenko had no background in rocketry, and at times exhibited a certain hostility toward the rocket scientists and the military men who supported them. But Nestorenko was surrounded by military men who had worked closely with the rocket specialists in Germany, several of whom worked with Korolev and Glushko before the war. Nestorenko’s Deputy, Gen. Gaidukov, had personally persuaded Stalin to create a missile program and had worked closely with Korolev in Germany.¹²⁶ Another leading figure and deputy to Nestorenko, Col. Tiulin, headed a missile research group in Germany, and worked with Korolev prior to the war at GIRD and RNII. Invariably, Nestorenko yielded in the face of pressure from his deputies.¹²⁷

The tepid support from Nestorenko notwithstanding, Korolev understood that neither he nor Tikhonravov was likely to get support from the current military and political leadership for space flight.¹²⁸ In order to circumvent leadership approval processes, Korolev resolved to fund Tikhonravov’s work at NII-4 outside of regular funding channels.¹²⁹ He told Tikhonravov: “Work, calculate, design in your institute; I will give you money and serve as the customer; I do not have any free people. They are all busy, no one can sit and do this work. Get agreement from your leadership so that I can order this work.”¹³⁰ Tikhonravov received approval from the Deputy Chief of GAU, Gen. Mrykin, who commented: “It is good that Korolev should pay for this work.” and G.N. Pashkov, the head of a group supervising rocketry in the Council of Ministers, who “wished him luck.”¹³¹

¹²⁵ Interview with Chertok.

¹²⁶ Gaidukov was the director of the Vystrel facility with Korolev as his deputy. His support was pivotal in gaining approval for initiation of the missile program in 1946. See Chapter 3 for an in depth discussion of the relationship between Korolev and Gaidukov.

¹²⁷ Interviews with Bazhinov and Maksimov.; Golovanov, “Start kosmicheskii ery”...; and Vetrov, “Mikhail Kladevich Tikhonravov...” pp. 40-41.

¹²⁸ Interview with Mishin, see also Golovanov, “Start kosmicheskii ery”...

¹²⁹ See “M.K. Tikhonravov” in Ishlinskii...; and G.S. Vetrov, “Mikhail Kladevich Tikhonravov, k 80 letniu dnia rozhdeniia” *Zemlia i Vselennaia*, May 1980, p. 40

¹³⁰ See “M.K. Tikhonravov” in Ishlinskii...

¹³¹ These accounts appear in the original version of “M.K. Tikhonravov” Iu.A. Ishlinskii, *Akademik S.P. Korolev: Uchenyi, Inzhener, Chelovek*, (Moscow: Nauka, 1986) but are omitted in the final version.

Korolev maintained a reserve fund for just such purposes, but it was a closely guarded secret. No one within the design bureau was certain of how much money he had reserved in this account. Even his administrative officer, Sergei Okhapkin, claimed ignorance noting, "Korolev had a genuine reserve, he always did, how much, no one knew: not the people in his own design bureau, not his subcontractors, not the ministry. This secret Sergei Pavlovich [Korolev] never opened to anyone..." But he did not dispense of these funds readily.¹³² They were set aside for critical tasks, such as those he wanted Tikhonravov to perform.

For the next three years Tikhonravov and his group concentrated on using the packet system to launch an artificial Earth satellite.¹³³ Their research, performed in cooperation with Korolev's design bureau within NII-88, included examination of the guidance requirements for entering into orbit, means of correcting inaccuracies in orbital insertion, thermal protection, and optimal characteristics for the launch vehicle.¹³⁴ By late 1953, Tikhonravov prepared a report on artificial satellites which would be the basis for Korolev's ensuing proposal to the leadership. The basic premise of the study was that the R-7 was capable of propelling a one ton object in excess of 8 km per second, the speed necessary to achieve Earth orbit. It divided satellites into two basic types: stabilized and unstabilized. Unstabilized satellites, "the most simple satellites" (PS) weighed approximately 1.1 to 1.4 tons, including 300-400 kg. of scientific instruments. Stabilized satellites weighing approximately 3 tons, were also examined with reference to the possibility of putting cameras on board. The study also included a discussion of projects involving manned spacecraft using existing rockets, manned space stations, and unmanned lunar flights, claiming all could be achieved in the near future.¹³⁵

Principal-agency theory concerns itself with the ability of principals to understand the true utility function of agents. The preceding paragraphs indicate that Korolev was

Maksimov and Vetrov confirmed that the original version was correct.

¹³² See Golovanov, *Korolev...* p. 479.

¹³³ The "paket" refers to the clustering of rocket boosters. This idea was developed by Tikhonravov at NII-4 under the guidance and sponsorship of Korolev. This project is discussed in more detail in chapter 5. Interview with Bazhinov, and Maksimov.

¹³⁴ See I.K. Bazhinov, "O teoreticheskikh isslekovaniakh problem sozdaniia iskusstvennykh sputnikov zemli v SSSR v 1947-1956 gg." (Theoretical research on problems of the creation of artificial Earth satellites in the USSR from 1947-1956) Separate publication Academy of Scientists Institute of the Natural Sciences and Technology, (Moscow: Nauka, 1981)

¹³⁵ M.K. Tikhonravov, S.P. Korolev, "Dokladnaia zapiska ob iskusstbennom sputnike zemli," (Report on artificial earth satellites,) in *Materialy po Istorii Kosmicheskogo Koroblia "Vostok,"* (Material on the History of the Spacecraft "Vostok"), (Moscow: Nauka, 1991)

able to convince the leadership and administrators that building long-range missiles was his overarching goal. To the extent that Korolev let them become aware of his true preference for space exploration, it was only as a vague dream some time off in the future. From the beginning though, it was clear to those working with Korolev that missiles were only a vehicle to achievement of Korolev's cosmic ambitions. Korolev indeed pursued research on spaceflight, but he did so in a way which was not obvious to his primary administrator, Dmitry Ustinov. Thus, when the opportunity presented itself, Korolev had a well developed research program to convince the leadership of the feasibility of space travel.

The Council of Chief Designers

The most important organizational tool devised by Korolev was the Council of Chief Designers. Driven by necessity, the Council combined the resources of institutes and design bureaus across five industrial ministries. Moreover, it was an informal organization which eluded cumbersome administrative procedures for interministerial coordination. Perhaps more so than any other policy implemented by Korolev, the Council provided Korolev and his colleagues technological autonomy from administrative structures.

The Council of Chief Designers was informally created on the test range of Kapustin Iar. Boris Chertok recalled the most important result of the first series of tests:

The process of the first flight tests strengthened the informal organ--the Council of Chief Designers under the direction of Sergei Pavlovich Korolev. The authority of this Council as an interdepartmental, not administrative, but scientific-technical leadership organization played a decisive role for all our activities which followed.¹³⁶

One of the early problems facing the scientists and engineers interested in ballistic missiles was coordinating the work of specialists working in different organizations under different jurisdictions. In the latter years of WW II, a vast number of engineers from various design bureaus and scientific research institutes traveled to formerly occupied areas of Europe looking for information on German technology programs. A group interested in surface to surface missiles coalesced around six Chief Designers, from five different ministries. In the Soviet system of industrial organization, crossing interministerial boundaries was no easy task. Simple interactions required the signatures of all concerned ministries. This process was time consuming, and ministers were reluctant to commit their resources to projects in which they were unlikely to enjoy the

¹³⁶ See Chertok, *Raketi i Liudi*,... p. 195.

rewards.¹³⁷

To overcome these problems, a unique organization was created by Korolev which permitted the informal cooperation of organizations from disparate ministries without the interference of the ministers.¹³⁸ This organization was formally named “the Council of Chief Designers for Collective Resolution of Scientific-technical Problems in the Creation of Ballistic Missiles.”¹³⁹ The Council was a “special organization of collective thought.”¹⁴⁰ One member, guidance specialist N.A. Piliugin, noted:

The Council of Chief Designers was not only the ‘splinters’ from the various organizations which we all represented but also above all a qualitatively new collective, a specific form of management. The Council was necessary because rocket technology is very many-sided. One organization, one man—even of the scale of Sergei Pavlovich Korolev—could not encompass it.¹⁴¹

G.A. Tiulin, who throughout his career was in charge of the interface between the designers and the military users, recalled that “the Council of Chief Designers was formulated in Germany, all of its members represented different ministries: someone was from aviation, someone from radio technical production. Even there were those, like Viktor Ivanovich Kuznetsov from the shipbuilding industry... We did not have interministerial barriers...”¹⁴²

¹³⁷ See Janous Kornai, *The Socialists System: The Political Economy of Communism*, (Princeton: Princeton University Press, 1992)

¹³⁸ All of the early participants agreed that the Council was Korolev’s idea. Interviews with Mishin, Chertok, Mozhorrin, and Maksimov.

¹³⁹ Raushenbakh, *Iz Istorii...* p. 225.

¹⁴⁰ *Krasnaia Zvezda*, April 8, 1989, p. 3.

¹⁴¹ As cited in Holloway, *op. cit.*, p. 392.

¹⁴² See “G.A. Tiulin” in *Dorogi v Kosmos, Vol. 1.*, (Moscow: Moscow Aviation Institute Press, 1992, p. 160.

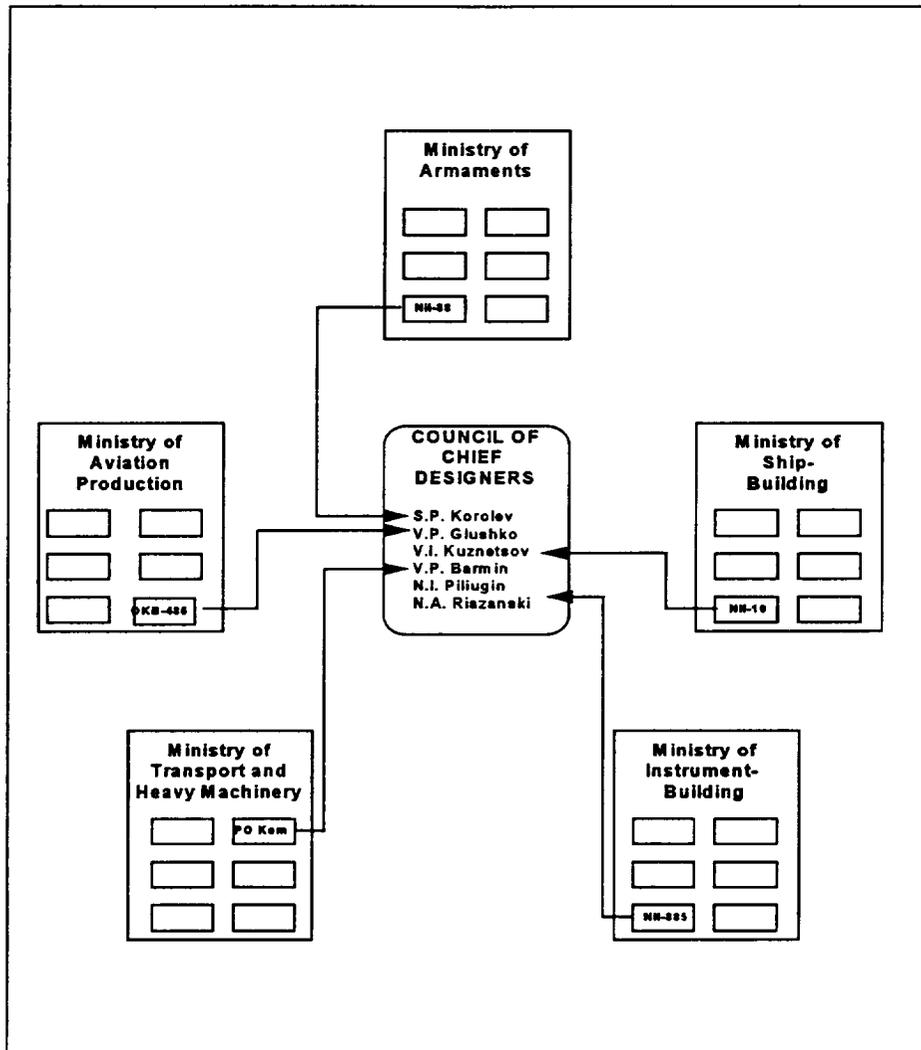


Figure 3 -- The Council of Chief Designers

The center of activity was Korolev's design bureau (OKB-3), within NII-88, located in Podlibki, outside of Moscow. Other members were spread throughout the Moscow suburbs. Glushko re-established the GDL-OKB, as OKB-486, in the Khimky region of Moscow.¹⁴³ At the same time, V. P. Barmin was appointed as the Chief designer of launch facilities.¹⁴⁴ Mikhail Riazanskii and Nikolai Piliugin worked at NII-885, located near the Central airport in Moscow, with Riazanskii as director and Piliugin as

¹⁴³See Glushko, *GDL-OKB...* p. 31.

¹⁴⁴See *Trud*, April 12, 1987, p. 1.

head of the section for inertial guidance systems.¹⁴⁵ Riazanskii and Piliugin were appointed as chief designers of radio control and automatic control systems respectively. The Chief Designer for Instruments, V. I. Kuznetsov, headed a design bureau within NII-10, and was under the Ministry of the Shipbuilding Industry (MSP).¹⁴⁶ In turn, each of the "big six," as they were called, held responsibility for the activities of enterprises working on missiles within that ministry and functioned, for all practical purposes, as a mini-minister. By 1960, there were 200-300 organizations involved in this informal structure.¹⁴⁷

There were several aspects of the operational procedures of the Council which made it an effective organization. Most importantly, the Council's decisions had authority over other agencies and ministries. An article originally written in 1958, but only recently published, recalls the significance of this aspect. "Creation of such an organ had decisive significance for the successful development of complexes. In the first stage, the authority of the Council permitted excluding the procedures of reaching agreement on technical solutions between departments."¹⁴⁸ V.P. Barmin recounted the ability of the Council to overcome ministerial resistance.

Each of us headed a design bureau, had the authority in his own area, and could implement decisions. Of course, far from always did our ministry leaders like it, and there were conflicts. As a result, S.P. Korolev later succeeded in securing a resolution whereby the decisions of the Council of Chief Designers were binding on all ministries and agencies.¹⁴⁹

Because the Council did not have to go through cumbersome interdepartmental coordination procedures, there was little opportunity for ministers, party officials, and military officers to interfere in its work. Since most proposals subjected to routine interdepartmental coordination procedures never survived the formal process of getting approval from sometimes dozens of state officials, the establishment of the Council was as much a matter of survival as expediency.¹⁵⁰

¹⁴⁵See, *Krasnaia Zvezda*, March 11, 1989 p. 3, for a biographical article on Riazanskii and *Krasnaia Zvezda*, February 25, 1989, p. 4, for a biographical article on Piliugin.

¹⁴⁶See *Krasnaia Zvezda*, February 25, 1989, p. 4.

¹⁴⁷See Ishlinskii, *Korolev...* p. 317.

¹⁴⁸See Vetrov, *Sekrety Ostrova Gorodomliia...*, pp. 14-15.

¹⁴⁹See *Izvestiia*, September 20, 1987, p. 3.

¹⁵⁰Fyodor Burlatskii noted that in his study of the approval process, only 30% of the "zapiski" successfully obtained signatures from the necessary officials, sometimes numbering in the dozens. Seminar given by Fyodor Burlatskii at the RAND Corp. April 28, 1989.

Barmin also recalled how the members of the Council acted outside the Soviet planning system with flexibility and autonomy to develop their own schedules, and mechanisms to maintain them.

The interrelationship and interdependence of the operations make missing a deadline in any section unacceptable. For that reason, every director and participant—from the Chief Designer to the shop master—in assessing the status of the work in his own area, considered the schedule above all as, by and large, the ultimate end and immediately sounded the alarm if there was a threat of a missed deadline. The feedback worked flawlessly. Any danger of missing a deadline went off like an alarm, immediately to the Council of Chief Designers, to the proper ministry or directing agency. In every serious instance, aid was rendered without delay. Depending on the circumstances, the aid might be people, equipment, finances, or additional production power.

I think it very significant that the work deadlines, although tightly compressed, were realistic, because they were established by the equipment designers and makers themselves.¹⁵¹

The local autonomy afforded to the Council allowed them to create a flexible and informal working relationship between design bureaus, suppliers, and scientists. A co-worker of Korolev's, B.E. Chertok, recalled that "settling a complex question took simply a visit or even a phone call."¹⁵² Another, Academician V.S. Avduevskii, described how this flexible relationship fostered productivity.

I remember, in 1953, various heat-shield coatings that were to prevent spacecraft from severely overheating upon entry into the atmosphere were developed and tested. Our group of young research-institute associates came up with a new idea for facilitating the development of a heat shield. We immediately went to the design bureau headed by Sergei Pavlovich [Korolev]. And by chance, we met him on the plant grounds, as he was returning from a shop. We spoke as we walked—it took Korolev only about 5 minutes to get the gist of the idea and to make some observations on its development. Within a half an hour, the designers were already working on the idea. And that is how it always was. Nobody ever ran into any kind of bureaucratic delay with Sergei Pavlovich, and there were never any problems of 'implementation.' All ideas worth doing were snatched up instantly and were quickly converted into designs, and trust of and good will toward those enthusiastic about their own work was the rule. That was the primary incentive that inspired the participants in this collective work, and there were many of them. Industrial and academic institutes and enterprises did not solicit the decisions and resolutions of

¹⁵¹See *Izvestiia*, September 27, 1987, p. 3.

¹⁵²See *Izvestiia*, October 1, 1987, p. 3.

higher agencies—they went straight to the chief design bureau and performed complex theoretical and experimental operations within schedules that spanned only months.¹⁵³

It was either a lack of interest or a lack of foresight on the part of the administrators which led to the creation of the Council of Chief Designers. If BRDDs were a high priority the leadership would have transferred the five key organizations into a single ministry when, in the immediate post-war years, there was a complete reorganization of the Soviet economy. The rocket scientists made their desire to be placed in a single ministry known to the Ustinov. That this was done suggests that Ustinov was not willing to force the issue among other ministerial officials, or to take it to a higher administrative level. Whatever his reasons, the creation of the Council, and Ustinov's support for the institution in the years to come, had far reaching consequences, both intended and unintended.

The Council of Chief designers proved to be a remarkable, though unusual, organizational structure. It was neither a formal hierarchy nor an informal coupling of individual organizations. In many ways, it combined the best of both forms of organization. The Council created the regularized procedures and lines of authority of a hierarchy while preserving the flexibility and autonomy of informal organizational coordination.¹⁵⁴ For Korolev, what mattered most was that the Council permitted him to coordinate activities across industrial ministries without having to go through the time consuming process of seeking ministerial approval for routine coordination. The Council also established the precedent of local autonomy which Korolev used to his advantage in the years to come.

Weak Administrative Structure: Necessary But Insufficient Cause

Setting aside for the moment the historical significance of the weakness of the Soviet administrative structure for the missile program, it is clear that it was an important contributive factor to Korolev's success in gaining approval to launch Sputnik. Principal-agency theory has illuminated many of the flaws in the Soviet system's ability to control a program which neither the leadership nor the administrators understood either by virtue of their own technical competence or by copying the work of the United States. For Korolev's success, control over information proved critical.

¹⁵³See *Literaturnaiia Gazeta*, September 30 1987, p. 14.

¹⁵⁴ On the strengths of hierarchical relations in see Oliver Williamson, *Markets and Hierarchies: Analysis and Antitrust Implication*, (New York: Free Press, 1975). On the value of informal coordination see Donald Chisholm, *Coordination Without Hierarchy: Informal Structures in Multiorganizational Systems*, (Berkeley: University of California Press, 1989).

If principal agency theorists are satisfied that their analytic framework has pointed out the important variables in this program, they must find the interaction of these variables to be somewhat disquieting. In the first place, Korolev's success was the result of contractual disequilibrium. Korolev held and used an informational advantage to advance his own agenda. Leadership attempts at restoring equilibrium through monitoring proved ineffective. From this perspective then, the case of Sputnik was a case of agents run amuck. They would stress that while Korolev was successful at launching Sputnik, it was his failure to build an effective ICBM that may have been more important to Soviet leadership. Sputnik was only a fortuitous consequence.

THE DECISION TO LAUNCH SPUTNIK: JUMPING THROUGH A POLICY WINDOW

Nevertheless, structural factors only contributed to the launch of Sputnik. They provided a necessary bureaucratic platform from which Korolev could push his program. To understand the decision-making process for Sputnik itself it is useful to employ the concept of a policy window. Kingdon describes policy using an *apropos* metaphor:

In space shots, the window presents the opportunity for a launch. The target planets are in proper alignment, but will not stay that way for long. Thus the launch must take place when the window is open, lest the opportunity slip away. Once lost, the opportunity may recur, but in the interim, astronauts and space engineers must wait until the window reopens.¹⁵⁵

For Kingdon, a policy window opens when various policy and event streams converge to reduce the constraints to policy initiatives. Well developed programs and policy solutions held by policy entrepreneurs are coupled with real or imagined problems at the time that event streams converge to place a broader issue on the political agenda. Such convergence, Kingdon argues is necessary for new programs to be initiated by policy entrepreneurs from lower levels within the polity. Without policy windows, an inherently stagnant bureaucracy would be unlikely to seriously consider any initiative coming from lower levels.¹⁵⁶

A series of event and policy streams converged to make it possible for Korolev to

¹⁵⁵ See Kingdon, *Agendas, Alternatives and Public Policies...* p. 171.

¹⁵⁶ *Ibid.*

bring his cosmic agenda out into the open. The first was a complete overturn of the political leadership. Stalin died in March 1953. His deputy in charge of the secret police, Lavrentii Beria, was arrested three months later, removing the most dangerous potential opponents to Korolev's space plans from the leadership. Ultimately, Malenkov's fall left the political leadership with precious little technical competence. The rest of the leadership was composed of self-described technological "ignoramuses."¹⁵⁷

The second stream was technical. By late 1953, Tikhonravov and Korolev had completed preliminary design work of a rocket capable of launching a satellite into orbit. The ostensible purpose of the rocket was for launching nuclear warheads. However by using his informational monopoly, Korolev was able to foist requirements and specifications more suited to space launch than military use. Along with Keldysh from the Academy of Sciences they had a well developed plan for a satellite program. All they needed was the right opportunity.

The opportunity was provided by the third stream which was international. In 1952, a group of international scientists announced the celebration of the International Geophysical Year (IGY) which would last from July 1957 to the end of 1958, and invited the nations of the world to participate by launching artificial earth satellites to conduct scientific research. Eisenhower's July 1955 announcement that the United States would participate was thus the official commencement of the space race. Korolev had a policy window; the task was to jump through it.¹⁵⁸

Throughout the tortuous process of fighting for approval of every step of the missile program, Korolev realized that Stalin would not easily be convinced of the value in returning to failed policies of the past. Stalin wanted a solid defense, not space spectaculars. Anything which detracted from that was sabotage. Given that Boris Chertok, Mikhail Riazanskii, Marshal Iakovlev, and Dmitry Ustinov were all under suspicion for sabotage over the previous three years, Korolev was reluctant to test his luck with Stalin by proposing that state resources be used for satellite launches.¹⁵⁹

Stalin died in March 1953. Left in his wake was a confused, amorphous, political leadership. Beria, who had the greatest cognizance of military technical affairs among the remaining leadership, was arrested in June and executed shortly thereafter. Georgi Malenkov, who was the political leader in charge of *Spetskomitet-2*, was locked in a political struggle with Khrushchev arguing that the focus of the Soviet economy should be

¹⁵⁷ See Strobe Talbott, editor and translator, N.S. Khrushchev, *Khrushchev Remembers: the Last Testament*, (New York: Little Brown, 1971) p. 46

¹⁵⁸ See Kingdon, *Agendas, Alternatives and Public Policies...*

¹⁵⁹ Chapter 5 covers the beginnings of Stalin's next purge in greater detail.

redirected from wartime priorities to those of a peacetime economy.¹⁶⁰ Malenkov argued that military-related production should be sharply cut back and was thus opposed to further development of long-range ballistic missiles. Opposing him, Khrushchev argued for increased military modernization.¹⁶¹ The political conflict was won decisively in January 1955, when Malenkov was forced to resign as Chairman of the Council of Ministers, eliminating yet another potential opponent of the space program.

From Korolev's perspective, aside from elimination of a potential opponent, the result of the debate was decision-making paralysis. In the absence of decision-making at the top, lower level administrators made decisions without consulting the political leadership. During mid to late 1953, Korolev, Ustinov, and Minister of the atomic industry, Malyshev, decided upon: development of an SLBM (the R-11); "Operation Baikal" (the test of an R-5 with a live atomic warhead); and the R-7 (the first ICBM) with virtually no discussions at the leadership level. For example, after hearing arguments by Korolev, that if they did not make a decision, no one will make such a decision for us upstairs" Pashkov, a department head in the State planning committee (GOSPLAN), decided to go ahead with the plan for "Operation Baikal," without even soliciting the opinions of the new Soviet leadership.¹⁶² Thus, by mid 1954, they were confident that decision making could be driven from the bottom up.¹⁶³

In 1953, Korolev completed the conceptual and theoretical work for a missile capable of delivering nuclear weapons. Only two months after Stalin's death, Korolev presented a proposal for the R-6 with an intended payload of three tons and a range of 8,000 km. Outwardly, it seemed to be a curious choice of vehicle size. Soviet atomic weapons at the time were only 1,000 kg., and thermonuclear warheads under development

¹⁶⁰ *Spetskomitet-2* was created in 1946 as a high level monitoring organization overseeing the missile programs. The committee was disbanded around 1951. See chapter 4 for a more detailed discussion.

¹⁶¹ See for example Breslauer, *Khrushchev and Brezhnev as Leaders...*; and, Bruce Parrott, *Politics and Technology in the Soviet Union*, (Cambridge: MIT Press, 1985).

¹⁶² See Iaroslav Golovanov, "Operatsiia Baikal" *Poisk*, 7:42 p. 7.

¹⁶³ For a discussion of the proposition that innovation tends to come from the bottom in public bureaucracies see John W. Kingdon, *Agendas, Alternatives, and Public Policies*, (Boston: Little Brown, 1984), Kingdon is basing his theory on the model of decision making developed in Michael D. Cohen, James G. March and Johan P. Olsen, "A Garbage Can Model of Organizational Choice," *Administrative Sciences Quarterly*, Vol. 17 (1972) pp. 1-25, more recent and detailed accounts appear in James G. March and Johan P. Olsen (eds.), *Ambiguity and Choice in Organizations*, (Bergen Norway: Universitetsforlaget, 1976); and James G. March and Roger Weissinger-Baylon, *Ambiguity and Command: Organizational Perspectives on Military Decision Making*, (Marshfield MA: Pitman Publishing, 1986).

would be in the range of five tons.¹⁶⁴ In reality, Korolev arrived at the three ton figure methodically. A missile with a one ton warhead was not large enough to launch a satellite into orbit, and a missile with a three ton warhead could be constructed from existing R-5 components, and would be large enough to launch a satellite into orbit.¹⁶⁵ The Minister of the atomic industry Viacheslav Malyshev, who was at the Scientific Technical Council (NTS) meeting, understood what Korolev was doing, and accused him of “attempting to develop a space booster disguised as a military missile.”¹⁶⁶ Over Malyshev’s objections, the project was approved. Only weeks before his arrest, Beria signed the decree authorizing development of the first ICBM without notifying the rest of the leadership.¹⁶⁷ Korolev had approval for the rocket he needed to get into space.

Following the successful test of a thermonuclear weapon in the fall of 1953, Malyshev returned to Korolev requesting that he increase the payload capacity of the R-6 to six tons. Korolev agreed, but only after acknowledgment that much greater funds would be committed to development of an entirely new system.¹⁶⁸ Tikhonravov’s calculations suggested that this new rocket -- the R-7 -- might be large enough to put a man into space.¹⁶⁹ Not only did Korolev now have a rocket capable of putting a satellite into space, but, he could also begin to think realistically of the possibility of putting a man into space. Tsiolkovskii’s dreams were becoming reality.

The third stream of events converging to open this policy window was the movement within the international space community to push for peaceful satellite launches. In 1950, an international group of scientists convened at the home of James Van Allen outside of Washington D.C. The topic of discussion was establishment an International Geophysical Year (IGY), coordinating international high altitude research during the unusually high solar activity predicted for 1957-1958. In October 1952, the IGY was officially announced, proposing satellite launches as the centerpiece. After open public discussion, on May 26, 1955, the National Security Council of the United States approved a program for orbiting a scientific satellite. The public announcement of U.S.

¹⁶⁴ The First Deputy to the Director of the Atomic research institute reported that Korolev discussed warhead size with Igor Kurchatov, the Chief Scientists for the atomic program, in 1952. Interview with Golovin.

¹⁶⁵ Interviews with Mishin, Chertok, and Vetrov.

¹⁶⁶ See Golovanov, *Korolev...* pp. 473-474; and Varfolomeyev, “Soviet Rocketry ...

¹⁶⁷ In fact one of the charges leveled against Beria was that he approved this program without consulting with that rest of the collective leadership. See Holloway, *Stalin and the Bomb...* p. 321.

¹⁶⁸ This discussion is covered in greater detail in Chapter 5. See also Golovanov, *Korolev...* pp. 473-475.

¹⁶⁹ See Tikhonravov, and, Korolev, “Dokladnaia zapiska ob iskusstvennom sputnike zemli...

participation was made on July 29th. There was no response from the Soviet Union.¹⁷⁰

Korolev was aware of the IGY proposal, and in late 1953 began circulating the satellite idea within the Academy of Sciences, first building support within Keldysh's institute. The two scientists had informally discussed the idea of space flight for years, but their discussions took on a more serious note in 1953.¹⁷¹ Korolev also held meetings with Academician Lavrov, astronomer, Academician Kykarkin, and the most famous member of the Academy, Petr Kapitsa. Together, Korolev and Keldysh proposed the idea that the first satellite should feature biological experiments on several types of living organisms. This supported Korolev's plans for manned space flight, and it quickly gained the support of the President of the Academy, A.N. Nesmeianov, a biologist. On May 25th, 1954, a meeting of the Presidium of the Academy approved Keldysh's proposal for creating an artificial satellite.

The same day, Korolev transmitted final approval of the specifications for the ICBM to Pashkov, at Gosplan, Riabikov, at the Council of Ministers, and Ustinov. This was the final stage in the formal approval process for the R-7. But the timing was no coincidence. On the following day Korolev sent another letter to the same list:

For your consideration I present the report of Comrade Tikhonravov, M.K. "Artificial Earth Satellites," and also translated material on this subject coming from the United States. The development of the new article [the R-7] which is currently taking place raises the possibility of creating an artificial earth satellites in the nearest years.

If we reduce the weight of the payload we may achieve the terminal speed of 8000 m/sec. The article [R-7] - satellite may be developed on the basis of the article currently under development; but requiring serious redevelopment of the latter [satellite].

It seems to me to that now it is an opportune and expedient time to consider organizing a scientific department for conducting initial basic research on satellites and more detailed development of related issues.

I request your decision.¹⁷²

¹⁷⁰ See, McDougall, *The Heavens and the Earth...* pp. 118-121.

¹⁷¹ Interviews with Eneev, Akim

¹⁷² S.P. Korolev, "O vozmoshnosti razrabotki isksstvennogo sputnika Zemli" ("The possibility of developing an artificial Earth satellite,") in Keldysh, *Tvorcheskoe Nasledie...* p. 343. Golovanov notes that the letter was sent to the same list as Korolev's acceptance of the ICBM specifications mailed a day earlier. See Golovanov, *Korolev...* pp. 519-520.

This letter was the first official communication with administrators regarding satellites.¹⁷³ However, it did not catch Ustinov by surprise. Korolev discussed the satellite proposal with him for the first time in February, and he was willing to support Korolev's satellite provided it did not put more important missile programs at risk.¹⁷⁴ Consequently, the proposal was not considered a high priority, and was put on the slow track for approval. Given the unfamiliarity of the decision-making apparatus with space technology, this process would take many months.¹⁷⁵ The proposal probably never reached the Presidium, but stalled in the Central Committee decision making apparatus.¹⁷⁶ In the absence of official sponsorship, Korolev continued to fund Tikhonravov out of his own reserve.

Korolev's proposal was greeted with indifference by most, and hostility by some. The Deputy director of NII-4, Gen. Grigori Tiulin, helped Korolev push the proposal through a resistant bureaucracy by writing yet another letter to Grigori Pashkov, the official in Gosplan who had responsibility for the missile program.¹⁷⁷ Tiulin compared Korolev, to Tsiolkovskii, that "enthusiastic fantasizer, town lunatic," and encouraged Pashkov to support his plans. They arranged a meeting with Vasilii Riabikov at the Council of Ministers. Korolev modified his tactics, stressing the political, rather than

¹⁷³ *Ibid.* See also Golovanov, *Korolev...* p. 520; and, "M.K. Tikhonravov," in Ishlinskii, *Korolev...*

¹⁷⁴ Interview with Piskaraev. See also Golovanov, *Korolev...* pp. 519-520.

¹⁷⁵ A former participant in Politburo decision-making noted that there were three basic speeds which proposals could move through the Soviet administrative system. The highest priority issues, such as crises of foreign affairs go directly to the General Secretary (or Premier) for immediate resolution regardless of time of day. Other high priority decisions, are routed through the bureaucracy within a matter of days to a couple of weeks. These would include the decisions which were made on the ICBM. Other decisions fall into the normal channels. Here, each proposal must go through a painstaking process of approval of all Central Committee Departments which might have some cognizance over it. This process usually takes several months before the proposal can even get in the queue for consideration by the Presidium. See Iuri Ra'an and Igor Lukes, *Inside the Apparatus: Perspectives on the Soviet Union from Former Functionaries*, (Lexington MA: Lexington Books, 1990).

¹⁷⁶ A former staff member of the Central Committee who did not begin working there until after Sputnik felt that, given the structure, it was unlikely that the first proposal ever reached the Presidium. Interview with Stroganov.

¹⁷⁷ Pashkov moved to Gosplan for a short time in the mid 1950s. His involvement in the missile program was informal stemming from his earlier work at the Ministry of Armaments and later at the Council of Ministers. Interview with Piskareev.

scientific, aspects of the first satellite flight, and the limited amount of additional resources he would require to conduct this mission. Riabikov was indifferent, but Gen. Mrykin, deputy chief of the Directorate of the Artillery Command for Special Technology (UZKA), objected to Korolev's proposal interjecting, "Why are we even talking about this?! When we launch the R-7, then we can think about satellites." Korolev had a list of participants in front of him and wrote "later" next to Mrykin's name.¹⁷⁸ Mrykin was not alone. There were others within the Soviet government, and even within the Council of Chief Designers, who felt Korolev's proposal was premature.¹⁷⁹ They did not share Korolev's sense of urgency over beating the Americans into space.

Undeterred, Korolev continued funding Tikhonravov's work. Another version of the "Document on Artificial Earth Satellites" was produced in July 1955, going into greater technical detail, with a discussion of the basic missions to be performed by satellites as well as organizational issues. Tikhonravov proposed expanding his group to 70-80 staff members, but Korolev pared this down to 30-35. Both were in agreement that the satellite design group should remain within NII-4 for the time being.¹⁸⁰ Korolev waited for the right time to submit this revised version the administrative agencies.

Korolev's did not have to wait long. On July 29, President Eisenhower announced that the United States would launch an Earth satellite during the IGY. Both Korolev and Keldysh had been keeping close track of the American space efforts, and their participation in the IGY did not come as a surprise. Nevertheless, the announcement created an international sensation in the popular press.¹⁸¹ Within the Soviet Academy of Sciences, Keldysh held a series of conferences on space research the summer of 1955 which built a broad base of support not only among the leading members, but among the rank and file.¹⁸²

The American announcement gave Korolev the pretext he was looking for. Korolev transmitted Tikhonravov's revised document to Pashkov on September 3. In the cover letter, he called attention to the political significance of the program, *underlining this phrase three times*, the economic uses of satellites, and finally the military uses, underlining the latter phrase a single time.¹⁸³ In the ensuing meetings, Korolev reiterated at the political significance of the space program. To make it appear scientifically legitimate, Korolev proposed that Keldysh, the new Vice President of the Academy, serve

¹⁷⁸ See Golovanov, *Korolev...* p. 520.

¹⁷⁹ Interviews with Chertok, Mozhorin, and Mishin.

¹⁸⁰ See "M.K. Tikhonravov," in Ishlinskii, *Korolev...*

¹⁸¹ See McDougall, *The Heavens and the Earth...*

¹⁸² Interview with Eneev, see also Golovanov, *Korolev...* p. 527.

¹⁸³ These comments came from Tikhonravov's original unpublished, article.

as the Chief Scientist and Chairman of an Academy commission coordinating the satellite effort. Korolev wanted to give the impression that he was only the project coordinator for Keldysh.¹⁸⁴ This also reassured Ustinov and the leadership that Korolev's first priority remained his missile work.

This superficial division of duties between Korolev and Keldysh also made political sense for the Academy. The Academy President, Nesmeianov, was under attack at the time for isolating the Academy from the industrial ministries.¹⁸⁵ The satellite program gave him a chance to demonstrate that the Academy could work together with industrial design bureaus to produce scientific experiments which could advance Soviet industry. Putting the project under Keldysh's direction also provided a demonstration of Nesmeianov's assertion that the Academy "can fulfill its role in the country's scientific orchestra if it is the conductor, not merely a single performer."¹⁸⁶

Korolev's strategy was finally successful. On January 30, 1956, the Council of Ministers issued a decree approving the use of one R-7 booster for launching an unstabilized 1,000-1,400 kg. satellite with unspecified scientific equipment comprising between 200-300 kg. of the overall weight. The satellite would be known as "Object D," and had a preliminary target launch deadline of the end of 1957. The technical proposal was exactly as Korolev had submitted to the leadership over 18 months earlier. It was Korolev's added emphasis on politics and the U.S. announcement that made the project more palatable to the Soviet leadership.

For more than a year and a half, Korolev and Keldysh pushed their proposal on the political leadership. Why did it stagnate for so long only to be summarily approved? The answer lies in timing. Kingdon developed the concept of a policy window, a limited time at which political streams, policy streams, and agendas converge, providing an opportunity for major policy changes to take place.¹⁸⁷ Korolev built political force behind his proposal, steadily raising it higher on the leadership agenda by building a coalition within the Academy. This was not enough, to open the window. The final push came from the American announcement of their intention to launch a satellite, and the strong public reaction supporting scientific space exploration. This opened the policy window. It was Korolev's bureaucratic acumen that enabled him to jump through it, by stressing the political aspect of beating the Americans into space.

¹⁸⁴ Interview with Eneev, Golovanov, *Korolev...* p. 519, 528.

¹⁸⁵ See Parrott, *Politics and Technology...* pp. 159-167.

¹⁸⁶ *Ibid.* p. 160.

¹⁸⁷ See Kingdon, *Agendas, Alternatives and Public Policies...* esp. pp. 174-180.

CONCLUSION

This paper began with the objective of explaining how Korolev was able to initiate the Soviet space program in terms that would invite comparison to other apparently similar programs. It concluded that part of the success of the program was explained by weak control by the Soviet leadership and “agents run amuck.” Without getting into historical details, such concepts could easily be applied to such programs as the U.S. atomic program in which Oppenheimer and Groves pursued an inefficient and duplicative research strategy well after the initial goal of the program had passed.¹⁸⁸ Evangelista characterized most U.S. programs as being driven primarily by the scientific community often using disingenuous arguments to support their technological flights of fancy by jumping through the appropriate policy windows.¹⁸⁹ Agents also enjoyed a significant degree of autonomy under the direction of Admiral Raborn, the manager of the Polaris missile program.¹⁹⁰ The U.S. ICBM program owed its initial success to the relaxation of monitoring organizations and regulations.¹⁹¹ The fact that each of these programs featured a very different type of programmatic leadership indicates the organizational approach taken in paper is more theoretically productive than explorations based on a single personality alone. The U.S. atomic program featured several intellectual leaders, and the programmatic leadership for the final push was split between a scientist and a military officer. The U.S. ICBM program was not notable for any single programmatic leader.

Ultimately, what may be most interesting about this program, therefore, was that Korolev was able to achieve any sort of programmatic autonomy in the Stalinist economic and political system. The system was indeed created to avoid such opportunistic behavior. Clearly, much of the credit for overcoming the obstacles of this system must be afforded to Sergei Korolev. But this paper has pointed out that a significant factor in the success of the Sputnik program was embodied in the failure of Soviet administrators to effectively administer the program.

We are led to the question of whether organizational factors were more important than Korolev himself? It is difficult to answer this question based on evidence alone. Instead, we must refer to conjecture based upon historical counterfactuals. That would be to posit whether Sputnik could have been launched without Korolev; or whether it could have been launched without agents run amuck. It is difficult to point to another individual in the Soviet Union other than Korolev who was capable of masterminding Sputnik. Neither Mishin nor Tikhonravov appeared to possess the administrative aggressiveness of

¹⁸⁸ See Richard Rhodes, *Making the Atomic Bomb*, (

¹⁸⁹ See Evangelista, *Innovation and the Arms Race...*

¹⁹⁰ See Harvey Sapolsky, *The Polaris Program...*

¹⁹¹ Edmund Beard,

Korolev; and Glushko may not have held the interpersonal skills to hold the diverse group of designers together. Other talented General Designers such as Iangel and Vladimir Chelomei did not share the cosmic ambition of Korolev. Nevertheless, it is at least plausible that one of these men could have risen to the challenge.

On the other hand, it does not seem plausible that Sputnik could have been launched without the initiative coming from the level of the scientists. Given the lack of interest on the part of Soviet ministers, it is unlikely that there would have even been a rocket program without some scientific autonomy. Moreover, under the watchful eye of the Ministry of Aviation Industry which was primarily interested in long-range aviation the Soviet rocket program would have been starved for funds. It is also worth noting that the Soviet leadership did initiate a space program, but even with the unconditional support of Ustinov, Iangel did not launch a satellite until 5 years after Korolev. Perhaps most convincingly though, without Korolev's apparently inflated throwweight requirements there would not have been a booster powerful enough to launch a satellite. There, of course can be no conclusive answer to the question of personality vs. structure. But if this discussion has at least pointed out that there is a question, then it has served its purpose well.

This paper also contains what may prove to be fruitful ground for further theoretical discussion of the causes of innovation. If the success of these programs was partially explained by the ability of agents to run amuck, then principal-agency theorists might be led to question the sanctity of stable contractual relations between the scientists and the state. It may be that stable contractual relations are difficult or impossible for at least certain types of innovation. Support for this notion comes from no less than the guiding force behind U.S. post-war science policy, Vannevar Bush who noted: "Research, however, is the exploration of the unknown. It is speculative, uncertain. It cannot be standardized. It succeeds, moreover, in virtually direct proportion to its freedom from performance controls."

Clearly however, there were innovations such as the Soviet atomic bomb program which were tightly controlled.¹⁹² The fact that the Soviet leadership had possession of American bomb designs suggests that emulation of technological programs redresses the informational imbalance between scientists and state administrators inherent in technological innovation. Most Soviet technological programs were characterized by emulation, and it could be argued that the R-7 and Sputnik represented one of the very few instances in which the Soviet leadership developed a significant military technology in advance of the rest of the world. Close control over technological programs was the rule in the Soviet system. A fruitful line of inquiry remains to be explored at another time relating state structure, innovation and sequence.

¹⁹² See Holloway, *Stalin and the Bomb...*

BEFORE SPUTNIK:
*National Security and the Formation of U.S. Outer Space Policy,
1953-1957*

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The successful launch of the first earth satellite by the Soviet Union on October 4, 1957 shocked the world, but nowhere was there greater consternation than in Washington, D.C.¹ The United States had always been first—first to exploit the splitting of the atom, first to successfully detonate a thermonuclear device—in the Cold War's scientific arena. To many Americans, the forces of democracy had been suddenly beaten to the punch by backward communists in the Soviet Union. In the wake of the announcement from Moscow, American pundits and Congressional leaders pressured the Eisenhower administration to redouble its efforts to place an American satellite in orbit. In what has been described as the "*Sputnik* panic,"² Americans demanded that the United States reassert the superiority of American technology by surpassing the Soviet Union in space exploration.

The widespread domestic outcry which followed *Sputnik* has diverted attention away from the formative years of the U.S. outer space program. By examining the period from 1953-1957 from a national security planning perspective, this essay contests the view that "political realism" and domestic considerations alone propelled the space race.³ Further, it challenges the conventional view that the Eisenhower administration failed to recognize the prestige value of spaceflight prior to the *Sputnik* launch. Rather, the American space effort grew logically out of the administration's evolving Cold War strategy. Based to a great extent on psychological considerations, this strategy accorded science and technology a significant and increasingly important role in Cold War planning. The administration believed that the United States needed to demonstrate technological superiority over the Soviet Union or risk forfeiting its position of leadership in the free world. By taking the lead in the scientific exploration of outer space, moreover, the United States could also demonstrate its commitment to scientific progress and the promise of peace. Viewed this way, *Sputnik* appears less instrumental than conventional wisdom holds. The American space effort, rather than being viewed as a response to Soviet success, should be seen as part of a broader

¹ The author wishes to thank Wilson Miscamble, C.S.C. of the University of Notre Dame, Dwayne Day of the George Washington University Space Policy Institute, Ronald Doel of Oregon State University, and the faculty and graduate student members of the Cold War History Group of the University of California, Santa Barbara for reading earlier drafts of this paper and for providing valuable criticism.

² Michael S. Sherry, *In the Shadow of War: The United States Since the 1930s* (New Haven: Yale University Press, 1995), 216.

³ Robert Divine, *The Sputnik Challenge* (New York: Oxford University Press, 1993), 110.

strategy to demonstrate not only the technological and military superiority of the United States, but also (paradoxically) its peaceful intentions.

Historians have tended to view American space policy largely as a product of the domestic outcry which followed the *Sputnik* launch. In most accounts, President Dwight D. Eisenhower, pressured by a panic-stricken press corps and opportunistic politicians, abandoned his policy of fiscal restraint in order to reassure a badly-shaken nation and quiet his political opponents.⁴ Most historians, notably Walter McDougall and Robert Divine, agree that prior to *Sputnik*, Eisenhower gave military and strategic imperatives priority over questions of national prestige.⁵ For Eisenhower, according to this interpretation, space-related research served two primary objectives. First, anticipating the day when the high-flying U2 spy plane would lose its invulnerability to Soviet surface-to-air missiles (SAMs), he sought the development and production of spy satellites to monitor Soviet military developments.⁶ Second, the president wanted to bolster the American

⁴Historians have emphasized Eisenhower's prudent response to the "Sputnik panic" and the missile gap crises which followed. In what has become a widely accepted view, Eisenhower refused to panic in the face of considerable congressional and public pressure for a massive arms build-up in reaction to *Sputnik*. Because of his commitment to balanced budgets and his determination to avoid an arms race, Eisenhower resisted political pressure to recklessly pursue a "Manhattan approach" to ICBM development or to pursue expensive space spectacles based on shoring-up American prestige. According to this perspective, U-2 intelligence convinced Eisenhower that the United States deterrent remained unaffected by the Soviet success. Nonetheless, Eisenhower's refusal to divulge the source of his confidence (the U2) meant that he could not convince the public of the prudence of his policies. For a concise summary of the traditional view, see Giles Alston "Eisenhower: Leadership in Space Policy," in *Reexamining the Eisenhower Presidency*, ed. Shirley Anne Warshaw (Westport, CT: Greenwood Press, 1993). The standard work on the Cold War in space is Walter McDougall, *The Heavens and the Earth: A Political History of the Space Age* (New York: Basic Books, Inc., 1985). Robert Divine especially emphasizes the importance of domestic politics in propelling the space race. See Divine, *Sputnik Challenge*. For other historians who support this interpretation, see Stephen Ambrose, *Eisenhower: The President* (New York: Simon and Schuster, 1984), esp. 423-461; Jack Manno *Arming the Heavens: The Hidden Military Agenda for Space, 1945-1995* (New York: Dodd, Mead & Company, 1982); Zuoyue Wang, "American Science and the Cold War, The Rise of the U.S. President's Science Advisory Committee" (Ph.D. diss., University of California, Santa Barbara, 1994), 100-182; Paul B. Stares, *Space Weapons and U.S. Strategy: Origins and Development* (London: Croom Helm, 1986), 38-58; and Sherry, *Shadow of War*, 214-237. On Eisenhower's response to the missile gap see McGeorge Bundy, *Danger and Survival: Choices About the Bomb in the First Fifty Years* (New York: Random House, Inc., 1988), 236-358; Peter J. Roman *Eisenhower and the Missile Gap* (Ithaca, NY: Cornell University Press, 1995).

⁵ McDougall emphasizes that the challenge *Sputnik* posed to America's image and prestige transformed the conflict into "total Cold War." By presaging nuclear parity and suggesting Soviet scientific superiority *Sputnik* turned the superpower rivalry into a colossal public relations contest: "The Cold War now became total, a competition for the loyalty and trust of all peoples fought out in all arenas of social achievement." See McDougall, *Heavens*, 8. Divine's recent study confirms McDougall's conclusion that public pressure following Soviet successes in space forced a major reorientation in space policy. Largely a study in presidential politics, Divine's book laments the reversal of Eisenhower's prudent and restrained economic policies and blames the reversal on opportunistic politicians and pundits. Political realism, Divine emphasizes, dictated that Eisenhower reorient American space policy towards capturing the lead in space exploration. It was not until the last two years of Eisenhower's presidency that "Ike would give as much weight to intangible factors such as world opinion and prestige as to missiles and space craft." See Divine, *Sputnik Challenge*, esp. 183, 205.

⁶ On the U.S. spy satellite program see Jeffrey T. Richelson, *America's Secret Eyes in Space: The U.S. Keyhole Spy Satellite Program* (New York: Harper & Row, 1990), 1-123; and Kenneth E. Greer,

deterrent capability through the development of ballistic missile systems. It was not until after *Sputnik*, these authors contend, that the promotion of American prestige became a primary objective of U.S. outer space policy. Soviet "firsts" in space and embarrassing American launch failures caused the administration to reorder its priorities. Henceforth, Eisenhower placed a premium on programs which he considered unnecessary from a national security perspective but imperative to promoting American prestige. Ultimately, these authors maintain that *Sputnik* did more than fire the starter's pistol for the space race. It also ushered in a new emphasis on prestige as a critical component of the Eisenhower administration's foreign policy.⁷

Admittedly, there is much to be gleaned from this interpretation; however, it tells only part of the story. From the decision to pursue the satellite program to the selection of a launch vehicle, psychological considerations permeated U.S. outer space policy. The American effort was predicated from the start on the belief that the nation which first successfully launched a satellite would be in a position to reap considerable prestige and psychological benefits—which could then be used as international currency in the struggle between Moscow and Washington. Because a powerful ballistic missile would hurl the satellite into orbit, a successful launch would signal to world audiences that the United States possessed an effective intercontinental ballistic missile (ICBM) capability. Eisenhower's National Security Council (NSC) believed that the satellite's unambiguous relationship to ICBM technology could affect the will of neutral nations—especially in the developing world—to resist Communist threats. Furthermore, administration officials saw a link between demonstrations of scientific and technical prowess and American credibility. They understood that the inevitable nuclear stalemate that would result from deployment of ICBMs placed a premium on alternative demonstrations of national power.⁸

"Corona," in *Corona: America's First Satellite Program*, ed. Kevin C. Ruffner (Washington, D.C.: History Staff, Center for the Study of Intelligence, Central Intelligence Agency, 1995.)

⁷ Two historians who challenge this view, in different contexts, are Robert J. McMahon and Rip Bulkeley. McMahon suggests that image, prestige, credibility and other psychological considerations always exerted a powerful influence on Eisenhower's foreign policy decisions. See Robert J. McMahon, "Credibility and World Power: Exploring the Psychological Dimension in Postwar American Diplomacy," *Diplomatic History* vol. 15, no. 4 (Fall 1991), 455-471. Bulkeley's critique of space historiography also notes the importance Eisenhower attached to psychological matters. He checks the Eisenhower administration's post-*Sputnik* rhetoric against its actions prior to the Soviet launch and finds that contrary to the administration's public statements, its space efforts were "not part of a disinterested policy of support for pure science." Rather the administration was concerned from the start that the satellite project "should be conducted and publicly presented in such a way as to secure the maximum benefit for the prestige and influence of the United States in the propaganda competition with the Soviet Union." See Rip Bulkeley, *The Sputniks Crises and Early United States Space Policy: A Critique of the Historiography of Space* (Bloomington and Indianapolis: Indiana University Press, 1991), 162.

⁸ McMahon defines prestige as an "elusive concept" that connoted "a blend of resolve, reliability, believability and decisiveness; equally important, it has served as a code word for America's image and reputation." See McMahon, "Credibility," 455. John Lewis Gaddis suggests that by as early as 1950, when the Truman administration adopted the important policy paper NSC-68, American security "had come

PARITY AND THE "PEACE OFFENSIVE"

Against a background of steadily increasing Soviet nuclear capabilities, the Eisenhower administration formally committed the United States to the scientific exploration of space in 1955. In 1949 the Soviets shocked the Truman administration with the detonation of an atomic bomb. Four years later the Soviets again demonstrated their technical proficiency by exploding a hydrogen weapon. At the same time, reports of Soviet successes in rocketry provided evidence that soon they would possess ballistic missiles.⁹ These developments came at a time when the United States—under the guidance of Eisenhower's "new look" strategy—relied heavily on nuclear weapons to deter Soviet aggression.¹⁰ To the consternation of policymakers, Soviet technological feats suggested that the era of American overwhelming superiority would soon give way to an age of nuclear stalemate.¹¹ Moscow's conciliatory tactics compounded the situation. In the years following Stalin's death, the new Soviet leadership helped bring the Korean War to a close; negotiated a peace treaty with Austria; pursued improved relations with such countries as Israel, Yugoslavia, and Greece; agreed to a summit with Western leaders; and, in general, emphasized "peaceful coexistence" over confrontation with the West.¹² These developments threatened to render

to depend as much on *perceptions* of the balance of power as on what that balance actually was." Consequently, "judgments based on such traditional criteria as geography, economic capacity, or military potential now had to be balanced against considerations of image, prestige, and credibility." Like the authors of NSC-68, Gaddis contends, Eisenhower and his advisors attached great importance to perceptions of power. John Lewis Gaddis, *Strategies of Containment: A Critical Appraisal of Postwar American National Security Policy* (Oxford: Oxford University Press, 1982), 92 and 144. For analysis of credibility and deterrence see Robert Jervis, *Perception and Misperception in International Politics* (Princeton, N.J.: Princeton University Press, 1976) and Richard Lebow, *Between Peace and War: The Nature of International Crises* (Baltimore: John Hopkins Press, 1981). On prestige and the space race see William H. Schauer, *The Politics of Space: A Comparison of the Soviet and American Space Programs* (New York: Holmes & Meier, 1976), esp. 91-105.

⁹ On the Soviet Union and nuclear weapons see David Holloway, *Stalin and the Bomb: The Soviet Union and Atomic Energy, 1939-1956* (New Haven: Yale University Press, 1994) and Richard Rhodes, *Dark Sun: The Making of the Hydrogen Bomb* (New York: Simon & Schuster, 1995). On Stalin's successors (especially Khrushchev) and technology, see Vladislav Zubok and Constantine Pleshakov, *Inside the Kremlin's Cold War: From Stalin to Khrushchev* (Cambridge: Harvard University Press, 1996), esp. 138-209.

¹⁰ On the "new look" see Gaddis, *Strategies*, 127-197; Bundy, *Danger*, 246-260, Robert A. Divine, *Eisenhower and the Cold War* (Oxford: Oxford University Press, 1981), 33-70. For extensive and detailed discussion of the strategy see Saki Dockrill, *Eisenhower's New-Look National Security Policy, 1953-1961* (New York: St. Martin's Press, Inc., 1996). On John Foster Dulles and massive retaliation see Gaddis, *The United States and the End of the Cold War: Implications, Reconsiderations, Provocations* (Oxford: Oxford University Press, 1992).

¹¹ See for example NIE 11-4-54, 27 August 1954, *Declassified Documents Catalog*, 1981, document 283A [hereafter DDC with year/document number].

¹² On Soviet peace initiatives after Stalin see James Richter, *Khrushchev's Double Bind: International Pressures and Domestic Coalition Politics* (Baltimore: Johns Hopkins University Press, 1994); Voltech Mastny, *The Cold War and Soviet Insecurity: The Stalin Years* (New York: Oxford University Press,

obsolete assumptions on how best to deal with the Soviet threat and forced officials in Washington to reevaluate their strategy for opposing the Soviet Union.

The National Security Council (NSC) warned in 1953 that Soviet nuclear capabilities combined with the new "soft line" coming from Moscow strengthened the Soviet hand by undermining American leadership. National Security Council report 162/2—the policy paper which guided the implementation of the "New Look" as basic national security policy—predicted that American retaliatory power remained strong enough to deter the Soviets from a general attack on the West.¹³ Nevertheless, the NSC cautioned that fear of involvement in nuclear war circumscribed the will of American allies to risk war and prematurely led to allied pressure to negotiate. According to this analysis, Soviet peace overtures exacerbated this trend. Because American allies "tend to see the actual danger of Soviet aggression as less imminent than the United States does," the NSC warned that they might fall prey to Soviet tactics designed to undermine the cohesion of the free world coalition. Assuming that Soviet peace gestures were "merely designed to divide the West," the NSC warned that the twin tactics of nuclear terror and peace rhetoric portended serious political and psychological difficulties for United States leadership. "Using both the fear of atomic warfare and the hope of peace," NSC 162/2 concluded, "such political warfare will seek to exploit differences among members of the free world, neutralist attitudes, and anti-colonial and nationalist sentiments in underdeveloped areas."¹⁴

Articulated in mid-1953, these themes achieved greater significance in the second half of the decade. Although the United States enjoyed a clear preponderance of power vis-a-vis the Soviet Union throughout the 1950s, alarming reports of Soviet technological and military growth and assertive diplomatic and economic initiatives by the Soviets in the Third World caused the U.S. to reassess the very *nature* of the Soviet threat.¹⁵ As Robert McMahon has shown, U.S. strategists deviated from the previous administration's emphasis on military and geostrategic concerns. They emphasized instead the political, ideological and psychological challenges posed by Soviet conciliatory tactics and initiatives in the developing world.¹⁶ The United States continued

1996), 171-198; Adam Ulam, *Expansion and Coexistence: Soviet Foreign Policy, 1917-1973* (New York: Praeger, 1974), 496-694; Zubok and Pleshakov, *Kremlin's Cold War*, 138-235.

¹³ NSC 162/2, 30 October 1953, *FRUS 1955-1957*, 2: 578-596.

¹⁴ National Security Council Planning Board, "Tentative Guidelines Under NSC 162/2 for FY 1956," 14 June 1954, *FRUS 1952-1954*, 2: 649-665.

¹⁵ See JCS to Wilson, June 23, 1954, *FRUS 1952-1954*, 2: 680-681; John Dulles to the NSC, 15 November 1954, *FRUS 1952-1954*, 2: 772-776; Streibert to the NSC, 19 November 1954, *FRUS 1952-1954*, 2: 784; and Allen Dulles to the NSC, 18 November 1954, *DDC*, 81/415B. Their concerns were likely based, in part, on intelligence estimates warning of Soviet advances in guided missiles technology. The first estimate to treat the subject was NIE 11-6-54, 5 November 1954. See Steury, "Missile Gap, *Intentions and Capabilities*, 55. See also NIE 11-4-54, 27 August 1954, *DDC*, 81/233A.

¹⁶ Robert J. McMahon, "The Illusion of Vulnerability: American Reassessments of the Soviet Threat, 1955-1956," *International History Review*, XVIII, 3 (August 1996), 591-619. On the Truman

to fret over the ramifications of the U.S.S.R.'s growing nuclear might to the cohesion of western alliances. But the dismantling of European empires and the emergence of dozens of newly independent states introduced a dynamic new variable into the international equation—one that threatened to alter the international *status quo* in favor of the Soviet Union. Administration officials feared that these previously "peripheral" states would gravitate *voluntarily* into the Soviet orbit, as a result of sympathy to communist ideology, lingering hostility to European imperialists, material necessity, or admiration for Soviet industrial and technological feats.¹⁷

These developments led to a major reappraisal of basic national security policy, formalized in NSC 5501 and adopted in January 1955. This new report emphatically reiterated the belief that Soviet peace tactics and the approach of nuclear balance posed the foremost challenges to the United States.¹⁸ "Greater receptivity by the allies to Soviet peace overtures" and "growing fears of atomic war on the part of the allies" threatened serious strains between the United States and its major allies. Furthermore, the growth of Soviet military only encouraged communist expansion in the developing world, which the paper described as "a major source of weakness in the position of the free world." To meet these challenges, NSC 5501 advised, the United States should place more emphasis on building the strength and cohesion of the non-communist world, including *both* developing nations and major industrialized allies. Solidifying principal alliances and shoring-up American leadership in the Third World, then, achieved a new urgency in U.S. policy.

The Eisenhower administration responded with a new emphasis on psychological and political activities. On the one hand, the United States needed to fortify its striking power to reassure American allies of its defense capabilities. On the other, the competition between the Soviet Union and the United States to acquire political, economic and military support from uncommitted countries meant that the United States had to present itself as the nation best-suited for leadership. Soviet initiatives challenged the United States to demonstrate its credentials as a promoter of peace and world development. As NSC 5501 stated, "The ability of the free world, over the long pull, to meet the challenge and competition of the Communist world will depend in large measure on the capacity to demonstrate progress toward meeting the basic needs and aspirations of its people." This meant encouraging modernization across the globe, fostering international trade, moderating disputes within the free world, and developing a sound economy. As the administration fine-tuned and modified this policy in the years between NSC 5501 and *Sputnik*, it also required countering Soviet technological feats

administration's geostrategy see Melvyn P. Leffler, *Preponderance of Power: National Security, the Truman Administration, and the Cold War* (Stanford, CA: Stanford University Press, 1992).

¹⁷ McMahan, "Illusion," 591-619.

¹⁸ NSC 5501, 7 January 1955, *FRUS 1955-1957*, 2: 24-38. For similar sentiments from the intelligence community, see NIE 11-3-55, 17 May 1955, *DDC*, 78/22B.

with American successes. At the same time, Soviet tactics designed to contrast the belligerence of the United States with the peaceful intentions of the Soviet Union mandated that the U.S. conduct its Cold War activities in a way that ensured their reception as peaceful and non-aggressive.

PRELUDE TO LIFTOFF

While policymakers deliberated on the repercussions of nuclear parity and the Soviet "peace offensive" to national security, scientists and military personnel investigated the feasibility of launching a "world-circling spaceship." These studies led to a scientific satellite program geared towards countering Soviet psychological gains. Early satellite proposals concentrated primarily on the scientific, reconnaissance, and military utility of satellite vehicles, but they also presciently noted the political and psychological ramifications of satellites. The Air Force think-tank RAND forewarned as early as 1946 that the achievement of a satellite craft "would inflame the imagination of mankind, and would probably produce repercussions in the world comparable to the explosion of the atomic bomb."¹⁹ This study had little appreciable impact, but a subsequent report by Manhattan Project scientist Aristid V. Grosse brought the potential propaganda consequences of a Soviet first launch directly to the top levels of the government.²⁰ Grosse's far-sighted report, presented to Eisenhower's Assistant Secretary of Defense for Research and Development Donald Quarles in August 1953, warned that because the Soviet Union had trailed the United States in the development of atomic and hydrogen warheads, it might attempt to take the lead in the development of a satellite. Noting that the satellite "would have the enormous advantage of influencing the minds of millions of people the world over," Grosse accurately predicted that the Soviets might forego complicated instrumentation in favor of putting the satellite into orbit before the United States. "If the Soviet Union should accomplish this ahead of us," he warned, "it would be a serious blow to the technical and engineering prestige of America the world over. It would be used by Soviet propaganda for all its worth."²¹

A number of spaceflight recommendations by prominent scientists and military leaders followed Grosse's report. Of special significance was a study delivered by the Technological Capabilities Panel (TCP) in February 1955.

¹⁹ Douglas Aircraft Company, Inc., "Preliminary Design of an Experimental World-Circling Spaceship," Report No. SM-11827, 2 May 1946 in John M. Logsdon, ed., *Exploring the Unknown: Selected Documents in the History of the U.S. Civil Space Program*, vol. 1 (Washington, D.C.: NASA History Office, 1995), 236-244. For more on RAND see Merton E. Davies and William R. Harris, *RAND's Role in the Evolution of Balloon and Satellite Observation Systems and Related U.S. Space Technology* (Santa Monica, CA: RAND Corp., 1988).

²⁰ R. Cargill Hall, "Origins of U.S. Space Policy: Eisenhower, Open Skies, and Freedom of Space," in Logsdon, *Exploring*, 213-229.

²¹ Grosse to Quarles, "Report on the Present Status of the Satellite Problem," 25 August 1953, in Logsdon, *Exploring*, 267-269.

James Killian, president of the Massachusetts Institute of Technology, coordinated this influential two-volume inquiry into the problem of surprise attack.²² In addition to its important recommendations for accelerating ballistic missile programs and for providing better strategic warning, the TCP called for the use of artificial satellites for intelligence purposes.²³ All three services proposed, or had already in progress, satellite programs. These included the Air Force WS 117L reconnaissance satellite program (later Corona under CIA auspices), the Navy's scientific satellite proposal (later renamed Vanguard), and the Army Project Orbiter (later renamed Explorer.) Additionally, civilian scientists urged the United States to contribute a scientific satellite as a contribution to the International Geophysical Year (IGY). In May 1955 the issue of U.S. government support for a scientific satellite came before the National Security Council, which agreed to launch such a satellite as a contribution to the IGY.²⁴

In analyzing the NSC's decision to launch a scientific satellite, historians have stressed that the President agreed to the proposal only half-heartedly. Walter McDougall and Robert Divine describe this early program as a relatively unimportant, low-priority facade, designed to divert attention away from the more important military and reconnaissance programs and to establish the legal principle of "freedom of space." In McDougall's words, the NSC gave "indubitable primacy" to the protection of the military and reconnaissance programs while the prescient findings of Aristid Grosse "vanished into White House files."²⁵ This interpretation is consistent with the argument that Eisenhower, because of his dogmatic commitment to fiscal responsibility, only belatedly—and under considerable public and congressional pressure—pursued space spectacles based on shoring up American prestige. Eisenhower either did not recognize the political ramifications of being first in space, this view suggests, or consciously chose to ignore them. Consequently, historians have found in Eisenhower's aversion to prestige-oriented space stunts an easy explanation for the American failure to beat the Soviets into space.

This interpretation, however, accords too much weight to Eisenhower's post-missile gap recollections and exaggerates his personal role in directing U.S. space efforts. As pundits and congressional leaders called the President to

²² McGeorge Bundy described the Killian report as one of the "most influential in the history of American nuclear policy" for its impact on the development of ballistic missile systems, intelligence collection recommendations, and efforts to provide better strategic warning to the threat of surprise attack. See Bundy, *Danger and Survival*, 325. See also James Killian's comprehensive memoir, *Sputnik, Scientists, and Eisenhower: A Memoir of the First Special Assistant to the President for Science and Technology* (Cambridge, MA: MIT Press, 1978).

²³ Portions of the report remain classified, although a general summary is in *FRUS 1955-1957*, 19: 41-56. The declassified sections of the TCP report and related documents may be found on *DDC 93/2972*, *93/3111*, *96/2701*, and *96/2778*. See also Bundy, *Danger and Survival* 325-328; and McDougall, *Heavens*, 115-118.

²⁴ Hill, "Origins," 221.

²⁵ McDougall, *Heavens*, 119-121.

account for failing to beat the Soviets into space, Eisenhower defended his actions by claiming the United States was not racing the Soviet Union to begin with.²⁶ Yet as Bulkeley has shown, the "bogus" distinction he drew between the allegedly peaceful, scientific and disinterested American program, and the militaristic Soviet one was merely a "damage-limiting public-relations exercise."²⁷ Eisenhower's largely self-serving memoirs too should be treated with care. Written after the missile gap episode and after Kennedy's victory in the early 1960s, Eisenhower's memoirs were clearly slanted to resurrect his damaged image, to highlight his restraint in light of JFK's free-spending policies.²⁸ While Eisenhower revisionists have correctly refuted the image of Eisenhower as an inactive president who followed public opinion rather than leading it, some have tended to overestimate the extent to which Eisenhower involved himself in policy-making. Admittedly, Eisenhower's balanced budget mandate did limit the scope and expense of national security programs and he did devote his personal attention overwhelmingly to missile and reconnaissance programs. Yet in space policy especially, Eisenhower only established broad guidelines regarding cost and priority. Having delegated the authority elsewhere, he left the matter to the executing agencies. The "hidden hand" President clearly deferred to the advice and judgment of his advisors in this case.²⁹

The traditional interpretation also over-states the importance of the "freedom of space" issue to the scientific satellite program.³⁰ Because the TCP recommended that government agencies re-examine international law to determine if artificial satellites violated air-space agreements—and because the IGY provided a convenient opportunity to establish the legal precedent for later reconnaissance satellites—this argument holds that the United States participated in the IGY primarily as "cover" for its intelligence operations. But the Eisenhower administration was less concerned with the "freedom of space" principle than it appears. The June 1955 interdepartmental progress report on the status of TCP recommendations, NSC 5522, supports this view.³¹ Submitted *after* the authorization of the IGY satellite, NSC 5522 reported that the Departments of State, Treasury, Defense and Justice all concurred that the

²⁶ See for example, Eisenhower's news conferences, 3 October 1957 and 9 October 1957, *Public Papers of the Presidents of the United States: Dwight D. Eisenhower*, 707-709, 719-32.

²⁷ See Bulkeley, *Sputniks Crises*, 120, 154-160.

²⁸ John Robert Greene, "Bibliographic Essay: Eisenhower Revisionism, 1952-1992, A Reappraisal" in *Reexamining the Eisenhower Presidency*, ed. Shirley Anne Warsaw (Westport, CT: Greenwood Press, 1993), 209-219.

²⁹ For the classic revisionist account, see Fred I. Greenstein, *The Hidden-Hand Presidency: Eisenhower as Leader*, (New York: Basic Books, Inc., 1982). For historiographical discussion see Shirley Anne Warsaw, ed. *Reexamining the Eisenhower Presidency* (Westport, CT: Greenwood Press, 1993) and Roman, *Missile Gap*, 9-18.

³⁰ McDougall, *Heavens*, 119-121, 134. For an alternative view, see Dwayne Day, "A Strategy for Reconnaissance: Dwight D. Eisenhower and Freedom of Space," unpublished manuscript from his forthcoming book.

³¹ NSC 5522, 8 June 1955, *DDC* 96/2811.

launching of an artificial satellite was permissible under international law. The Departments reported that "by customary law every State has exclusive sovereignty 'over the space above its territory'. However, *air space ends with the atmosphere*. There has been no recognition that sovereignty extends into the airless space beyond the atmosphere."³² The Departments expressed little concern for U.S. vulnerability to criticism on that front. The IGY satellite, according to Defense Department comments, was intended "for propaganda and scientific purposes." Its connection to the freedom of space principle provided a supplementary motive, but did not drive early U.S. outer space policy.

What about intelligence? To be sure, intelligence applications undoubtedly provided the primary impetus for satellite research and development. Not coincidentally, the CIA generously contributed funds to the IGY program, a sign of its importance to the intelligence community.³³ However, CIA funding of the scientific satellite does not by itself prove the Agency's overriding concern for the legality of reconnaissance overflight. Instead, the evidence suggests that Central Intelligence conceived of the IGY satellite in terms of its psychological significance to U.S. leadership. CIA comments on the TCP satellite recommendation devoted five lengthy paragraphs to discussion of its "psychological warfare value," only one short paragraph to intelligence applications, and zero paragraphs to freedom of space. As the Agency commented, the Soviets undoubtedly endeavored to "further her influence over neutralist states and to shake the confidence of states allied with the United States." Should the Soviets launch a satellite before the United States, the American reputation as the scientific and industrial leader of the world would be called into question—a Soviet first launch would provide Soviet propaganda with "sensational and convincing evidence of Soviet superiority" to neutral and allied states. Repeating Grosses's earlier prediction, the CIA advised: "The nation that first accomplishes this feat will gain incalculable prestige and recognition throughout the world."³⁴

As the Central Intelligence Agency and Defense Department comments suggest, the Eisenhower administration was not insensitive to the relationship between American technology and U.S. prestige. They hardly failed to appreciate the psychological significance of spaceflight. The IGY satellite program, it seems, was from the outset a defensive rear-guard action designed to protect the United States from a Soviet propaganda broadside. The United States had to get a satellite into space before—or at least not much later than—the Soviets, and it had to design its program in such a way that would deflect potentially damaging Soviet propaganda.

The timing of the decision itself reflects this view. Scientists had been debating the merits of an earth satellite for several years and the TCP recommended a reconnaissance satellite in early 1955, but not until the Soviets

³² NSC 5522, 8 June 1955. Emphasis added.

³³ Day, "Strategy for Reconnaissance."

³⁴ NSC 5522, 8 June 1955.

declared their intention to launch a satellite did proposals in the United States receive pressing urgency. When, on April 16, 1955, the Soviet Union announced the creation of a space flight commission charged with orbiting a space laboratory, American scientists and policymakers reacted swiftly.³⁵ Joseph Kaplan of the National Academy of Scientists wrote to Alan T. Waterman, Director of the National Science Foundation, calling for swift executive action on the IGY proposal. "I should like at this time to dwell briefly on the urgency of this matter," Kaplan wrote after the Soviet announcement, reminding Waterman that if funds were not forthcoming by July, it would be virtually impossible for the satellite launch to take place before the end of the IGY in December 1958. To make perfectly clear the importance of immediate action Kaplan enclosed a copy of the *Washington Post* article reporting the Soviet announcement and added, "the critical shortage of time cannot be over-emphasized."³⁶ Kaplan's sentiment is reflected in the official actions of the U.S. National Committee for the International Geophysical Year (USNC-IGY). When the USNC-IGY gave its formal approval to the project at its May 18, 1955 meeting, the official proposal noted not only the usual scientific, technical and budgetary considerations, but also drew attention to the importance of expediting the IGY satellite launch. As the attachment labeled "Factors Affecting USNC-IGY Schedule" mentioned, "it is of interest to note that at least one other nation has announced plans for a similar program under the direction of an extremely able physicist."³⁷ The meaning was clear. The Soviet announcement made American success in this field imperative.

This sentiment was not lost on Eisenhower's advisors. Nelson A. Rockefeller, who succeeded C.D. Jackson as Eisenhower's psychological warfare guru, prepared a substantial memorandum for the NSC calling for immediate action. Rockefeller placed considerable emphasis on beating the Soviets to the launching pad. Noting the psychological importance of being first to launch a satellite, Rockefeller cautioned the NSC of the "costly consequences of allowing the Russian initiative to outrun ours through an achievement that will symbolize scientific and technological advancement to peoples everywhere." He urged the NSC to act quickly in order to deny the Soviets an opportunity to deprive the United States of whatever psychological and prestige awards were to be gained. Clearly sensitive to the political ramifications of spaceflight, he continued emphatically, "The stake of prestige that is involved makes this a race that we cannot afford to lose."³⁸

³⁵ "Interplanetary Commission Created," *Washington Post*, 17 April 1955 in Logsdon, *Exploring*, 308.

³⁶ Kaplan to Alan Waterman, National Science Foundation, 6 May 1955, in Logsdon, *Exploring*, 302-303. This was Kaplan's second letter on the subject and contained an urgent tone not present in the first. See Kaplan to Detlev Bronk, President, National Academy of Sciences, 14 March 1955, in Logsdon, *Exploring*, 301-302.

³⁷ USNC-IGY, "Minutes of the Eighth Meeting," 18 May 1955, in Logsdon, *Exploring*, 295-308.

³⁸ Rockefeller to Lay, 17 May 1955, *FRUS 1955-1957*, 11: 731-733.

In addition to speed, Rockefeller listed other essential parameters for the program, many of them firmly rooted in political and psychological concerns. Since "vigorous propaganda will be employed to exploit all possible derogatory implications of any American success that may be achieved, it is highly important that the U.S. effort be initiated under auspices that are least vulnerable to effective criticism." Rockefeller feared that first launch by the United States of an uninstrumented satellite could be quickly discounted if the Soviets were to follow it with the launching of a more sophisticated type. Even though the United States should endeavor to be first, Rockefeller cautioned, the American satellite should also possess sophisticated instrumentation. Furthermore, the U.S. should launch a satellite under international (IGY) auspices in order to ward off any Soviet propaganda which might bill the American effort as somehow militaristic or aggressive. Finally, Rockefeller advised, the American project should share with the international community the information gleaned from the satellite in order to enhance its perception as a scientific and therefore peaceful project.³⁹

Rockefeller's memorandum possesses a fundamental significance. All of its themes were presented to the National Security Council; it was attached to NSC 5520, the document authorizing the IGY project, and, most important, its suggestions were incorporated into the project's guidelines.⁴⁰ NSC 5520 emphasized in no uncertain terms the importance of the timely success of the satellite project to American prestige. The document began by reminding its readers that the Soviets were believed to be working on a satellite program and warned that "considerable prestige and psychological benefits will accrue to the nation which first is successful in launching a satellite." Just as important, NSC 5520's provisions were designed to cut to a minimum ammunition available for the Soviet propaganda machine.

Historians have looked to two of these provisions—one placing the project under international auspices and the other mandating that it not materially delay the ICBM and reconnaissance satellite programs—as proof that Eisenhower appreciated neither the importance of being first into space nor the propaganda value of spaceflight.⁴¹ On the contrary, these directives were predicated on maximizing American prestige gains at the expense of the Soviets. The NSC believed that the United States needed to launch a satellite as quickly as possible to reap the prestige benefits of being first into space and to demonstrate progress in ballistic missile development. Paradoxically, however, they did not want to use an actual ICBM to do so. The Council wanted to sidestep propaganda charging the U.S. with nuclear belligerence. They also did not want it to appear as if the United States were actually racing the Soviet Union, which would happen if an uninstrumented satellite were hastily

³⁹ Rockefeller to Lay, 17 May 1955.

⁴⁰ NSC 5520, 20 May 1955, *FRUS 1955-1957*, 11: 725-733.

⁴¹ Giles Aston, "Eisenhower: Leadership in Space Policy," 104-106; McDougall, *Heavens*, 132-134; Divine, *Sputnik Challenge*, 102-105.

hurled into space. So the American satellite had to be as "scientific" as possible and had to provide some useful information. In short, the satellite had to be quick, but not too quick; it had to demonstrate success in ballistic missile technology without using "real" ballistic missiles; and it had to be used as a propaganda weapon without appearing to do so. In light of these confusing mandates it seems that the shock of October 1957 was preordained not by the administrations' insensitivity to political concerns, but rather by its very fixation on them.

The three basic principles of NSC 5520—timeliness, peaceful image, and non-interference—figured prominently in the selection of a launch vehicle for the satellite. McDougall argues that assuring the project's "civilian flavor" and non-interference with military programs governed the selection of the rocket vehicle because Eisenhower did not appreciate the political implications of being first in space. If the Eisenhower administration clearly understood the ramifications of spaceflight, he asks, why then did it assign the satellite to the doomed Project Vanguard? Was not the selection of the Vanguard rocket, in McDougall's words, a "disaster"? If so, it was by no means clear at the time. In fact, the Vanguard rocket was selected precisely because it promised to deliver the best combination of *all three* considerations.

A reexamination of the evidence suggests that timeliness figured just as prominently—if not more so—in the selection of a launch vehicle.⁴² It should be kept in mind that the job of selecting a launch vehicle fell to Assistant Secretary of Defense Donald Quarles, to whom the "vanishing" Grosse report was addressed, who was fully aware of Rockefeller's memorandum, and who was fully cognizant of the aims established in NSC 5520. If Quarles disregarded the importance of a timely launch, he did so despite the policy guidance papers, not because they had mysteriously vanished. Significantly, Quarles's comments to the TCP progress report NSC 5522 noted that the IGY satellite was intended "for propaganda and scientific purposes" and mentioned nothing about "freedom of space" or intelligence applications.⁴³ Furthermore, the available evidence suggests that the Stewart Committee—the subcommittee (named after its director Homer J. Stewart) Quarles appointed to recommend a launch vehicle for the satellite—assigned speed a high priority.

Confronted with promising proposals from all three services, the committee selected a launch vehicle based on the three principles of NSC 5520:

⁴² Divine and McDougall argue that the Eisenhower administration attached very little importance to speed because of his overriding concern for ballistic missile programs and his determination to maintain the American project's civilian character. See McDougall, *Heavens*, 122; Divine, *Sputnik Challenge*, 102-110; Giles Alston, "Eisenhower: Leadership in Space Policy," 104-105. Bulkeley, on the other hand, provides convincing evidence to the contrary. He writes, "the historical perception of ... Eisenhower's early space policy has been coloured by the fact that after Sputnik 1 the administration staged a damage-limiting public-relations exercise ... which drew a bogus but meretricious distinction between its own peaceful, scientific and allegedly disinterested satellite project and the somehow more sinister and less noble, if more effective, Soviet one." See Bulkeley, *Sputniks*, 156-162.

⁴³ NSC 5522, 8 June 1955.

timeliness, peaceful image, and non-interference with ICBM development. It first ruled out the powerful Atlas rocket, the Air Force ICBM-in-progress. Even though the committee expressed concerns that the satellite might interfere with the development of this important ICBM project, timeliness also weighed heavily on this decision. The first test launches of Atlas-B were scheduled for January, February and March 1958, at best an uncomfortably narrow margin for the IGY.⁴⁴ The committee rejected the Atlas for its guaranteed tardiness and was then left to choose between the Army Orbiter project and the Naval Research Laboratory's (NRL) project. Contrary to McDougall's claim that there was "little doubt" that the Army proposal promised a satellite soonest,⁴⁵ half of the committee members thought Orbiter less likely to succeed than the NRL Viking rocket. Moreover, some members also believed that the bigger, heavier Orbiter rocket would cost considerably more than the Viking. Finally, the Navy's satellite promised far superior instrumentation and was designed as a research rocket, not a weapon. Committee members voted three in favor of the Viking rocket, two dissented, and one abstained on account of illness.⁴⁶

Faced with a less than decisive vote for the NRL project, Quarles accepted vigorous Army demands to reconsider. Major General Leslie Simon of the Army Ordnance Corps protested that developmental problems cast doubt on the Navy's ability to launch a satellite within the IGY. Simon's urgent plea focused on the Army's ability—and the Navy's inability—to orbit a satellite before the Russians. He promised an Army launch by January 1957 and warned, "Since this is the date by which the U.S.S.R. may well be ready to launch, U.S. prestige dictates that every effort should be made to launch the first U.S. satellite at that time."⁴⁷ When the Navy got word that the Army was attempting to snatch their hard-won project, the NRL responded with assurances of its own. Earning a second hearing before the Stewart Committee, the Naval Research Laboratory reversed its earlier estimates and confidently announced that "the first satellite can be launched eighteen months from the start of the program." This revision of the earlier estimate was supported from the Glenn L. Martin Company, producer of the Viking. The company's executive vice president stated: "We see no reason why it should not be possible to put a satellite in being in approximately 18 months."⁴⁸ As Green and Lomask stated in their official history of the Vanguard project, the assurances from reputable industrial firms, particularly in regard to delivery dates, impressed the Stewart Committee. The time element, enthusiastically

⁴⁴ It should be noted here that McDougall also cites the official *Vanguard* history by Green and Lomask for his interpretation of these events. Contance McLaughlin Green and Milton Lomask, *Vanguard: A History* (Washington, D.C., 1970), 41.

⁴⁵ McDougall, *Heavens*, 123.

⁴⁶ Green and Lomask, *Vanguard*, 45-52.

⁴⁷ Quoted in Green and Lomask, *Vanguard*, 52-53.

⁴⁸ Quoted in Green and Lomask, *Vanguard*, 54.

stressed by the Army general who spoke for Orbiter, now appeared to be about equal in both the Army and Navy propositions.⁴⁹ Thus, in accordance with NSC 5520, even though schedule may not have been the primary consideration and was certainly not the *only* consideration, it is clear that the scientists and administration officials charged with implementing the satellite decision nevertheless appreciated its significance and its connection to American prestige and credibility.

TECHNOLOGY, CREDIBILITY, AND THE BANNER OF PEACE

Even if the administration understood the satellite program in terms of its prestige and political value, important questions remain unanswered. If Eisenhower believed, as his post-*Sputnik* and subsequent missile gap statements suggested, that the Strategic Air Command (SAC) possessed sufficient firepower to inflict massive and unacceptable damage in response to a Soviet first strike—if, in other words, the efficacy of the U.S. deterrent to general war remained unaffected by Soviet ballistic missile deployment—why then did the administration place such a high priority on a seemingly insignificant proposal to launch a ten-pound sphere into the atmosphere? The answer to this question brings us back to the administration's broader national security concerns. The satellite proposal should be seen in relation to the administration's efforts to counteract the Soviet's supposed two-pronged strategy of nuclear threat and the promise of peace. Because the administration believed that Soviet successes in atomic weaponry threatened to dismantle U.S. alliances and encouraged third-world neutralism, the United States attached maximum urgency to its own ballistic missile programs.

Furthermore, the satellite's self-evident relation to the ICBM made early success in this field an important objective of American foreign policy. A crucial passage in NSC 5520 stated this psychological connection explicitly: "The inference of such a demonstration of advanced technology and its unmistakable relationship to intercontinental ballistic missile technology might have important repercussions on the political determination of free world countries to resist Communist threats, especially if the USSR were to be the first to establish a satellite."⁵⁰ In short, the administration was fighting fire with fire. It sought to counter Soviet "war and peace" tactics with similar efforts of its own. To counteract Soviet gains in nuclear weapons and rocketry, it endeavored to demonstrate its own proficiency. At the same time, the Soviet peace offensive pushed the administration to do so in a manner that made the United States appear the true bearer of peace and freedom.

In the face of serious challenges to U.S. leadership, then, technology itself provided a means for demonstrating not only American military power,

⁴⁹ Green and Lomask, *Vanguard*, 55.

⁵⁰ NSC 5520, 20 May 1955.

but also America's peaceful intentions. This became increasingly clear as Soviet technological advances coupled with Soviet peace overtures again forced a review of basic national security policy. The State Department's Policy Planning Staff (PPS) recommended such a review in October 1955. The PPS expressed an especially strong concern for the emphasis in Soviet diplomacy on "amiability and lure." These flexible tactics caused American allies to let down their guard and strengthened impulses towards neutralism and disengagement. To face this challenge, the Staff warned, the U.S. needed to double its efforts to build free world unity. This meant both maintaining the credibility of the U.S. deterrent and demonstrating American peaceful intentions. Technology would help: "We shall have to replace the cement of fear with new means of cohesion [including] common efforts to use technological advances for peaceful ends."⁵¹ At once a symbol of national power and human progress, the PPS advised, technology should form a major component of U.S. policies to contain Communist expansion and reinforce American leadership.

This sentiment was echoed two months later by an Office of Defense Mobilization-Defense Department (ODM-Defense) working group charged with recommending to the NSC responses to Soviet technological gains. The task force, warning that the Soviet Union was several years ahead of the U.S. in important fields of weaponry and perhaps leading by two or more years in ICBMs, prescribed constant vigilance and preparation. Although the United States in 1955 still possessed superior overall firepower, Soviet advances suggested that "it will take continuous, unrelenting effort on the part of the U.S. to maintain such superiority on into the future." Dire consequences awaited: "Failure to maintain technological superiority by the U.S. could result in loss of confidence by the Free World in U.S. technology and power; accelerated Soviet expansion geographically and economically; swing of important uncommitted nations into the Soviet orbit; [and] defection of important countries now members of the Free World community." Weapons systems alone would not suffice, the report cautioned. The U.S. must reflect *overall* technological superiority including technology for peaceful purposes, inventiveness in basic research, and pools of scientific and technical personnel and institutions. Achieving and maintaining of technological superiority, the working group advised, were now indispensable elements of U.S. policies to counter Soviet expansion.⁵²

With each passing year the NSC placed greater and greater stress on science and technology as central components of United States national security policy. The ODM-Defense and PPS reports were transmitted to the NSC planning board and incorporated into the Eisenhower administration's third

⁵¹ Department of State, "General Comments on NSC 5501", 3 October 1955, *FRUS 1955-1957*, 19: 123-125.

⁵² "Report by the ODM-Defense Working Group", 20 December 1955, *FRUS 1955-1957*, 19: 173-177.

major revision of basic national security policy, NSC 5602.⁵³ Reflecting a broader trend in national security planning, NSC 5602 included expanded emphasis on U.S. policies to counter Soviet flexible diplomatic initiatives and technological gains. This 1956 revision of national security policy, like its 1955 predecessor NSC 5501 and its 1957 successor NSC 5707, recommended that the United States shore-up American leadership by pursuing policies which reassured the world of American peaceful intentions and technological superiority.⁵⁴

Why such an emphasis on scientific research and technological innovation? First and foremost, the NSC called for maintaining technological superiority out of fear that the Soviets might make a breakthrough rendering the American deterrent inadequate or obsolete. The National Security Council also saw a link between technological superiority and American leadership. The NSC felt that the United States had to demonstrate to its allies its capacity to fulfill its defense commitments. Furthermore, the NSC expressed concern that Soviet technological and economic progress might serve as "an impressive example" for peoples of the developing world, which might result in the expansion of Soviet influence.⁵⁵ If the United States fell too far behind in technological innovation, the NSC believed, it would drastically weaken the position of the free world. Industrialized allies and developing nations, lacking confidence in American abilities, would increasingly operate independently of the United States, undermining its ability to contain Soviet expansion.

The years dividing the Eisenhower administration's initial satellite decisions from *Sputnik* suggested to the administration that its worst fears were coming true. Anti-colonialist sentiment in the developing world and strains in the Atlantic alliance seemed to verify that Soviet "war and peace" tactics were working all too well. Many intelligence analysts and policymakers in the administration warned apocalyptically that unless the U.S. moved quickly, it faced isolation from its allies and perhaps even from the rest of the world.⁵⁶ The Eisenhower administration responded to these warnings immediately. By May 1956, a year after approving the IGY satellite project, the National Security Council boosted the ICBM to the highest priority of all defense programs in the country, placed the shorter-range IRBM directly beside it, and tacked second-highest priority on the satellite program.⁵⁷

⁵³ NSC 5602/1, March 15, 1956, *FRUS 1955-1957*, 19: 242-268.

⁵⁴ NSC 5707/8, June 3, 1957, *FRUS 1955-1957*, 19: 507-524. See also NSC meeting, 28 February 1957, *DDC*, 96/1053.

⁵⁵ NSC 5602/1, 263.

⁵⁶ See for example NIE 100-5-55, 14 June 1955, *FRUS 1955-1957*, 19: 85-87; NSC 5525, 31 August 1955, *FRUS 1955-1957*, 9: 529-531; DOS comments on NSC 5501, 3 October 1955 *FRUS 1955-1957*, 19: 123-125; and NIE 100-7-55, 1 November 1955, *DDC* 88/3158.

⁵⁷ For official DOS chronologies of important developments in the ICBM and satellite programs see *DDC* 94/2000, *DDC* 94/2000 and *DDC* 81/221A.

The first of these decisions came in September 1955, when the NSC met to discuss the ballistic missile program. The decision to attach to the ICBM program the highest priority above all other defense programs again illustrates the significance the Eisenhower administration attached to psychological matters in formulating its Cold War policy. This sentiment was most clearly expressed by the State Department. Acting Secretary of State Herbert Hoover, Jr., interrupted a seemingly constipated discussion concerning the precise wording of the ICBM directive—whether the program should be pursued with "all practicable speed" or "all possible speed"—to remind the NSC of the tremendous importance of the ICBM to American foreign relations. "If the Soviets were to demonstrate to the world that they actually had an ICBM before we had such a weapon," he warned emphatically, "the result would have the most devastating effect on the foreign relations of the United States of anything that could possibly happen." Hoover pointed out that the Western coalition was held together essentially by the knowledge that the United States could protect them. "If this umbrella of protection were removed," he continued, repeating familiar logic, "neutralism would advance tremendously throughout the free world." To assure continued free world leadership, in other words, the United States had to maintain its technological edge: the U.S. had to have an ICBM as soon as possible.⁵⁸

President Eisenhower, who was not present at this meeting, removed any doubts about his feelings on these matters. He unambiguously resolved the dispute over how best to word the NSC directive, changing the phrase "all practicable speed" to "maximum urgency." He also authorized, "in view of known Soviet progress in this field," placing the ICBM program as an R&D program of the highest priority above all others. Finally, he ordered the State Department to study of the political ramifications of the *intermediate* range ballistic missile, an inquiry to determine whether early achievement of an IRBM by the United States would counter the implications of a Soviet first ICBM.⁵⁹

Of course, the most important issue at stake here was American credibility. The administration felt it had to make clear the reliability and superiority of U.S. power. However, the threat of immediate and massive destruction posed by ballistic missiles carrying hydrogen warheads complicated matters. The administration understood that in a situation of nuclear parity its freedom of action would be sharply circumscribed by the catastrophic consequences of nuclear war. In such a situation *perceptions* of power became paramount and placed a premium on overall technological superiority. As Vice President Nixon expressed at the September 1955 NSC meeting, "The important thing is not merely the achievement of a developed weapons capability in the ICBM field, but, from the point of view of foreign

⁵⁸ NSC meeting, 8 September 1955, *FRUS 1955-1957*, 19: 111-122.

⁵⁹ NSC meeting, 8 September 1955.

relations, that the peoples of the free world *believe* that you have achieved an ICBM."⁶⁰

In the eyes of policymakers, programs like the scientific satellite were valuable because they reinforced confidence in the capacity of the United States to resist Communist threats through the visible display of technological prowess. This sentiment was most clearly expressed by Under Secretary Hoover. He called the NSC's attention to the fact that the earth satellite was helping them overcome some of the psychological difficulties posed by Soviet nuclear capabilities. The mere knowledge that the U.S. was pursuing the project had "gone a long way to help the free peoples of the world realize that we were forging ahead in our technical capabilities." As the National Security Council believed, such confidence was the cement necessary to maintain the cohesion of the western alliance.⁶¹

The administration also knew, however, that earth-circling spaceships could only go so far to demonstrate military capabilities, especially when the intelligence community predicted that the United States lagged behind the Soviets by almost two years in ballistic missile technology.⁶² Consequently the NSC moved quickly to expand its missile programs, granting the IRBM the same "maximum urgency" as its intercontinental cousin. The decision to step-up the IRBM came when the study Eisenhower commissioned to forecast the consequences of Soviet first achievement of a ballistic missile system predicted disaster. The report, prepared in the State Department by the Policy Planning Staff, emphasized the psychological ramifications of Soviet first achievement of an intermediate range missile. This Soviet "first" would "reduce the free world's confidence in U.S. technological superiority and enhance its fears as to the consequences of war." As a result, the Planning Staff warned, American allies would face increased domestic pressure to adopt independent foreign policies. They would more vigorously oppose policies carrying risk of war and would be more likely to compromise on outstanding East-West issues. Moreover, the Soviets could exacerbate these trends toward neutralism by conciliatory tactics intended to persuade the allies of the wisdom of accommodation. American achievement of an IRBM at the earliest date, the report concluded, would be necessary to strengthen confidence in American retaliatory power and to prevent the erosion of Western alliances.⁶³

President Eisenhower concurred that the United States needed to possess and demonstrate an effective ballistic missile capability as soon as possible. When Secretary Dulles presented the Planning Staff report to the National Security Council in December, the President reacted in an uncharacteristically vocal and temperamental fashion. With great emphasis, Eisenhower hammered Council members for apparent inaction, bureaucratic resistance

⁶⁰ NSC meeting, 8 September 1955. Emphasis added.

⁶¹ NSC meeting, 8 September 1955.

⁶² NIE 100-7-55, 1 November 1955, *DDC*, 88/3158.

⁶³ DOS memo, undated, *FRUS 1955-1957*, 19: 154-161.

and obstructive interservice rivalries. In response to a comment by Air Force Assistant Secretary Trevor Gardner that the Soviets possessed a two-year lead over the U.S. in ballistic missiles, Eisenhower responded cryptically, saying that he "would like to know what had been going on since last July when he had issued his strong directive on achievement of a U.S. capability in the field of ballistic missiles." Fully subscribing to the views of the State Department as to the "profound and overriding political and psychological importance" of such weapons, Eisenhower warned that he was "absolutely determined not to tolerate any fooling with this thing." The NSC action record for the meeting reinforced these sentiments with equal force. Eisenhower, noting that the political and psychological impact of an effective IRBM would be so great that early U.S. achievement of such a missile would be of "critical importance" to the national security interests of the United States, assigned both the ICBM and the IRBM programs highest priority of all defense programs in the country.⁶⁴

These actions run counter to the image of Eisenhower as a President who only belatedly recognized the importance of prestige to American foreign policy. To be sure, to note the tremendous political and psychological values the administration attached to ballistic missiles and to note that the scientific satellite program was pursued because of its obvious relationship to such weapons does not necessarily mean that the administration assigned the satellite program the same priority as the missile programs. Nor does Eisenhower's enthusiastic endorsement of the ballistic missile programs mean that the President harbored equal enthusiasm for the satellite project. Indeed the evidence suggests otherwise. The missile programs were by far the most important research and development projects in progress and were so because the President and his advisors believed they should be. The evidence also suggests that Eisenhower was not overly enthusiastic about the satellite program to begin with. He was skeptical of its spiraling costs and he harbored doubts about whether orbiting such a satellite was in fact even possible.⁶⁵

On the other hand, the Eisenhower administration placed considerable emphasis on the project, attaching to the IGY satellite a significance not fully appreciated in the historical literature. When the NSC met in May 1956 to discuss the progress of the program, the Council reaffirmed its belief that the satellite should not interfere with ICBM or IRBM programs. However, the NSC also commanded that the satellite be given sufficient priority in relation to other R&D projects to ensure a launch during the IGY. Thus the administration ranked the urgency of the satellite program just below the missile programs and above the roughly 180 other high-priority DOD programs.⁶⁶

⁶⁴ NSC meeting, 1 October 1955, *FRUS 1955-1957*, 19: 166-170. See also footnote no. 9, *ibid.*, 170.

⁶⁵ These sentiments are well documented by Divine and McDougall and are also illustrated by Eisenhower's comments at the NSC meeting, 3 May 1956, *DDC*, 87/1614.

⁶⁶ NSC meeting, 3 May 1956.

Just as important, it would be incorrect to conclude that because the President voiced some skepticism toward the project that he therefore failed to understand its political and psychological significance. Eisenhower's comments at the May 1957 NSC meeting are instructive. The meeting, which took place shortly after a National Intelligence Estimate (NIE) predicted the USSR would make a major effort to be first in launching a satellite,⁶⁷ reveals that Eisenhower fully understood the political implications of the scientific satellite expressed in NSC 5520. Complaining about the spiraling costs of instrumentation for the satellite, Eisenhower charged the scientists with wasting too much time and money on gadgets instead of focusing on the main objective of getting a satellite into orbit in the first place. Betraying skepticism about the technical feasibility of the project, he confessed he was annoyed by the tendency to "gold plate" the satellite before "we had proved the basic feasibility of orbiting any kind of earth satellite." He pointedly stressed "that the element of national prestige, so strongly emphasized in NSC 5520, depended on getting a satellite into orbit, and not on the instrumentation of the scientific satellite." Eisenhower's comments suggest that he was fully aware of the prestige value of the satellite long before *Sputnik* and the ensuing domestic outcry.⁶⁸

SPUTNIK RECONSIDERED

If the years preceding *Sputnik* saw the administration placing more and more emphasis on technology as an extension of foreign policy, it remains true that the period immediately following the Soviet satellite saw these efforts stepped up dramatically. The expansion of the space program after October 1957 has been discussed in detail elsewhere, but a few comments linking national security strategy before and after *Sputnik* are in order.⁶⁹ Considering that *Sputnik* ushered in the highly politicized "missile gap", historians have generally explained the expansion and acceleration of the space program in terms of domestic politics. While one cannot disregard the very real political pressure to which Eisenhower was in the wake of *Sputnik*, the emphasis placed on domestic politics obscures the fact that the administration's actions immediately following *Sputnik* were consistent with the evolution of its broader national security strategy. From 1953 to 1957, as Soviet technological gains threatened confidence in American superiority and as "peaceful coexistence" appeared to undermine U.S. leadership, the

⁶⁷ NIE 11-5-57, 12 March 1957, in Steury, *Intentions*, 59-62.

⁶⁸ NSC meeting, 10 May 1957, *DDC*, 87/846 and 87/844.

⁶⁹ In addition to the works cited in note 4 above, see Roger D. Launius, *NASA: A History of the U.S. Civil Space Program*, (Malabar, FL: Krieger Publishing Co., 1994) and John Logsdon, "Opportunities for Policy Historians: The Evolution of the U.S. Civilian Space Program," in *A Spacefaring People: Perspectives on Early Spaceflight* ed. Alex Roland (Washington, D.C.: U.S. Government Printing Office, 1985), 81-107.

Eisenhower administration placed greater and greater stress on efforts to advertise American peaceful intentions and to maintain American technological superiority. *Sputnik* merely confirmed the wisdom of such policies. A first-rate propaganda victory, it seemed to prove that the Soviet "peace and war" strategy—embodied in a scientific satellite launched by a powerful ballistic missile—was working spectacularly. Indeed, the *Sputnik* outcry seemed to verify the most dire predictions of intelligence officers and policymakers as confidence in American leadership appeared shaken around the world and at home.

To the NSC, *Sputnik* not only sapped U.S. prestige by suggesting Soviet technological superiority, but it also lent added credibility to Soviet pronouncements—particularly Khrushchev's claim a few months earlier that it had successfully tested an ICBM.⁷⁰ At a meeting of the national security council a few days after the launch of *Sputnik*, Allen Dulles interpreted the event as part of a trilogy of Soviet propaganda moves—the August ICBM test, the September hydrogen bomb tests, and the satellite launch. Together, he warned, they seemed to provide the world with convincing evidence that the Soviets possessed a substantial lead in the technology necessary to construct an operational ICBM. As Donald Quarles admitted, *Sputnik* revealed that the Soviets possessed even more competence in long-range rocketry and in auxiliary fields than the U.S. had given them credit.

Additionally, Council members interpreted reactions to *Sputnik* abroad as verifying earlier fears that Soviet technological success would undermine American leadership. As the Director of Central Intelligence warned, *Sputnik* was exerting a "very wide and deep impact" in Western Europe, Africa and Asia. Acting Secretary of State Christian Herter echoed Allen Dulles's assessment. He reported to the NSC that even the best allies "require assurance that we have not been surpassed scientifically and militarily by the USSR." The situation appeared even more disastrous outside the Western alliance, Herter cautioned, because the Soviet feat seemed to affirm the wisdom of neutrality. The neutral countries, he noted, "are chiefly engaged in patting themselves on the back and insisting that the Soviet feat proves the value and wisdom of the neutralism which these countries have adopted." To the NSC, then, *Sputnik* confirmed predictions that Soviet technological spectaculars could deal a severe blow to U.S. prestige and credibility.⁷¹

The administration's overall response to *Sputnik* is best summarized in a State Department memorandum evaluating reactions to the Soviet satellite. The document is especially important because many of its concerns came to be addressed by subsequent revisions of U.S. space policy. The memorandum outlined four major effects on world public opinion:

⁷⁰ In a memorandum to the President, White House Press Secretary James Hagerty cautioned that the satellite does tend to corroborate the Soviet ICBM claim of 27 August 1955. Hagerty to Eisenhower, 7 October 1957, *DDC*, 87/126.

⁷¹ NSC meeting, 10 October 1957, *DDC*, 87/1653.

1. Soviet claims of scientific and technological superiority over the West and especially the U.S. have won greatly widened acceptance.
2. Public opinion in friendly countries shows decided concern over the possibility that the balance of power has shifted or may soon shift in favor of the USSR.
3. The general credibility of Soviet propaganda has been greatly enhanced.
4. American prestige is viewed as having sustained a severe blow.

Harking back to the earlier predictions of NSC 5520 and 5522, the State Department expressed the belief that *Sputnik's* repercussions would be greatest among the newly independent or dependent peoples, largely preoccupied with economic development. The technologically less-advanced areas of the world would be most easily "dazzled" by the feat. They were also the areas "least able to understand it" and "most vulnerable to the attractions of the Soviet system." The State Department warned that by demonstrating the ability of the Soviet system to compete on a technological level with the West, *Sputnik* meant that developing nations would be more likely to turn to the Soviet bloc for technical and material aid. This, the Department reasoned, would place them directly or indirectly in the Soviet camp. Because "the satellite, presented as the achievement and symbolic vindication of the Soviet system, helps to lend credence to Soviet claims," *Sputnik* paved the way for an intensive psychological warfare campaign.⁷²

These views were reflected in the National Security Council's second major statement of outer space policy, NSC 5814. Formally adopted in August 1958 after the creation of NASA, it no longer repeated the 1953-1957 warnings that the U.S.S.R. was threatening to surpass the United States in science and technology. By this time, the Soviets had orbited two other satellites, one carrying a live dog and the other nearly 100 times heavier than the biggest American satellite.⁷³ These successes, compounded by televised American failures, including the Vanguard launch—the "ignominious flop" that burst into flames before viewers around the world⁷⁴—seemed to verify the NSC's predictions. As NSC 5814 stated, "The USSR has surpassed the United States and the Free World in scientific and technological accomplishments in outer space, which captured the imagination and admiration of the world." Echoing lines of reasoning established long-before *Sputnik*, the Security Council warned

⁷² DOS, "Reaction to the Soviet Satellite," 16 October 1957, *DDC*, 81/373A. For similar expressions see also: USIA Circular Telegram to All Missions, 16 October 1957, *FRUS 1955-1957*, 24: 167-168; CIA Consultants to Allen Dulles, 23 October 1957, *DDC*, 95/3241; NIE 11-4-57, 23 November 1957, *FRUS 1955-1957*, 19: 665-672; Arneson to John Dulles, 14 November 1957, *FRUS 1955-1957*, 11: 768-769; Soviet Embassy to DOS, 16 November 1957, *FRUS 1955-1957*, 24: 185-187; USIA survey, December 1957, *DDC*, 86/2225; USIA memo, 17 December 1957, *FRUS 1955-1957*, 11: 779-782.

⁷³ After the launch of *Sputnik III*, weighing 2,925 pounds, Khrushchev remarked to Arab leader Gamel Abdel Nasser that the United States "will need very many satellites the size of oranges to catch up." Lester A. Sobel, ed., *Space: From Sputnik to Gemini* (New York: Facts on File, Inc., 1965), 40.

⁷⁴ Killian, *Sputnik, Scientists, and Eisenhower*, 119.

that further Soviet demonstrations of superiority in outer space technology would "dangerously impair" confidence in over-all U.S. leadership. Strength in space technology was necessary to "enhance the prestige of the United States among the people of the world and [to] create added confidence in U.S. scientific, technological, industrial and military strength."⁷⁵

The National Security Council dictated the overall goals and parameters of the now-adolescent space program. In addition to important military and reconnaissance applications, the NSC directed NASA to "judiciously select" projects designed to achieve a "favorable world-wide psychological impact." Of the possibilities—unmanned earth satellites, lunar rockets, manned earth satellites, planetary probes, manned circumlunar flights—manned spaceflight ranked highest because "to the layman" manned exploration represented the "true conquest" of outer space. "No unmanned experiment can substitute for manned exploration in its psychological effect on the peoples of the world." Besides prestige-oriented space spectacles, NSC 5814 also called for international cooperation in space activities and directed the U.S. to seek a treaty banning the use of space for military purposes, both to establish the United States as leader in the use of outer space for peaceful purposes.

The Eisenhower administration's 1958 outer-space policy statement suggests that *Sputnik* inspired an increased emphasis on the psychological impact of U.S. policies. This included a renewed emphasis not only on space programs but on other foreign *and domestic* policies as well. As a revision of basic national security policy advised in May 1958, "The psychological impact abroad of our policies, both foreign and domestic, plays a crucial part in the over-all advancement of U.S. objectives. It is essential therefore that along with the pertinent military, political and economic considerations, the psychological factor be given due weight during the policy forming process."⁷⁶ But what if there had been no *Sputnik*? As this essay has argued, the expanded emphasis on psychological matters did not just derive from domestic pressure nor did it stem solely from the *Sputnik* challenge. It should be seen instead as part of a broader response to the changing nature of the Cold War, a by-product of "peaceful coexistence" in an era of nuclear devastation. As a 1960 NIE put it, peaceful coexistence, "a strategy to defeat the West without war," involved a political struggle to capture the support of peoples across the world. By manipulating issues of peace, disarmament, anticolonialism and economic development, by dramatizing the growth of Soviet power, and by capturing the imagination of the world's peoples with their technical prowess, the Soviets threatened to attract the allegiance of the underdeveloped and uncommitted states against the West.⁷⁷ If an era of "total Cold War" developed after October 1957, in which science, technology,

⁷⁵ NSC 5814/1, 18 August 1958, *FRUS 1958-1960*, 2: 845-863.

⁷⁶ NSC 5810/1, "Psychological Aspects of U.S. Policies," 5 May 1958, *DDC*, 94/2261.

⁷⁷ NIE 11-4-60, undated, in Steury, *Intentions*, 141-146.

education and the pursuit of national prestige ranked with military and economic strength as vital forces in the U.S.-Soviet struggle⁷⁸, it was as much a product of the changing nature of the Soviet-American rivalry as it was a product of *Sputnik*. *Sputnik* simply provided the defining image of a struggle already underway and a race already being run.

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⁷⁸ Wang, "American Science," vii.

Cover Stories and Hidden Agendas: Early American Space and National Security Policy

Dwayne A. Day

Abstract:

The recent declassification of a large number of National Security Council documents clearly shows that the centerpiece of the early American civilian space program--the U.S. scientific satellite for the International Geophysical Year (IGY)--was in fact started because of the desire by President Eisenhower and his top advisors to establish a legal precedent for flying reconnaissance satellites over the Soviet Union. Eisenhower approved the U.S. scientific satellite program in 1955 as a means of serving as a "stalking horse" for future intelligence satellite programs.¹ Furthermore, not only was the Department of Defense interested in this strategy, but the Central Intelligence Agency was as well, and actually contributed several million dollars in funding to the civilian U.S. scientific satellite program.

It was language that perfectly in keeping with the popular conception of space at the time, but which was not well-received in the White House. On February 19, 1957, before a collection of spaceflight enthusiasts gathered in San Diego, Major General Bernard Schriever delivered a speech entitled "ICBM - A Step Toward Space Conquest." Schriever was the head of the Western Development Division (WDD), the Air Force development office which was assigned the task of building an operational ICBM as quickly as possible. Schriever's role in developing the ICBM was well-known. What was unknown, however, was the fact that WDD was also responsible for developing intelligence satellites. The Air Force planned to launch 92 intelligence satellites over the next five years, culminating in a large signals intelligence satellite in 1962. It was an ambitious plan, but one still lacking money and unknown to the outside world.

Schriever could not speak in San Diego of the classified mission he oversaw. Instead he talked about how WDD's experience in developing the Atlas ICBM could be applied to space. He also spoke of the value of space to the military, and he did not mince words:

In the long haul our safety as a nation may depend upon our achieving 'space superiority.' Several decades from now the important battles may not be sea battles or air battles, but space battles, and we should be spending a certain fraction of our national resources to insure that we do not lag in obtaining space supremacy.²

The next day, arriving at his headquarters in Los Angeles, Schriever had a telegram from the Office of the Secretary of Defense waiting for him. It was explicit: do not use the word "space" in any more speeches. Remembering back on this event, Schriever's frustration still showed. "I was angry," he recalled over 40 years later while sitting in his office in Washington. But he was an Air Force officer and the Secretary of Defense was his boss. There was never any question about what he would do: "I didn't use the word space anymore in my speeches."³

The language in Schriever's speech was not unusual for the times. Wernher von Braun, who had far more visibility as a spokesperson for space than Schriever, had used the term "conquest" often when discussing space, including a series of high-profile articles for *Colliers'* magazine. But where von Braun saw space as new territory to be conquered like the Old West, Schriever saw it as new territory from which to wage battle. He had not been reticent to talk about it in these terms, and despite the muzzling from the Pentagon, the message had already gotten out. On March 4, *Newsweek* ran an article about the American Vanguard space program. A small accompanying article included a picture of a stern-looking Schriever and referred to him as "one of the major prophets of space warfare." It quoted the general as stating that "the compelling motive for the development of space technology is... national defense."⁴

Schriever was only mentioned in the sidebar article, but the main story was unlikely to be any more soothing to the Eisenhower White House, for it was titled "Race Into Space: Can We Win?" The story likely rattled the White House because President Eisenhower and his advisors had explicitly chosen a space policy and a public posture that attempted to downplay the idea the United States was attempting to "race" the Soviets into space. They had chosen a policy which portrayed the fledgling American space

program as a small, scientific effort--the development of a rocket and satellite combination referred to as Vanguard. Official Pentagon policy was to make no mention of a race and no mention of a military space program.

The only public space program was in actuality a cover, a deception. It shielded what the White House and Pentagon leadership actually cared about, the political vulnerability of its defense programs. This was not unique to the space program. It was a common strategy for the way that Eisenhower approached many sensitive national security missions--hiding them behind open programs, usually scientific and civilian in appearance, so that they would not be challenged openly by the Soviets. It was to become a common strategy for the later military space program, but it all started with Vanguard.

The Killian Report

In September 1954, the Science Advisory Committee of the Office of Defense Mobilization, under orders from President Eisenhower, began a scientific study of the problem of surprise attack.⁵ Eisenhower was concerned about recent Soviet developments in various strategic weapons systems and asked the Committee to evaluate American capabilities to respond to them using the latest advances in science and technology. This study was headed by James Killian, then president of the Massachusetts Institute of Technology. The group was known as the Technological Capabilities Panel; it issued its report "Meeting the Threat of Surprise Attack" on February 14, 1955. This was often referred to as the "Killian Report" and it greatly impressed Eisenhower. It convinced him that science and technology could be used to defeat an enemy.

During the course of its deliberations, the study's intelligence panel, headed by Polaroid's Edwin "Din" Land, became aware of two advanced proposals for intelligence collection. One was a nuclear powered reconnaissance satellite using a television camera. This was outlined in a report by the Air Force's think-tank, the RAND Corporation, known as *Project Feed Back*. The other idea that Land's panel investigated was a U.S.

Air Force development program called BALD EAGLE which was intended to develop a high-altitude reconnaissance aircraft.

While investigating the aircraft program, the panel became aware of another proposal by the Lockheed Skunk Works for its own high-flying strategic reconnaissance aircraft, known as the CL-282. Land brought this proposal to the attention of President Eisenhower in November 1954. Unlike the Air Force program to develop a reconnaissance aircraft, the CL-282 would be configured to carry out strategic reconnaissance prior to hostilities--so-called pre D-Day reconnaissance. This was a mission that the Strategic Air Command had previously rejected, but one that those on the TCP thought vital.

Eisenhower approved the CL-282 project and placed it under the charge of the Central Intelligence Agency. The plane eventually became known as the U-2. The program was managed by a newcomer to the CIA, Richard Bissell. The aircraft was never mentioned in the TCP report itself, but was described in a highly classified annex. This annex was for the "Eyes Only" of President Eisenhower, and was probably destroyed by him along with another classified annex on the submarine-launched ballistic missile program.⁶

According to Eisenhower's staff secretary, then-Colonel Andrew Goodpaster, Eisenhower assigned the U-2 mission to the CIA for three reasons. First, he thought it would be less provocative if a civilian pilot, rather than a military one, flew the aircraft into foreign territory. Second, he wanted the product--the reconnaissance photographs--to be evaluated at the national leadership level, as opposed to being evaluated within the military services. Based upon his long years of experience in the military, Eisenhower knew that the military had an incentive to interpret intelligence to its advantage. Finally, he was concerned about not antagonizing the Soviets by pursuing a provocative program in the open. He was concerned that the military would pursue the program in a way that would only escalate tensions between the superpowers.⁷ According to Goodpaster, Eisenhower was always distressed to see magazines carrying advertisements of bombers

and fighter aircraft. He felt that the military encouraged defense contractors to place such ads and that they projected an image of a society preparing for war with the Soviet Union. This could prompt the Soviets to respond the same way, leading to a spiraling arms race. For Eisenhower, stealth and concealment were the preferable approach, hence the U-2 was given to an organization that could operate in secret.

Those involved in the TCP report realized that overflight of another nation's territory by such an aircraft would constitute a clear violation of international law and could be viewed as a hostile act by the Soviets. In fact, such issues were not abstract, since American aircraft flying missions on the periphery of the Soviet Union were being fired upon on a regular basis and even shot down. The consequences of violating national airspace was clearly a major concern for those planning aircraft reconnaissance missions. But a satellite, flying much higher, would not necessarily violate international law since no clear definition existed of where "airspace" ended and "space" began. Realizing this, Land and the others on the panel decided to attempt to strongly influence the *establishment* of international law.

The intelligence committee recommended that the United States develop a small artificial earth satellite to establish the right of "freedom of space" for future larger intelligence satellites.⁸ Doing so would allow the United States to distinguish between "national airspace" and "international space." By establishing the definition itself, the United States could later use international space to its advantage by flying intelligence satellites over the Soviet Union.⁹

Land, Killian and others in 1955 considered the reconnaissance satellite to be technologically unrealistic in the near future. They believed that the CL-282 and an Air Force reconnaissance balloon program (later known as GENETRIX) were more realistic near-term possibilities worthy of the most effort. But they felt that the United States should begin work toward establishing a precedent to enable future satellite reconnaissance missions. The TCP advocated using an ostensibly civilian program to clear a path for a future military program.

The Scientific Satellite Program

In parallel to the deliberations of the Technological Capabilities Panel, serious proposals for an initial U.S. scientific satellite were emerging. For example, Wernher von Braun and his colleagues at the Army Ballistic Missile Agency in Huntsville, Alabama, teamed up with the Office of Naval Research to propose a satellite called *Orbiter*. Later in the year, the American Rocket Society prepared a detailed survey of possible scientific and other uses of a satellite and proposed it to the National Academy of Sciences' U.S. National Committee for the International Geophysical Year. The IGY was to run from June 1957 to December 1958 and involve international cooperation on the study of the earth.

As it was, 1954 proved to be a very significant year for the generation of ideas concerning scientific and intelligence collection systems. In addition to both the Feed Back and CL-282 proposals, the National Academy was now considering a scientific satellite as well. These projects became inextricably politically linked.

The Feed Back and the Killian reports were both highly secret, although the *Orbiter* proposal was not. The CL-282 proposal, in particular, was known to only a handful of people.¹⁰ One person who did know of all three projects, as well as of the TCP report, was the Assistant Secretary of Defense for Research and Development, Donald Quarles.

Quarles was also no stranger to proposals for Earth-orbiting satellites. In 1952, Aristid Grosse, a physicist at Temple University, had been asked by President Truman to prepare a report on "the Present Status of the Satellite Problem." The report was not ready before Truman left office and instead the White House forwarded it to Quarles, who as Assistant Secretary of Defense for Research and Development was in charge of virtually all defense-related research projects.

On March 14, 1955 (the same day as the presentation of the TCP report), the U.S. National Committee on the International Geophysical Year of the National Academy of

Sciences (NAS) presented a recommendation to Alan Waterman, the Director of the National Science Foundation (NSF). The Committee recommended that a scientific satellite be developed as part of the IGY.¹¹ After the TCP report came out, Quarles asked Waterman to formally suggest the National Academy's idea to the National Security Council. Four days later Waterman sent a letter to Robert Murphy, Deputy Under Secretary of State, proposing that the United States conduct just such a scientific mission.¹² Those at the National Academy would not have been privy to information about Feed Back, CL-282, or the TCP report, so they were unlikely to recognize the strategic objectives behind Quarles' support of their satellite proposal.

Four days later Murphy met with Waterman, Detlev Bronk, President of the NAS, and Lloyd Berkner, one of the Academy's influential members, to discuss the issue. In a letter one month later, Murphy stated that such a proposal would "as a matter of fact, undoubtedly add to the scientific prestige of the United States, and it would have a considerable propaganda value in the cold war."¹³ Having gained the support of the Department of State, Waterman then discussed the issue once again with Quarles, who suggested that he consult the Director of Central Intelligence, Allen Dulles, on how best to proceed. Waterman did so and gained Dulles' support for the program. He also spoke with Percival Brundage, the Director of the Bureau of the Budget, to gain his cooperation when needed. Thus, the scientific satellite proposal now had the support of the Departments of State, Defense, and the Central Intelligence Agency, as well as the Bureau of the Budget. Waterman also agreed to formally propose the full program to an executive session of the National Science Board on May 20.¹⁴ Waterman was lining up bureaucratic support for the project at Quarles' urging.

Whether any of these other people were aware that Quarles' interest in the proposal had been prompted by a classified national security report is unknown. But clearly Quarles was on a mission to enact one of the TCP's recommendations and he worked quickly.

NSC 5520

The speed at which these events took place is startling. Only nine weeks after the TCP report recommended the approval of a scientific satellite program, on May 20, 1955, the National Security Council approved a top-level policy document known as NSC 5520, "U.S. Scientific Satellite Program." The document stated that the United States should develop a small scientific satellite weighing 5 to 10 pounds. It was very clear about why the United States should do this:

The report of the Technological Capabilities Panel of the President's Science Advisory Committee recommended *that intelligence applications warrant an immediate program leading to a very small satellite in orbit around the earth, and that re-examination should be made of the principles or practices of international law with regard to 'Freedom of Space' from the standpoint of recent advances in weapon technology.*¹⁵

The document continued:

From a military standpoint, the Joint Chiefs of Staff have stated their belief that intelligence applications strongly warrant the construction of a large surveillance satellite. While a small scientific satellite cannot carry surveillance equipment and therefore will have no direct intelligence potential, it does represent a technological step toward the achievement of the large surveillance satellite, and will be helpful to this end so long as the small scientific satellite program does not impede development of the large surveillance satellite.¹⁶

NSC 5520 also stated:

Furthermore, a small scientific satellite will provide a test of the principle of 'Freedom of Space.' The implications of this principle are being studied within the Executive Branch. However, preliminary studies indicate that there is no obstacle under international law to the launching of such a satellite.

It should be emphasized that a satellite would constitute no active military offensive threat to any country over which it might pass. Although a large satellite might conceivably serve to launch a guided missile at a ground target, it will always be a poor choice for the purpose. A bomb could not be dropped from a satellite on a target below, because anything dropped from a satellite would simply continue alongside in the orbit.

Although the document correctly noted the limited utility of satellites as active military offensive threats, this was not the purpose of the surveillance satellite program. In fact, deploying weapons systems in orbit has never been a significant aspect of American military space policy.

A year later, another White House document stated that the scientific satellite program would have the target date of 1958 "with the understanding that the program developed thereunder will not be allowed to interfere with the ICBM and IRBM programs but will be given sufficient priority by the Department of Defense in relation to other weapons systems to achieve the objectives of NSC 5520."¹⁷ In other words, the scientific satellite would not be allowed to interfere with ballistic missile programs like Atlas and Jupiter, but it also would not be allowed to languish without attention while the Department of Defense focused on other programs with more direct military utility. Such inattention would have effectively undercut the entire purpose of NSC 5520. At the same time, the launching of such a satellite was *not* to interfere with the development of the intelligence satellite.

NSC 5520 specifically directed that the scientific satellite program be associated with the International Geophysical Year. "Freedom of space" could be challenged by the Soviets more easily if the U.S. simply launched a satellite at any time. The IGY provided an international context for conducting the program--an excuse. It was a legitimate cover story even better than the civilian auspices of the existing program. Even if the Soviets had not announced their intention to build a satellite for the IGY, the United States would be able to use the IGY to justify its program if the Soviets complained. Quarles himself specifically noted this reality only a week after the approval of NSC 5520.¹⁸

The Technological Capabilities Panel report was perhaps one of the most influential documents of the Cold War. It served as the starting point of a number of major American defense programs in the 1950s. Not only did it recommend the development of what became the U-2, the scientific satellite program, and reconnaissance

satellites, but it also recommended the development of what became the Polaris submarine-launched ballistic missile, the SOSUS underwater sonar array, and the extension of the Distant Early Warning (DEW) Line. The freedom of space recommendation was therefore one among many, and it was in no way particularly special. It was merely one that was unlikely to make progress without specific high-level involvement. Quarles gave it the start that it required.

Defining the Heavens

The TCP's extensive list of recommendations required a concerted implementation effort by the various agencies and military services that were affected. It required an extensive oversight effort as well and this task fell to the Operations Coordinating Board of the National Security Council which produced a progress report in June 1955 on the status of the TCP recommendations. This progress report, known as NSC 5522, also included reports from various government departments on their views on the Panel's recommendations. In response to the TCP recommendation concerning freedom of space, NSC 5522 noted that a program had already been started to meet the recommendation. Further it stated:

State, Treasury, Defense and Justice Comment: Any unilateral statement by the U.S. concerning the freedom of outer space is unnecessary. It is clear that the jurisdiction of a state over the air space above its territory is limited and that the operation of an artificial satellite in outer space would not be in violation of international law. State and Justice point out that by the convention on international civil aviation of 1944 (to which the U.S. is a party, but the U.S.S.R. is not) and by customary law every State has exclusive sovereignty "over the air space above its territory." However, air space ends with the atmosphere. There has been no recognition that sovereignty extends into airless space beyond the atmosphere.¹⁹

This statement may have appeared self-evident to those involved, but in effect it begged the question: if space was not sovereign territory (a question for which there was no precedent), how was a nation to determine where the atmosphere--which *was*

sovereign territory--ended and space began? The edge of the atmosphere was not a clearly defined boundary and, indeed, could not be defined until satellites began orbiting the Earth to measure the extent of the atmosphere. Still, it made sense for the Departments to advise that the United States not issue a unilateral statement concerning freedom of space, for such a statement would only draw more attention to the subject at a time when the whole point of the scientific satellite program was to establish freedom of space in as inconspicuous a manner as possible. For the government lawyers as well as the policy makers, it was better to simply do it and talk about it later.

The CIA also expressed its opinion on the subject, in a commentary that proves highly illuminating and remarkably prescient, especially in light of the world reaction to Sputnik two years later:

The psychological warfare value of launching the first earth satellite makes its prompt development of great interest to the intelligence community and may make it a crucial event in sustaining the international prestige of the United States.

There is an increasing amount of evidence that the Soviet Union is placing more and more emphasis on the successful launching of the satellite. Press and radio statements since September 1954 have indicated a growing scientific effort directed toward the successful launching of the first satellite. Evidently the Soviet Union has concluded that their satellite program can contribute enough prestige of cold war value or knowledge of military value to justify the diversion of the necessary skills, scarce material and labor from immediate military production. If the Soviet effort should prove successful before a similar United States effort, there is no doubt but that their propaganda would capitalize on the theme of the scientific and industrial superiority of the communist system.

The successful launching of the first satellite will undoubtedly be an event comparable to the first successful release of nuclear energy in the world's scientific community, and will undoubtedly receive comparable publicity throughout the world. Public opinion in both neutral and allied states will be centered on the satellite's development. For centuries scientists and laymen have dreamed of exploring outer space. The first successful penetration of space will probably be the small satellite vehicle recommended by the Technological Capabilities Panel. The nation that first accomplishes this feat will gain incalculable prestige and recognition throughout the world.

The United States' reputation as the scientific and industrial leader of the world has been of immeasurable value in competing against Soviet aims in both neutral and

allied states. Since the war the reputation of the United States' scientific community has been sharply challenged by Soviet progress and claims. There is little doubt but that the Soviet Union would like to surpass our scientific and industrial reputation in order to further her influence over neutralist states and to shake the confidence of states allied with the United States. If the Soviet Union's scientists, technicians and industrialists were apparently to surpass the United States and first explore outer space, her propaganda machine would have sensational and convincing evidence of Soviet superiority.

If the United States successfully launches the first satellite, it is most important that this be done with unquestionable peaceful intent. The Soviet Union will undoubtedly attempt to attach hostile motivation to this development in order to cover her own inability to win this race. To minimize the effectiveness of Soviet accusations, the satellite should be launched in an atmosphere of international good will and common scientific interest. For this reason, the CIA strongly concurs in the Department of Defense's suggestion that a civilian agency such as the U.S. National Committee of the IGY supervise its development and that an effort be made to release some of the knowledge to the international scientific community.

The small scientific vehicle is also a necessary step in the development of a larger satellite that could possibly provide early warning information through continuous electronic and photographic surveillance of the USSR. A future satellite that could directly collect intelligence data would be of great interest to the intelligence community.

The Department of Defense has consulted with the [Central Intelligence] Agency, and we are aware of their recommendations, which have our full concurrence and strong support.²⁰

The Department of Defense in mid-1955 was not pursuing an active intelligence satellite program. All it had at the time was a series of small Air Force technology development efforts. But the scientific satellite program was underway and the lawyers were now debating the legalities of the program in secret.

If those involved with the legal issues needed their thinking sharpened about issues of international airspace, they could ask for no better lesson than that provided less than a year later by the GENETRIX reconnaissance balloon program, which had also been endorsed by Killian and Land. Hundreds of balloons were launched beginning in January 1956 so that they would drift over the Soviet Union, their cameras photographing the

countryside. Officially, the balloons were part of a scientific program intended to photograph clouds. In reality, they carried sophisticated reconnaissance equipment.

The majority of the balloons were never seen again and American officials knew that they had come down (or been shot down) inside the Soviet Union. This was in reality a rather ironic development; because of the planned future flights of the U-2 at 70,000 feet, the balloons had been ballasted to fly lower than their operational altitude. This was done so that the Soviets would not be provoked into quickly developing a capability to track and shoot down objects at that extreme altitude. The result was that as the balloons cooled at night, they sank below 40,000 feet and well within range of Soviet aircraft, which shot them down in the early morning hours before they rose back to their operational altitude.

On February 7, anticipating the Soviet response, Eisenhower suggested to Secretary of State John Foster Dulles that the operation be suspended and “we should handle it so it would not look as though we had been caught with jam on our fingers.” On February 9, the Soviets held a press conference outside Spridonovka Palace. About fifty balloons and instrument containers were placed on display. The balloons, the Soviets said, were part of an espionage project and had been a clear violation of their airspace. It was a major embarrassment for the United States, but the U-2 was still under development and promised far greater capabilities.

Meanwhile, legal issues concerning exactly what “freedom of space” meant occupied U.S. government lawyers. The State Department's Policy Planning Staff was assigned the task of reporting on-going progress on achieving several of the TCP report's recommendations. On October 2, 1956, the Policy Planning Staff reported some preliminary thinking on the issue of freedom of space:

So far as law is concerned, space beyond the earth is an uncharted region concerning which no firm rules have been established. The law on the subject will necessarily differ with the passage of time and with practical efforts at space navigation. Various theories have been advanced concerning the upper limits of a state's jurisdiction, but no firm conclusions are now possible.

A few tentative observations may be made: (1) A state could scarcely claim territorial sovereignty at altitudes where orbital velocity of an object is practicable (perhaps in the neighborhood of 200 miles); (2) a state would, however, be on strong ground in claiming territorial sovereignty up through the "air space" (perhaps ultimately to be fixed somewhere in the neighborhood of 40 miles); (3) regions of space which are eventually established to be free for navigation without regard to territorial jurisdiction will be open not only to one country or a few, but to all; (4) if, contrary to planning and expectation, a satellite launched from the earth should not be consumed upon reentering the atmosphere, and should fall to the earth and do damage, the question of liability on the part of the launching authority would arise.²¹

GENETRIX had provided a good warning of what could happen if an intelligence mission went wrong and if a program's cover was blown. A different lesson was provided in July, when the U-2 made a half dozen sorties over the Soviet Union. The U-2, like GENETRIX, also had a cover story. It was portrayed as a civilian weather reconnaissance aircraft. But the aircraft went virtually unnoticed outside of the aviation trade press, where some reporters accurately surmised its true purpose. Although the Soviets tracked the plane immediately, they did not protest. Lacking the ability to knock the U-2 out of the sky, they chose not to publicly admit their vulnerability to American reconnaissance technology.

The U-2 demonstrated a number of things to Eisenhower and his advisors. First and foremost, it demonstrated the immense value of overhead reconnaissance systems. The photographs returned by the U-2 were stunning in their quality. The U-2 also demonstrated that both the United States and the Soviet Union had a stake in keeping certain things private. Finally, it demonstrated that a cover story could work. Concealment and obfuscation of intelligence missions had a benefit for superpower relations even when the other side suspected, or actually knew, what was happening.²² This was the guiding principle of the satellite program adopted under NSC 5520. It was to be a guiding principle for other space programs as well.

Selecting a Satellite Plan

After the scientific satellite concept had received approval with NSC 5520 in May 1955, it had to be turned into programmatic reality. Not surprisingly, this task fell to Donald Quarles. On June 8, 1955, Secretary of Defense Charles Wilson wrote a memo placing Quarles in charge of starting the scientific satellite program. Quarles then created an Advisory Group on Special Capabilities, chaired by Homer J. Stewart, to select a scientific satellite and a method for launching it. They held hearings and listened to presentations by the Army, Navy and Air Force. The Army's proposal was basically a variation of von Braun's earlier Orbiter concept. The Air Force submitted a proposal from Schriever's Western Development Division, but did not make a concerted effort to win the program. The Navy Research Laboratory proposed using a modified upper atmosphere research rocket. The Advisory Group selected the Navy proposal, which as named Vanguard.²³

Many involved, particularly Army group, which consisted primarily of Wernher von Braun's "rocket team," were surprised that the Army proposal had lost out. The Army team had extensive experience with ballistic missiles and had begun developing their proposal a year before. When explaining the decision years later, members of the Advisory Group gave a number of reasons, including Navy developments in satellite instrumentation, the supposed lower costs and growth potential of the Vanguard, and the desire to avoid using a ballistic missile for the program.²⁴ The latter point was the most relevant one: NSC 5520 was quite explicit in its statement that the satellite program should not interfere at all with ICBM and IRBM programs. There was no way that the Army proposal could be selected without interfering with Army development of the Redstone booster as the basis of an IRBM to be called Jupiter--at least without significant additional cost.

The Advisory Group's decision in favor of the Navy program did not settle the issue. The Huntsville group, justifiably, felt that they deserved to win. "There wasn't much confidence, frankly, in the Vanguard." said Fred Durant, one of the original

members of the Orbiter group. The Navy proposal was too new and the team unproven. But according to Durant it was not necessarily arrogance that caused the Army team to be so stunned. The Huntsville group was more confident because of their longer experience launching rockets and making mistakes.²⁵ The Vanguard team had none of that experience and lacking that, would have to make their own mistakes before achieving success. From the perspective of the Army, that meant that the Soviets were more likely to reach the goal first.

Throughout 1955 and 1956, the Army team proceeded with development of a Jupiter/Redstone rocket designed to conduct re-entry tests of ballistic nosecones while the Navy developed the Vanguard and the NSF and National Academy of Sciences developed the satellite for flying atop it. But the Army continued to lobby behind the scenes to obtain permission to proceed with their own satellite launching program.

On April 23, 1956, the newly formed Army Ballistic Missile Agency, under the command of Major General John B. Medaris, informed the Office of the Secretary of Defense that a Jupiter missile could be fired in an effort to orbit a small satellite as early as January 1957. It proposed that this be considered an alternate to the Navy Vanguard program. On May 15, the Secretary of Defense's Special Assistant for Guided Missiles disapproved ABMA's proposal. On May 22, the Assistant Secretary of Defense informed ABMA that no plans or preparations should be initiated for using either Jupiter or Redstone missiles as satellite launch vehicles.²⁶

But all good military officers and bureaucrats know that there is no such thing as a "no" in Washington. ABMA took its plea to Deputy Secretary of State Hoover, who was in charge of the Operations Coordinating Board which was responsible for overseeing the implementation of the NSC 5520 decision. In June 1956, then-Colonel Andrew Goodpaster, who was serving as Eisenhower's staff secretary, reported on an incident that demonstrated both the Huntsville group's lobbying and their perception of the prejudice against them. Goodpaster stated:

On May 28th Secretary Hoover called me over to mention a report he had received from a former associate in the engineering and development field regarding the earth satellite project. The best estimate is that the present project would not be ready until the end of '57 at the earliest, and probably well into '58. Redstone had a project well advanced when the new one was set up. At minimal expense (\$2-\$5 million) they could have a satellite ready for firing by the end of 1956 or January 1957. The Redstone project is one essentially of German scientists and it is American envy of them that has led to a duplicative project.

I spoke to the President about this to see what would be the best way to act on the matter. He asked me to talk to Secretary Wilson. In the latter's absence, I talked to Secretary [Deputy Secretary of Defense] Robertson today and he said he would go into the matter fully and carefully to try to ascertain the facts. In order to establish the substance of this report, I told him it came through Mr. Hoover (Mr. Hoover had said I might do so if I felt it necessary).²⁷

This incident started a new evaluation of the satellite selection process which ultimately rejected the Huntsville group once again. On June 22, 1956, Homer J. Stewart, who was Chairman of the Advisory Group on Special Capabilities, reported the results of two meetings held by the Group in late April to Charles C. Furnas, Assistant Secretary of Defense for Research and Development who had replaced Quarles (who was now Secretary of the Air Force). Stewart reported that although Project Vanguard was suffering some minor setbacks and was short of highly capable people, in general the project was on a satisfactory schedule and "one or more scientific satellites can be successfully placed in orbit during the IGY."²⁸ Stewart also stated:

Redstone re-entry vehicle No. 29, now scheduled for firing in January 1957, apparently will be technically capable of placing a 17 pound payload consisting principally of radio beacons and doppler-equipment in a 200-mile orbit, even with the degradation in performance below the present design figures which might reasonably be expected, but without any appreciable further margin. This capability will depend upon successful accomplishment of several developments, such as the use of a new fuel in the Redstone booster, and the spinning cluster of fifteen solid propellant motors. The probability of success of this single flight cannot be reliably predicted now, but it would doubtless be less than 50 per cent.

Stewart explained why the Army proposal should be rejected once again:

In any case, such a single flight would not fulfill the Nation's commitment for the International Geophysical Year because it would have to be made before the beginning of that period. Adequate tracking and observation equipment for the scientific utilization of results would not be available at this time. Moreover, any announcement of such a flight (or worse, any leakage of information if no prior announcement were made) would seriously compromise the strong moral position internationally which the United States presently holds in the IGY due to its past frank and open acts and announcements as respects VANGUARD.

Stewart mentioned that a Redstone could be used as a backup later in 1957 if Vanguard fell behind schedule and that No. 29 was the only vehicle which could be used without interference in the Redstone program. Finally, he concluded, "At the present time, therefore, the Group does not recommend activating a satellite program based on the Redstone missile, but will reconsider this question and the possibilities of the ICBM program at its subsequent meetings when the critical items of the VANGUARD program are further advanced."²⁹

On July 5, 1956, E.V. Murphree, DoD's Special Assistant for Guided Missiles, wrote to Reuben B. Robertson, Jr., the Deputy Secretary of Defense. Murphree stated that he had looked into the matter of using a Jupiter re-entry test vehicle for possibly launching a satellite into orbit. He stated that the January 1957 test could be adapted to this purpose with little effort and no impact on the program and said that an attempt could be made as early as September 1956, although this *would* affect the Jupiter program. Both dates were before the June 1957 start of the International Geophysical Year.

Murphree further noted that proposals for using the Jupiter were not new and that the original Redstone satellite and re-entry test vehicle proposals resulted from a common study (the early Orbiter proposal) which argued that the same vehicle could be used for both. Murphree also stated that the first two tests of the Jupiter were essentially propulsion system tests and could accomplish much of their goals for that program even if used for satellite launch attempts. He continued: "There is, however, room for serious doubt that two isolated flight attempts would result in achieving a successful satellite, and

the dates of such flights would be *prior* to the Geophysical Year for which a satellite capability is specifically required, and prior to the time when tracking instrumentation will be available."³⁰ (emphasis added)

Murphree then stated that these facts had been taken into consideration at the time that the Office of the Secretary of Defense reviewed the satellite program and decided to assign the mission to the Navy group. He stated: "That decision was based largely on a conviction that the VANGUARD proposal offered the greater promise for success. The history of increasing demands for funds for this program confirms the conviction that this is not a simple matter. I know of no new evidence available to warrant a change in that decision at this time."

The rest of Murphree's memorandum is extremely interesting and is reprinted below in full:

While it is true that the VANGUARD group does not expect to make its first satellite attempt before August 1957, whereas a satellite attempt could be made by the Army Ballistic Missile Agency as early as January 1957, little would be gained by making such an early satellite attempt as an isolated action with no follow-up program. In the case of VANGUARD, the first flight will be followed up by five additional satellite attempts in the ensuing year. It would be impossible for the ABMA group to make any satellite attempt that has a reasonable chance of success without diversion of the efforts of their top-flight scientific personnel from the main course of the JUPITER program, and to some extent, diversion of missiles from the early phase of the re-entry test program. There would also be a problem of additional funding not now provided.

For these reasons, I believe that to attempt a satellite flight with the JUPITER re-entry test vehicle without a preliminary program assuring a very strong probability of its success would most surely flirt with failure. Such probability could only be achieved through the application of a considerable scientific effort at ABMA. The obvious interference with the progress of the JUPITER program would certainly present a strong argument against such diversion of scientific effort.

On discussing the possible use of the JUPITER re-entry test vehicle to launch a satellite with Dr. Furnas, he pointed out certain objections to such a procedure. He felt there would be a serious morale effect on the VANGUARD group to whom the satellite test has been assigned. Dr. Furnas also pointed out that a satellite effort using the JUPITER re-entry test vehicle may have the effect of

disrupting our relations with the non-military scientific community and international elements of the IGY group.

I don't know if I have a clear picture of the reasons for your interest in the possibility of using the JUPITER re-entry test vehicle for launching the satellite. I think it may be helpful if Dr. Furnas and I discuss this matter with you, and I'm trying to arrange for a date to do this on Monday.³¹

Robertson's special assistant, Charles G. Ellington, forwarded the memos to White House Staff Secretary Andrew Goodpaster. Goodpaster wrote on the bottom of Ellington's cover memo, "Secy. Robertson feels no change should be made--per Mr. Ellington. Reported to President."³²

On September 20, 1956, Jupiter-C rocket number RS-27 was launched from Cape Canaveral. It flew 3,355 miles, reached an altitude of 682 miles, and achieved a velocity of Mach 18. It carried a deactivated fourth stage that was filled with sand under specific orders from Major General Medaris. Medaris had received specific orders himself. He had been instructed by someone in the Pentagon to ensure that the Jupiter's upper stage was not fueled and did not "accidentally" place a satellite in orbit before the International Geophysical Year. Wernher von Braun had been told to keep quiet, and did so.³³

Thus, despite the obvious potential to launch a satellite sooner to beat the Soviets into space, or simply to maximize the possibility that the United States would place something in orbit, no such effort was made. Despite much high-level discussion of the psychological impact of being first into space, neither the White House or Pentagon officials pursued this feat with great commitment. Indeed, there was no clear desire to simply be first.

How to "Beat" the Soviets

As one would expect, the scientists involved in creating the program stressed that a scientifically useful program would enhance U.S. prestige. National Science Foundation Director Alan Waterman specifically noted that the schedule was less important than the

prestige to be gained from a program that produced a major scientific breakthrough. In other words, being first but not scientifically significant *wasn't* as important for national prestige as accomplishing something scientifically noteworthy.³⁴ *One could win the race, but lose the scientific competition.*

Rather surprisingly, this was also the conclusion of the National Security Council's Planning Board. NSC 5520 had mentioned the possibility of the Soviets developing a satellite, but took no position on whether the U.S. should attempt to launch before the Soviets. The Defense Department's response in NSC 5522 stated with more urgency that the United States should be first, but must do so carefully. The NSC Planning Board, in November 1956, made an amazing statement:

The USSR can be expected to attempt to launch its satellite before ours and to attempt to surpass our effort in every way. It is vitally important in terms of the stated prestige and psychological purposes that the United States make every effort to (1) make possible a successful launching as soon as practicable and (2) put on as effective an IGY scientific program as possible. The prestige and psychological set-backs inherent in a possible earlier success and larger satellite by the USSR could at least be partially offset by a more effective and complete scientific program by the United States. Even if the United States achieved the first successful launching and orbit, but the USSR put on a stronger scientific program, the United States could lose its initial advantage.³⁵

Thus, one year before Sputnik, the NSC's official position was that the United States could lose prestige *even* if it launched a satellite first but the Soviets developed a better science program. Science, therefore, was a higher priority than schedule.

The issue of the propaganda value of launching a satellite had been mentioned in numerous documents, including RAND reports, intelligence assessments, and NSC 5520 and NSC 5522. In NSC 5522, the CIA equated it with the psychological impact of the atomic bomb. Clearly, many top U.S. policy-makers felt that it was a major issue.

But Eisenhower always dismissed these concerns. He just did not believe that it would be that important.³⁶ His concern was with the political vulnerability of

reconnaissance systems, not a race for prestige. He proved to be dreadfully wrong from a domestic political standpoint, but not necessarily from the standpoint of international law.

Sputnik Crisis?

By the fall of 1957, the Vanguard satellite program was proceeding roughly on schedule, with first launch anticipated for late 1957 or early 1958, during the International Geophysical Year. No one, not the Huntsville team or the Vanguard engineers themselves, expected the first launch to be successful. All rockets blew up the first time they were launched. But Vanguard had a year and a half to place a satellite in orbit. A year and a half to fail. The primary criteria was that Vanguard achieve orbit before the American intelligence satellite was ready to fly.

The satellite reconnaissance program, however, was underfunded and not making significant progress. Rather surprisingly, this was the fault of Donald Quarles, who had served as Secretary of the Air Force and then risen to become Deputy Secretary of Defense. Although Quarles had immediately appreciated the potential for using a civilian scientific satellite to establish freedom of space for future military satellites, he was skeptical of the reconnaissance satellite then under development by Schriever's Western Development Division. Quarles felt that the program was unlikely to produce anything in the short term and he therefore refused to provide significant funding for development. As many of those involved in the program noted, Quarles created a self-fulfilling prophecy: Quarles thought that the program was not advanced to deserve funding, but the program was not advancing *because* it was underfunded.

Quarles had ordered those in charge of it to not build any actual hardware. Schriever's underlings essentially ignored the order, pushing ahead with a satellite design. But they lacked money. They had asked for \$117 million in 1956 and got almost nothing. General Schriever was bewildered. "Now what can I do?" he asked later. "I can't understand it. One of the great problems is surprise attack, and here we're saying we can do a satellite reconnaissance program, and we get \$3 million..."¹³⁷

Eisenhower's scientific advisors Din Land and James Killian took renewed interest in the reconnaissance satellite by the fall of 1957 and the Science Advisory Committee even sponsored a special briefing for the White House on the subject on September 20.³⁸ A proposed interim reconnaissance satellite was gaining increased attention from Washington at the same time that the small Vanguard satellite was taking shape. The strategy was proceeding, but by October it was overtaken by events.

On October 4, 1957, the Soviet Union launched a 184 pound metallic ball called *Sputnik*. It was instantly major news around the world. On October 7, acting on the publicity generated in the wake of Sputnik, President Eisenhower asked Donald Quarles, by then Deputy Secretary of Defense, to explain why the United States was in the position it was. Goodpaster recorded Quarles' explanation in the minutes of the meeting: "The Science Advisory Committee had felt, however, that it was better to have the Earth satellite proceed separately from military development. One reason was to stress the peaceful character of the effort, and a second was to avoid the inclusion of material, to which foreign scientists might be given access, which is used in our own military rockets." Furthermore, "He [Quarles] went on to add that the Russians have in fact done us a good turn, unintentionally, in establishing the concept of freedom of international space--this seems to be generally accepted as orbital space, in which the missile is making an inoffensive passage."³⁹

Two days later, Eisenhower mentioned the subject of getting "beaten" in another staff meeting. "When military people begin to talk about this matter, and to assert that other missiles could have been used to launch a satellite sooner, they tend to make the matter look like a 'race,' which is exactly the wrong impression."⁴⁰ As far as Eisenhower and Quarles were concerned, the United States had never been in a race and had certainly not been "beaten." The complex strategy had not gone entirely according to plan, but the end result was the same for them. But Eisenhower also had a blind spot. While he was concerned that taking certain actions like publicly racing the Soviets into space would prompt them into escalating the Cold War, he failed to understand that failing to take

these actions could allow others to establish the agenda. He and his advisors were caught in a web of political manipulation that may have been too subtle and complex for their own good.

The true purpose of the early American space program, however, remained shrouded in secrecy for decades. It was only one of many secrets surrounding the program. There were others.

The CIA and the Scientific Satellite

When Alan Waterman met with Allen Dulles in early May 1955 to discuss NSF sponsorship of a scientific satellite, he also met with Richard Bissell, whom he described as "the one in Central Intelligence who is following this closely."⁴¹ Bissell had reason to follow it closely, since he was then in the middle of managing the newly-created U-2 reconnaissance aircraft program. Use of the U-2 hinged on issues of international law and the CIA therefore had good reason to pay attention to any subject involving international airspace.

But even more surprising is the discovery that, as the scientific satellite program continued and ran into significant cost overruns, the CIA actually provided money for it to continue. In April 1957, the Director of the Bureau of the Budget, Percival Brundage, sent a lengthy memo to Eisenhower on the Vanguard cost overruns. Vanguard was initially supposed to cost 15-20 million dollars. By spring 1957, it was projected to cost ten times that amount. Brundage recounted the funding difficulties of the program and stated "Apparently, both the Department of Defense and the National Science Foundation are very reluctant to continue to finance this project to completion. But each is quite prepared to have the other do so." He also noted that the National Science Foundation had contributed an extra \$5.8 million in funds to the Department of Defense to fund the program and that the CIA had contributed \$2.5 million of its own money to the program as well.⁴²

Why was the CIA, which had no official stake in the scientific satellite program and no space programs underway or even under study, willing to spend its own money on a civilian scientific space program? The answer is unknown. But it was likely due to Bissell's intervention, since he was the person delegated to follow the program and he was also in charge of the U-2 reconnaissance aircraft.⁴³ By April 1957, when the CIA provided the money to the scientific satellite program, the U-2 had already made nearly a dozen flights over the Soviet Union, each protested vigorously, but quietly, by the Soviets. Although the CIA did not have a reconnaissance satellite program at this time, it would be given one by Eisenhower less than a year later, a program code-named CORONA. Not surprisingly, Richard Bissell was placed in charge of that endeavor as well. Bissell was in control of a substantial amount of funding for covert and technical operations at CIA and it is likely that the money to support the scientific satellite program came from these funds or from Director of Central Intelligence Allen Dulles' substantial discretionary account (which may have accounted for up to a sixth of the CIA's budget at the time).

Brundage concluded his memo to Eisenhower by noting that the Air Force had already started its own, much larger, reconnaissance satellite. "Therefore, whether or not the International Geophysical Year satellite project is completed, research in this area will not be dropped." But this missed the point, since the scientific satellite program had less to do with research than with establishing legal precedent.

Further Hidden Agendas

The Soviets launched *Sputnik II* on November 5 and it had an even more profound public relations impact than its predecessor. *Sputnik II* was not only far larger than *Sputnik I*, but it also carried a dog, demonstrating a sophistication that belied early administration attempts to downplay the Soviet achievement. The size of the payload was sufficient for the carrying of an atomic bomb, which heightened Americans' fear that the Soviets could now effectively attack the United States. A little over a month later, the U.S. attempt to launch the Vanguard satellite ended in embarrassing failure. Clearly, in

the realm of space exploration, the Soviets had taken a substantial lead over the United States. From an international legal standpoint, this should have rendered the subject of freedom of space moot, but it did not. Furthermore, the Eisenhower administration continued its practice of using deception to cover its real goals.

In November, newly-appointed Secretary of Defense Neil McElroy proposed centralizing control of the various American space projects then underway, such as Vanguard and WS-117L, along with advanced ballistic missile development. McElroy proposed that they be put in a Defense Special Projects Agency (DSPA), which would be responsible for whatever projects the Secretary would assign to it. The idea for the DSPA apparently came from the Science Advisory Council in mid-October, just days after both Sputnik and McElroy's nomination.⁴⁴ Eisenhower himself expressed the opinion that a fourth service should be established to handle the "missiles activity."⁴⁵ McElroy said that he was weighing the idea of a "Manhattan Project" for anti-ballistic missiles. The president thought that a separate organization might be a good idea for this problem.⁴⁶ In testimony before Congress, Quarles, whom some regarded as an Air Force partisan, stated that long-range, surface-to-surface missiles had been assigned to the Air Force because it possessed the targeting and reconnaissance capabilities to use them, *not* because it was uniquely an Air Force mission.⁴⁷ Space could conceivably be treated in the same way.

Although the plan for incorporating ballistic missile development in the new agency was eliminated, the new space agency idea proceeded. The Special Projects Agency would act as a central authority for all U.S. space programs and would essentially contract out missions to the separate services, civilian government agencies, and even universities and private industry. "Above the level of the three military services, having its own budget, it would be able to concentrate on the new and the unknown without involvement in immediate requirements and inter service rivalries." McElroy stated in front of Congress that "the vast weapons systems of the future in our judgment need to be the responsibility of a separate part of the Defense Department."⁴⁸ This proposal was placed in a DoD reorganization bill. At this point, it was still assumed that the entire

American space program would remain under military control, although at the level of the Secretary of Defense in an office specially created to manage it.

Discussion of the Defense Special Projects Agency continued within the Administration. Its name was changed to the Advanced Research Projects Agency (ARPA) and Eisenhower sent a message to the Congress on January 7, requesting supplemental appropriations for the agency.⁴⁹ In early January the newly-created President's Science Advisory Committee addressed the issue of ARPA.

On February 7, 1958, James Killian and Din Land, who was also a member of the President's Board of Consultants on Foreign Intelligence Activities, met with Eisenhower and his staff secretary, General Andrew Goodpaster. There they briefed him on the potential of both a recoverable space capsule and supersonic reconnaissance aircraft program, suggesting that in order to speed up the development of a reconnaissance satellite, the U.S. should pursue the recoverable capsule idea as an "interim" solution. Eisenhower accepted this recommendation at that time and the satellite program was soon named "CORONA."

An equally important result of this first meeting was the decision to finalize Secretary of Defense McElroy's proposal and create the Advanced Research Projects Agency (ARPA) to house highly technical defense research programs. General Electric executive Roy Johnson was named as its director. Eisenhower decided to give ARPA control of all military space programs. The military man-in-space program, meteorological programs, and WS-117L would all be turned over to ARPA.

Sputnik also led to the creation of NASA to manage a civilian space program. Although Eisenhower had initially felt that the military could handle the task of space science, he was eventually persuaded that a civilian space agency was needed, in part by Vice President Nixon, who argued that a civilian agency was important for international prestige purposes. A military space agency could not be used as an effective means to "show the flag," particularly if the president was interested in keeping the Cold War from heating up. But a civilian space agency could be used to great effect for psychological

purposes. The creation of these new bureaucracies proceeded apace, drawing much attention from the Congress and the public. ARPA was officially in charge of the nation's WS-117L reconnaissance satellite program, whose existence had leaked to the press in the aftermath of Sputnik.

While all this was being done, Eisenhower had also directed that the recoverable satellite program—the program which eventually became known as CORONA—be handled by a covert team involving the Air Force and the CIA. For many of those who had been involved in it, including those who had proposed it, the recoverable satellite program simply ceased to exist. As far as they knew, WS-117L was the only satellite program that the United States had.

Those in charge of WS-117L eventually split it off into several programs, including the reconnaissance program known as SENTRY (later SAMOS), an early warning satellite known as Midas, and Discoverer, an engineering and development program which was to include the launching of biomedical payloads such as mice and monkeys. In reality, Discoverer was nothing more than a cover for the CORONA program, and SENTRY appears to have been continued at least in part as a sleight of hand—to distract attention away from Discoverer. Canceling it would have been too suspicious and would have raised the ire of the Air Force. Continuing it kept attention elsewhere. While the American public paid attention to NASA and ARPA and SENTRY, another program materialized into existence unnoticed. It was just like the strategy used earlier with the scientific satellite program.

Freedom of Space Marches On

By the first half of 1958 the issue of the militarization of space flared up again due to the expanding space programs. The National Security Council addressed it initially in a classified document in August 1958. Known as NSC 5814/1, the document stated that the United States must "seek urgently a political framework which will place the uses of U.S. reconnaissance satellites in a political and psychological context more favorable to the

U.S. intelligence effort." Responding to this, the State Department declared that one of the priorities for the United States was establishing "an acceptable policy framework for the WS-117L program..."⁵⁰ Even within this highly-classified document, CORONA was nowhere mentioned.

Protection of WS-117L then became the U.S. goal, and the State Department debated it internally and eventually brought it to the United Nations. At the suggestion of the United States, the United Nations created the UN Ad Hoc Committee on the Peaceful Uses of Outer Space (COPUOS). COPUOS became the source of much heated debate over the next several years, as the Soviets refused to participate and instead complained about American nuclear weapons and overseas bases, stating that concessions on these issues were a prerequisite to their participation in COPUOS. Calls by COPUOS for cooperation between the superpowers on space projects were met with derision from the Soviets, who feared that such cooperative efforts would reveal the limitations of their ICBM technology. Much controversy was generated, but no actual policy. All the time that this was being discussed in the United Nations, the newspapers, and in classified State Department meetings, CORONA continued its development totally unknown to even those at high levels of the government, who only discussed the legal protection of the overt WS-117L program.

The advent of military reconnaissance satellites themselves created their own legal issues. In January 1959, O.G. Villard, Jr., of Stanford University and a member of the National Academy of Sciences and the Space Science Board (SSB) wrote Lloyd V. Berkner, Chairman of the SSB. Villard expressed concern that the U.S. military might attempt to portray its satellite launchings as scientific in nature. This deception could have negative effects on American space science, particularly with regards to international cooperation. Villard stated that it was in the best interests of U.S. scientists that such deception not occur.

On January 28, 1959, Berkner brought the issue to the attention of Killian, who was by now Eisenhower's science advisor. On February 13, Killian in turn mentioned it to

NASA Administrator T. Keith Glennan, and Gordon Gray, Eisenhower's Special Assistant for national security affairs. Gray felt that it might require further action by the National Security Council.⁵¹ The results of their discussion of the issue are not known, but this discussion took place over a year after Eisenhower had directed that a small reconnaissance satellite program be peeled away from the bigger reconnaissance program (the one that Villner referred to in his letter) and be conducted covertly. Indeed, the first launch was scheduled to take place later in the month—under the cover of an engineering and scientific program!

The first Discoverer was launched on February 28, 1959. It was in actuality a test of equipment for the CORONA program. Although the satellite did not reach orbit, the Soviets still protested the flight, decrying its military nature. This prompted Richard Leghorn, the architect of Eisenhower's 1955 "Open Skies" proposal and the president of Itek, which was then managing the manufacture of CORONA cameras, to draft a proposal for the president titled "Political Action and Satellite Reconnaissance." In it Leghorn stated:

The problem is not one of technology. It is not a problem of vulnerability to Soviet military measures. The problem is one of the political vulnerability of current reconnaissance satellite programs.

For many years the U.S. has had overflight capabilities (aircraft and balloons) which have been substantially invulnerable to Soviet military countermeasures, but very vulnerable politically. Already the Communists (East Germany) have attacked Discoverer I as an espionage activity, and we can anticipate powerful Soviet political countermeasures to the Discoverer/Sentry series.⁵²

Leghorn continued:

What is needed is a program to put reconnaissance satellites "in the white" through early and vigorous political action designed to:

1. blunt in advance Soviet political countermeasures;
2. gain world acceptance for the notion that the surveillance satellites are powerful servants of world peace and security, and are not illegitimate instruments of espionage;

3. regain the political initiative of the “open skies” proposal.

Leghorn was fully aware of all American reconnaissance satellite efforts and it is impossible to believe that his proposal was anything other than a continuation of his earlier thinking on overflight. But at this time the United States still had not orbited a covert reconnaissance satellite (and would not for over a year, suffering a string of failures with CORONA) and was not *overtly* anywhere near flying a reconnaissance satellite. Taking any public position at all on the subject seemed premature at best and foolish at worst. From the White House’s point of view it was best to let the political deliberations at the United Nations run their course. Leghorn’s proposal went nowhere.

Gary Powers’ U-2 reconnaissance aircraft was shot down on May 1, 1960, creating yet another public embarrassment for Eisenhower that in fact revealed a carefully planned and executed strategy to gather intelligence on the Soviet Union—a strategy that like GENETRIX, CORONA and Vanguard also relied upon a scientific cover story to mask the true mission of the program. Although the downing ruined the upcoming summit, the U-2 had proved an intelligence bonanza for the United States, something which Eisenhower did not wish to emphasize even in his television address to the nation following the incident.⁵³ He had no desire to reveal America's intelligence coup and no desire to inflame relations with the Soviet Union.

Soviet Premier Khrushchev used the event to maximum propaganda effect, rejecting Eisenhower’s renewed proposal for “Open Skies.” Khrushchev declared, “as long as arms exist our skies will remain closed and we will shoot down everything that is there without our consent.” France’s President de Gaulle then asked whether this would include satellites, noting that Soviet satellites had already carried cameras into space. Khrushchev then replied “As for sputniks, the U.S. has put up one that is photographing our country. We did not protest; let them take as many pictures as they want.”⁵⁴

The State Department continued to discuss the subject in secret. By mid-1960, the Bureau of European Affairs at the State Department had even drafted a policy paper

concerning the planned upcoming launch of the SAMOS reconnaissance satellite. One option proposed was an "open approach" which advocated the sharing of all reconnaissance photographs taken by SAMOS. This approach was considered "more likely to facilitate wide acceptance of photographic satellites than the 'closed' approach."⁵⁵ While the State Department was debating the merits of sharing reconnaissance satellite photographs with the world community (something that the United States had not done even with U-2 photographs), CORONA's engineers were preparing for another launch. The memo was written August 12. Six days later CORONA returned its first images of the Soviet Union. There was no talk in the White House of sharing the photos with anyone.

The State Department continued to debate the merits of the American space program, but gradually even SAMOS itself was enveloped within the dark cloak of secrecy that surrounded CORONA. State Department discussions in general, and public statements in particular, ceased. Freedom of space had essentially been achieved. Further discussion was largely irrelevant. And CORONA began to chalk up success after success, as the press focused on SAMOS and the public paid attention to NASA and its daring Mercury astronauts.

Conclusion

Any close study of the Eisenhower presidency reveals a president who frequently rejected overt and provocative policies in favor of covert actions intended to achieve the same result but without heightening Cold War tensions. It also reveals a president who saw little separation between national security and science and who was fully willing to use allegedly "civilian" science programs to cover military operations. Reconnaissance is perhaps the premier example of this. First with the U-2, then with CORONA, Eisenhower chose to change direction and place the programs under different management primarily to avoid public scrutiny. He allowed the existing programs to continue before they slowly disappeared. He also used scientific cover stories extensively to cover the reconnaissance

programs. Few expected these cover stories to last forever. They were, in the language of the intelligence community, "melting assets." But they worked for a time. Rather surprisingly, they did not appear to have any negative effects for the civilian scientific community.

There is no evidence among Eisenhower's scientist advisors of any real debate over this practice of using science as cover for intelligence programs. They seem to have not recognized any line between the scientific establishment and the national security establishment. The idea of the scientific establishment deliberately separating itself from the military establishment did not come until later. And perhaps most ironically of all, this deliberate blurring of the lines between scientific and military establishments that Eisenhower did so much to create was one of the things he warned of in his farewell address.

¹ Several authors, working independently and mostly from unclassified sources, reached this conclusion in the mid-1980s. Due to recent document declassifications at several U.S. archives (most of the documents cited here were only declassified in 1995-96), it can now be proven beyond the shadow of a doubt that the American government was pursuing a definite strategy in its plan to launch a scientific satellite vehicle as part of U.S. participation in the International Geophysical Year (IGY). See Walter A. McDougall, *The Heavens and the Earth* (New York: Basic Books, 1985), and R. Cargill Hall, "Origins of U.S. Space Policy: Eisenhower, Open Skies, and Freedom of Space," in John M. Logsdon, ed., *Exploring the Unknown*, NASA SP-4407, (Washington, DC: U.S. Government Printing Office, 1995). The author is indebted to their trail-blazing work.

² Major General Bernard A. Schriever, Commander, Western Development Division, "ICBM - A Step Toward Space Conquest," February 19, 1957.

³ General Bernard A. Schriever, interview by Dwayne A. Day, July 17, 1997.

⁴ "For Defense," *Newsweek*, March 4, 1957, p. 66.

⁵ J.R. Killian, Jr., to General Curtis E. LeMay, September 2, 1954, Papers of Curtis LeMay, Box 205, Folder B-39356, Manuscript Division, Library of Congress.

⁶ Information on the classified annexes comes from an interview by Donald E. Welzenbach with James Killian and is referenced in: Donald E. Welzenbach, "Science and Technology: Origins of a Directorate," *Studies in Intelligence*, Vol. 30, Summer 1986, RG 263, National Archives and Records Administration (hereafter referred to as NARA). Although the intelligence section of the TCP report remains classified and awaits review, the index has been declassified. It includes the word "satellites," but apparently in the context of satellite countries of the U.S.S.R. "The Report to the President by the Technological Capabilities Panel of the Science Advisory Committee, February 14, 1955, Office of the Staff Secretary: Records of Paul T. Carroll, Andrew J. Goodpaster, L. Arthur Minnich and Christopher H. Russell, 1952-61, Subject Series, Alphabetical Subseries, Box 16, "Killian Report-Technological Capabilities Panel (2)", Dwight D. Eisenhower Library (hereafter referred to as DDE).

⁷ General Andrew Goodpaster, interview by Dwayne A. Day, March 19, 1996. Goodpaster went to the White House in October 1954 as a Colonel and was promoted to Brigadier General while there. He eventually rose to the rank of General and assumed command of Supreme Headquarters Allied Powers Europe (SHAPE) in 1969.

⁸ Although the majority of the contents of the intelligence section of the TCP report remain classified, crucial portions were printed in other documents which have now been declassified. For instance, a cover letter accompanying the report upon its delivery to the Policy Planning Staff at the Department of State declares that one of the intelligence panel's conclusions was the need for the "re-examination of the principles of freedom of space, particularly in connection with the possibility of launching an artificial satellite into an orbit about the earth, in anticipation of use of larger satellites for intelligence purposes." See "Report to the President on the Threat of Surprise Attack," Policy Planning Staff, Department of State, March 14, 1955, General Records of the Department of State: Records Relating to State Department Participation in the Operations Coordinating Board and the National Security Council, 1947-1963, Box 87, "NSC 5522 Memoranda", RG 59, NARA.

⁹ Another document, dated only two weeks later, called for the Department of State to discuss a TCP recommendation on freedom of space. It stated: "The present possibility of launching a small artificial satellite into an orbit about the earth presents an early opportunity to establish a precedent for distinguishing between 'national air' and 'international space,' a distinction which could be to our advantage at some future date when we might employ larger satellites for intelligence purposes." Robert R. Bowie, "Memorandum for Mr. Phleger," Policy Planning Staff, Department of State, March 28, 1955, Department of State Central Files, 711.5/3-2855.

¹⁰ In fact, Schriever, who was responsible for one of the most advanced weapons development projects in the United States military, did not learn of it until later, when he overheard someone discussing it on the phone and attempting to conceal its identity.

¹¹ Joseph Kaplan, Chairman, United States National Committee, International Geophysical Year 1957-58, National Academy of Sciences, to Dr. A.T. Waterman, Director, National Science Foundation, March 14, 1955.

¹² Alan T. Waterman, Director, Memorandum for Mr. Robert Murphy, Deputy Under Secretary of State, March 18, 1955.

¹³ Robert Murphy, "Memorandum for Dr. Alan T. Waterman, Director, National Science Foundation," April 27, 1955.

¹⁴ Alan T. Waterman, Director, to Donald A. Quarles, Assistant Secretary of Defense (Research and Development), May 13, 1955.

¹⁵ The newly released part of the document is in italics. NSC 5520, May 20, 1955, General Records of the Department of State: Records Relating to State Department Participation in the Operations Coordinating Board and the National Security Council, 1947-1963, Box 112, "NSC 5520", RG 59, NARA.

¹⁶ Ibid. This portion of the document remained classified until 1995.

¹⁷ "James S. Lay, Jr., Executive Secretary, National Security Council, Memorandum for the National Security Council, "U.S. Scientific Satellite Program," November 9, 1956, General Records of the Department of State: Records Relating to State Department Participation in the Operations Coordinating Board and the National Security Council, 1947-1963, Box 86, "NSC 5520 - US Scientific Satellite Program (Memoranda)", RG 59, NARA.

¹⁸ Memorandum, "Discussion at the 250th Meeting of the National Security Council, Thursday, May 26, 1955," May 27, 1955, Files of Dwight D. Eisenhower as President, Ann Whitman File, NSC Series, Box 6, "250th Meeting of NSC, May 26, 1955," DDE.

¹⁹ National Security Council NSC 5522 June 8, 1955 Comments on the Report to the President by the Technological Capabilities Panel, p. S-5, White House Office, Office of the Special Assistant for National Security Affairs: Records, 1952-61, NSC Policy Papers, Box 16, Folder NSC 5522 Technological Capabilities Panel, DDE.

²⁰ National Security Council NSC 5522 June 8, 1955 Comments on the Report to the President by the Technological Capabilities Panel, p. A-55-6

²¹ Robert R. Bowie, Policy Planning Staff, Department of State, "Recommendations in the Report to the President by the Technological Capabilities Panel of the Science Advisory Committee, ODM (Killian Committee): Item 2 - NSC Agenda 10/4/56", General Records of the Department of State: Records Relating to State Department Participation in the Operations Coordinating Board and the National Security Council, 1947-1963, Box 87, "NSC 5522 Memoranda", RG 59, NARA.

²² These "gentlemen's agreements" were a tenet of the Cold War. They were certainly common in the field of espionage, where the superpowers frequently chose to keep quiet when they caught the other side

spying. They were also part of a larger unwritten code of cooperation between the two nations, such as the tacit, unspoken agreement not to seek the assassination of the other side's leaders.

²³ Constance McLaughlin Green and Milton Lomask, *Vanguard: A History* (Washington, DC: Smithsonian Institution Press, 1971), pp. 34-56.

²⁴ *Ibid.*, p. vi. Green and Lomask added: "To these observations, I can add from my own experience that inter-service rivalry exerted strong influence; also, that any conclusion drawn would be incomplete without taking into account the antagonism still existing toward von Braun and his co-workers because of their service on the German side of World War Two."

²⁵ Fred Durant, interview by Dwayne A. Day, July 27, 1997.

²⁶ *Redstone Arsenal Complex Chronology, The ABMA/AOMC Era, 1956-62*, Redstone Arsenal webpage.

²⁷ Colonel A.J. Goodpaster, "Memorandum for Record," June 7, 1956, White House Office, Office of the Staff Secretary: Records, 1952-1961, Box 6 "Missiles and Satellites," DDE.

²⁸ Homer J. Stewart, Chairman, Advisory Group on Special Capabilities, Memorandum for the Assistant Secretary of Defense (R&D), "VANGUARD and REDSTONE," June 22, 1956, White House Office, Office of the Staff Secretary: Records, 1952-1961, Box 6, "Missiles and Satellites," DDE.

²⁹ Stewart's memorandum was stamped "SECRET," but there is some doubt as to whether it was actually written in May 1956 instead of June. It is rare for a report of a meeting to be written two months after the meeting. Furthermore, the memo also mentions the Group's *upcoming* meeting on June 19 and 20 concerning the propulsion systems for Vanguard and invites contractor representatives to attend this meeting, which would already have happened by the time the memo was written. The June 22 date may be a typo.

³⁰ E.V. Murphree, Special Assistant for Guided Missiles, Memorandum for Deputy Secretary of Defense, "Use of the JUPITER Re-entry Test Vehicle as a Satellite," July 5, 1956, White House Office, Office of the Staff Secretary: Records, 1952-1961, Box 6, "Missiles and Satellites," DDE.

³¹ In another brief, one-page memorandum from C.C. Furnas to the Deputy Secretary of Defense, dated July 10, 1956 and stamped "Secret," Furnas mentioned the meeting that he and Murphree had with Robertson on July 9. Furnas used this memorandum as a cover letter to forward the previous report to him by Homer Stewart's Advisory Group on Special Capabilities. He concluded by saying "I trust that this will serve your purpose in reporting your evaluation of the suggestion that a Redstone vehicle will be used." C.C. Furnas, Assistant Secretary of Defense for Research and Development, Memorandum for Deputy Secretary of Defense, July 10, 1956, White House Office, Office of the Staff Secretary: Records, 1952-1961, Box 6, "Missiles and Satellites," DDE.

³² William Ewald, *Eisenhower the President: Crucial Days 1951-1960* (Englewood Cliffs, NJ: Prentice-Hall, 1981), p. 284.

³³ Ernst Stuhlinger, letter to Dwayne A. Day, August 23, 1997.

³⁴ Alan T. Waterman, National Science Foundation, Memorandum to Mr. Percival Brundage, Bureau of the Budget, "Funding of Earth Satellite Program, International Geophysical Year," April 7, 1956, General Records of the Department of State: Records Relating to State Department Participation in the Operations Coordinating Board and the National Security Council, 1947-1963, Box 86, "NSC 5520 - US Scientific Satellite Program (Memoranda)," RG 59, NARA.

³⁵ James S. Lay, Jr., Executive Secretary, National Security Council, Memorandum for the National Security Council, "U.S. Scientific Satellite Program," November 9, 1956, with attached: "Draft Report on NSC 5520, U.S. Scientific Satellite Program Background," General Records of the Department of State: Records Relating to State Department Participation in the Operations Coordinating Board and the National Security Council, 1947-1963, Box 86, "NSC 5520 - US Scientific Satellite Program (Memoranda)," RG 59, NARA.

³⁶ Goodpaster interview.

³⁷ General Bernard Schriever interview by ArcWelder Films.

³⁸ David Z. Beckler, Executive Officer, Science Advisory Committee, Memorandum for General Goodpaster, "Special Briefing," September 19, 1957, Office of the Staff Secretary: Records of Paul T. Carroll, Andrew J. Goodpaster, L. Arthur Minnich and Christopher H. Russell, 1952-61, Subject Series, Alphabetical Subseries, Box 23, "Science Advisory Committee (2) Sept.-Oct. 1957," DDE.

³⁹ Brigadier General Andrew Goodpaster, Memorandum of Conference with the President, October 7, 1957, Office of the Staff Secretary: Records of Paul T. Carroll, Andrew J. Goodpaster, L. Arthur Minnich

and Christopher H. Russell, 1952-61, Subject Series, Department of Defense Subseries, Box 6, "Missiles and Satellites," DDE.

⁴⁰ Brigadier General Andrew Goodpaster, Memorandum of Conference with the President, (following McElroy swearing in) October 9, 1957, Office of the Staff Secretary: Records of Paul T. Carroll, Andrew J. Goodpaster, L. Arthur Minnich and Christopher H. Russell, 1952-61, Subject Series, Department of Defense Subseries, Box 6, "Missiles and Satellites," DDE.

⁴¹ Waterman to Quarles, May 13, 1955.

⁴² Percival Brundage, Director, Bureau of the Budget, Memorandum for the President, "Project VANGUARD," April 30, 1957, White House Office, Office of the Staff Secretary: Records, 1952-1961, Box 6 "Missiles and Satellites," DDE.

⁴³ Former CIA Deputy Director of Science & Technology Albert "Bud" Wheelon has speculated that the money probably came from Allen Dulles' substantial discretionary DCI budget.

⁴⁴ Goodpaster interview.

⁴⁵ Eisenhower's comments on this subject appear in numerous documents. For instance, in October 1957 Goodpaster reported "The President went on to say he sometimes wondered whether there should not be a fourth service established to handle the whole missiles activity." Brigadier General A.J. Goodpaster, "Memorandum of Conference with the President, October 11, 1957, 8:30 AM," October 11, 1957, Ann Whitman File, DDE Diary Series, Box 67, "Oct. 57 Staff Notes (2)," DDE. In January 1958 Goodpaster reported "In the course of the discussion the President indicated strongly that he thinks future missiles should be brought into a central organization." Brigadier General A.J. Goodpaster, Memorandum of Conference with the President, January 21, 1958," January 22, 1958, Office of the Staff Secretary: Records of Paul T. Carroll, Andrew J. Goodpaster, L. Arthur Minnich and Christopher H. Russell, 1952-61, Subject Series, Department of Defense Subseries, Box 6, "Missiles and Satellites, Vol. II (1) [January-February 1958]" DDE. In February 1958, Goodpaster reported "The President said that he has come to regret deeply that the missile program was not set up in OSD rather than in any of the services." Brigadier General A.J. Goodpaster, "Memorandum of Conference with the President, February 4, 1958 (following Legislative Leaders meeting)," February 6, 1958, Office of the Staff Secretary: Records of Paul T. Carroll, Andrew J. Goodpaster, L. Arthur Minnich and Christopher H. Russell, 1952-61, Subject Series, Department of Defense Subseries, Box 6, "Missiles and Satellites, Vol. II (1) [January-February 1958]," DDE.

⁴⁶ Brigadier General A.J. Goodpaster, Memorandum of Conference With the President, October 11, 1957, Ann Whitman File, DDE Diary Series, Box 27, "Oct. 57 Staff Notes (2)," DDE. In February, another memo states "The President said that he has come to regret deeply that the missile program was not set up in OSD rather than in any of the services. Personal feelings are now so intense that changes are extremely difficult." Brigadier General A.J. Goodpaster, Memorandum of Conference With the President, February 4, 1958, (Following Legislative Leaders meeting)," February 6, 1958, Office of the Staff Secretary: Records of Paul T. Carroll, Andrew J. Goodpaster, L. Arthur Minnich and Christopher H. Russell, 1952-61, Subject Series, Department of Defense Subseries, Box 8, "Missiles and Satellites, A National Integrated Missile and Space Vehicle Development Program, December 10, 1957," DDE.

⁴⁷ Robert Frank Futrell, *Ideas, Concepts, Doctrine, Vol. 1*, (Washington, DC: U.S. Government Printing Office, 1989), p. 589. The comments on Quarles' partisanship come from the interview with Goodpaster.

⁴⁸ *Organization and Management of Missile Programs, Hearings before a Subcommittee of the Committee on Government Operations*, U.S. House of Representatives, 86th Cong., 2d Sess. (Washington, D.C.: U.S. Government Printing Office, 1959), p. 133.

⁴⁹ *Ibid.*

⁵⁰ McDougall, *The Heavens and the Earth*, pp. 182-83.

⁵¹ Gordon Gray, Special Assistant to the President, to Brigadier General Andrew J. Goodpaster, February 16, 1959, with attached: James R. Killian, Jr., to Gordon Gray, Special assistant to the President, February 13, 1959; James R. Killian, Jr., to Dr. T. Keith Glennan, Administrator, National Aeronautics and Space Administration, February 13, 1959; Lloyd V. Berkner, Chairman, Space Science Board, National Academy of Sciences, to Dr. James R. Killian, Jr., Special Assistant to the President for Science and Technology, January 28, 1959; O.G. Villard, Jr. Space Science Board, to Dr. L.V. Berkner, President, Associated Universities, Inc., January 22, 1959, Office of the Staff Secretary: Records of Paul T. Carroll, Andrew J. Goodpaster, L. Arthur Minnich and Christopher H. Russell, 1952-61, Subject Series, Department of Defense Subseries, Box 15, "Space [January-June 1959]," DDE.

⁵² Richard S. Leghorn, Political Action and Satellite Reconnaissance, [Draft], April 24, 1959, Office of the Staff Secretary: Records of Paul T. Carroll, Andrew J. Goodpaster, L. Arthur Minnich and Christopher H. Russell, 1952-61, Subject Series, Department of Defense Subseries, Box 15, "Space [January-June 1959]," DDE.

⁵³ The U-2 also raised once again the issue of where airspace ended and space began. At the Eleventh International Astronautical Federation Congress in Stockholm, Sweden, Spencer M. Beresford presented a paper which connected the U-2 and violations of international airspace with the possibility of future flights by military MIDAS and SAMOS flights. A State Department official obtained a copy of Beresford's paper before his presentation and notified the U.S. Information Service in Stockholm that the paper raised a number of "highly sensitive" topics which the United States should not comment. W.E. Gathright, to USIS-Stockholm, "TOUSI II, Joint State USIA Message," August 12, 1960, with attached: Remarks of Spencer M. Beresford, United States of America, at the Eleventh Annual Congress of the International Astronautical Federation, Stockholm, Sweden, August 16, 1960, General Records of the Department of State, Bureau of European Affairs, Office of Soviet Union Affairs, Subject Files, 1957-1963, Box 6, "12 Satellite and Missile Programs," RG 59, NARA.

⁵⁴ Khrushchev was referring to the U.S. Tiros weather satellite launched in August.

⁵⁵ Foy D. Kohler, Bureau of European Affairs, to Phillip J. Farley, "SAMOS," July 18, 1960, General Records of the Department of State, Bureau of European Affairs, Office of Soviet Union Affairs, Subject Files 1957-1963, Box 6, "12 Satellite and Missile Programs," RG 59, NARA.

The Sputniks and the IGY

by Rip Bulkeley

The programs which launched the first artificial earth satellites were conducted by the Soviet Union and the United States during the second half of the 1950s, within the overall framework of the International Geophysical Year (IGY). The IGY was an ambitious international undertaking, comprising a network of planet-wide geophysical studies, which was proposed in 1950 and carried out in 1957-58. Sixty-seven national scientific teams, from countries with widely dissimilar political systems and levels of economic development, participated in different ways and to differing degrees. In view of the generally hostile relations between the countries of the North Atlantic Treaty Organization and those of the Warsaw Treaty (signed only two years before the opening of the IGY) it is particularly remarkable that nearly all the members of the two rival alliances took part in the Year, and that the two nuclear superpowers led the way in this cooperation, in spite (or perhaps because?) of the fact that many of the scientific topics to be studied were of considerable military as well as scientific significance.

The proposal to develop and use the daring technological innovation of artificial satellites for IGY experiments was a late addition to the program, and like one or two other areas with similar dramatic appeal, such as Antarctic exploration, it became a focus for informal but intense rivalry between the Soviet Union and the United States, as the only two nations with the technological capacity to enter such a 'race'. At first glance, the rival IGY satellite programs recall the old dictum that nations which challenge one another over prestige will usually need to 'cooperate in order to compete'. However, the precise extent and nature of the IGY cooperation in this area has been little studied to date.

1) The U. S. Proposal

The use of artificial satellites for IGY experiments was proposed unilaterally by the U. S. IGY Committee in October 1954. At that point the Soviet Union had not yet officially joined the Year, which had been established as an international scientific committee, by the International Council of Scientific Unions (ICSU), only two years previously. An informal Soviet delegation was however present at the successive Assemblies, in Rome, of the International Union of Geodesy and Geophysics (IUGG) and the Comité Scientifique de l'AGI (CSAGI), the annual coordinating meeting for the IGY, at which the satellites idea was proposed and then, in principle, accepted. And the Soviet Academy of Sciences announced in Rome that it had decided to join the Year, and was about to form the requisite national IGY committee through which to do so. For its part, the U. S. IGY Committee was now obliged to 'take back' the CSAGI satellite resolution, which it had written itself, for further domestic consideration. It would be necessary, first, to determine whether the idea was technically feasible and scientifically desirable, within the short time-frame of the IGY, and second, in the event of a positive determination on this point, to persuade the economically conservative and militarily preoccupied Eisenhower administration to divert the necessary resources from its urgent missile program. This process took several months, but finally, on 29 June 1955, U. S. IGY scientists took part in the official White House announcement of the world's first satellite program, appropriately but unfortunately designated 'Vanguard' by its planners.

For the next fourteen months there was only one, very public, national program for a scientific IGY satellite, that of the United States.

2) The Soviet Response before Sputnik 1

The Soviet Academy of Sciences was obliged to begin its belated participation in the IGY by forming a national committee, reviewing the entire IGY program as formulated to that date, determining what additional activities it might like to suggest, and starting to prepare its scientific teams, instruments and experimental stations.¹ In March 1955 the Soviet Academy informed the secretary of CSAGI, Marcel Nicolet, that its committee president would be Academician I. P. Bardin,² and in April, that its representatives on the CSAGI committee would be Academicians V. V. Belousov and N. V. Pushkov. On 12 April *Pravda* told the Soviet public, in general terms, that there would be a Soviet IGY program. Further details were anxiously awaited, and wherever possible requested, by Western scientists, including the overall president of the IGY, Sydney Chapman.³ But the record of the informal Rome conversations indicates that the Soviet delegation could reasonably have formed the impression that national reports were to be prepared for presentation at the next annual CSAGI Assembly, scheduled for Brussels in September 1955, and not before. This was, in any case, the procedure which they followed, to the extent of bringing multiple copies of their report to Brussels, rather than forwarding it to Nicolet for circulation in advance.⁴

In a separate development, the official Soviet media announced in April 1955 the formation of an "Interagency Commission on Interplanetary Travel". The U. S. committee prepared a major presentation of its recently announced satellite program for Brussels, and hoped for news of Soviet plans, despite the fact that no announcement linking the new Commission with the Soviet IGY program had yet been made from Moscow. The Americans were disappointed when no leading Soviet experts in the rocket sciences even came to Brussels, and the single Soviet delegate to attend the relevant working group adopted an entirely passive role.⁵

The CSAGI working groups were responsible for coordinating the global scientific effort within the IGY disciplines, both at the annual international meeting and through subordinate meetings and correspondence, insofar as was possible for busy working scientists with many other current commitments, during the rest of the time. An overall 'reporter' for each discipline was tasked with the preparation of a manual or group of manuals, for distribution to the participating stations, which should embody the detailed experimental plans and guidelines drawn up in the preparatory consultations. In the satellites part of the Rockets and Satellites discipline, the preparation of instruments, launch vehicles and tracking stations was of course fraught with the additional burden of novelty. The late arrival of the Soviet Union in the IGY, and its continued silence on the question of satellite experiments, left the U. S. scientists frustratingly unable to conduct the necessary dialogue. In February 1956 further details of the U. S. program were circulated to all national committees, and in the same month the first informal indications were received that the Soviet satellite program would include scientific experiments of the sort appropriate for the IGY.⁶ Lloyd Berkner, vice-president of the IGY and reporter for Rockets and Satellites, proposed that a full two days of the next CSAGI Assembly, scheduled for September in Barcelona, should be given over to a symposium on the satellite program.⁷ Meanwhile he continued to urge that the Soviet Union be pressed to join its satellite program with the IGY.⁸ The Soviet IGY committee, however, remained uncommunicative in general, and completely silent on the matter of satellites. No response having been received to the proposal for a two-day symposium, this was curtailed to a single day. The only information given about Soviet plans was a terse announcement from Bardin, to the effect that there would indeed be a Soviet IGY satellite program, and that information about proposed launch schedules and experiments would be supplied in due course. One resolution passed by the rockets and satellites working group at Barcelona, and not contested by the Soviet delegates, recommended "that for all IGY satellites the

radio systems employed for tracking and telemetering be compatible with those which have been announced at the current CSAGI meeting in order that the same ground-based receiving equipment can be used throughout".⁹ The "announced" systems were of course those planned for the U. S. Vanguard program, using a frequency of 108 megahertz, which had been described in U. S. documentation distributed before the meeting.¹⁰ Other resolutions at Barcelona called for "countries having satellite programs" [i.e. the Soviet Union] to supply information about their tracking equipment and launch schedules. However, it was to be a further nine months before any such information was officially supplied by the Soviet IGY committee.

The problem for IGY planners was exacerbated, rather than eased, by the amount of unverified information about the likely shape of the Soviet satellite program that had appeared by late 1956, including the disturbing claim that Soviet scientists might attempt to place a satellite in orbit during 1956 (which quite apart from any prestige considerations would have implied a general disregard for the IGY framework).¹¹ This informal material was compiled and assessed by various bodies to the best of their ability.¹² But although some of the estimates derived from it were later proved to have been remarkably accurate, it could not be used or even referred to within the CSAGI structures, because none of it had been supplied or endorsed by the Soviet IGY committee.

On 6 March 1957 Radio Moscow confirmed that the size of the first Soviet satellite would be around 50 kg, as had already been suggested by unofficial sources. But it was only in June, less than a month before the start of the IGY, that Soviet scientists began to provide any detailed information about their rocket and satellite programs. A seven-page document was sent to Berkner, giving brief indications of the types of experiment to be carried on sounding rockets and satellites, but with no technical information about the measuring instruments or telemetry. Three "zones" for rocket launches were listed as "Franz Joseph Land", "the Antarctic, mainly in the area of Mirny", and "middle latitudes of the USSR". The site for satellite launchings was not specified.¹³ In the same month the Soviet journal *Radio* published two articles giving detailed explanations of how the satellite's radio telemetry could usefully be observed by amateurs on frequencies of about 20 and 40 megahertz; a further two articles appeared in the same journal in July, another in August, and another in September.¹⁴ The Central Amateur Shortwave Radio Station of the Soviet Union went on to broadcast specimens of the planned satellite signals "several times a week" during August and September, without any notice being taken by the outside world.¹⁵

Berkner's first draft proposal on the interchange of rocket and satellite data, intended for a future manual, had been written, with no Soviet input, in December 1956.¹⁶ In July 1957 it was rewritten, without any significant changes, by Admiral Day, the IGY's Coordinator, to form the relevant chapter for the first edition of The CSAGI Guide to IGY World Data Centres.¹⁷ At that stage, the only material taken from the Bardin document was the designation of rocket launching zones.

Expressing his dissatisfaction with the lack of detail in the Bardin document, on 23 July 1957, the British space scientist Harrie Massey drew particular attention to the absence of any specification of a telemetering frequency.¹⁸ Three days later, however, Massey attended a meeting with a party of Soviet rocket scientists who were on a two weeks' visit to their British counterparts. On this occasion A. M. Kasatkin gave a detailed description of one of the principal Soviet meteorological sounding rockets, including its telemetering frequency of 22 megahertz.¹⁹ Then on 16 August Bardin wrote again to Berkner, this time giving the exact frequencies to be used in Soviet satellite telemetry. A note on the copy of this letter in Chapman's files states that the U. S. IGY office forwarded the original to Berkner at Boulder, where he would have been attending the Assembly of the International Radio Science Union (URSI).²⁰ However, the letter

appears to have miscarried, and its importance was missed by the U. S. IGY staff, with the result that U. S. scientists preparing their country's satellite-tracking stations were left ignorant of the Soviet decision on frequencies until shortly before the launch of Sputnik 1 on 4 October 1957.

The Bardin letter had not been copied to Nicolet at the international IGY office in Brussels, where its significance would not have been overlooked. But, either in response to a recent pressing enquiry about the telemetry frequency from the British, or else by accident, a copy was sent to the Royal Society.²¹ Although the British did not set the probability of a Soviet satellite high enough to make any advance preparations for tracking it,²² one British scientist put his mind to devising a method for studying the distribution of ionization in the upper atmosphere by comparative observation of the signals on the two frequencies, and presented this at the Washington meeting, three days before the launch of Sputnik 1.²³

The final source of information of the Soviet satellite program, prior to Sputnik 1, was the September issue of the Soviet Academy's journal Achievements of Physical Science, a special two-volume issue devoted exclusively to articles about past or planned experiments to be carried on rockets and satellites.

It is worth mentioning here that the contrast which is usually drawn between American openness and Soviet secrecy about their IGY satellite plans, prior to October 1957, has probably been overdrawn in the literature. As late as mid-June of 1957 W. T. Blackband, a senior physicist with the Royal Aircraft Establishment, was still urging that both the United States and the Soviet Union should be pressed to provide full details of their telemetry systems. He continued: "Of course both have agreed to standardize, but it has been so hard for us to learn details of American plans that it is likely that the Russians do not know much, and, knowing little they will go their own way."²⁴

3) Problems of the Soviet IGY Committee

By comparison with the wealth of advance information that was distributed about the U. S. Vanguard satellite program, that provided by the Soviet IGY committee about what was nominally 'their' satellite program can fairly be described as 'too little too late'. But several considerations are worth mentioning at this point. First, nations joining in the IGY were not thereby committing themselves to adopt U. S. values or policies in the conduct of their scientific programs. In the Antarctic, for example, nations maintaining territorial claims, such as Argentina, Britain or Chile, frequently pointed out that their acceptance of international scientific activities within 'their' sectors during the Year should not be regarded as establishing any sort of political precedent.²⁵ Next, as has been made clear, no procedures for the conduct of satellite experiments, including the nature and extent of information to be released in advance, had been mutually discussed, elaborated and agreed, under IGY auspices, prior to the Washington Conference which convened only a few days before Sputnik 1. Doubtless the lack of such a meeting was largely due to the non-attendance of Soviet rocket scientists at Brussels and Barcelona, but it seems certain that the participation of such personnel in IGY meetings was not something controlled by the Soviet IGY committee. Even in the United States, a satellite program which had been initiated, and in its early phases planned, entirely by the national IGY committee showed signs of reverting to more direct government control after the national furore occasioned by the first two sputniks. In the Soviet case it seems doubtful that the Academy of Sciences ever had much say in any aspect of the first sputniks, other than their scientific instrumentation.

The Soviet Academy of Sciences may have been a *de facto* department of the Soviet government, but the IGY committee formed under its auspices probably carried little political

weight. Only one member of its inner circle, Pushkov, was actually a member of the Communist Party.²⁶ Bardin's two communications to Berkner, in June and August 1957, contain clear and probably deliberate indications of his helplessness in matters pertaining to the Soviet satellite. The first points out that he is merely *forwarding* the document, adds that he hopes it is what Berkner expected, and goes on to apologize for sending it so late. In the second he once again emphasizes that the frequency information comes from "the specialists" and he is merely passing it on.²⁷

It is also reasonable to assume that the Soviet decision to use the prototype A-1 military launcher for their satellite program placed them under severe constraints in respect of security, of a kind also experienced, though to a lesser degree, in the United States. Influential Soviet officials may well have had some inkling of Lloyd Berkner's excellent connections with the political leadership of the United States, as well as its intelligence community.²⁸ If so, they would have mistrusted the repeated attempts at obtaining information closely related to their ICBM program that were channelled through the IGY, such as Berkner's proposal for a two-day conference at Barcelona.²⁹ Such fears, if they existed, may or may not have been justified. There were always excellent scientific reasons for coordinating the two countries' satellite programs as early as possible. But it is certainly noticeable that nothing like the same pressure for advance information of Soviet plans was generated by the U. S. IGY leadership in any of the thirteen other subject areas of the IGY.

In June 1957 the political leadership of the Soviet Union was rocked by a crisis in which Khrushchev, who had strongly backed the development of a satellite-launching potential within the Soviet rocket program, was hard put to it to retain political power. While the crisis and its resolution in Khrushchev's favour came after Bardin had sent the seven-page description of the Soviet satellite program to Berkner, and after the first *Radio* articles had gone to press, it may be presumed that if matters had gone the other way, and Khrushchev's rivals, who were largely opposed to the diversion of military resources for a satellite program, had succeeded in overthrowing him, then even the small amount of information which began to flow that summer would have dried up.³⁰ If the Soviet satellite program had been closed down completely, of course, we would not be sitting here today. Conversely, by rewarding the Soviet leader's gamble with a political triumph, the first two successful sputniks probably made it easier for some Soviet scientists to develop interactions with their Western colleagues.

In the event, the Soviet reluctance to share advance information about their satellite plans was not immediately harmful to their scientific or political interests. The tracking stations of other IGY nations were able to be adapted to the required frequencies and orientations within days, sometimes hours, of the launching of Sputnik 1. It can be argued, however, that the lack of a cooperative international network of tracking stations, such as might have been built up by following a more open policy, cost the Soviet scientists the prestige of one of the most impressive discoveries in the early years of space science, the Van Allen radiation belts, which could not be clearly detected from the partial orbital and experimental data which were all that they could obtain with their own resources.³¹

4) To Cooperate, or Not to Cooperate? - Writing the Book

The CSAGI Conference on Rockets and Satellites, held in Washington from 30 September to 5 October 1957, was in effect the first real joint discussion between Soviet and American scientists about the arrangements for satellite experiments within the IGY. While minutes of some of its working groups survive, no full record of the conference proceedings appears to be extant. There

seems to have been little disagreement, at this stage, about the arrangements for the exchange of experimental results. What proved controversial was the nature and extent of the 'operational data' to be made available by those launching a satellite for observers in other countries. The Americans at first wanted flash announcements of all launchings to be broadcast within one hour, and precise details of launch sites and orbital inclination angles to be given. This was modified at Washington to allow a two-hour notice period, and for successful launchings only. Reference to the launch site was deleted, and the phrase "Complete orbital elements at an instant near the time of launching" was substituted, presumably because such data could be packaged in such a way as to protect the location of the launch site or at least, appear to do so, for reasons of 'face'.

The issue of telemetry frequencies was a subject for intense discussion. Kasatkin defended his country's choice on the grounds of its scientific value for the study of ionospheric refraction, and suggested that the tracking precision, for which the Americans had opted with their higher frequency, might be attainable through statistical treatment of a large number of observations of a lower frequency beacon. It might also be practicable to include a tracking signal at the U. S. frequency in the "next series" of Soviet satellites. In reply to a cross-examination from Porter and others about the design of the Soviet transmitter, the polarization of its signal, and the design of tracking station antennas, he stated that the Soviet delegation "had not been prepared to give detailed information of this nature at this conference".³² Western participants repeatedly underlined the undeniable inference that, if the Soviet scientists wanted observational support for their satellite program from scientific institutions and amateurs around the world, as they appeared sincerely to do, then they would have to provide considerably more information on some of its technical aspects than had been given so far. On the other hand Kasatkin's reference to the articles in *Radio* may have come as a surprise to most Western delegates. The telemetry issue was resolved by endorsing both the American and the Soviet choice., and the potential value of the Soviet 40 megahertz frequency for ionosphere measurements was also accepted.³³ The draft Guide to IGY World Data Centres had proposed that orbital predictions (ephemerides) be distributed to observing stations via the IGY's global telecommunications network, known as Agiwarn.³⁴ This was accepted, but with a rider that "additions" to the text might be needed after further study. In general, the conference recognized that much remained to be done in building effective global cooperation for the satellites portion of the IGY.

The urgency of these tasks was underlined by the news, on the evening of 4 October 1957, of the launching of Sputnik 1. At the last session of the conference on the following day Blagonravov volunteered a few more details of the spacecraft, namely its size, weight and the expected battery life for its transmitter. Chapman closed the meeting with a speech congratulating the Soviet scientists, but drawing attention to the indirect way in which CSAGI had been informed of the launch (through the news media) and contrasting the openness of the American program with the "silence" of the Soviet effort. He ended with a plea "that our resolutions concerning timely announcements and adequate information will be fully observed".³⁵

Blagonravov had also remarked that Sputnik 1 was not a properly instrumented satellite of the kind which Soviet scientists were planning for the IGY, but merely a preliminary test vehicle.³⁶ This distinction, which had also been floated within the Vanguard program, raised concerns that Sputnik 1 might never be registered and reported as an IGY experiment, despite the worldwide publicity which it had generated for the Year. After a ten-day interval, during which the Soviet IGY committee showed little sign of conforming with Chapman's recommendations, the CSAGI coordinator Day cabled Moscow to request information about the satellite's orbit for distribution on Agiwarn, "while understanding from press reports that satellite now orbiting is not part of IGY programme". Yu. D. Boulanger, one of the vice presidents of the Soviet committee, replied that,

on the contrary, Sputnik 1 was "launched ... in accordance with the Soviet IGY programme".³⁷ The U. S. committee responded by distributing its own ephemerides for the two objects then in orbit, through the Agiwam system.³⁸

There followed a period of acute misunderstanding and disagreement. Replying to a further telegram from Day, Boulanger listed 26 foreign observing stations to which his committee was already supplying ephemerides for Sputnik 1. This was not yet being done through Agiwam, but Boulanger stated that the IGY network would be used from the beginning of November.³⁹ At about the same time the deputy president of the Soviet Academy's Astronomical Council, A. G. Masevitch, wrote to Fred Whipple, director of the Smithsonian Astrophysical Observatory (SAO), who had proposed the first international nomenclature for satellites, and whose observatory was coordinating the Moonwatch program for optical satellite observations by voluntary groups. The purpose of her letter was to inform Whipple, "according to our agreement with Mr. L. Campbell in Barcelona", of the telegraphic codes which the Soviet committee proposed to use when transmitting ephemerides, and which it desired observing stations to use when sending data to Moscow. She added that stations in the USA, Japan, and South America (areas not yet represented in the Soviet distribution list) would also be supplied with predictions, about 48 hours in advance of the relevant transit, as soon as their precise geographical coordinates and IGY station numbers were sent to Moscow.⁴⁰

Seemingly unaware of these favourable, if tardy, developments, Berkner wrote to Chapman on 7 November with his considered opinion as to the degree of compliance and non-compliance of the Soviet committee with the existing IGY agreements about cooperation in respect of satellites. The Soviet committee, he thought, had probably met the requirements of the IGY in respect of advance notice and early publication of orbital data, especially in the case of Sputnik 2, which had been launched a few days earlier on 3 November. But little of that information, such as it was, had been sent through IGY channels. He accepted, also, that it would be unreasonable to expect the results of on-board experiments to be communicated internationally for some time. However, "we should reasonably expect ... under the CSAGI agreements to have early and frequent information from the Soviet Union on its orbital observations and on its telemetry code in order that scientific information from the satellite could be observed and interpreted by observers of other nations. In my opinion, failure to provide this information promptly seems inexcusable on their part, and with this I am sure you must agree." He concluded by expressing strong support for an attempt which was currently being mounted by Day to secure the attendance of Soviet scientists at a meeting on satellites to be held at the Royal Society at the end of November, which could be extended for a second day for the express purpose of hammering out a clear arrangement on the exchange of satellite information, by which the Soviet committee might thereafter feel itself to be bound.⁴¹ Chapman responded on 20 November. While he agreed with much that Berkner had said, he disagreed strongly with his interpretation of the IGY rules on the matter of telemetry codes. As Chapman pointed out, the ability of foreign observers to record but not interpret the telemetry from the sputniks was no different in principle to that which "was expected to arise from the US satellites" - perhaps a tactless remark, in view of the fact that none had yet been launched.⁴² Nicolet had already sent Chapman his own opinion to the same effect, namely that Berkner was reading far too much into the IGY rules. In Nicolet's typically brusque opinion, the rules had been written by the Americans and were now being followed by the Russians.⁴³

Apparently as unaware as Day of what Masevitch was doing, V. A. Troitskaya, the secretary of the Soviet IGY committee, cabled Day on 14 November to the effect that precise orbital data could not be supplied "as satellites still move about in space". Such information could only be supplied at some indefinite future date, "after final reduction of observation results".⁴⁴ A

week later, Belousov informed Day that the Soviet committee would not now be sending a representative to the second part of the Royal Society meeting, which was therefore cancelled.⁴⁵

A few days later the cooperation pendulum swung yet again, when Bardin sent Day a detailed proposal for the transmission of ephemerides from the Moscow Research Institute of Terrestrial Magnetism, Ionosphere and Radio-Wave Propagation (NIZMIR) to observers around the world, and the transmission of data on Soviet satellites from foreign observers to Moscow. Though Day was sceptical at first, he soon realised that the new Soviet proposal would have to be taken seriously.⁴⁶ In December he replied to Bardin with a letter agreeing that the interchange of visual observations, both between observers and between the two IGY World Data Centres (WDCs), one in the Soviet Union and the other in the United States, and between those Centres themselves, to which a third was about to be added in Britain, was now a priority. The second type of data exchange had not yet begun, but should do so immediately.⁴⁷

Day first tried, unsatisfactorily, to incorporate the new Soviet communication codes into the existing text of the Guide.⁴⁸ Then in January he went to Moscow for a full discussion with the Soviet committee on all aspects of data exchange. The meeting was conducted amicably, despite the continuing dispute between the U. S. and Soviet academies over the latter's claim that parts of the upper stage (Alpha-1) of the Sputnik 1 carrier rocket had crashed on U. S. territory after reentry from orbit, and should therefore be returned to the Soviet authorities.⁴⁹ At this meeting the chairman of the Soviet committee's working group on rockets and satellites, E. K. Fedorov, presented Day with a complete redraft of the Guide chapter which proposed several important changes. The time-frame for a launch announcement and initial details of orbit was relaxed still further to "the day of launching". Orbital predictions should be supplied only "to the institutions participating in observations", in other words, in return for data supplied by them. Preliminary accounts of satellite observations and a description of the on-board experiments should be published several weeks after a launch. Full scientific reports should be published within a year. No explicit provision was made for observers to send their observations or recordings of one country's satellite to a WDC located in another country, although this was already being done. In a subsequent letter repeating the Soviet proposals, Fedorov categorically rejected the possibility of sharing the telemetry codes, and hence the unreduced experimental data, with other scientists: "All investigation work and the whole analysis of observational data should be done by the launching country". The letter underlined the impression already received by Day, that the Soviet proposals were not intended for further discussion.⁵⁰

Undismayed, Day presented a further revision of the Guide, now incorporating what he saw as "the two programme principle" insisted on by the Soviet committee, to a meeting of the CSAGI Bureau in Brussels on 27 February. This document was rejected by Belousov in March, with a statement that he could not accept anything beyond the Fedorov draft. A series of amendments proposed by the U. S. committee, however, were incorporated into the February draft. Berkner, as the IGY discipline reporter, then authorized this version both for distribution by Day and for inclusion in the Manual on Rockets and Satellites, which was to be published in July in time for the Moscow CSAGI Assembly. At Berkner's suggestion, a statement was added to this section of the Guide, explaining that, because of the novelty of satellite experiments, certain aspects of the data exchange could not yet be finalized, but that meanwhile Berkner's own proposals on the exchange of precision observations, and on depositing the reduced satellite data at the WDCs, were being appended as a basis for discussion at the forthcoming CSAGI conference in Moscow.⁵¹

At the CSAGI Bureau meeting in February, Berkner reported that the three IGY satellites launched to date, two Soviet and one American, had yielded "very substantial scientific information". There had been "some delay and problems" with the exchange of orbital observations of Sputnik 1, caused by "understandable failure to foresee the exact problems of encoding and communicating the necessary information", but a better system had now been devised "through close collaboration with the nations concerned". "Certain necessary revisions in the World Data Guide" were being worked out with Day, and "Certainly future problems remain to be solved as might be expected in dealing with such a new form of scientific activity."⁵²

On 20 May Fedorov wrote again to Day, flatly rejecting the revised version of the Guide that had been circulated in April. Perhaps because of the obscurity of the circumlocution "primary prediction authority", which Day had started using to refer to the national committee that a satellite belonged to, Fedorov mistakenly supposed that there were now no provisions requiring observers to send their data "to the country that launched the satellite". He also rejected out of hand any obligation to pass "to certain scientific institutions ... the unprocessed data of registration of different measurements carried out on rockets and satellites".⁵³ Since Berkner's suggestion, appended to the April version of the Guide, had carefully explained that the data in question should first "be reduced and corrected as may be necessary to put them in the form of physically significant parameters useful for scientific analysis", it seems likely that Fedorov had recast this as an unreasonable request for raw data, simply in order to reject it. Drawing attention to the likelihood of linguistic confusions, Day wrote to Berkner that the completion of the Guide would now have to be left to the CSAGI Assembly, due to open in Moscow on 29 July.⁵⁴ More than two-thirds of the way through its course, the IGY was still without an agreed structure for scientific cooperation on satellites.

5) The Moscow Assembly

At the CSAGI Assembly in Moscow, discussions about scientific cooperation on satellites were distracted both by positive and by negative developments. On the positive side, scientists were naturally more interested in sharing and discussing some of the earliest results of satellite experiments, than in discussing a set of bureaucratic rules about future exchanges of data. On the negative side, the conference was racked with severe political disagreements between Western delegations and the Soviet hosts, which placed considerable tensions on all participants, and which sometimes meant that experienced delegates were unable to attend a formal session, because they were caught up in something going on elsewhere behind closed doors.⁵⁵

The working group on rockets and satellites was chaired by Homer Newell, convenor of the U. S. committee's panel on IGY rocket experiments, in his capacity as Berkner's alternate. At the end of the meeting Newell was obliged to report that it had been impossible for American and Soviet scientists to reach agreement on the outstanding issues of data exchange in respect of satellites. In his view, the resolutions passed by the working group "are so general that they do not guarantee an automatic and adequate flow of the kinds of data needed to make it possible for researchers in countries other than launching countries to conduct research on artificial satellites and the radio signals from them."⁵⁶ In a subsequent confidential report he summarized these disagreements as arising from "a firm party line: ... don't give away any basic rocket and satellite data. ... They refused to: (a) provide orbital elements for Soviet satellites during the satellites' lifetimes; (b) provide precision radio tracking data for satellites; (c) agree to an automatic dispatch

of basic data to the World Data Centers.⁵⁷ Berkner's suggestions for the Guide, in particular, seemed "to upset them".⁵⁸

Another type of data which Soviet delegates at the Moscow Assembly refused to supply were the physical characteristics of rocket stages placed in orbit, on the grounds that studying such objects had "no scientific value". When the Americans proposed to cease sending orbital predictions for such objects, however, Massevitch reportedly contradicted herself by stating that after all, they were "of some scientific value". The line on withholding information about operational aspects of the Soviet satellites was firmly held, and Newell formed the impression that "the day's work was being reviewed each evening, and specific orders issued with regard to the position to take up on the following day".⁵⁹

Other U. S. delegates also noted "a rather sharply drawn line between the research effort and the 'hardware' by means of which the research was accomplished". Logical contortions, or simple silence, were resorted to whenever the discussions in Moscow showed signs of crossing this line.⁶⁰ Discussing this distinction, Newell emphasized that "basic data" were usually essential to establish the methodological credentials of a piece of research. His impression was that such material was provided in some of the papers on upper atmosphere rocket experiments, but was rigorously withheld in respect of satellite experiments. American attempts to acquire operational data about the Soviet satellite program beyond the confines of the conference, such as from the Sputnik Exhibition which was staged in Moscow to coincide with the CSAGI and IAU Assemblies, were also frustrated.⁶¹

A careful reading of the actual amendments to the Guide which were agreed by the Moscow working group, however, suggests that Newell's reproaches, though not without grounds, may have been overdrawn. On the third point, §17 of the Guide, the Soviet delegates did indeed refuse to send such data automatically. But on the first and second points, §§ 8, 9 and 13 in the Moscow version of the Guide committed every launching authority to give the approximate orbital characteristics of its satellite within 24 hours of the launch, to relay orbital predictions to observing stations, and to lodge reduced results of precision observations of the orbit with World Data Centres within six months. The main effect of the Moscow amendments was to delete all references to "complete" data, and to substitute such phrases as "results ... necessary for processing scientific experiments", or "the observational scientific data concerned" with a particular experiment.⁶² The Soviet scientists were not, then, refusing to hand over *any* basic data from their satellite observations and experiments. But they were certainly refusing to hand over *all* their data, and reserving the right to choose what they would hand over, and to whom. It is relevant to note that the U. S. State Department may not have given its final approval to Berkner's proposal for exchanging the complete precise orbital data, either, prior to the Moscow Assembly.⁶³

The working group meetings in Moscow appear to have ignored the slightly variant version of the Guide chapter given in the official Manual on Rockets and Satellites. The Moscow revision of Day's April draft thus became the final text of the Guide. It was circulated in October 1958, shortly before the end of the Year, and published in the *Annals of the IGY* in 1959.⁶⁴ The U. S. and Soviet IGY committees both agreed to an *ad hoc* extension of the IGY for the calendar year of 1959, a period known as the International Geophysical Cooperation (IGC). But there was no meeting of the full CSAGI Assembly or an equivalent successor body during this period, nor of its working group on rockets and satellites. The ICSU Assembly of October 1958 in Washington had created a new Committee on Space Research (COSPAR), which was intended to take over the

functions of the IGY working group. However, Soviet objections to its constitution meant that it was unable to contribute to the development of the principles of international cooperation on space science until the early 1960s. Chapter XI of the CSAGI Guide, including the important disagreements and reservations entered by the Soviet Union and the United States, therefore remained the last official word on this subject for some time.

6) Exchanging Data

Whatever may have been the contents and status, at any particular date, of the arrangements for cooperation on scientific satellites proposed by the CSAGI Guide, the overt purpose of including a rockets and satellites discipline within the IGY, as with all its other disciplines, was to promote the exchange of relevant geophysical data and research findings between the participating committees. The effectiveness of this part of the IGY can therefore be assessed, at the cost of a little repetition, from the extent to which such exchanges actually took place. Unfortunately most of the primary evidence on this aspect of the IGY derives from internal documents or public exchanges in which either the United States or the Soviet Union, but most often the United States, tended to assume that what it wanted to happen was what had been positively agreed to by the other party, instead of listening carefully to what the other party had actually said it would or would not do.

The accusations of bad faith levelled against the Soviet IGY committee by Odishaw and by the director of the U. S. National Science Foundation, Alan Waterman, within less than three weeks of the opening of the space age on 4 October 1957, were not a good omen for how such matters would be handled over the next two years.⁶⁵ One typical U. S. document, written around 18 November 1957, contrasted the detailed descriptions of Vanguard instrumentation, telemetry and experimental plans which had been circulated during 1956 and 1957, with the absence of such information from Bardin's document of June 1957. It went on to characterize Soviet information on the first two Sputniks as "belated and somewhat incomplete" and "ineffective", by comparison with the "detailed orbital data" on Sputnik 1 which had been sent by the U. S. committee to all the others, and specifically to the Soviet Academy on 27 October 1957. Although it noted that the proposals on data exchange in the CSAGI Guide had not been formally adopted by the Washington Conference, the document tended throughout to treat them as a set of mutually agreed 'rules' which the Soviet Union was infringing.⁶⁶

The early, unilateral versions of the Guide had included a recommendation, later dropped, that a launching authority should announce the "approximate period of launchings" in advance. With the exception of Sputnik 1, both the United States and the Soviet Union were generally held to have complied with this, usually through press statements or news broadcasts.⁶⁷ In respect of prompt announcements of a successful launch, both sides also complied, except that the Soviet authorities used the official IGY Agiwam channels only for one satellite, Sputnik 3, on the day after its launching, and for two lunar probes launched in 1959.

The hasty condemnations of their Soviet colleagues by a few American scientists are all the more puzzling, in retrospect, in the light of early moves by the Soviet committee to establish a modest level of cooperation. As noted above, Sputnik 1 was confirmed as an IGY experiment on 18 October. The delay seems to have been a matter of confusion rather than deliberate obstruction. Then on 31 October Boulanger sent Day the list of 26 stations outside the Soviet Union to which predictions were already being sent, adding that predictions would be circulated on

the Agiwam network from the beginning of November.⁶⁸ Meanwhile Massevitch had already written directly to Whipple on 26 October, arranging to send predictions to the SAO, and promising to send them to observatories in the USA, South America and Japan, as soon as the relevant coordinates were provided.⁶⁹ Predictions for Sputnik 2 began to be received at the SAO on 5 November.⁷⁰ Thereafter something seems to have gone wrong, perhaps as a result of Odishaw's bilateral intervention into a process that was being fostered with some success by Day from Brussels, in his role as IGY Coordinator, or perhaps because the Soviet committee was rethinking the proposed arrangements. For whatever reason, the Soviet committee never did distribute its predictions through Agiwam, and did not even copy to the CSAGI office those which were already being distributed to a limited number of stations. There also seems to have been an interruption in the supply of predictions to the SAO.⁷¹

The Soviet committee continued to show an interest in *receiving* observational data on their own satellites from abroad. At the end of November Bardin sent Day the proposed codes for such messages, and Massevitch sent Shapley a list of 68 satellite-observing stations in the Soviet Union, complete with coordinates.⁷² But that this was not expected to be a one-sided arrangement is shown, first, by the fact that Bardin included outward codes for the transmission of ephemerides to foreign observers of the sputniks, and second, by the explicit Soviet proposal, in January, to amend the Guide so as to underline the reciprocity of such exchanges.

In December the U. S. committee responded by sending a list of visual (Moonwatch) stations to Massevitch. This was followed in March with a combined list of over 100 stations, which included not only U. S. stations but also those established by other national IGY committees in cooperation with the U. S. committee and the SAO.⁷³ But the Soviet committee apparently made few if any changes to its existing distribution of orbital predictions.⁷⁴ By July 1959 the flow of predictions to the SAO had dried up, but visual and photographic observations of Soviet satellites from Soviet stations were still arriving at a rate of about two messages a week.⁷⁵ In May 1959 an *Izvestiya* article stated that over 70,000 "tables of observations", from all IGY fields, had been supplied to foreign investigators from the World Data Centre B in Moscow.⁷⁶

While the Soviet committee generally declined to publish the codes for interpreting telemetry from the early sputniks, the code for the cosmic ray detector on Sputnik 3 was given to an American scientist at the Moscow Assembly in August 1958, and was regularly used by foreign scientists thereafter.⁷⁷

In the sphere of scientific results, the Soviet committee's *Preliminary Report* on Sputniks 1 and 2 was published at the end of January 1958, much as required by the provisional IGY arrangements. The first report on work with meteorological rockets in the Arctic and Antarctic followed in March.⁷⁸ A preliminary scientific report on the first two sputniks appeared in August 1958, and a final one in March 1959. Although this was after the one-year deadline specified for the IGY, the stipulation could not be said to have been seriously breached, in view of the numerous scientific papers based on observations and measurements with the first two sputniks which had already been presented at the Moscow Assembly, some of which were also published in Russian journals during 1958.⁷⁹ The Sputnik 3 experiments were also covered in some of this literature, and studies of the orbit of its upper stage (1958 1) were published from December 1958. A final scientific report on Sputnik 3 appeared in May 1959, carefully meeting the one-year deadline.⁸⁰

Just as the U. S. committee had given a far more detailed account of its satellite-launching plans in advance, including technical details of the launch vehicle which were never matched by any information from the Soviet Union, so too the data and reports on satellite observations and experiments which were circulated by the U. S. committee, on both Soviet and American satellites, were both prompt and abundant. The set of documents drawn up by the U. S. committee in 1959 (reproduced below as Appendix A) omits some of the earliest Soviet information, and includes on the American side of the expression several items which hardly amount to satellite data or results, such as bibliographies. But it should be added, in fairness, that if the lists were to be completed with the advance descriptions of satellite experiments and equipment supplied by either side, the balance would certainly tip still further in the Americans' favour. Nor do the summary entries convey the real extent of the American cooperation; for example, on every working day between 16 May 1958 and 16 July 1959 the SAO sent about eight to ten observations, of all satellites, to the Agiwarn centre at Fort Belvoir for onward distribution to the global IGY network, including of course the Soviet Union.⁸¹ (The Fort Belvoir facility may not have forwarded them daily, but it certainly did so several times a week.) One noticeable feature is the regular use of the Agiwarn network, for launch announcements, that was made by the U. S. committee, in accordance with the Guide. Another point worth making is that some of the fully processed scientific observations took many months to complete and publish, just as they did in the Soviet Union.

The U. S. satellites made more use of interrogated, and less of continuous telemetry than the early sputniks, with the result that Soviet tracking stations were less able to record U. S. telemetry and therefore less interested in acquiring the codes for processing it, even though they were made available.⁸² From Berkner's original draft onwards, all versions of the CSAGI Guide included a clause which went unchallenged, and which read in its final version as follows:

"18. Raw data whether film records of optical observations, primary records of radio observations and telemetered signals are not suitable for exchange but it is expected that they will be available for consultation through WDCs when so requested."⁸³

The continuous radio telemetry of Sputnik 1 was broadcast for 23 days, that of Sputnik 2 for 7, and that of Sputnik 3 for 691, thanks to its use of solar-powered batteries. Very large amounts of the raw data were thus able to be recorded by tracking stations outside the Soviet Union. One of the bitterest disputes between the U. S. and Soviet committees, in respect of this part of the IGY, began with a Soviet claim that such recordings "are not forwarded to the Soviet Union immediately", "in spite of the existing thesis of the CSAGI Guide for WDC".⁸⁴ References in the document to the U. S. Atlas communications experiment in December 1958 and to unpublished information from Explorer IV, namely its Project Argus data, suggest that it was probably intended to make anti-American propaganda at a time when the disputes in COSPAR and the U. N. Space Committee (COPUOS) were extremely severe. There was however a genuine issue at stake, and one which had not been resolved by the IGY discussions, because they had tended to assume that the raw data from a satellite would be in the hands of its launching authority, and because they had overlooked the fact that the WDCs would be expected to harmonize their holdings by copying material between themselves.⁸⁵ The Soviet committee could not in fact point to any provision within the IGY arrangements which required the transfer, let alone the immediate transfer, of such material, but their moral case was superficially strong. The propaganda problem was, however,

that such recordings had already been handed over by U. S. scientists to their Soviet colleagues, as the Soviet note itself remarked.

By May 1958 Donald Menzel, director of the Harvard Observatory, had already been in correspondence with Fedorov about the handling of recordings of signals from the sputniks. He had also already sent "some tapes" directly to the Soviet Union. Under Odishaw's guidance, the U. S. IGY office told Menzel that they were "interested in getting these tapes for transmittal to the U.S.S.R. as a part of the IGY program", and asked how much material might be involved. Menzel estimated that at that point there were between 50 and 100 tapes in the hands of various groups.⁸⁶ Odishaw wrote to Belousov offering to send tapes of sputnik signals, and asking for tapes of Explorers 1 and 3. Belousov replied thanking him for the offer and regretting that the Soviet committee had no tapes of the Explorers. At the end of July six tapes of Sputnik 1 telemetry were delivered to the Soviet committee at the CSAGI Assembly in Moscow, and a further six, of Sputniks 1 and 2, were delivered to the Soviet Embassy in Washington in August. In September and October the Soviet committee sent requests for tapes of Sputnik 3. Odishaw replied asking for tapes of Explorer 4, which "you must have" in view of its higher inclination. The Soviet committee simply repeated its request, and the Americans handed over 34 tapes from Sputnik 3 on 31 December 1958. A Soviet request for more Sputnik 3 tapes, in February 1959, was countered with another request for Explorer 4 tapes in April.⁸⁷

Although the record of these exchanges dries up with Odishaw's understandably curt reply to Belousov at the end of July 1959, it seems safe to conclude that the Americans never received any tapes of their satellites' telemetry from the Soviet Union, and that the last tapes sent to the Soviet Union by the U. S. committee were those despatched at the end of 1958.⁸⁸ But in late July or early August 1959 one further tape (at least) was probably sent directly from the University of Alaska's Geophysical Institute to the Soviet physicist M. G. Kroshkin, who had sent the request in February 1959 (repeated in March) referred to above. Once again Odishaw expressed a preference for placing such exchanges on an official basis, preferably through the World Data Centres, but did not finally intervene to prevent a direct transfer, which presumably ensued.⁸⁹ The sending of this tape is of particular interest, in view of Belousov's accusation in May, that "The most valuable in scientific respect part of these records made in Alaska has not been received at all."⁹⁰

The Soviet satellite tracking stations were all sited within the U.S.S.R., and hence unable to record the continuous telemetry from their satellites while over the southern hemisphere. Berkner, for one, had long recognized the potential scientific value of such data.⁹¹ A Soviet request to the Australians for records of the southern telemetry of Sputnik 3 is known to have been refused.⁹² It is not known whether any of the tapes of sputnik telemetry given by American scientists to their Soviet colleagues contained such data.

The official picture of the extent of scientific cooperation in respect of the IGY satellites is given by interim and final catalogues of the holdings of the WDCs in January 1959 and December 1962. The first of these was compiled from the WDC A report, with some input from WDC C in Britain, but none from WDC B in Moscow. It includes only two Soviet documents, and omits the "Preliminary Report" on Sputniks 1 and 2 which had reached Washington in February 1958, and seems to be unreliable for that reason alone.⁹³ The holdings of Soviet material in WDC A must surely have increased quite rapidly during 1959. From one source or another, at least, Homer Newell was able to produce a comprehensive comparative survey of the space science

achievements of the United States and the Soviet Union, by the end of the year.⁹⁴ The final catalogue of WDC holdings, drawn up in consultation with all three WDCs, was published in the *Annals of the IGY*. It lists extensive series of Soviet orbital reports on Soviet satellites, as well as hundreds of scientific papers from Soviet scientists. None of the handful of raw data records held in WDCs A and C was of Soviet origin, and no such holdings are recorded for WDC B. Using a crude measure of page-length, American contributions of all types outnumbered those from the Soviet Union in an approximate ratio of 3 to 2. No Soviet scientific papers discuss the orbits or experimental data from American satellites. Dozens of papers by American and other Western scientists discuss the orbital data, and some the experimental data, from Soviet satellites.⁹⁵

7) Discussion

The events related in this paper show that the IGY-IGC period was not some golden age of cooperation between the early satellite programs of the Soviet Union and the United States. It is probably more useful to see the IGY interactions over satellites as continuous with the frictions in COSPAR and COPUOS which immediately followed them. Such agreements over satellite cooperation as it was possible to reach within the IGY structures were arrived at only tardily, in the middle of 1958. They were imperfectly devised, incomplete, and marred with get-out clauses. Even such as they were, the Soviet committee failed to observe the clauses which had apparently been agreed, for example in the matter of distributing orbital predictions through the Agiwarn network. The last part of this paper will summarize what the author suggests were the obvious and less obvious causes for things having been so.

The first consideration must be the unusual properties of satellites in respect of international scientific cooperation, especially as it was understood at that time. The remainder of the IGY was conducted, for the most part, within a traditional structure of national compartmentalization. The plans of national committees were strongly coordinated for each discipline or sub-discipline, above all in respect of making similar, often synchronous, observations with similar instruments. But the actual work of taking such measurements was not done publicly, in the direct presence of foreign colleagues. They were taken at the various stations equipped and manned for that aspect of the discipline by a team sponsored by a national committee. Data were subsequently 'worked up', reduced and tabulated, and only deposited with a World Data Centre in due course, when they were thought to be ready. By general consensus, the initial scientific analysis of the data was held to be the privilege of the primary observers, or their close institutional or national colleagues. Multinational or transnational scientific enterprises were still exceptional during the IGY. Some scientific teams from relatively developed countries, such as Poland, the Netherlands and the Soviet Union, mounted major or minor expeditions to less developed countries or colonial territories, such as Viet-Nam, Curaçao and Egypt, respectively. Oceanographic expeditions naturally visited many countries and sometimes internationalized their personnel to a small degree. In Antarctica there was an internationally-staffed Weather Central under U. S. overall control, and some other exchanges of personnel. The Trans-Antarctic Expedition was staffed by several countries, but only on an 'old Commonwealth' basis. The strongest internationalization in Antarctica was that addressed to meteorology, both for immediate practical reasons and also because of the long transnational tradition in that science, itself the product of obvious scientific requirements.⁹⁶

The conduct of the early Soviet space program shows many signs of insisting that the separation of national efforts, which was the dominant pattern elsewhere in the IGY, should be applied to satellites also. They would launch the scientific packages, collect the data, tabulate the data, and write the papers. They would then publish the papers and deposit the reduced data at WDCs in their own time. They were not interested in receiving raw satellite data from U. S. satellites or providing their own to other scientists. However, Soviet scientists were powerless to alter the fact that their satellites were public objects. The physical characteristics of their orbits and continuous radio signals were exposed to anyone, from school-children to intelligence agencies. But in Western countries that did not mean that data downloaded by a military service, for example, would automatically have been placed at the disposal of the local IGY committee.

The attempt to develop cooperation in respect of the IGY satellites also suffered from the close involvement of the new technology with the top secret missile programs of the Soviet Union and the United States. In the prevailing circumstances, the U. S. demand for a full and immediate disclosure of all the 'operational data' from the Soviet satellites was certain to be perceived, and rejected, as an attempt to acquire military intelligence. U. S. IGY officials certainly did consult regularly with the State Department and occasionally with the C.I.A., and U. S. scientists attending foreign conferences were routinely required to report back on any matters that might be of interest to their government, as, doubtless, were Soviet scientists also. There were of course perfectly legitimate scientific reasons for American scientists to wish to discover, if they could, how their Soviet colleagues were adapting their instrumentation to cope with the stresses of the on-board and near-space environments. But the fact was that many of those problems also had to be addressed in missile and warhead development, and they could not be freely discussed without careful scrutiny by the relevant security agencies on each side. Soviet scientists were probably entitled to be suspicious in this area. There were no similar demands from the U. S. committee about the specifications and performance of Soviet lorries taking scientific instruments into the Libyan desert, even though the lorries, too, may have affected the eventual scientific results. One other aspect of this part of the problem, already mentioned above, is that the Soviet IGY committee probably had no control over, and not much liaison with, the group of scientists and engineers under Korolev who were actually charged with launching the first sputniks. (A somewhat similar situation developed in the United States when the U. S. Army's Explorer project was added to the IGY program after Sputnik 1.)

There must also have been widespread considerations of 'face'. The Soviet Union came late into an IGY program that was dominated by the United States and its allies. The U. S. scientific agenda had become the IGY agenda; their norms were assumed to be 'the' norms of international science; they already held the key positions and were writing the rules. Prestige plums, such as the South Pole station, were already spoken for. Intentionally or not, the United States also became the Year's chief paymaster. By contrast, it is evident to anyone reading between the lines of the few contemporary accounts of the internal Soviet preparations for the IGY that there were enormous organizational, logistical and financial problems to be overcome. Much of the infrastructure for the Soviet IGY program was simply not in place until the middle of 1958 or later.⁹⁷ (This single fact, more than any other, explains the Soviet determination to extend the Year through 1959.) Faced with difficulties arising from the relative backwardness of their country,⁹⁸ Soviet scientists may sometimes have needed to conceal the fact that they were *unable* to do something behind arguments which stated that they could not *agree* to doing it. With the benefit of hindsight, it is possible to see that if the Americans had had a better appreciation of

how long the sort of things they were looking for were bound to take in the Soviet Union, and had exercised a little more patience even while letters slowly limped from one country to another (by modern standards), there might have been far less friction. On the other hand, exactly the same point can sometimes be made about the Soviet committee. Kroshkin wrote asking for further data from Sputnik 3 in March 1959; by April the Americans were moving to meet his request, but in May there came Belousov's intemperate intervention into the process. A little more patience in Moscow and Kroshkin would have received the Alaskan data far sooner than, presumably, he did, and much heat and fury would have been avoided.

Also in the matter of 'face', the willingness of the leadership of the U. S. delegation to rain on the Soviet parade, at the 5th CSAGI Assembly in Moscow, can hardly have smoothed the way for negotiations in the rockets and satellites working group or any other part of the meeting.

Considerations of prestige were also present on the American side, of course, especially between 4 October 1957 and 31 January 1958. The hasty American accusations of bad faith, over Sputnik 1, were not only churlish but also short-sighted, since they probably did much to set back negotiations over space cooperation which were still at a very early stage at the end of 1957.

Finally, however, it is important to remember that the satellites portion of the IGY was at best a mating of scorpions, conducted in a fog of mutual prejudice and mistrust which the rational ideals of international scientific cooperation could only partly dispel. From time to time in their internal discussions, American IGY scientists consciously reminded each other that they were dealing with foreigners, and should make due allowance for the strange expectations and ways of doing things of such people. In the case of the feared and detested communist enemy, however, it must have been enormously difficult for scientists passionately committed to Western ideals, as nearly all of them were, to go on making such allowances indefinitely. And the same could doubtless be said, *mutatis mutandis*, about the obverse relationship. The feelings of triumph, pride and sheer relief must have been overwhelming for Soviet scientists who worked on the early sputniks, and the temptation to snub the Americans *for a change* must sometimes have proved just as irresistible to others, as it did to Fedorov in January 1958.

Taking all these difficulties into account, however, what is really striking about the Soviet IGY satellite program is not that the level of cooperation achieved was so imperfect, but that there was after all some degree of useful scientific interaction and exchange, even on such a militarily sensitive topic in the depth of the Cold War. As one optimistic scientist told the U. S. IGY committee, and anyone else who may have been reading over its shoulder, in his confidential report on the Moscow CSAGI Assembly:

"The most important over-all conclusion to be reached from the Moscow Conference, however, is not that cooperation was sometimes difficult and incomplete, but on the contrary that there was indeed more cooperation than ever before and that with patience and understanding it may yet be possible to achieve a working relationship among scientists as far apart as the United States and Soviet Union."⁹⁹

About the Author

Rip Bulkeley is an independent historian of science living in Oxford, England. He has been working on the history of the International Geophysical Year since 1991. During this project he has been assisted by research fellowships from the Royal Society and the Leverhulme Trust, as well as a Smithsonian Visiting Fellowship (1992-93) at the National Air and Space Museum, Washington. He is the author of The Sputniks Crisis and Early United States Space Policy, Macmillan, 1991. He is currently completing a monograph on scientific cooperation and the origins of the Antarctic Treaty.

Notes and References

Abbreviations (a) General - B: = Box; D: = Drawer; F: = File; CF = Central Files; IGY = IGY Archive.

(b) Archives - CNA = Canadian National Archives, Ottawa; CP = Sydney Chapman Papers, University of Alaska; DDE = Dwight D. Eisenhower Library, Abilene; SP = John Simpson Papers, University of Chicago; NAS = U. S. National Academy of Sciences; NHO = NASA History Office; RS = Royal Society.

¹"Draft Report of the Meeting of the CSAGI Bureau with the Soviet Delegation at the IUGG Assembly", Rome, 25 September 1954 - CP, B: 62, F: 254.

²This was also announced in *Soviet News* on 11 March 1955.

³Chapman-Bardin, 4 April 1955 - CP, B: 62, F: 254; Chapman-Belousov, 8 May 1955 - *ibid.*

⁴Nicolet-Bardin, 5 August and 1 September 1955 - CP, B: 62, F: 254, and B: 52, F: 51.

⁵Wyckoff-Odshaw, 26 September 1955, "Report of Activity at CSAGI Meeting in Brussels" - NAS IGY, D: 18, F: TPESP Sat. Corr. Jan.-Sep. 1955.

⁶A full and clear account of the Porter-Sedov encounter at a conference in Freudenstadt, which was the principal source of this information at the time, is contained in "The USSR Satellite Program for the International Geophysical Year", DSI Report No. 8/56, Canadian Department of National Defence, July 1956.

⁷Berkner-Chapman & Nicolet, 29 February 1956 - CP, B: 53, F: 65.

⁸Berkner-Nicolet, 9 April 1956 - *ibid.*

⁹*Annals of the IGY*, vol. VI, p. 457. Only one Soviet rocket scientist, S. M. Poloskov, went to Barcelona, and nothing is known about the extent of his participation in the relevant discussions.

¹⁰John Hagen, the director of the Vanguard program, sent details of the American satellite, including its telemetry frequency, to the British IGY committee on 1 August 1956 (RS, NGY/74 (56)), and the same document was sent to all national committees by Nicolet a few days later - CN-CIR-15-568/6, 6 August 1956. There were also indications in J. Van Allen (ed.) Scientific Uses of Earth Satellites (1st edn), published at about this time, that the Americans were considering the use of frequencies of the order of 100-200 megahertz, but no precise figure was given.

¹¹"Soviets Plan to Launch Space Satellite This Year", *New York Daily Worker*, 3 January 1956.

¹²The U. S. IGY Committee produced one such compilation for internal use: "A Summary of Some Recent Public Information on USSR Rocket and Satellite Developments", January 1956 - NAS IGY, D:18, F: TPESP Sat. Corr. Jan. 1956; see also the excellent Canadian DND/DSI report cited above (n. 6).

¹³"USSR Rocket and Earth-Satellite Program for the IGY", 10 June 1957 - NAS IGY, D: 19, F: TPESP Sat. Corr. June 1957.

¹⁴Translations of five articles were published in 1958 in the IGY Manual on Rockets and Satellites, *Annals of the IGY*, vol. VI, pp. 222-54. One article contains the intriguing statement that: "As a last resort, the resonant circuits may be tuned to a frequency of 40 Mc/s by using the harmonics of the generator GSS-6 (see *Radio*, No. 5, 1956)"! - O. Rzhiga and A. Shakhovskoy "Use of UHF receiver to monitor the satellite", *Radio*, No. 7, July 1957, *Annals of the IGY*, vol. VI, p. 253. Until this reference has been checked, the author assumes that the May 1956 article gave details only of the general tuning method, not of the actual frequencies or the intention to use them for satellites.

¹⁵A. M. Shakhovskoy, "USSR Amateur Radio Observations of Signals from the Soviet Artificial Satellites", *Annals of the IGY*, vol. XII, pt. II, p. 916.

¹⁶Berkner, "Draft of Preliminary Proposal" etc., 19 December 1956 - NAS IGY, D: 18, F: TPESP Sat. Corr. Dec. 1956.

The CSAGI Guide to IGY World Data Centres, 1st edn, 7 June 1957, Ch. XI (added 10 July 1957). A draft version of the "IGY Manual on Rockets and Satellites" was also circulated by Berkner at about this date.

¹⁸Fraser-Berkner, 23 July 1957 - NAS CF, F: International Relations 1957: IGY General; Berkner-Fraser, 29 July 1957 - *ibid.* The comments of Richard Porter, convenor of the satellite technical panel of the U. S. IGY committee, on what was missing from the Bardin document, put telemetry in fourth place, after launch site, launching schedule, and program agency: - MS notes on Reid circular, 24 June 1957 - NAS IGY, D: 19, F: TPESP Sat. Corr. June 1957.

¹⁹"Report of a Meeting at University College London - Friday July 26th, 1957", Guided Weapons Department, Royal Aircraft Establishment, 13 August 1957 - Australian National Archives, Adelaide, Ref. D174/T1, Item A750/1/1 Pt. 1. The Soviet scientists had also visited the Cranfield College of Aeronautics, where, on 19 July 1957, another member of their delegation, B. N. Petrov, gave a detailed account of the scientific programme planned for Soviet satellites: U.S. Secretary of the Navy to U.S. Secretary of Defense, "The U. S. Satellite Program", n.d. but early November 1957 - NHO, F: 006596. According to Harrie Massey the account of a Soviet meteorological rocket, given to the IGY Conference on Rockets and Satellites in Washington two months later, was not substantially different from that given to the British - Massey, Report on the Washington Conference, RS, NGY/117 (57). Interestingly, the Soviet scientists in Britain attributed the choice of the 22 megahertz frequency [sic] to "equipment inherited from a wartime application in other work". This suggests that it may have been a frequency in use for sounding rocket experiments for some years, but if so it does not appear to have been detected, or noticed, by the network of U. S. monitoring stations around the external borders of the Soviet bloc.

²⁰Bardin-Berkner, 16 August 1957 - CP, B: 62, F: 257.

²¹The British sub-committee on satellites first formally discussed the Soviet frequencies on 9 September 1957, three weeks before the Washington conference - RS, NGY/93 (57). The sub-committee was "profoundly disappointed that the resolution adopted at Barcelona whereby both types of satellites would radiate the same frequency has been disregarded". Nicolet seems to have first learned of the existence of Bardin's letter giving the frequencies from a press report at the end of October or early November, and only then to have obtained a copy of it from David Martin, the Assistant Secretary of the Royal Society - Nicolet-Berkner, 5 November 1957 - CP, B: 62, F: 257. In replying to Nicolet on this point, Berkner stated that the information on frequencies had already appeared in the *New York Times* at the end of July; the author has not yet been able to verify this - Berkner-Nicolet, 7 November 1957 - CP, B: 62, F: 257.

²²H. Massey and M. O. Robbins, History of British Space Science, Cambridge U. P. 1986, p. 39.

²³W. T. Blackband. See "Draft Proceedings of the First Session of the Working Group on IGY Satellite Internal Experiments and Instrumentation Program", October 1957 - NAS IGY, F: unknown. It transpired that features of the upper atmosphere, unknown at the time the proposal was drafted, rendered the method unworkable.

²⁴Blackband-Martin, 17 June 1957 - RS, NGY/76 (57).

²⁵The fact that it did in fact do so is beside the present point.

²⁶V. A. Troitskaya, secretary of the committee, described this inner circle, to which she had considerable access, especially during foreign conferences, because of her competence with French and English, as comprising Bardin and three of the committee's vice presidents, Belousov, Pushkov, and Yu. D. Boulanger. The role and status of the fourth vice president, F. F. Davitaya, was not touched on - interviews with the author.

²⁷Notes 13 and 20 above.

²⁸A. A. Needell, Science, Progress, and National Security in Cold War America: the Horizons of Lloyd V. Berkner, forthcoming.

²⁹The proposal for a satellite conference at Barcelona actually originated from Richard Porter, chairman of the U. S. IGY committee's panel on satellites, after discussions with members of the International Astronautical Federation (a body which had enjoyed more success in 'drawing out' Soviet space scientists, to that date, than had the CSAGI). But Nicolet presented it to the Soviet committee as Berkner's idea.

³⁰B. Harvey, Race Into Space: the Soviet Space Programme, Ellis Horwood, 1988, pp. 28-9.

³¹

R. Bulkeley, The Sputniks Crisis and Early United States Space Policy, Macmillan, 1991, pp. 117-18.

³²Draft Minutes, Working Group on Satellite Launching, Tracking and Computation, CSAGI Conference on Rockets and Satellites, 1 October 1957 - NAS IGY, D: 72, F: Porter 16 C (continued).

³³*Annals of the IGY*, vol. VI, pp. 458-9.

³⁴A full description of the mature Agiwarn system, including its satellites component, is given in *Annals of the IGY*, vol. VII, pt. 1.

³⁵Chapman, Closing Remarks, quoted in W. Sullivan, Assault on the Unknown, Hodder & Stoughton, 1962, pp. 69-70; see also pp. 1-2.

³⁶*Ibid.*

³⁷Day-Chapman et al., 19 October 1957 - CP, B: 62, F: 257.

³⁸Chapman's MS notes of telephone conversation, Shapley-Chapman, 4 November 1957 - CP, B: 62, F: 257.

³⁹Day-Chapman et al., 31 October 1957 - *ibid.*

⁴⁰Massevitch-Whipple, 26 October 1957 - NAS IGY, D: 19, F: TPESP Sat. Corr. Oct. 1957 (2). The reference was to the conference of the International Astronautical Federation, Barcelona, 6-12 October 1957, not to the CSAGI Assembly of 1956. By 5 November the SAO had begun to receive the Soviet ephemerides - *New York Times*, 8 November 1957.

⁴¹Berkner-Chapman, 7 November 1957 - CP, B: 62, F: 257. The accusation, that the Soviet committee was refusing to meet an alleged obligation to provide the telemetry codes for Sputnik 1, had already been sent directly to Bardin by Hugh Odishaw, the secretary of U. S. IGY committee, on 1 November, and this may well have been the source of Berkner's confident indignation here. The author has not yet traced a copy of Odishaw's letter, but however it was worded it seems unlikely to have eased the path to better cooperation. Quite independently, Day sided with Chapman and Nicolet in rejecting the American interpretation of the relevant passage in the CSAGI Guide - Day-Odishaw, 8 November 1957 - NAS IGY, D: 34, F: CSAGI General Part 5. But even a week later Day remained unaware that Soviet ephemerides were now being sent to Harvard - Day-Chapman et al., 14 November 1957 - *ibid.* In his opinion, the aim of the Royal Society meeting would be "an attempt to get things back on to the IGY rails whence they seem to have strayed." - Day-Berkner, 14 November 1957 - CP, B: 62, F: 257.

⁴²Chapman-Berkner, 20 November 1957 - *ibid.*

⁴³Nicolet-Chapman, 13 November 1957 - *ibid.*

⁴⁴In Day-Chapman et al., 14 November 1957, *ibid.*

⁴⁵Day-CSAGI Bureau, 22 November 1957 - *ibid.*

⁴⁶Bardin-Day, 25 November 1957; Day memo, 28 November 1957; Day-Bardin, 6 December 1957 - all at *ibid.* Day later told Odishaw that his conversation with Troitskaya in November, at which she handed over the new Soviet proposal, had helped him to appreciate that "their IGY admin difficulties ... are apparently little different from those pertaining in most countries. Almost everywhere a handful of workers is taking on extra IGY tasks without sufficient assistance and is striving to get organised." - Day-Odishaw, 7 December 1957 - NAS IGY, D: 34, F: CSAGI - Earth Satellites, Part 1.

⁴⁷Day-Bardin, 6 December 1957 - NAS IGY, D: 19, F: TPESP Sat. Corr. Dec. 1957. Day's wording tactfully ignored the fact that visual observations and predictions were already being sent to the Soviet committee by American and British scientists - see for example, R. W. Porter, "Summary of Report on the Earth Satellite Program", by 30 October 1957, p. 2 - NAS IGY, D: 3, Attachment to Minutes, 24th Mtg, USNC-IGY Executive Committee. Day was careful to apologize for this deliberate omission in a letter to Alan Shapley, the CSAGI reporter for World Days who was responsible for the IGY World Warning Agency, based at the

Fort Belvoir installation of the National Bureau of Standards' Central Radio Propagation Laboratory outside Washington, and therefore closely involved with the whole IGY communications system for data exchange. Day hoped that Shapley had "been able to understand the objective in my letter ... to Bardin", which had of course been to draw the Soviet committee into cooperation rather than to confront them with offensive accusations: Day-Shapley, 16 December 1957 - NAS IGY, D: 19, F: TPESP Sat. Corr. Dec. 1957.

⁴⁸Day-Berkner, 28 January 1958 - CP, B: 62, F: 252.

⁴⁹*Science*, vol. 126, # 328, 27 December 1957; Nesmeyanov-Bronk, 7 January 1958, and Bronk-Nesmeyanov, 29 January 1958, in Odishaw, memo, 14 February 1958 - NAS IGY, D: 1, F: USNC Corresp (Jan - July 1958).

⁵⁰Day-Berkner, 20 January 1958 - CP, B: 62, F: 252; "Amendments to CSAGI Guide to IGY WDCs suggested by Soviet IGY Committee, 6/7 Jan 1958" - attached to the former; Fedorov-Day, 20 January 1958 - *ibid.* See also Day-Berkner, 28 January 1958 - *ibid.*

⁵¹The 27 February text, referred to in Berkner's letters of 21 March 1957 to Day and Belousov (NAS IGY, D: 19, F: TPESP Sat. Corr. Mar. 1958), has not been found by the author. It can safely be assumed that it was equivalent to that in the fourth issue of Amendments to the CSAGI Guide to IGY World Data Centres, 2 April 1958, minus the amendments which were incorporated from Odishaw-Day, 19 March 1958 - NAS IGY, D: 72, F: Porter 16A. There were in fact several differences between Day's version and that which appeared in the IGY Manual on Rockets and Satellites, *Annals of the IGY*, vol. VI, three months later. The main one was an additional "note" from Berkner which largely contradicted the "two programme principle" conceded by Day, by stating that observers might send their data to any computing centre they liked, and that the U.S. committee definitely wished to receive observations of Soviet satellites in order to do its own computations of their orbits - *Annals*, vol. VI, p. 468, para. (A).

⁵²Berkner, "Report on Rockets and Satellites", February 1958 - CP, B: 62, F: 252.

⁵³Fedorov-Day, 20 May 1958 - NAS IGY, D: 34, F: CSAGI - Manuals and Annals, Part 1.

⁵⁴Day-Berkner, 23 May 1958 - *ibid.*

⁵⁵Berkner was obliged to miss the conference for personal reasons. For a graphic account of the political problems as they affected one distinguished American scientist, see J. A. Simpson, "An Account of Experiences in the Soviet Union, 1958", n.d. - SP, B: 95, F: 1.

⁵⁶Newell, "To CSAGI Bureau", ca. 9 August 1958 - CP, B: 58, F: 162. This was, of course, a flat rejection of the Soviet view that telemetered data, in particular, was not intended for use by researchers from other countries, and that they themselves had no wish to receive such data from American satellites.

⁵⁷Newell, "Impressions Received During the Fifth General Assembly of the Comité Speciale pour l'Année Géophysique Internationale", 18 August 1958 - NAS IGY, D: 73, F: IGY: CSAGI Moscow Mtg. 1958.

⁵⁸Newell, "Items of non-agreement", MS notes, n.d. - *ibid.*

⁵⁹Newell, "Impressions" - n. 57 above.

⁶⁰"Comments of Delegates on the Scientific Meetings", n.d., p. 9 - NAS IGY, D: 2, F: USNC Agenda, 15th Meeting; see also P. Hart, "Report on Fifth Assembly of CSAGI, Moscow, August 1958", 29 January 1959 - NAS IGY, D: 35, F: Delegates' Reports - Moscow.

⁶¹Newell, "Impressions", *loc. cit.* n. 57; by contrast, two American scientists were easily able to buy geiger counters from a scientific equipment shop in Leningrad, of a type that would not have been publicly available in the United States at that date - Simpson, "An Account", n. 55, pp. 45-6.

⁶²"Amendments to Chapter XI", n.d., attachment 5 to Document 145, 5th CSAGI Assembly - NAS IGY, D: 35, F: CSAGI - 5th Assembly, Moscow, 1958 - Documents.

⁶³P. Hart, untitled minutes of a meeting between Hugh Odishaw and State Department officials, 14 July 1958 - NAS IGY, D: 35, F: CSAGI 5th Assembly - Correspondence.

⁶⁴*Annals of the IGY*, vol. VII, pt. II, ch.XI.

⁶⁵For the Odishaw-Bardin letter of 1 November 1957, see nn. 41 - 43 above. An anonymous memorandum, noting Waterman's proposal that "we can point out to good advantage the Soviet's lack of frankness in making available information on their earth satellite", was drafted with his approval on 23 October 1957. This suggests that Odishaw may have been responding to political guidance from Waterman, even if he ignored the latter's recommendation that the issue should be taken up through CSAGI, rather than bilaterally - "Soviet Non-cooperation with IGY", 23 October 1957 - DDE, White House Office Papers, Staff Research Group Series, B: 15, F: N. S. F.

⁶⁶MS text, 10 pp., n.d., no title, ca. 18 November 1957 - NAS IGY, D: 20, F: TPESP Sat. Corr. Undated.

⁶⁷Berkner's first draft ("Preliminary Proposal", 19 December 1956 - n. 16 above) made explicit provision for the use of the news media in this way, but Day dropped the reference from his revised version in July 1957.

⁶⁸Text of cable is in Day-Chapman et al., 31 October 1957 - CP, B: 62, F: 257.

⁶⁹Massevitch-Whipple, 26 October 1957 - NAS IGY, D: 19, F: TPESP Sat. Corr. Oct. 1957 (2).

⁷⁰*New York Times*, 8 November 1957. Soviet ephemerides and observations were first sent directly to the SAO on 5 November 1957. After an interruption of unknown date and duration (see n. 71 below), they continued from January 1958 to at least the middle of 1959. They are another striking omission from the listing of satellite data received from the Soviet Union, that was prepared for Odishaw in 1959 (see Appendix A).

⁷¹Shapley-Odishaw, 24 March 1958, states that the SAO *began* receiving regular station predictions from Moscow only on 17 January 1958. Presumably those received in November 1957 did not at first become a regular service - NAS IGY, D: 19, F: TPESP Sat. Corr. Mar. 1958.

⁷²Bardin-Day, 25 November 1957 - CP, B: 62, F: 257; Massevitch-Shapley, 26 November 1957 - *ibid.* In a subsequent interview with *Izvestiya*, 2 April 1958, Bardin amended this figure to 66.

⁷³Odishaw-Belousov, 19 March 1958 - CNA, RG77, vol. 26, F: 4-G7-S7-17 pt. 2.

⁷⁴The minutes of the British subcommittee on artificial satellites show that orbital predictions for Soviet satellites continued to be received from the Soviet committee through 1958 and on into 1959, and that visual observations and, occasionally, recordings of sputnik telemetry, were routinely despatched to Moscow from British observatories.

⁷⁵Boggs-Weldon, 21 July 1959 - NAS IGY, D: 20, F: TPESP Sat. Corr. Oct. 1959.

⁷⁶"In World Centre 'B'", *Izvestiya*, 20 May 1959.

⁷⁷Richter-Reid, 10 September 1958 - NAS IGY, D: 20, F: TPESP Sat. Corr. Sep. 1958; Space Science Board Committee on International Relations, Minutes of 2nd Meeting, 15 October 1958, p. 3 - SP, B: 96, F: 6; British IGY Committee, Artificial Satellites Sub-Committee, Radio Methods Working Group, Minutes, 4 December 1958 - RS IGY.

⁷⁸"Preliminary Report on Launching in the USSR of the First and Second Artificial Earth Satellites (1957 and 1957)", received in Brussels 3 February 1958 - *Annals of the IGY*, vol. VI, p. 488; "Information Nr.1 on the USSR meteorological rocket firings under the IGY programme", 13 March 1958 - attachment to Belousov-Odishaw, 13 March 1958 - CP, B: 62, F: 252. The preliminary report on the sputniks was received by the U. S. IGY committee on 11 February 1958, but surprisingly, and tactlessly, neither the date nor even its reception was acknowledged by the latter in the compilation "Material on IGY Rockets and Satellites sent to USA from USSR" - attachment A, Odishaw-Belousov, 31 July 1959 - NAS IGY, D: 20, F: TPESP Sat. Corr. July 1959. The early orbital predictions sent to the SAO were also ignored, or rather, their publication and re-transmission to the Soviet Union were listed as data flowing in the *opposite* direction - see item A:25 in Appendix A.

⁷⁹For details, see *Annals*, vol. XII, pt. 1, p. ix.

⁸⁰*Artificial Earth Satellites*, #2, Moscow, 1959.

⁸¹Mechau-Hart, 16 July 1959 - NAS IGY, D: 23, F: Rockets & Satellites. Shapley-Odishaw, 24 March 1958, n. 71 above, shows that the first observation of a Soviet satellite (1957) was sent to Agiwarn from the SAO on 19 March 1958. Many of the early U. S. IGY satellites orbited at low angles of inclination, which probably meant that their ephemerides were of little interest to Soviet observers - Massevitch-SAO, n.d. but ca. June 1959 - *ibid.*

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For evidence that Soviet satellites may have had some interrogated telemetry from as early as Sputnik 2, see Richter-Reid, 10 September 1958, n. 77 above.

⁸³CSAGI Guide to World Data Centres, Ch.XI, first circulated 22 October 1958.

⁸⁴Belousov-Newell, "Fulfillment of the V CSAGI Resolutions", 15 May 1959 - NAS IGY, D: 73, F: IGY: CSAGI Corresp.

⁸⁵In June 1959 a document prepared for the U. S. committee's satellite panel recognized that "there has not as yet been any definite guidance [from CSAGI] on whether this [data for exchange] should be raw or processed data" - "The US-IGY Earth Satellite Program", June 1959 - NAS IGY, D: 73, F: TPESP Meeting 21 July 1959.

⁸⁶Reid, memo for record, 27 May 1958 - NAS IGY, D: 19, F: TPESP Sat. Corr. May 1958. The Harvard Observatory had a long history of good relations with Soviet astronomers under its previous director, Harlow Shapley, both directly and through the International Astronomical Union.

⁸⁷Anon., "Notes on Belousov Communication to Newell", May 1959 - NAS IGY, D: 49, F: 646 etc. The date of March 1959 for Kroshkin's request, given in the attachment to this document, has been corrected to February in the light of: JCT-AWF, 11 February 1959 - NAS IGY, D: 49, F: 630.

⁸⁸Odishaw-Belousov, 31 July 1959, and attachments - NAS IGY, D: 20, F: TPESP Sat. Corr. July 1959.

⁸⁹Odishaw-Elvey, 30 April 1959, and Elvey-Odishaw, 7 July 1959 - NAS IGY, D: 49, F: 646 etc.

⁹⁰Belousov, "Fulfillment", n. 84 above.

⁹¹Berkner-Fraser, 29 July 1957 - n. 18 above.

⁹²J. W. Dungey, "The Radiation Belts", in D. R. Bates (ed.), The Planet Earth, (2nd edn), Pergamon Press, 1964, p. 311.

⁹³Office of Coordinator, Catalogue of IGY Data received at WDCs by January 1959, Ch. XI, March 1959. It seems scarcely credible, but might WDC A have refused to 'count' any Soviet material not addressed directly to it? At all events, the omission of the Soviet "Preliminary Report" from WDC A's listing might account for its omission from the U. S. committee's compilation later in the year (Appendix A).

⁹⁴H. E. Newell, "U. S. and U. S. S. R. Space Science Results", 15 December 1959 - NASA Release No. 59-277.

⁹⁵*Annals of the IGY*, vol. XXXVI, 1964, ch. XI, "Rockets and Satellites - Catalogue of Data in the World Data Centers", January 1963. "All papers received through December 1962 ... are included." - p. 578.

⁹⁶If the sciences of the upper atmosphere and space had been able to develop harmoniously out of meteorology, instead of breaking away from it, they might perhaps have inherited a more securely internationalist cultural viewpoint.

⁹⁷U. S. Department of Commerce, *Soviet Bloc International Geophysical Year Information*, 16 November 1957, pp. 1-12; *ibid.*, 25 April 1958, pp. 1-7; *idem*, *Information on Soviet Bloc International Geophysical Cooperation*, 12 June 1959, pp. 1-2. Also Hart, "Report", n. 60 above.

⁹⁸One possibly apocryphal rumour has it that stocks of duplicating paper for the 5th CSAGI Assembly in Moscow had to be flown in from Brussels, either because of a physical shortage or else because existing supplies could not be 'released' to the Soviet Academy even for such a prestigious event.

⁹⁹"Comments of Delegates", n. 60 above, p. 8.

October 15, 1959

SUPPLEMENT TO ATTACHMENT B
(July 1959)

MATERIAL ON IGY ROCKETS AND SATELLITES RECEIVED
FROM USSR

- | | <u>Date of</u>
<u>Receipt</u> |
|--|----------------------------------|
| I. <u>Launching and Frequency Information Via AGIWARN</u> | |
| 1. Second Cosmic Rocket to Moon | Sept. 14, 1959 |
| 2. Third Cosmic Rocket to Moon | Oct. 4, 1959 |
| II. <u>Report Series</u> | |
| A. <u>Bulletin of Stations of Optical Observations of Earth Satellites</u> | |
| 3. No. 3 | Aug. 18, 1959 |
| 4. No. 4 | Aug. 18, 1959 |
| 5. No. 5 | Aug. 18, 1959 |
| 6. No. 6 | Aug. 18, 1959 |
| B. <u>IGY Information Bulletin</u> | |
| 7. No. 7 | Sept. 1959 |
| C. <u>Results of observations of Soviet Artificial Earth Satellites</u> | |
| 8. No. 7: 1958 Delta (Rocket), May - June 1958 | Oct. 1959 |

Date of
Receipt

F. Printed Matter and Reprints

17. IGY Information Bulletin Nos. 1 - 6

as issued

G. Preprints and Reports

18. Information No. 1 on USSR Meteorological Firings

March 1958

19. Flight Information Summaries on Rockets fired in USSR during IGY. Information on flight summaries includes rocket number; location of firing; date and time of firing; flight objectives; kind of instrumentation, existence of telemetry; flight remarks (for some rockets) indicating peak altitude, parachute recovery of nose-cone, existence of concurrent biological experiments, and, for one rocket, comments on receipt of electron concentration data and on stabilization of rocket.

July 1959

20. Issue No 6 : Results of Observations of Soviet Artificial Earth Satellites (Nov. 59)

July 1959

MATERIAL ON IGY ROCKETS AND SATELLITES
SENT TO USA FROM USSR

	<u>Date of Receipt</u>
I. <u>Launchings and Frequency Information</u>	
1. Via AGIWARN, announcement of launching of Sputnik III gives inclination of orbit, apogee, period, weight, shape, one frequency, and experiments.	May 16, 1958
II. <u>Additional Cables, AGIWARN messages and AIRMAIL messages</u>	
2. Via AGIWARN, one observation of 1958 Epsilon	July 1959
3. Via cable, satellite predictions of Sputnik III for Cambridge, Massachusetts.	regularly
III. <u>Reports, Preprints, Reprints</u>	
A. <u>Rocket and Satellite Report Series</u>	
4. No. 1: Preliminary Results of Scientific Researches on the First Soviet Artificial Earth Satellites and Rockets	August 1958
B. <u>Bulletin of Stations of Optical Observations of Artificial Earth Satellites</u>	
5. No. 1	December 1958
6. No. 2	April 1959
C. <u>Bulletin of Residuals of Observations</u>	
7. (unnumbered) 1957 Beta, 4 Nov 1957 - 28 Feb 1958	March 1959
8. No. 1 1957 Beta, 1 - 10 March 1958	March 1959
9. No. 2 1957 Beta, 11 - 20 March 1958	March 1959
D. <u>Results of Observations of Soviet Artificial Earth Satellites</u>	
10. Issue No. 1: 1958 Delta (Rocket), 16 Mar - 30 June 1958	December 1958
11. Issue No. 2: 1958 Delta (Rocket), 1 July - 31 July 1958	December 1958
12. Issue No. 3: 1958 Delta (Rocket), August 1958	May 1959
13. Issue No. 4: 1958 Delta (Rocket), September 1958	May 1959
14. Issue No. 5: 1958 Delta (Rocket), October 1958	June 1959
E. <u>Artificial Earth Satellites</u>	
15. Issue No. 1: Results of Scientific Investigations conducted during the IGY with the aid of the First and Second Artificial Earth Satellites	March 1959
16. Issue No. 2: Results of Scientific Investigations received with the aid of the Third Artificial Earth Satellite	May 1959

October 15, 1959

SUPPLEMENT TO ATTACHMENT A
(July 1959)

MATERIAL ON IGY ROCKETS AND SATELLITES
SENT TO USSR

	<u>Date of Transmittal</u>
I. <u>Launching and Frequency Information Via AGIWARN</u>	
1. Explorer VI	Aug. 7, 1959
2. Vanguard III	Sept. 18, "
3. Explorer VII	Oct. 13, "
II. <u>Report Series</u>	
A. <u>IGY Satellite Report Series</u>	
4. No. 9: Symposium on Scientific Effects of Artificially Introduced Radiations at High Altitudes (15 September 1959)	Oct. 8, 1959
B. <u>Special Reports of the Smithsonian Astrophysical Observatory</u>	
5. No. 27: Research in Space Science (June 30, 1959)	Aug. 6, 1959
6. No. 28: Research in Space Science (Sept. 16, 1959)	Oct. 15, "
7. No. 28A: Research in Space Science (Sept. 23, 1959)	"
8. No. 29: Research in Space Science (Sept. 21, 1959)	"
III. <u>Preprints and Reports</u>	
9. Rocket-Grenade Observation of Atmospheric Heating in the Arctic, by W. G. Stroud et al	Aug. 6, 1959
10. A Simplified Falling-Sphere Method for Upper-Air Density, Part II: Density and Temperature Results from Eight Flights, by L. M. Jones et al	Sept. 28, "
IV. <u>Reprints</u>	
11. Eight reprints from journals of general availability	
V. <u>Tape Recordings</u>	
12. Two reels of recordings of Sputnik III signals for 15 May 1958 to 17 June 1959	Aug. 3, 1959

IV. Tape Recordings (continued)

- 85. Six reels delivered to Embassy of the USSR (Sputniks I and II).
- 86. Thirty-four reels shipped by air to Federov (Sputnik III).

Aug. 6, 1958

Dec. 31, 1958

G. Miscellaneous Preprints and Reports

- | | |
|--|----------------|
| 62. Determination of Coefficient J of Second Harmonic in Earth's Gravitational Potential from Orbit of 1958 Beta 2 by Becar et al. | Sept. 18, 1958 |
| 63. Simplified Satellite Predictions from Modified Orbital Elements | Oct. 23, 1958 |
| 64. Radiation Observations of 1958 Epsilon, by Van Allen | Dec. 20, 1958 |
| 65. Composition of the Upper Atmosphere by J. Townsend. | Dec. 17, 1958 |
| 66. Introductory Remarks for Argus Symposium, by R. W. Porter. | July 16, 1959 |
| 67. The Argus Experiment, by Nicholas Christofilos. | July 16, 1959 |
| 68. Satellite Observations of Radiation Artificially Injected into the Geomagnetic Field, by J. A. Van Allen, et al. | July 16, 1959 |
| 69. Measurement of Trapped Electrons from a Nuclear Device by Sounding Rockets, by Major Lew Allen, Jr. | July 16, 1959 |
| 70. Theory of Geomagnetically Trapped Electrons from an Artificial Source, by Captain Joseph A. Welch, Jr. | July 16, 1959 |
| 71. Optical, Electromagnetic and Satellite Observations of High-Altitude Nuclear Detonations, Part I, by Philip Newman. | July 16, 1959 |
| 72. Optical, Electromagnetic and Satellite Observations of High-Altitude Nuclear Detonations, Part II, by Allen M. Peterson. | July 16, 1959 |

H. Printed Matter and Reprints

- | | |
|--|--------------|
| 73. Smithsonian Contributions to Astrophysics, Vol. 2, No. 10: Orbital Data and Preliminary Analysis of 1957 Alpha and Beta. | July 3, 1958 |
| 74. Interim Bibliography of the IGY. | Dec. 8, 1958 |
| 75. Literature of Space Sciences and Exploration (bibliography by NRL). | Dec. 8, 1958 |
| 76. Proceedings of the IRE, February 1959: Special Issue on the Nature of the Ionosphere - An IGY Objective | May 5, 1959 |
| 77. Nine reprints from journals of general availability. | as issued |
| 78. IGY Bulletin, Nos. 1 - 24. | |

I. Copies of Foreign Data Received by WDC-A (sent as need indicated)

- | | |
|---|-----------------------------------|
| 79. Reports on Japanese Observations of Satellites for October - November, 1957 and January - May 1958. | June 3, 1958 and
June 16, 1958 |
| 80. Observations of 1957 Alpha from Pakistan. | June 3, 1958 |
| 81. Flight Summaries from British Ministry of Supply for Skylark Rockets No. 7 and 9. | June 11, 1958 and
Aug. 8, 1958 |

J. Flight Summaries for U. S. IGY Rockets

- | | |
|--|---|
| 82. Duplicates forwarded as received; also, compilation to July 1, 1958, in Rocket Report No. 2. | Dec. 11, 1958.
Jan. 9, 1959 and
Apr. 17, 1959 |
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K. Six-Monthly Catalogue of Data

- | | |
|---|---------------|
| 83. Catalogue of data in IGY WDC-A for Rockets and Satellites (January 1959). | Jan. 15, 1959 |
|---|---------------|

IV. Tape Recordings

- | | |
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| 84. Six reels delivered to Moscow at the Fifth USAGI Assembly (Sbornik I). | July 1958 |
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	as-issued
30. No. 10: Processed Observational Data for USSR Satellites 1957 Alpha and 1957 Beta (March 1, 1958)	"
31. No. 11: Status Reports on Optical Observations of Satellites 1958 Alpha and 1958 Beta (March 31, 1958)	"
32. No. 12: Miscellaneous Information on the Artificial Earth Satellites (April 30, 1958)	"
33. No. 13: Orbital Results for Satellite 1957 Beta One (May 21, 1958)	"
34. No. 14: Reports and Analyses of Satellite Observations (July 15, 1958)	"
35. No. 15: The Descent of Satellite 1957 Beta One (July 20, 1958)	"
36. No. 16: Positions of Satellite 1957 Beta One during the First 100 Revolutions (July 25, 1958)	"
37. No. 17: Positions of Satellite 1958 Alpha during the First 1400 Revolutions (September 5, 1958)	"
38. No. 18: Satellite Data and Analyses (October 4, 1958)	"
39. No. 19: Research in Space Science (December 6, 1958)	"
40. No. 20: Research in Space Science (January 5, 1959)	"
41. No. 21: Research in Space Science (February 27, 1959)	"
42. No. 22: Research in Space Science (March 20, 1959)	"
43. No. 23: Research in Space Science (March 30, 1959)	"
44. No. 24: Research in Space Science (April 9, 1959)	"
45. No. 25: Research in Space Science (April 20, 1959)	"
46. No. 26: Research in Space Science (May 21, 1959)	"

D. Smithsonian-ABMA 1958 Epsilon Orbital Data Series

47. Issue No. 1: July 26 - August 2, 1958	Oct. 17, 1958
48. Issue No. 2: August 2 - August 13, 1958	Oct. 17, 1958
49. Issue No. 3: August 13 - August 27, 1958	Oct. 17, 1958
50. Issue No. 4: August 27 - September 19, 1958	Oct. 17, 1958

E. Other Observational Reports

51. Orbital Data of Russian Earth Satellites I and II as determined by USASKDL.	Apr 23, 1959
52. Ephemeris of 1957 Alpha 2 (Sputnik I). by A. Eckels, R. Jastrow, et al (sent via airmail).	May 21, 1959

F. Jet Propulsion Laboratory Reports

53. Calibration Records for the IGY Earth Satellite 1958 Gamma.	Dec. 8, 1958
54. Calibration Record for the IGY Earth Satellite 1958 Alpha.	Dec. 8, 1958
55. Microlock: A Minimum-Weight Radio Instrumentation System for a Satellite	Dec. 8, 1958
56. Application of Microlock to IGY Satellite Instrumentation	Dec. 8, 1958
57. Ballistics of the Explorer	Dec. 8, 1958
58. Satellite Temperature Measurements for 1958 Alpha	Dec. 8, 1958
59. Explorers I and III Instrumentation	Dec. 8, 1958
60. U. S. Explorer Satellites	Dec. 8, 1958
61. Temperature of an Orbiting Missile	Dec. 8, 1958

12. No. 2: Flight Summaries for the U.S. Rocketry Program for the IGY, Part I: 5 July 1956 - 30 June 1958 (March 1, 1959). Information on flight summaries includes rocket number; rocket type; precise location of firing; date and time of firing; flight objectives; information on the flight: especially weight and dimensions of rocket, weight of payload, trajectory information including peak altitude; detailed description of telemetry and tracking equipment; detailed description of geophysical instrumentation; performance of rocket, tracking and telemetry; performance of geophysical instrumentation, and indication of quality and amount of data recovered and (in some cases) preliminary scientific results. Apr. 17, 1959

B. IGY Satellite Report Series

13. No. 1: Processed Observational Data for USSR Satellites 1957 Alpha and 1957 Beta (March 1, 1958). May 14, 1958
14. No. 2: Status Reports on Optical Observations of Satellites 1958 Alpha and 1958 Beta (April 30, 1958). May 26, 1958
15. No. 3: Some Preliminary Reports of Experiments in Satellites 1958 Alpha and Gamma (May 1, 1958). May 26, 1958
16. No. 4: Observational Information on Artificial Earth Satellites (July 15, 1958). Aug. 1, 1958
17. No. 5: Radio Observations of Soviet Satellites 1957 Alpha 2 and 1957 Beta 1 (July 30, 1958). Aug. 1, 1958
18. No. 6: Reports and Analyses of Satellite Observations (August 15, 1958). Sept. 3, 1958
19. No. 7: Simplified Satellite Prediction from Modified Orbital Elements (January 1, 1959). Apr. 17, 1959
20. No. 8: Ephemeris of Satellite 1957 Alpha 2 and Collected Reports on Satellite Observations (June 15, 1959) July 15, 1959

C. Special Reports of Smithsonian Astrophysical Observatory

21. No. 1: Preliminary Orbit Information for USSR Satellites Alpha One and Alpha Two (October 14, 1957) as issued
22. No. 2: Additional Orbit Information for USSR Satellites 1957 Alpha One and Beta One (November 5, 1957) "
23. No. 3: Some Preliminary Values of Upper Atmosphere Density from Observations of USSR Satellites (November 15, 1957) "
24. No. 4: Glossary of Astronomical Terms for the Description of Satellite Orbits (November 30, 1957) "
25. No. 5: Soviet Orbit Predictions and Orbital Information for USSR Satellites 1957 Alpha One, Alpha Two, and Beta (December 4, 1957) "
26. No. 6: Visual Observations of Alpha One made by Moonwatch Stations during Lifetime of the Object (December 17, 1957) "
27. No. 7: An Interim Model Atmosphere Fitted to Preliminary Densities Inferred from USSR Satellites (December 31, 1957) "
28. No. 8: Soviet Orbit Information for USSR Satellites 1957 Alpha Two and Beta One (January 31, 1958) "
29. No. 9: Basic Orbital Data for Satellite 1957 Beta One (February 21, 1958) "

MATERIAL ON IGY ROCKETS AND SATELLITES
SENT TO USSR

Date of
Transmittal

I. Launching and Frequency Information

A. Communications through AGIWARN

(Cables sent giving date and time of launching, date and time of injection into orbit, place of launching, approximate geographical coordinates of injection point, estimates of orbit inclination, apogee, perigee, and period, weight and dimensions of satellite, radio frequencies, power level, expected battery life and scientific experiments; and in the case of space probes, such of above information as was appropriate.)

1. Explorer I	Feb. 1, 1958 (early morning hours)
2. Vanguard I	March 17, 1958
3. Explorer III	March 26, 1958
4. Explorer IV	July 26, 1958
5. Vanguard II	Feb. 17, 1959
6. Pioneer IV	March 3, 1959

Above cables also sent to CSAGISEC, COORDDAY, and MOSCOWMCG.

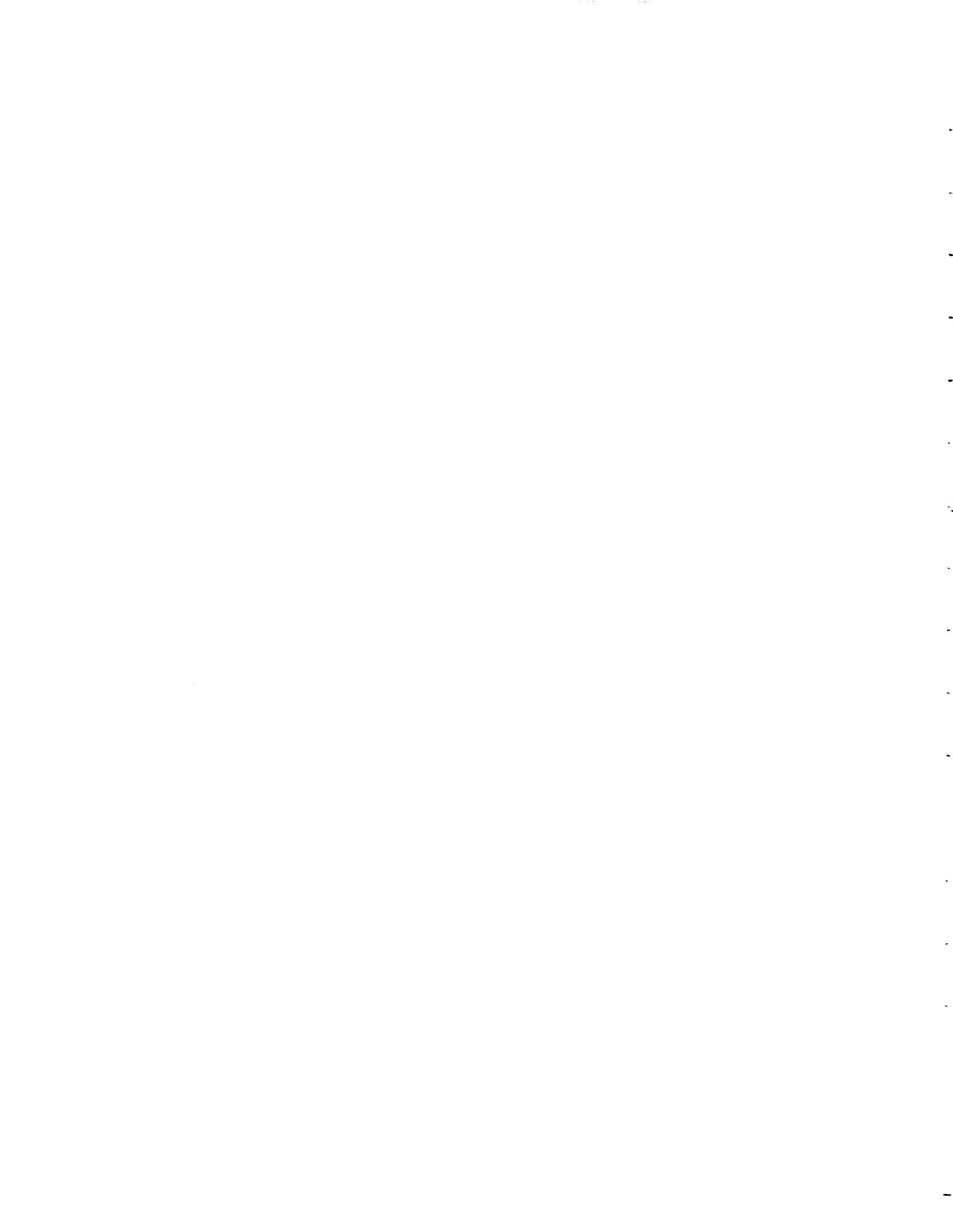
II. Additional Cables, AGIWARN Messages, and AIRMAIL Messages

7. Via AGIWARN, selected photographic (and a few visual) observations of Sputnik III sent on an average of every second day.	since May 1958
8. Via AGIWARN, predictions of all orbiting bodies launched by U. S.	regularly
9. Via AIRMAIL, predictions (ephemerides) sent weekly from SAO for all orbiting bodies. These predictions are valid for all observers anywhere in the world.	since Feb. 1959
10. Cable to V CSAGI Assembly with preliminary results of 1958 Epsilon, by Van Allen et al.	August 1958

III. Reports, Preprints, Reprints, and Data

A. IGY Rocket Report Series

11. No. 1: Experimental Results of the U.S. Rocket Program for the International Geophysical Year to 1 July 1958 (July 30, 1958)	Aug. 1, 1958
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Sputnik, the Gaither Committee, and the Escalation of the Cold War
Dr. David L. Snead
University of Richmond and Randolph-Macon College

The crises President Dwight D. Eisenhower faced at the end of 1957 can be traced to both domestic and foreign policy issues. Without underemphasizing the widespread disenchantment with Eisenhower's handling of race relations and the economy, the concern of most Americans in late 1957 lay elsewhere. For the first time, the Soviet Union had made a significant technological advancement ahead of the United States. On October 4, 1957, the Soviet Union shocked the world with the launch of Sputnik. Coupled with the Kremlin's earlier claim of a successful test of an intercontinental ballistic missile (ICBM), the launch of Sputnik II on November 3, and the embarrassing failure of the United States Vanguard rocket in December, the Soviet satellite represented a clear challenge to U.S. technological superiority. More importantly, it raised the possibility that the Soviet Union might be able to launch a surprise nuclear attack against the United States using this new missile technology. Eisenhower's attempts to minimize the implications of the Soviet accomplishments only inflated fears as many Americans assumed he was trying to conceal U.S. military weaknesses.¹

In the midst of the uproar surrounding Sputnik, Eisenhower received a top-secret report prepared by a blue ribbon committee of leading scientific, engineering, economic, and military experts. The panel, called the Gaither committee in recognition of its first chairman, H. Rowan Gaither, Jr., emphasized both the inadequacy of U.S. defense measures designed to protect the civil population and the vulnerability of the country's strategic nuclear forces in the event of a Soviet attack. The Gaither committee members viewed these defense measures--ranging from a missile system to defend the continental United States to the construction of shelters to protect the population from radioactive fallout--and the maintenance of sufficient strategic forces to launch military strikes against Soviet targets as essential for the preservation of U.S. security. They concluded that in the case of a surprise Soviet nuclear attack the United States would be unable to defend itself with any degree of success. The report emphasized the urgent need for the Eisenhower administration to strengthen the country's continental and civil defenses and to accelerate the development of its strategic striking power. It stressed that the United States either had to respond immediately to the expanding Soviet military capabilities or face potentially grave consequences.

The Gaither committee recommended that the United States reduce the vulnerability of its strategic forces, strengthen and enlarge its nuclear ballistic missile capabilities, improve the ability of the armed forces to wage limited military operations, reorganize the Department of Defense, and construct fallout shelters to protect the civilian population. These recommendations would cost \$44.2 billion spread between 1959 and 1963. The price was high, but the committee concluded that the costs for not instituting them would be higher yet--the possible subjugation of the United States to the Soviet Union. It stressed that, "The next two years seem to us critical. If we fail to act at once, the risk [of not preparing for a Soviet attack], in our opinion, will be unaccept-

¹ For U.S. reaction to Sputnik, see Robert A. Divine, *The Sputnik Challenge* (New York: Oxford University Press, 1993); and Walter A. McDougall, ... *the Heavens and the Earth: A Political History of the Space Age* (New York: Basic Books, Inc., Publishers, 1985).

able."² The committee accentuated that by the end of this two year period the Soviet Union would possess sufficient nuclear forces to overwhelm U.S. defenses and to eliminate U.S. strategic nuclear capabilities. The only way the United States could avoid this "risk" was to adopt the recommendations advocated by the committee.

Of all the Gaither committee recommendations, Eisenhower disagreed only with a few. While he opposed construction of fallout shelters and expanding military capabilities to wage limited war, he approved the implementation of most of the other recommendations at least in part. His requests for supplementary appropriations to the FY 1958 defense budget and increases to the FY 1959 budget reveal the importance of the Gaither report. Between the two budgets, Eisenhower added nearly \$4 billion in defense spending, an almost ten percent increase to annual expenditures. He accelerated the development and deployment of ICBMs, intermediate range ballistic missiles (IRBMs), and the Polaris submarine launched missile system. He ordered the reduction of the vulnerability of the Strategic Air Command (SAC) through the construction of early warning radar, the dispersal of SAC forces to a larger number of airfields, and the implementation of alert programs. Furthermore, he sought and received Congressional approval for the reorganization of the Defense Department.

The influence of the Gaither report did not end with these changes. As a senator and then president, John F. Kennedy championed many of the same programs recommended by the committee. After the contents of the report were leaked to the media in December 1957, many critics, including Kennedy, challenged Eisenhower's policies. The Massachusetts senator questioned why the United States was not doing more to overcome the apparent Soviet lead in military preparedness. While Eisenhower refused to expand military spending beyond certain levels, Kennedy did not show the same inhibitions. In the 1960 campaign and his presidency, Kennedy received advice from at least a dozen Gaither committee members and even cited the Gaither report as evidence of Eisenhower's failure to respond adequately to the Soviet threat. His "flexible response" military strategy reflected much of the advice contained in the Gaither report. He accelerated ballistic missile developments, expanded limited war capabilities, and advocated civil defense programs.

The Gaither committee's conclusions and recommendations had a clear influence on the Eisenhower and Kennedy administrations. The report, however, has been ignored or, at a minimum, underemphasized by most scholars.³ One of the main reasons for this slight is that scholars

² U.S. Congress. Joint Committee on Defense Production. *Deterrence and Survival in the Nuclear Age (The "Gaither Report" of 1957)* [hereafter *Gaither Report*] (Washington, D.C.: Government Printing Office [hereafter GPO], 1976), 25.

³ See for example Saki Dockrill, *Eisenhower's New Look National Security Policy, 1953-61* (New York: St. Martin's Press, 1996), 210-11; Divine, *Sputnik Challenge*, 40-41, 84, 125-7, and 196; Chester J. Pach, Jr. and Elmo Richardson, *Presidency of Dwight D. Eisenhower*, Revised edition (Lawrence: University Press of Kansas, 1991), 173; McDougall, *The Heavens and the Earth*, 151; Stephen E. Ambrose, *Eisenhower: The President*, v. 2 (New York: Simon and Schuster, 1984), 434-35; John Lewis Gaddis, *Strategies of Containment: A Critical Appraisal of Postwar American National Security Policy* (New York: Oxford University Press, 1982), 185-86; Samuel P. Huntington, *The Common Defense: Strategic Programs in National Politics* (New York: Columbia University Press, 1961), 111-13; McGeorge Bundy, *Danger and Survival: Choices About the Bomb in the First Fifty Years* (New York: Random House, 1988), 335-37; Desmond Ball, *Politics and Force Levels: The Strategic Missile Program of the Kennedy Administration* (Berkeley, CA: University of California Press, 1980), 27-30; Richard A. Aliano, *American Defense Policy from Eisenhower to Kennedy: The Politics of Changing Military Requirements, 1957-1961* (Athens, OH: Ohio University Press, 1975), 59; John C. Donovan, *The Cold Warriors: A Policy-*

have focused on Sputnik as the cause for the changes in Eisenhower's policies. Sputnik captured the world's attention and allowed the Soviet Union the opportunity to boast of its technological excellence. With each orbit around the earth, Sputnik instilled in Americans a sense of vulnerability. Yet as much as the satellite magnified concerns about Soviet missile capabilities, it was the Gaither report that provided specific recommendations to overcome any possible deficiencies in U.S. military preparedness.

Establishment and Activities of the Gaither Committee

President Eisenhower's National Security Council (NSC) ordered the creation of the Gaither committee in April 1957 after questions were raised about the implications of radioactive fallout, the correct balance between shelters and evacuation, and the requirements for stockpiling emergency materials.⁴ These issues were not new. Ever since the Soviet Union acquired the capability of attacking the United States, the president and his advisors recognized the potential consequences of a nuclear exchange for the civilian population, the country's infrastructure, and the government's ability to continue to function.⁵ After studying a Federal Civil Defense Administration (FCDA) report recommending the United States build a \$32 billion shelter system, the NSC decided to perform a series of studies examining the countries civil defense needs.⁶ It requested that the Science Advisory Committee appoint a panel of experts--soon to be called the Gaither committee--to study U.S. active and passive defense measures.⁷

Through the early summer, Gaither and the Office of Defense Mobilization's Science Advisory Committee selected individuals to serve on this panel. Gaither divided the committee into two principle groups: the Steering Committee and the Advisory Panel. After he became ill, he stepped down as the committee's director in September to be replaced by Robert Sprague and William Foster. Sprague and Foster directed the Steering Committee, which also consisted of Dr. James Baxter, Dr. Robert Calkins, John Corson, Dr. James Perkins, Dr. Robert Prim, Dr. Hector Skifter, William Webster, Dr. Jerome Wiesner, and technical advisor, Edward Oliver. The Advisory Panel included Gaither (after his illness), Admiral Robert Carney, General James Doolittle, General John Hull, Dr. Mervin Kelly, Dr. Ernest Lawrence, Robert Lovett, John McCloy, and Dr. Frank Stanton. In addition to these individuals, two other groups played important advisory

Making Elite (Lexington, MA: D.C. Heath and Company, 1974), 130-49; and David A. Rosenberg, "The Origins of Overkill: Nuclear Weapons and American Strategy, 1945-1960," *International Security* 7:4 (Spring 1983), 46-49.

⁴ See Robert A. Divine, *Blowing on the Wind: The Nuclear Test Ban Debate, 1954-1960* (New York: Oxford University Press, 1978), 54; and Allan A. Winkler, *Life Under A Cloud: American Anxiety About the Atom* (New York: Oxford University, 1993), 84-135. See also Letter to President Eisenhower [from eight Representatives], June 7, 1957, Dwight D. Eisenhower Library [hereafter EL], White House Central Files, Official Files, Box 526, Folder - (3), 2-4.

⁵ See for example, Report by the Joint Strategic Plans Committee, August 24, 1951, National Archives [hereafter NA], RG 218, JCS, 1951-1953 - Geographic File, CCS 350.09 USSR (12-19-49), Sec. 14, 5.

⁶ Memorandum of Discussion at the 318th Meeting of the National Security Council, April 4, 1957, *Papers Related to the Foreign Relations of the United States 1955-1957*, 19 (GPO, 1990), 463-64.

⁷ Among the members of the Science Advisory Committee at the time of the Gaither study were Dr. Lloyd V. Berkner, Dr. Hans A. Bethe, Dr. Detlev W. Bronk, Dr. Hugh L. Dryden, Dr. James B. Fisk, Dr. Caryl P. Haskins, Dr. Albert G. Hill, Dr. James R. Killian, Jr., Dr. Edwin H. Land, Dr. Emanuel R. Piore, Dr. Isidor I. Rabi, Dr. Herbert Scoville, Jr., Dr. Alan T. Waterman, and Dr. Jerrold R. Zacharias.

roles: a subcommittee of the Science Advisory Committee containing Dr. James Fisk, Dr. James Killian, and Dr. Isidor Rabi, and a committee from the Institute for Defense Analyses composed of General James McCormack and Dr. Albert Hill.

In addition to its permanent members, the Gaither committee recruited nearly seventy expert consultants from leading scientific organizations, engineering firms, strategic think tanks, and business institutions to provide advice and make recommendations.⁸ These consultants provided invaluable background material and technical support to the committee. In fact, some scholars have argued that several of these advisors actually played much larger roles than their titles as technical consultants would indicate. In particular, Colonel George Lincoln and Paul Nitze seemed to have had great influence on the final report.⁹

The high caliber of this committee was without question. A sample of the qualifications of some of the members of the Steering Committee and Advisory Panel should provide ample evidence of its expertise. Killian and Baxter served as the respective presidents of Massachusetts Institute of Technology and Williams College. Because of his research at the Radiation Laboratory on molecular beams, Rabi won the 1944 Nobel Prize for physics. During the last years of the Truman administration, Lovett and Foster acted as the Secretary and the Deputy Secretary of Defense, respectively. These men and the rest of the Gaither committee represented some of the best minds in the country.

By late August, the Gaither committee and its various subcommittees were earnestly examining the complex issues that surrounded U.S. strategic capabilities. For active defenses, the committees studied how the United States could prevent attacking Soviet forces from reaching their targets. Generally, this meant the development of sufficient forces of interceptor airplanes, anti-aircraft guns, and surface-to-air missiles to destroy attacking Soviet bombers and/or missiles. In conjunction with its examination of active defenses, the experts explored passive defense measures designed to protect the civil population from the effects of a nuclear attack if Soviet bombers and/or missiles reached their targets. These measures were designed to achieve the earliest possible warning of an impending Soviet attack and to shield the population from the worst effects of nuclear explosions.

The Gaither committee had access to voluminous sources, which detailed U.S. offensive and defensive capabilities. The committee received briefings from the Defense Department, the Net Evaluation Subcommittee of the NSC, the Central Intelligence Agency (CIA), the Atomic Energy Commission, the FCDA, the Office of Defense Mobilization, and the NSC Representative on Internal Security.¹⁰ In addition to these briefings, the committee had access to both CIA and Air Force intelligence estimates, to special studies performed by the agencies mentioned above, and to studies by private organizations like the Rand Corporation and the National Academy of

⁸ For a complete membership list, see *Gaither Report*, 41-45.

⁹ See Kaplan, *Wizards of Armageddon*, 128-34; David Callahan, *Dangerous Capabilities: Paul Nitze and the Cold War* (New York: HarperCollins Publishers, 1990), 167-71; and Steven L. Rearden, *The Evolution of American Strategic Doctrine: Paul Nitze and the Soviet Challenge* (Boulder, CO: Westview Press, 1984), 41-46.

¹⁰ Informal Memorandum for Use at Meeting with Mr. Gaither, June 25, 1957, EL, White House Office [hereafter WHO], Office of the Special Assistant for National Security Affairs: Records, 1952-1961 [hereafter OSANSA], NSC Series, Briefing Notes Subseries, Box 8, Folder - Fallout Shelters (3), 3-4. See also John Prados, *The Soviet Threat: U.S. Intelligence Analysis & Russian Military Strength* (New York: Dial Press, 1982), 68-69.

Sciences. The committee members also questioned the nation's top military leaders and inspected its key defense installations.¹¹

The Gaither Committee's Conclusions and Recommendations

On November 4, the leaders of the committee presented their preliminary conclusions to President Eisenhower. Three days later they delivered their final report to the NSC. At the first meeting, Gaither spoke for the committee and summarized its major conclusions. He explained that the currently planned active defense system was inadequate. The programmed passive defenses did not provide sufficient protection for the civilian population. SAC was vulnerable to a Soviet surprise attack. By 1959, U.S. vulnerability would increase with the advent of ICBMs. The risks to the country would continue to grow until there was a workable arms control agreement. Finally, Gaither stressed that "The long-run peril to the U.S. civil population demands prompt and effective measures for increasing our basic and inherent strengths and for melding the will and resources of the free world."¹²

In its final report to the NSC on November 7, the committee wasted little time defining the Soviet threat. Instead, it accepted the basic American Cold War attitude that the Soviet Union sought world domination. It argued that "We have found no evidence in Russian foreign and military policy since 1945 to refute the conclusion that the USSR intentions are expansionist, and that her great efforts to build military power go beyond any concepts of Soviet defense."¹³ The threat as the committee members envisioned it encompassed both economic and military factors.

Although it recognized the current economic superiority of the United States, the committee viewed this advantage as fleeting. It argued that while the United States was economically much superior to the Soviet Union, this difference was shrinking at a rapid rate. When coupled with the Soviet Union's emphasis on military spending rather than producing consumer goods, the decline of U.S. economic strength in comparison to the Soviet Union seemed even more stark. The Gaither report emphasized that while the two adversaries presently spent almost equal amounts on defense, current trends in spending indicated that the Soviet Union would surpass the United States in defense spending by the 1960s. It concluded that "This extraordinary concentration of the Soviet economy on military power and heavy industry makes . . . available economic resources sufficient to finance both the rapid expansion of their impressive military capability and their politico-economic offensive by which, through diplomacy, propaganda and subversion, they seek to extend the Soviet orbit."¹⁴

The committee found the Soviet military threat closely paralleling the economic one. After examining recent military and technological developments, the committee presented a picture of an ever-strengthening communist menace. It stressed that the Soviet development of atomic weapons, long-range aircraft, both ICBMs and IRBMs, a huge submarine force, an extensive air

¹¹ See William C. Foster, "Search for Survival," June 1958, EL, WHO, Office of the Staff Secretary [hereafter OSS], Subject Series, Alphabetical Subseries, Box 13, Folder - Foster, William C. May-July 1958 (1), 1-2; and Memorandum for James S. Lay, Jr., December 24, 1957, NA, RG 273, NSC, Folder - NSC 5724 (background documents), 1.

¹² Security Resources Panel Advisor's Notes for Conference, November 4, 1957, EL, WHO, OSS, Subject Series, Alphabetical Subseries, Box 13, Folder - Gaither Report November 1957-December 1958 (1), 2-3.

¹³ *Gaither Report*, 1.

¹⁴ *Ibid.*, 4.

defense system, and an army composed of 175 divisions posed a serious threat to the United States and its allies. Together with the economic threat, the Soviet Union's growing military strength challenged the supremacy of U.S. world power.¹⁵

Faced with the Soviet economic and military advances, the committee issued three "broad-brush" opinions. First, the active defense systems currently in place and those planned for the future offered little defense against a determined Soviet attack. Second, the passive defense measures designed to protect the civilian population provided little or no protection from the effects of a nuclear blast and/or radioactive fallout. Finally, because of the low levels of both active and passive defenses, the security of the United States rested primarily on SAC. The committee warned that "The current vulnerability of SAC to surprise attack during a period of lessened world tension (i.e. a time when SAC is not on a SAC 'alert' status), and the threat posed to SAC by the prospects of an early Russian ICBM capability, call for prompt remedial action."¹⁶

The committee made several recommendations to help strengthen U.S. continental and civilian defenses. The highest priority was to reduce SAC vulnerability and to increase the strategic retaliatory capability of U.S. nuclear forces. SAC forces, the committee argued, should be able to react with between 7 and 22 minutes warning. Additional air bases needed to be constructed to augment the dispersal of strategic forces. Active defenses surrounding SAC bases through the use of Nike-Hercules or Talos surface-to-air missiles should be strengthened. Additionally, it emphasized the need to accelerate and expand the introduction of both ICBMs and IRBMs into U.S. strategic retaliatory forces. It recommended expanding the number of planned IRBMs and ICBMs from 60 to 240 and from 80 to 600 by 1963, respectively. Finally, it stressed that the United States needed to improve the ability of its military forces to wage limited operations that fall short of general war.¹⁷

In addition, the committee advocated programs of slightly less priority. The committee made its recommendations based on the belief that "Protection of the civil population is a national problem requiring a national remedy."¹⁸ It estimated that if the Soviet Union launched a nuclear attack, the American civil population would suffer between 70 and 150 million casualties (between 35 and 75 percent of the estimated 1965 population).¹⁹ It questioned the capability of the United States to acquire sufficient warning of a Soviet attack to initiate civil defense plans and to notify the population if an attack was indeed underway.²⁰ It concluded that the implementation of a \$25 billion program of fallout shelters and civil defense planning "would symbolize *our will to survive*, and our understanding of our responsibilities in the nuclear age."²¹ [emphasis in original]

The committee also made recommendations in other areas. It stressed the need to improve the organization of the Defense Department so that it could effectively incorporate scientific and technological advances into its programs. It emphasized the importance of obtaining a greater understanding of Soviet intentions through hard intelligence. Finally, it argued that any changes in U.S. policies to reduce its vulnerability needed to be integrated with a broader foreign

¹⁵ Ibid., 4-5.

¹⁶ Ibid., 5.

¹⁷ Ibid., 6-7.

¹⁸ Ibid., 10.

¹⁹ Ibid., 18-20.

²⁰ Ibid., 7-8.

²¹ Ibid., 22.

policy that would insure that allied countries would not see it as “a retreat to ‘Fortress America.’”²²

The committee calculated that these recommendations would cost approximately \$44 billion spread over five years (FY1959-FY1963). The active defense measures, including the reduction of SAC vulnerability, the construction of missile defense systems, and the expansion of U.S. military capabilities, would cost \$19 billion, while the measures to protect the civilian population with improved radar and fallout shelters would cost \$25 billion.²³ The committee concluded that the United States could afford these programs although they “would necessitate . . . an increase in taxes, a somewhat larger federal debt, substantial economies in other government expenditures, and curbs on inflation.”²⁴

The committee stressed the importance of implementing these recommendations immediately or risk losing the military advantage to the Soviet Union. It argued that during the next two years, 1958 and 1959, the United States would be in a position to launch a decisive attack on the Soviet Union if necessary, while at the same time, it would remain in position to negotiate from a position of strength. Beyond this period, the committee expressed grave concerns about the future of the United States. “The next two years,” the committee emphasized, “seem to critical. If we fail to act at once, the risk in our opinion will be unacceptable.”²⁵

The National Mood and Initial Reactions to the Gaither Report

The Gaither committee presented its report to the NSC during one of the most tumultuous periods of the Eisenhower administration. In the preceding months Eisenhower had experienced a protracted budget crisis, was forced to intervene in the integration of schools in Little Rock, and had received reports of an impending economic downturn. Even more troubling, the launch of Sputnik seemed to challenge U.S. national security. The potential implications of the Soviet rocket capability had a profound impact on the Gaither committee and how Eisenhower, Congress, and the country would receive its findings. Sputnik raised questions about Eisenhower’s ability to lead the nation, the United States military position *vis-à-vis* the Soviet Union, and the status of the United States among the world’s scientific and technical elite.²⁶ David Beckler, a Gaither Committee member, described these concerns when he argued that “Although the satellite is not a military weapon, it tends to be identified in the minds of the world with the impressive military and technological strength of the USSR. In a military sense it underscores Soviet long-range missile claims. In a technological sense it shows the Soviets to have impressive technological sophistication and resources.”²⁷

By the time the NSC received the Gaither report on November 7, Eisenhower was already under intense pressure to modify his national security programs. The launch of Sputnik and the Soviet announcement of a successful ICBM test raised considerable public concern about U.S.

²² *Ibid.*, 11.

²³ *Ibid.*, 22.

²⁴ *Ibid.*, 12.

²⁵ *Ibid.*, 14. For the timetable the committee used in making its recommendations, see *ibid.*, 15-17.

²⁶ For U.S. reactions to Sputnik, see Divine, *The Sputnik Challenge*; and McDougall, . . . *the Heavens and the Earth*.

²⁷ Memorandum for Mr. Victor Cooley, Acting Director ODM, October 8, 1957, EL, WHO, Office of the Special Assistant for Science and Technology [hereafter OSAST], Box 3, Folder - Space October 1957-October 1959, 1.

military strength.²⁸ Previously, Eisenhower had been able to quell criticisms of his defense policies by reminding the American people of his widespread experience and knowledge in these fields. After October 1957, things were different. Eisenhower's status as a war hero and popular president were no longer sufficient to allay the people's doubts about weaknesses in U.S. security. Over consecutive weeks in late October, *Aviation Week* argued that Eisenhower and his advisers "have been and still are embarked on a fiscal policy that is shaking the military, scientific and industrial foundations of our national defense system so badly that only emergency action with the utmost speed will prevent a major deterioration of our atomic airpower strength in relation to the Soviets in the immediate future."²⁹ The following week it claimed that "In the face of this overwhelming mass of evidence on the growth of Soviet military strength from new technological weapons, our own national leadership has been executing a policy aimed at reducing our own atomic-airpower strength in being, artificially retarding the pace of our military technological development and thoroughly discouraging the best efforts of both military and scientific leaders concerned with this vital program."³⁰

Senators and congressmen reached similar conclusions. Comparisons to the attack on Pearl Harbor were widespread. In special hearings to address the adequacy of U.S. missile programs that began in November 1957, Senator Lyndon Johnson claimed that "We meet today in the atmosphere of another Pearl Harbor."³¹ Charles Donnelly, a legislative assistant, explained that "there were few in January [1957] who foresaw that, before the end of the year, the United States would suffer a Pearl Harbor in the Cold War and be striving to repair its damaged prestige just as desperately as, in 1942, it was trying to reconstitute its battered naval strength."³²

The general population showed similar concerns. *Newsweek* concluded that Sputnik represented a "defeat in three fields: In pure science, in practical know-how, and in psychological cold war."³³ *Life* argued "Let us not pretend that Sputnik is anything but a defeat."³⁴ One public opinion poll revealed that 49 percent of the American people believed that the Soviet Union was "ahead of the United States in the development of missiles and long distance rockets."³⁵ Another poll in late November 1957 found only 26 percent of Americans satisfied with U.S. defense policies and 53 percent advocating that they be reexamined.³⁶ After the embarrassing failure of the Vanguard rocket in December, the national mood grew more somber. *U.S. News & World Report*

²⁸ *Newsweek* found that "Most Americans are in favor of a crash program to put the U.S. ahead in the missile race. . . . There was concern but no panic. Rather Americans seemed to have suffered a severe blow to their pride. They weren't used to being second best, and they wanted to catch up. Above all, they understood that catching up might well be a matter of survival. "The U.S., Ike, and Sputnik," *Newsweek*, 50:18 (October 28, 1957), 30. See also "The Moon's Meaning," *ibid.*, 50:16 (October 14, 1957), 39.

²⁹ Robert Holtz, "Why Mr. President?," *Aviation Week* 67:16 (October 21, 1957), 21.

³⁰ *Ibid.*, "Intelligence Without Leadership," *Aviation Week* 67:17 (October 28, 1957), 21.

³¹ United States Congress, Senate, *Inquiry into Satellite and Missile Programs*, Hearings before the Preparedness Investigating Subcommittee of the Committee on Armed Services, 85th Congress, 1st and 2nd Sessions, 1957-1958, 342.

³² Chris Donnelly, *United States Defense Policies in 1957* (GPO, 1958), 1.

³³ "Into Space: Man's Awesome Adventure," *Newsweek*, 50:16 (October 14, 1957), 37.

³⁴ Quoted in McDougall, . . . *The Heavens and the Earth*, 145.

³⁵ George H. Gallup, *The Gallup Poll*, v. 2 (New York: Random House, 1972), 1521.

³⁶ American Institute of Public Opinion, November 24, 1957, reprinted in Hazel Gaudet Erskine (ed.), "The Polls: Defense, Peace, and Space," *The Public Opinion Quarterly* 25:3 (Fall 1961), 483.

claimed that the "U.S., today, is far behind Soviet Russia in the big race for superrockets."³⁷ A week later, it reported a growing awareness and fear of nuclear war. "These new fears about war," it opined, "seemed more immediate and personal than war fears in the past. When past wars threatened, people worried about whether their sons might be called into service. . . . Now, all at once, war became a personal thing for everyone--something that could hit you, yourself, right in your home."³⁸

The Soviet Union did nothing to discourage these fears. During Eisenhower's second term, he faced a Soviet disinformation campaign designed to raise Soviet military and technological prestige while undermining U.S. strength.³⁹ One week after the launch of Sputnik, Khrushchev claimed that "We [the communists] now have all the rockets we need: long-range rockets, intermediate-range rockets and short-range rockets."⁴⁰ In November, Khrushchev gave two, seemingly threatening, interviews. He argued that "If war is not averted, the Americans will experience the most devastating war ever known to mankind. It will rage not only in Europe and Asia, but, with not less fury, in the United States."⁴¹ A little over a week later, he bragged that "The fact that the Soviet Union was the first to launch an artificial earth satellite, which within a month was followed by another, says a lot. If necessary, tomorrow we can launch 10, 20 satellites. All that is required for this is to replace the warhead of an intercontinental ballistic rocket with the necessary instruments. There is a satellite for you."⁴²

It was in this atmosphere that the Eisenhower administration received the Gaither report. If the president could have kept the report a secret, the committee's findings might not have become so important. However, almost immediately leaks about the committee began to surface. On December 20, any remaining secrecy concerning the Gaither committee's conclusions disintegrated in a front page story in the *Washington Post*. The headlines read: "NATO VOTES MISSILE BASES, PEACE TRY; SECRET REPORT SEES U.S. IN GRAVE PERIL." In the ensuing article, reporter Chalmer Roberts disclosed the committee's most important findings. He wrote:

The still top-secret Gaither Report portrays a United States in the gravest danger in its history.

It pictures the nation moving in frightening course to the status of a second-class power.

It shows an America exposed to an almost immediate threat from the missile-bristling Soviet Union.

³⁷ "U.S. Satellite - A Myth Exploded," *U.S. News & World Report* 43:24 (December 13, 1957), 31.

³⁸ "The Changing Mood in America," *ibid.*, 43:25 (December 20, 1957), 43.

³⁹ The leading scholars of Soviet propaganda in the late 1950s and early 1960s, Arnold Horelick and Myron Rush, claim that "For four years [1957-1961], Khrushchev and other Soviet leaders gave every indication in their public statements that they were indeed in a hurry to capitalize on their initial advantage and that they were bent on acquiring a large force of first-generation ICBM's." Arnold L. Horelick and Myron Rush, *Strategic Power and Soviet Foreign Policy* (Chicago: The University of Chicago Press, 1965, 1966), 36. See also McDougall, *... the Heavens and the Earth*, 237; Vladislav Zubok and Constantine Pleshakov, *Inside the Kremlin's Cold War: From Stalin to Khrushchev* (Cambridge, MA: Harvard University Press, 1996), 192-94; and Bundy, *Danger and Survival*, 416.

⁴⁰ *Pravda*, October 11, 1957, reprinted in Horelick and Rush, *Strategic Power and Soviet Foreign Policy*, 43.

⁴¹ *Pravda*, November 19, 1957, reprinted in Horelick and Rush, *Strategic Power and Soviet Foreign Policy*, 48.

⁴² *Pravda*, November 29, 1957, reprinted in Horelick and Rush, *Strategic Power and Soviet Foreign Policy*, 44-45.

It finds America's long-term prospect one of cataclysmic peril in the face of rocketing Soviet military might and of a powerful, growing Soviet economy and technology which will bring new political propaganda and psychological assaults on freedom all around the globe.⁴³

Public knowledge of the report made the administration's evaluations more difficult. As an internal document, Eisenhower and his advisers had great freedom in assessing the report's worth. However, in the public arena that was still reeling from the shock of Sputnik, the report fanned fears. It seemed to symbolize U.S. weaknesses. People demanded its release to the public. Eisenhower refused on the grounds of executive privilege.⁴⁴ By refusing to do so, he created the impression that he had something to hide.⁴⁵

Influence of the Gaither Committee

As many Americans clamored for the release of the report, Eisenhower and his advisers attempted to evaluate the committee's findings. Stephen Ambrose argues that the president ultimately "rejected the Gaither Report. He refused to bend to the pressure, refused to initiate a fallout shelter program. It was one of his finest hours."⁴⁶ This is a rather shortsighted view of the influence of the Gaither report. Between January and July 1958, the committee's recommendations remained at the forefront of the Eisenhower administration's deliberations concerning national security issues. In particular, the administration evaluated ways to limit SAC vulnerability, accelerate ballistic missile capabilities--including ICBMs, IRBMs, and the Polaris system--improve limited military operations capabilities, reorganize the defense establishment, improve continental defenses, and implement various shelter strategies. It can be argued that the Gaither committee did not present any revolutionary new ideas or programs, but as Eisenhower's Assistant for National Security Affairs Robert Cutler explained, "It certainly helped, and pushed and prodded," many of them.⁴⁷

Eisenhower realized in late 1957 that he needed to address certain deficiencies in U.S. national security programs. He also recognized that any additional appropriations in the FY 1959 budget would not go into place until July 1958 and that something needed to be done before then. After Defense Secretary Neil McElroy proposed supplementing the FY 1958 defense budget, Eisenhower agreed to seek an additional \$1.26 billion to accelerate and/or augment the Polaris missile system, SAC dispersal, missile detection, and the development of IRBMs and ICBMs.⁴⁸ Congress acted quickly. On January 23, 1958, the House of Representatives voted unanimously

⁴³ Chalmer Roberts, "Enormous Arms Outlay Is Held Vital to Survival," *Washington Post*, December 20, 1957, Sec. A, pp. 1, 19. Roberts was not the first to write about the Gaither report, but his article provided the most in-depth description and discussion of it. For early articles, see the *New York Herald Tribune*, November, 23, 1957, 1; and *Aviation Week* 67:22, December 2, 1957, 28.

⁴⁴ Eisenhower to LBJ, January 21, 1958, EL, WHO, OSANSA, NSC Series, Administration Series, Box 4, Folder - NSC Agenda and Minutes - 1960, 1.

⁴⁵ See political cartoon in "Perils, Problems, The Job Ahead," *Newsweek* 51:2 (January 13, 1958).

⁴⁶ Ambrose, *Eisenhower*, v. 2, 435.

⁴⁷ Comments by R.C. [Robert Cutler] on W. C. Foster article, May 29, 58, EL, WHO, NSC Series, Briefing Notes Subseries, Box 8, Folder - Fallout Shelters (2), 1.

⁴⁸ Memorandum of Conference with the President, December 5, 1957, *ibid.*, OSS, Subject Series, Department of Defense Subseries, Box 2, Folder - Budget, Military (6) (September 1957-January 1959), 1.

to grant the entire request.⁴⁹ The House argued that its purpose was “to accelerate and expand certain high priority programs in the interest of shortening the time by which our military capabilities will have been advanced so as to more arrestingly deter war and more swiftly and devastatingly respond to any attack. In short, it is to buy time.”⁵⁰

As the president and Congress implemented initial changes in U.S. national security programs in January, the NSC began to deliberate the Gaither committee’s conclusions more fully. When the Gaither committee presented its report to the NSC in November, the United States planned to have 10 ICBMs in 1959, 30 in 1960, and 50 in 1961. In addition, by 1961, the United States forecast stationing 120 IRBMs in Europe and commissioning 3 nuclear submarines carrying 16 Polaris missiles each.⁵¹ Over the last two months of 1957 and in 1958, the administration began to re-examine these force goals. In December, Eisenhower agreed to an ICBM force of 130 missiles. In March 1958, the JCS asked for additional funding for other programs. It requested \$400 million for the Polaris missile system, \$100 million for developing solid-propellant IRBMs and ICBMs, and \$100 million for the Titan ICBM.⁵² In April, Eisenhower agreed to expand the number of IRBMs to 180 missiles.⁵³

At the same time as administration officials were examining ballistic missile capabilities, they were also discussing how to reduce SAC vulnerability. The Gaither committee recommended five specific ways to lessen the vulnerability of U.S. retaliatory forces: increasing alert capabilities, dispersing SAC forces, obtaining greater warning of an attack, hardening SAC bases, and building anti-aircraft and anti-missile defenses. In his memoirs, Eisenhower explained that of all the committee’s recommendations, he “was personally interested most in the measures to put more SAC bombers on an alert status and to disperse our SAC bases.”⁵⁴ With the exception of hardening SAC bases, the Eisenhower administration adopted these recommendations at least in part.⁵⁵

SAC worked under two scenarios in developing plans to reduce its reaction times. Under the first, the presumed Soviet attack would use bombers, which would be detected at least 30 minutes prior to reaching their targets. Until 1960, SAC expected any Soviet attack to provide this amount of warning. After 1960, SAC planned for the second scenario where the Soviet first strike would involve ballistic missiles. Under such an attack, SAC forces would receive less than 15 minutes warning. One scholar aptly concludes “It would be difficult to overstate the impact

⁴⁹ Memorandum for the Record, January 27, 1958, *ibid.*, WHO, NSC Staff, Special File Series, Box 3, Folder - Gaither Report, 2-3.

⁵⁰ *Ibid.*, 1.

⁵¹ Comparison of Estimated US-USSR Missile Operational Capability, January 5, 1958, *ibid.*, OSANSA, NSC Series, Briefing Notes Subseries, Box 16, Folder - Security Resources Panel, 1.

⁵² Memorandum for the Secretary of Defense, Appendix A, March 19, 1958, Library of Congress [hereafter LC], Nathan F. Twining Papers, Box 105, Folder - Memos 13-31 MR 1958, 1

⁵³ Memorandum of Discussion at the 363rd Meeting of the NSC, April 24, 1958, EL, Dwight D. Eisenhower [hereafter DDE] Papers, NSC Series, Box 10, Folder - 363rd Meeting of NSC, April 24, 1958, 6.

⁵⁴ Eisenhower, *Waging Peace*, 222. At the an NSC meeting in January 1958, Eisenhower asserted that “money expended on improving the early warning system and the dispersal of SAC bases to be money well spent.” Discussion at the 350th NSC Meeting, January 6, 1958, EL, DDE Papers, NSC Series, Box 9, Folder - 350th Meeting of the NSC 18. See also Memorandum for General LeMay, January 20, 1958, LC, Thomas D. White Papers, Box 15, Folder - Chief of Staff Signed Memos January 1958-December 1958, 1.

⁵⁵ Memorandum for General Cutler, April 23, 1958, EL, WHO, OSANSA, NSC Series, Briefing Notes Subseries, Box 16, Folder - Security Resources Panel, 1-2.

that this time reduction [from the introduction of the ICBM] had on the analysis of national security and on U.S. society.”⁵⁶ In March 1958, SAC accelerated the implementation of 15 minute alert status. It proposed having 158 aircraft on 15 minute alert by mid-1958, 355 by mid-1959, 425 by mid-1960, and 480 by mid-1961.⁵⁷ Of these aircraft, SAC expected to have 85 B-52 bombers on 15 minute alert in 1959, 140 in 1960, and 165 in 1961.⁵⁸ SAC made substantial progress in achieving its goals. By May 1960, SAC commander Power could disclose the fulfillment of this goal.⁵⁹

Tied closely to the reduction of reaction times was the Gaither committee’s recommendation to disperse SAC forces to a larger number of airfields. The committee was concerned that U.S. nuclear retaliatory capabilities would be concentrated at a limited number of vulnerable airfields. It recommended the construction of additional SAC bases and possibly using non-SAC and/or commercial airfields as alternatives. In February 1958, Defense Secretary McElroy announced that the supplementary appropriations for FY 1958 and the funding contained in the FY 1959 budget would “provide for completion of the dispersal of the heavy bomber wings and of a substantial number of the medium bomber wings.”⁶⁰

While reducing the reaction time of SAC forces and dispersing SAC squadrons to more airfields won widespread support within the administration and in military circles, hardening SAC bases did not. The Gaither committee recommended building blast shelters to protect SAC aircraft, equipment, and personnel. The JCS and Defense Department concluded that “Any program to harden other than the SAC numbered Air Force command control centers does not appear to be warranted at this time.”⁶¹ They explained that while hardening might protect personnel and planes, it would not prevent the destruction of the runways or reduce the dangers posed by radiation.⁶²

In addition to the issues of alert, dispersal, and hardening, the Gaither committee made two other recommendations, which were designed to reduce the vulnerability of SAC and protect the continental United States. It advocated acquiring early warning of an attack and constructing active defenses against both aircraft and missiles. The Soviet Union possessed, or would in the near future, the capability to launch an attack against the United States using airplanes, ICBMs, and submarine-launched missiles. After evaluating the Gaither committee’s proposals for air defense weapons systems, the JCS decided to “provide for NIKE and/or HAWK protection at 55 SAC (41 bomber, 9 refueling and 5 missile) bases, with incidental protection afforded 15 (8

⁵⁶ Jack H. Nunn, *The Soviet First Strike Threat: The U.S. Perspective* (New York: Praeger Publishers, 1982), 159.

⁵⁷ “Supplemental Report on Items in Security Resources Panel Report,” March [?] 1958, EL, WHO, OSANSA, NSC Series, Policy Papers Subseries, Box 22, Folder - Gaither Report, 3.

⁵⁸ Memorandum for the Secretary of Defense, March 21, 1958, NA, RG 218, JCS, 1958 - Geographic File, CCS 381 US (1-31-50) Sec. 76 RB, 4.

⁵⁹ Hopkins, J.C., and Sheldon A. Goldberg, *The Development of Strategic Air Command, 1946-1986 (The Fortieth Anniversary History)* (Offutt Air Force Base, Nebraska: Office of the Historian, SAC, 1986), 101.

⁶⁰ Statement of Secretary of Defense Neil McElroy Before the Preparedness Investigating Subcommittee of the Senate Committee on Armed Services, February 26, 1958, EL, WHO, OSS, Subject Series, Department of Defense Subseries, Box 1, Folder - Department of Defense Vol. 2 (5) February 1958, 8.

⁶¹ “Report by the Joint Strategic Plans Committee to the Joint Chiefs of Staff on Provision of Blast Shelters at SAC Bases,” February 19, 1958, NA, RG 218, JCS, 1958 Geographic File, CCS 381 US (1-31-50) Sec. 75, 2585.

⁶² Memorandum for the Record, January 31, 1958, NA, RG 51, Office of Management and Budget Records, General Budgetary Administration, Subject Files, Series 51.14a - Subject Files for the National Military Establishment and Department of Defense, 1953-1961, Box 3, Folder - Defense Department Air Defense Programs, 2.

bomber, 6 refueling and 2 missile) additional SAC bases for a total of 70 projected bases, by end FY 1961.”⁶³ Furthermore, it recommended the performance of “vigorous research” on the development of defenses against ICBMs.⁶⁴ It also emphasized that the “operational availability of BMEWS [Ballistic Missile Early Warning System] for ICBM should be actively pursued.”⁶⁵

The concern over the submarine threat led to an increase in the FY 1959 budget of \$262 million more than had been requested prior to the Gaither committee.⁶⁶ An even more telling indication of the fear generated by submarines was a JCS plan for dealing with them. The JCS argued that “the most practical solution [to the submarine threat] lies in establishing control over the launching submarine prior to the launching of its missiles. In peacetime, this control includes detection, tracking, identification, hold-down tactics, and in certain situations constituting an immediate and vital threat to the security of the United States, destruction of the submarine.”⁶⁷

One of the last Gaither committee recommendations concerned augmenting U.S. limited military operations capabilities. The committee was very worried that the administration’s reliance on nuclear weapons as the main deterrent against the Soviet Union reduced U.S. military options in the event of a crisis and made a nuclear war more likely. Civilian strategists had been debating various aspects of limited war strategies since at least 1954 with the discussions reaching a peak after the publication of Henry Kissinger’s *Nuclear Weapons and Foreign Policy* in 1957.⁶⁸ The Gaither committee did not recommend specific increases in limited war capabilities but did call for a study of whether the United States was prepared for such conflicts.

The Defense Department, Air Force, and Eisenhower questioned whether the United States did not already possess the necessary capabilities to wage limited military operations. Secretary of Defense McElroy expressed concern at the increased costs involved in augmenting U.S. conventional forces.⁶⁹ Deputy Defense Secretary Donald Quarles doubted any war with the Soviet Union could be fought without nuclear weapons and feared that if the United States announced that it could occur, then it would encourage Soviet aggression with conventional weap-

⁶³ “Report by the Joint Strategic Plans Committee to the Joint Chiefs of Staff,” March 3, 1958, NA, RG 218, JCS, 1958 Geographic File, CCS 381 US (1-31-50) Sec. 75 RB, 2605.

⁶⁴ Memorandum for the Secretary of Defense (Area Defense Against ICBMs), March 31, 1958, LC, Twining Papers, Box 105, Folder - Memos 13-31 MR 1958, 2.

⁶⁵ Memorandum for the Secretary of Defense (BMEWS), March 28, 1958, *ibid.*, 1. See also “Report by the Joint Strategic Plans Committee to the Joint Chiefs of Staff,” March 24, 1958, NA, RG 218, JCS, 1958 Geographic File, CCS 381 US (1-31-50) Sec. 76, 2655.

⁶⁶ “Supplemental Report on Items in Security Resources Panel Report,” March [?] 1958, EL, WHO, OSANSA, NSC Series, Policy Papers Subseries, Box 22, Folder - Gaither Report, 7.

⁶⁷ Report by the Deputy Director for Strategic Plans, July 17, 1958, NA, RG 218 JCS, 1958 Geographic File, CCS 381 US 91-31-50) Sec. 78, 2751.

⁶⁸ See Henry A. Kissinger, *Nuclear Weapons and Foreign Policy* (New York: Harper & Brothers, 1957), Robert Endicott Osgood, *Limited War: The Challenge to American Strategy* (Chicago: The University of Chicago Press, 1957), and R. McClintock, “A National Doctrine for Limited War,” October 4, 1957, NA, RG 59, Records of the Department of State, Policy Planning Staff Records, 1957-61, Lot 67D 548, Box 121, Folder - Military and Naval Policy. For excellent bibliographies of the writings concerning limited war strategies, see Morton H. Halperin, *Limited War: An Essay on the Development of the Theory and An Annotated Bibliography* (Cambridge, MA: Center for International Affairs, Harvard University, 1962); and Department of the Army, Pamphlet 20-60: *Bibliography on Limited War*, Headquarters, Department of the Army, February 1958.

⁶⁹ Memorandum of the Discussion at the 364th Meeting of the NSC, May 1, 1958, EL, DDE Papers, NSC Series, Box 10, Folder - 364th Meeting of NSC, May 1, 1958, 4.

ons.⁷⁰ Both Air Force Chief of Staff Thomas White and JCS Chairman Twining “insisted that the United States already possessed strong capabilities for fighting limited war.”⁷¹ President Eisenhower acknowledged concerns that he had with augmenting U.S. forces for limited military operations. He believed that “Each small war makes global [nuclear] war more likely.”⁷²

While the NSC debated limited military operations capabilities, an interdepartmental study group discussed these issues and completed a 250 page examination in June. Unfortunately, most of its report and the discussions related to it remain classified. However, it evidently reached several general conclusions. While the United States could use more limited war capabilities, its current forces were adequate. If a limited war did occur, the United States needed to notify the enemy of its intentions. The public needed to be educated about the role of nuclear weapons.⁷³ The interdepartmental group’s final report did not lead to any substantial changes in Eisenhower’s programs concerning limited military operations.

The last two Gaither committee recommendations dealt with the reorganization of the defense establishment and the construction of fallout shelters. In making its recommendation concerning reorganization, the committee concluded that the defense establishment was not incorporating scientific and technological advances into its military programs in an efficient manner and was plagued by bureaucratic conflicts. Eisenhower could not have agreed more. In his 1958 state of the union address, he argued that “The first need is to assure ourselves that military organization facilitates rather than hinders the functioning of the military establishment in maintaining the security of the nation.”⁷⁴ After several months of deliberations, Eisenhower made six recommendations for changes in the organization of the defense establishment. A designated unified commander rather than a commander should lead troops deployed overseas from a particular service branch. The designated unified commander should answer directly to the Secretary of Defense who answered to the president. The JCS should serve the Secretary of Defense directly rather than particular military branches. Each chief should concentrate on managing his respective branch, not on developing operational plans. A new position of Director of Defense Research and Engineering needed to be created. Congress should appropriate funds to the Secretary of Defense rather than to the individual services.⁷⁵ In August, Congress sent Eisenhower a bill that contained most of what he requested.

The Eisenhower administration’s response to the five year \$25 billion shelter program was not nearly as favorable. Eisenhower and Vice President Richard Nixon expressed serious reservations about the effectiveness of shelters in maintaining the viability of the country after a nuclear exchange. The question for them was not whether the shelters would reduce casualties. They recognized that shelters would substantially lower casualty rates. However, the president “noted that it had been said that fallout shelters might save 50 million people, a reduction of 35% in casualties. In talking about such figures, we were talking about the complete destruction of the

⁷⁰ *Ibid.*, 4.

⁷¹ *Ibid.*, 7.

⁷² *Ibid.*, 10.

⁷³ Conference, June 17, 1958, EL, WHO, OSS, Subject Series, Alphabetical Subseries, Box 21, Folder - Nuclear Exchange (Sept. 1957-June 1958) (3), 1. See also Memorandum for the National Security Council, June 18, 1958, NA RG 59, State Department/OCB and NSC, 1947-63, Lot 63D 95, Box #111, 2.

⁷⁴ Dwight D. Eisenhower, “Annual Message to the Congress of the State of the Union,” January 9, 1958 *Public Papers of the Presidents of the United States: Dwight D. Eisenhower, 1958*, 7.

⁷⁵ *Ibid.*, 247-48. See also Chris Donnelly, *United States Defense Policies in 1958* (GPO, 1959), 48-50.

United States.”⁷⁶ Nixon was even more blunt. He “suggested that it be assumed that 40 million people would be killed in event of enemy attack if we had shelters, and 60 million would be killed if we did not have shelters. If 40 million were killed, the United States would be finished. He did not believe we could survive such a disaster. Our major objective must be to avoid the destruction of our society.”⁷⁷

The FCDA was the only government agency to support the program without reservations. Leo Hoegh, the FCDA’s director, argued that shelters would bolster the deterrent power of retaliatory forces, strengthen the position of U.S. negotiators, and would reduce casualties in a war 35 to 45 percent.⁷⁸ Opponents, such as Secretary of State John Foster Dulles, Robert Cutler, and Atomic Energy Commission chairman Admiral Lewis Strauss, questioned the costs and effectiveness of shelters, thought they might make war more likely, and wondered about their impact on U.S. allies.⁷⁹ After these discussions, the NSC decided not to accept the Gaither committee’s shelter recommendation. But, it did create an interdepartmental committee to study passive defenses, institute a public education program, and support research on different types of shelters.⁸⁰ It finally recommended spending \$35 million in FY 1959 for certain minimal shelter studies.⁸¹

During the first six months of 1958, Eisenhower instituted alert and dispersal programs, expanded early warning radar coverage, programmed anti-aircraft and anti-missile defenses, and accelerated the development and deployment of several different missile systems. While the specific recommendations did not reflect complete agreement with those of the Gaither committee, they do show its considerable influence. After the summer of 1958, the Gaither report was rarely discussed within the Eisenhower administration or mentioned in public debates. However, the report’s obscurity during this time does not signify its lack of importance in helping shape debates concerning U.S. national security programs. The changes in these programs during the first half of 1958 were only the first of many to occur before Eisenhower left office.

Between July 1958 and the end of his presidency, Eisenhower continued to expand strategic missile forces, disperse U.S. nuclear delivery systems, increase SAC alert capabilities, expand radar coverage, and construct active defenses. The Gaither committee proposed the expansion of five separate offensive missile systems: Thor and Jupiter IRBMs, Atlas and Titan ICBMs, and the Polaris SLBM. By the end of FY 1963, it recommended that the United States deploy 240 IRBMs, 600 ICBMs, and 6 Polaris submarines carrying 16 SLBMs. In total, these forces would have consisted of almost 940 nuclear missiles.⁸² Over his last three years in office, Eisenhower met and then surpassed these force levels. In August 1958, the Defense Department studied expanding the programmed ICBM force to 200 missiles (110 Titan and 90 Atlas).⁸³ In November

⁷⁶ Memorandum of Discussion at the 351st NSC Meeting, January 16, 1958, EL, DDE Papers, NSC Series, Box 9, Folder - 351st Meeting of NSC, January 16, 1958,, 8.

⁷⁷ *Ibid.*, 11-12.

⁷⁸ *Ibid.*, 2.

⁷⁹ *Ibid.*, 6-11.

⁸⁰ *Ibid.*, 4.

⁸¹ [Untitled], March 28, 1958 - R.C., EL, WHO, OSANSA, NSC Series, Briefing Notes Subseries, Box 8, Folder - Fallout Shelters, 1.

⁸² *Gaither Report*, 34.

⁸³ See Jacob Neufeld, *The Development of Ballistic Missiles in the United States Air Force 1945-1960* (Washington, D.C.: Office of Air Force History, United States Air Force, 1990), 190; and Roman, *Eisenhower and the Missile Gap*, 179.

1959, the Defense Department proposed and Eisenhower approved a force of 270 ICBMs (140 Titans and 130 Atlas).⁸⁴ By Kennedy's inauguration in January 1961, Eisenhower had programmed the deployment of 810 ICBMs (130 Atlas, 140 Titan, and 540 Minuteman).⁸⁵

Eisenhower also supervised a similar expansion of the development of Polaris missile submarines. He saw the Polaris as a major hedge against the Soviet Union launching a surprise attack. By providing a virtually invulnerable second strike capability, the Polaris would force Soviet leaders to consider even more seriously the consequences of attacking the United States. In 1958, Eisenhower approved plans to construct 9 Polaris submarines. A year later, he agreed to expand the force even further to 15.⁸⁶ By July 1960, the president approved the construction of 24 Polaris submarines.⁸⁷ These 24 submarines added 384 SBLMs to the already planned 810 ICBM force.

In addition to the ICBM and Polaris forces, the Eisenhower administration implemented its plans to deploy both Thor and Jupiter IRBMs overseas. In April 1958, Eisenhower had agreed to a Defense Department recommendation to deploy 12 IRBM squadrons (9 Thor and 3 Jupiter) containing 15 missiles each. Ultimately, four Thor and 3 Jupiter squadrons became operational in Great Britain, Turkey, and Italy between 1959 and 1962.⁸⁸ The Eisenhower administration limited the deployment of IRBMs to seven squadrons when it realized that reliable ICBMs would be available which would make the IRBMs unnecessary and obsolete. However, while the IRBMs were plagued with shortcomings, they "demonstrated America's resolve to defend its allies and represented the only display of strategic missiles in Europe."⁸⁹

The ICBM and IRBM forces and the Polaris submarines represented only two legs of the U.S. nuclear arsenal. The third part of the nuclear triad remained SAC bombers. The Gaither committee did not recommend substantial increases in bomber force levels, but it did emphasize the importance of reducing SAC vulnerability. It proposed the implementation of alert forces, the further dispersal of bomber squadrons, the improvement of early warning, and the construction of active defenses. Eisenhower and the NSC focused on each of these issues between 1958 and 1961. Additionally, Eisenhower adopted proposals to modernize the composition of the bomber and tanker forces. While he phased out the B-36 in 1958 and began to reduce the importance of the B-47 in 1959, he increased the deployment of B-52 bombers from 243 in 1957 to 567 in 1961. Furthermore, he modernized the tanker force by introducing the KC-135.⁹⁰

Despite significantly expanding U.S. military programs in the three years after Sputnik and the Gaither committee, Eisenhower faced almost constant criticism that his defense policies failed to provide adequate guarantees for the nation's security. More specifically, his policies were

⁸⁴ See Neufeld, *Ballistic Missiles*, 184; and Roman, *Eisenhower and the Missile Gap*, 197.

⁸⁵ Roman, *Eisenhower and the Missile Gap*, 150-1 and 187. By the time Eisenhower left office, he had deployed 12 Atlas ICBMs and launched two Polaris submarines carrying a total of 32 SLBMs. See Desmond Ball, "The Development of the SIOP, 1960-1983," in Desmond Ball and Jeffrey Richelson (eds.), *Strategic Nuclear Targeting* (Ithaca, N.Y.: Cornell University Press, 1986), 57.

⁸⁶ Roman, *Eisenhower and the Missile Gap*, 184.

⁸⁷ *Ibid.*, 190.

⁸⁸ Neufeld, *Ballistic Missiles*, 224-26.

⁸⁹ *Ibid.*, 232.

⁹⁰ *Alert Operations and the Strategic Air Command, 1957-1991* (Offutt Air Force Base, NE: Office of the Historian, Headquarters Strategic Air Command, 1991), 77. See also, Peter J. Roman, "Strategic Bombers over the Missile Horizon," *Journal of Strategic Studies* 18 (March 1995), 200-10.

challenged in the area of missile strength. Senators Stuart Symington, Lyndon Johnson, and John F. Kennedy led a chorus of opposition to Eisenhower's military programs. Symington claimed in early 1958 that "It is a tragic fact that, even after the warnings contained in the Sputnik launchings, and despite the previously known deficiencies in SAC, nothing has been done to rectify those deficiencies."⁹¹ The leak of the Gaither report played an instrumental role in furthering the perception that U.S. missile capabilities were inferior to those of the Soviet Union. One recent scholar aptly concludes that while the Gaither report did not create the missile gap or fears of a national emergency, it "was essential to their circulation beyond the intelligence community and, ultimately, outside the administration."⁹²

Claims of a missile gap periodically resurfaced between 1958 and the 1960 presidential election.⁹³ Senator Symington wrote Eisenhower in the summer of 1958 "we [Symington and his advisers] believe our national intelligence system is underestimating the enemy's current and future ballistic missile capability. . . . As a result we also believe that our national defense plans and programs are not being effectively related to sound estimates of Soviet capability."⁹⁴ Others criticized the administration for failing to recognize and overcome the emergence of the alleged Soviet quantitative lead in missile capabilities. If the Soviet Union did have such a lead, Eisenhower's critics argued that the communist leaders might be more willing to take policy risks in pursuit of its goal of world domination. Senator Lyndon Johnson's chief legal counsel captured the essence of the critics' concerns when he argued that "we [U.S. leaders] have been unwilling to face the disagreeable facts that we are actually in a state of war, that the enemy has prepared for war and that unless we work 365 days a year with an urgency, as though we were in a war, we are liable to be licked and become a second-class country."⁹⁵

In 1958, Senator John Kennedy argued that the United States needed to overcome its military deficiencies. He advocated adding more tanker aircraft to SAC's forces, accelerating the development and deployment of ICBMs, IRBMs, and SLBMs, improving continental defenses, expanding airlift capabilities, and increasing manpower for limited military operations.⁹⁶ He complained that if these measures were not implemented, the Soviet "missile power will be the shield from behind which they will slowly, but surely, advance--through Sputnik diplomacy, limited brush-fire wars, indirect non-overt aggression, intimidation, and subversion, internal revolution, increased prestige or influence, and the vicious blackmail of our allies. The periphery of the Free World will slowly be nibbled away. The balance of power will gradually shift against us."⁹⁷

⁹¹ Statement of the Senate Democratic Caucus on The Current Status of the Strategic Air Force by Senator Stuart Symington, January 7, 1958, LC, White Papers, Box 17, Folder - Congressional (M-Z), 6.

⁹² Roman, *Eisenhower and the Missile Gap*, 33.

⁹³ See Robert J. Watson, "The Eisenhower Administration and the Missile Gap, 1958-1960," paper presented at the 1996 Annual Meeting of the Society for Military History, Washington, D.C., 1996; Roman, *Eisenhower and the Missile Gap*, 138-39; and Bottome, *The Missile Gap*, 115-46.

⁹⁴ Stuart Symington to the President, August 29, 1958, EL, DDE Papers, Bryce N. Harlow Records, Box 2, Folder - [Missiles] Sen. Stuart Symington, 1958, 6.

⁹⁵ *Inquiry into Satellite*, 2469.

⁹⁶ "Speech to the Senate on the Missile Gap by John F. Kennedy," August 14, 1958, reprinted in Senator John F. Kennedy, *The Strategy of Peace* (New York: Harper & Brothers, 1960), 42.

⁹⁷ *Ibid.*, 37-38.

During the 1960 election campaign and his presidency, Kennedy asked many former members of the Gaither committee to serve in important advisory roles.⁹⁸ The new president shared many of the committee's views and attempted to include them in his policies. In a campaign speech in October 1960, Kennedy cited the Gaither report in his arguments that Eisenhower was not doing enough to meet the Soviet threat. He claimed that during the Eisenhower administration, "The Soviet Union decided to go all out in missile development. But here in the United States, we cut back in funds for missile development. We slashed our defense budget. We slowed up the modernization of our conventional forces--until, today, the Soviet Union is rapidly building up a missile striking force that endangers our power to retaliate--and thus our survival itself."⁹⁹ Not surprisingly then, by the end of 1963, most of the committee's recommendations, with the significant exception of fallout shelters, had become part of U.S. policy.

Kennedy and his advisers believed that "A posture of flexible response was deem[e]d to be more credible in support of American security interests and foreign policy objectives, because a clearer and closer correspondence could be struck between the military force that was to be applied by the President and the political stakes and the scope of the military conflict at issue between the United States and an enemy power."¹⁰⁰ To achieve this policy, he expanded U.S. nuclear forces even more, increased U.S. capabilities to wage limited wars, and recommended an enlarged civil defense program. In implementing these changes, he increased expenditures for the military services from \$41.3 billion in 1960 to \$47.9 billion in 1963 and added approximately 225,000 military personnel to Eisenhower's force levels.¹⁰¹ At a news conference in 1963, Kennedy bragged that "The fact of the matter is, when we came into office we had 11 combat ready divisions; we now have 16. We increased the scheduling of Polaris, nearly double per year. We've increased the number of planes on 15 minute alert from 33 percent of our strategic air force to 50 percent. In a whole variety of ways . . . we've strengthened ourselves in defense and space."¹⁰² Furthermore, by the time he was assassinated in November 1963, the United States had deployed 631 ICBMs and 160 SLBMs and had programmed the deployment of an additional 800 missiles.¹⁰³

Conclusions

The Gaither committee finished its report at a time in the Cold War of extremely high tension. The Soviet launch of Sputnik I in October and Sputnik II in November raised serious questions of the vulnerability of the United States. While it was much easier to launch a rocket into space than to hit a target with a nuclear weapon thousands of miles away, the Soviet satellites

⁹⁸ David L. Snead, "Eisenhower and the Gaither Report: The Influence of a Committee of Experts on National Security Policy in the Late 1950s," Ph.D. Dissertation, University of Virginia, 1997, 272.

⁹⁹ "Speech to the American Legion by John F. Kennedy," October 1960, quoted in "Kennedy on National Defense," *Aviation Week and Space Technology* 73:17 (October 24, 1960), 21.

¹⁰⁰ Edward A. Kolodziej, *The Common Defense and Congress, 1945-1963* (Columbus, OH: Ohio State University Press, 1966), 328.

¹⁰¹ *The Statistical History of the United States: From Colonial Times to the Present* (New York: Basic Books, Inc., 1976), 1123 and 1141.

¹⁰² The President's News Conference of April 3, 1963, in *Public Papers of the Presidents of the United States: John Fitzgerald Kennedy*, (GPO, 1963), 308.

¹⁰³ Ball, *Politics and Force Levels*, 50-1.

seemed to indicate that country's nuclear superiority over the United States. Khrushchev's claims that his country possessed this capability only heightened concerns. While American fears were shortsighted, especially when U.S. Strategic Air Command bombers were included in a comparison of U.S. and Soviet strengths, it was hard for them to feel secure when Sputnik could pass over the United States with impunity.

The Gaither committee was not immune to these fears. Its conclusions were pessimistic and its recommendations reflected deeply held fears of the Soviet Union. It asked for an incredibly comprehensive security system. It requested military capabilities that would have allowed the United States to launch a preventive war or an overwhelming retaliatory strike, and to wage limited wars with or without nuclear weapons. Although Eisenhower wondered whether he could "carry out all of these plans and still maintain a free economy in the United States," he still carefully considered the committee's conclusions.¹⁰⁴ While he did not accept all of them, he did find many of the recommendations necessary and incorporated them into his national security programs with a careful eye on limiting their impact on the economy.

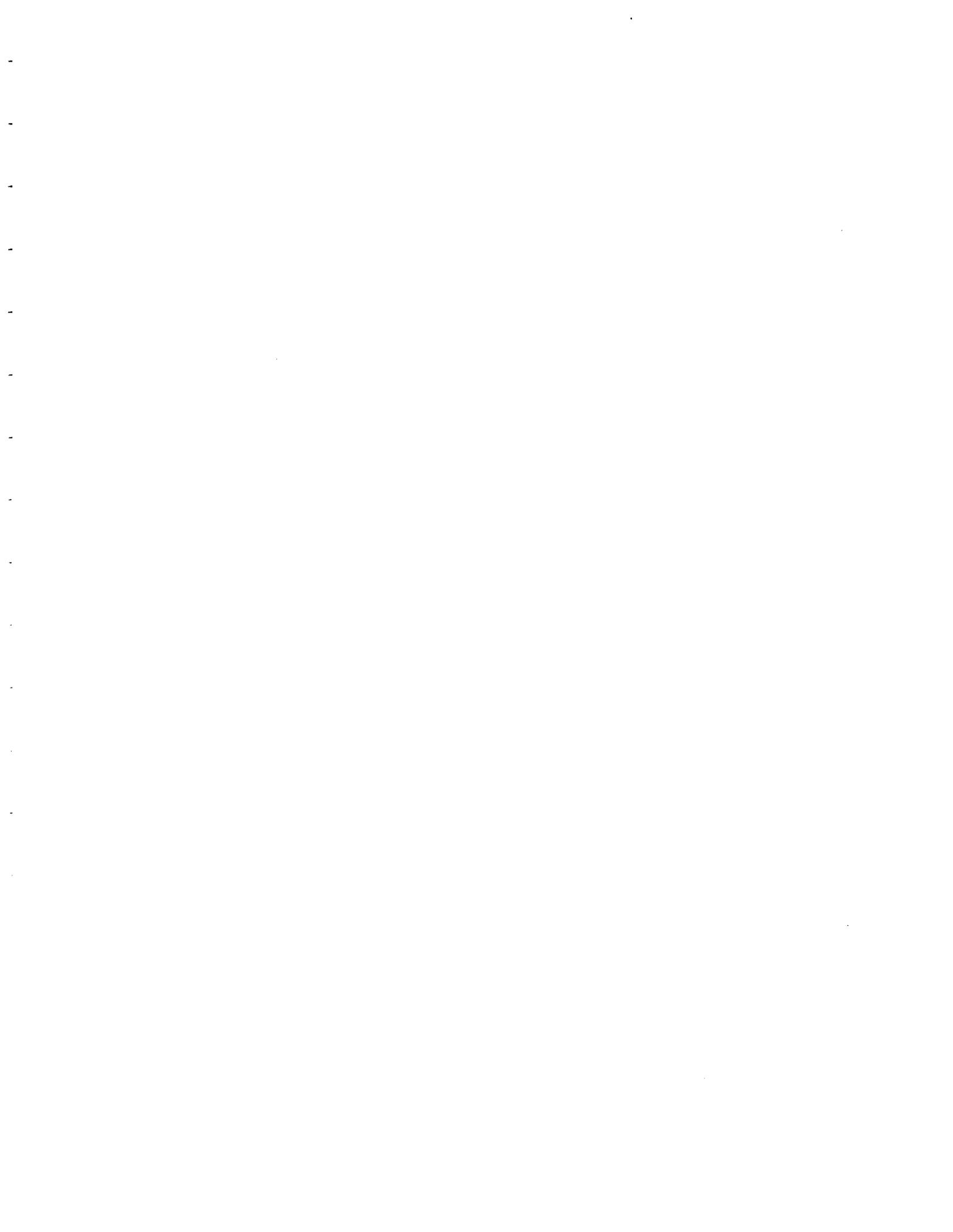
Between November 1957 and July 1958, the Gaither report remained the centerpiece of discussions of national security issues within the Eisenhower administration. After careful analysis, Eisenhower adopted changes to his national security policies, which reflected the influence of the Gaither committee's recommendations. By July 1958, he increased force levels for IRBMs, ICBMs, and SLBMs; ordered the dispersal of SAC forces to more airfields and improved in SAC's alert status; expanded early warning radar coverage; constructed additional anti-missile defenses; reorganized the Defense Department; and initiated studies of U.S. limited war capabilities and fallout shelters. While he did not accept all of the Gaither committee's recommendations, their impact is clear.

The influence of the Gaither committee did not end in the summer of 1958. For the remainder of Eisenhower's presidency and during the Kennedy administration, the presidents continually reevaluated the policies that the Gaither committee brought into focus. During these years, the specific Gaither committee recommendations lost their relevance as new reports and intelligence estimates forced the two administrations to reevaluate U.S. strategic needs. However, the import of the committee's conclusions, specifically its calls for greater strategic capabilities, limited war forces, and fallout shelters, provided a continued impetus for discussions of U.S. national security needs.

¹⁰⁴ Memorandum of Discussion at the 356th Meeting of the NSC, February 28, 1958, EL, DDE Papers, NSC Series, Box 9, Folder - 356th Meeting of the NSC, February 27, 1958, 11.

Autobiographical Paragraph

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ORGANIZING THE UNITED STATES GOVERNMENT FOR OUTER SPACE: 1957-1958

By

EILENE GALLOWAY

Defining the Problem

The dramatic orbiting of the first Sputnik by the Soviet Union on October 4, 1957 was like a spark that ignited and speeded the process of developing the exploration and peaceful uses of outer space on a continuing and larger scale. People throughout the world were astonished by this phenomenal opening of outer space as a new environment, and surprised that the Soviet Union was first to accomplish this feat. But the news struck Capitol Hill like a thunderbolt because thrusting the 184-pound satellite into outer space was evidence of the capability of launching intercontinental ballistic missiles, and therefore instantly perceived as a crisis for U. S. national defense. This perception was reinforced on November 3, 1957 when a second Sputnik weighing 1,120 pounds began circling the Earth. The U. S. was still working on the civilian scientific Vanguard satellite of 3.25 pounds.

There was instantaneous reaction by the Senate Armed Services Committee. Senator Lyndon B. Johnson, Chairman of the Preparedness Investigating Subcommittee, brought forceful leadership to this challenge, 1/ and on November 25, 1957 began the basic investigation of the nation's resources for achieving a superior space program. The "Inquiry into Satellite and Missile Programs" 2/ called upon experts representing government and industry, science and technology, education, military and civilian fields of knowledge. These hearings continued through November and December and into January 1958, recording 2,476 pages of the facts essential for understanding the total situation as a basis for planning the future. The sense of urgency was a driving force during these hearings which began at 9 A. M. and often lasted until 9:00 P.M.

An understanding of the comprehensive nature of the task was revealed by the testimony of scientists and engineers. Instead of fearing rockets as weapons, they hailed them as advanced technology for producing many benefits for mankind. Thus, the problem that required solution was two-dimensional: to preserve outer space for peaceful exploration and uses, and prevent its becoming a new arena for warfare. This situation was a classic case of presenting a choice between good and evil.

It became apparent that organization of the resources required for a space program would need to take the following factors into account: (1) satellites are inextricably international as they orbit over national boundary lines in 90 minutes or less; (2) all spacecraft require communications to send and receive information from the Earth; (3) a network of tracking stations is essential and requires international agreements; (4) the geostationary orbit used for global communications has been declared a "limited natural resource", already organized by the International Telecommunication Union; (5) nations must guard against pollution, contamination of the Earth and outer space, including celestial bodies; (6) provision must be made for protecting the health and safety of astronauts; (7) measures must be taken to cope with interference from space debris; (8) space vehicles can operate and produce benefits only when they comply with the specific rules of space technology and science; and (9) space exploration is expensive but large projects can promote patterns of international cooperation.

As the configuration of the total problem took shape during the Preparedness Hearings, major issues arose. What should be the roles of military and civilian organizations? How should national and international aspects be administered? How should the Congress be organized to handle space legislation?

On November 21, 1957 the Rocket and Research Panel submitted a proposal for creating a National Space Establishment, an independent civilian agency separated from the military and funded on a long-term basis. A similar proposal had been sent to President Eisenhower by the American Rocket Society on October 14, 1957, only ten days after the Sputnik launching. The two proposals were combined and on January 4, 1958 the Congress was urged to establish a new civilian space agency authorized to conduct manned and unmanned space missions, consider a permanent base on the Moon, flights to Mars and Venus, and develop a variety of peaceful uses. Scientists and engineers promised international leadership on this "endless frontier" and identified benefits which could be expected from space activities: 3/

There will be a rich and continuing harvest of important practical applications as the work proceeds. Some of these can already be foreseen -- reliable short-term and long-term meteorological forecasts, with all the agricultural and commercial advantages that these imply; rapid, long-range radio communications of great capacity and reliability; aids to navigation and to long-range surveying; television relays; new medical and biological knowledge, and so forth. And these will be only the beginning. Many of these applications will be of military value; but their greater value will be to the civilian community at large.

The Subcommittee concluded that the satellite was not yet a weapon, the Soviet Union had led the world into outer space, and it was now essential for the United States to make a tremendous effort to organize the resources for achieving preeminence in space. A finding was that the "same forces, the same knowledge, and the same technology which are producing ballistic missiles can also produce instruments of peace and universal cooperation": communications, meteorology, navigation and remote sensing. The responsibilities of the Subcommittee were limited to defense and it was necessary to create a special committee to handle the civilian aspects of space legislation. 4/

Investigation by House and Senate Committees

On February 6, 1958, the Senate established the Special Committee on Space and Astronautics with Senator Lyndon B. Johnson as chairman. Membership on the Committee was determined by the concern of existing committees with the variety of subjects involved in space applications that could cut across their jurisdictions. To solve what could become a complicated legislative problem, action had to be taken to avoid dispersal of the legislative process within the Congress, fix responsibility, and give outer space matters the highest priority.

In the House of Representatives a similar "blue ribbon" Committee on Astronautics and Space Exploration was created on March 5, 1958 with the Majority Leader, Hon. John W. McCormack as Chairman.

While these committees were considering how to organize the Executive Branch, Congress moved swiftly to pass interim legislation to speed U. S. space development.

The Secretary of Defense was authorized to engage in advanced research projects leading to the creation of the Advanced Research Projects Agency (ARPA), and for one year to be responsible for space projects as designated by the President 5/ The Supplemental Military Construction Authorization Act provided \$10 million in transfer authority to the Secretary of Defense for advanced research. 6/

Among the organizations in a unique position to furnish basic information and advice on planning for the future development of space activities were the National Advisory Committee on Aeronautics (NACA), the International Geophysical Year (IGY) coordinated by the International Council of Scientific Unions (ICSU), and the Department of State on U. S. foreign policy for arms control.

Congress established the National Advisory Committee on Aeronautics (NACA) on March 3, 1915 as an independent agency reporting to the President. NACA was given authority to "supervise and direct the scientific study of the problems of flight, with a view to their practical solution...and to direct and conduct research and experiments in aeronautics." 7/ Research included missiles and manned aircraft; rocket research was concerned with engines for space and ballistic missions. Although a small agency with limited funds, NACA was successful with its expert staff in relations with the Department of Defense and as a link between the government and the aviation industry. 8/

The International Geophysical Year (IGY) was established by the international scientific community from July 1, 1957 to December 31, 1958 for scientific research of the world's total environment: the Earth, oceans, atmosphere, and outer space. This 18-month "year" was a period of peak sunspot activity favorable for interdisciplinary research. Two such studies had been made in what were termed polar Years in 1882-1883 and 1932-1933. Since that time, advances in communications and aviation technology had produced new tools for indepth research and 67 nations took part in the IGY which was organized by scientific disciplines, national committees, governmental sponsorship, and international coordination. 9/

In February 1953, the U. S. National Committee for the IGY was created by the National Academy of Sciences-National Research Council, the scientific U. S. organization that adheres to the International Council of Scientific Unions. The role of the government in administering U. S. contributions to the IGY was undertaken by the National Science Foundation which received an appropriation from Congress of \$43,500,000 for IGY research. Additional financial and logistical support came from other government agencies involved with geophysical projects, e. g., the Department of Defense, Weather Bureau, Bureau of Standards, and Coast and Geodetic Survey. The linkage between the scientific community and the government was effectively managed, both nationally and internationally, by organizations with clear policy objectives, implementing programs, and adequate funding. 10/

The United States and the Soviet Union each made a commitment to launch a satellite during the IGY. The U. S. decision was announced by the White House on July 29, 1955: 11/

... the President has approved plans by this country for going ahead with the launching of small, unmanned earth-circling satellites as part of the United States participation in the International Geophysical

Year... This program will, for the first time in history, enable scientists throughout the world to make sustained observations in the regions beyond the earth's atmosphere.

Three days later, on August 2, 1955, the Chairman of the USSR Academy of Sciences, L. I. Sedov, stated, during a press conference at the International Congress of Astronautics, that the Soviet Union planned to launch a satellite. This announcement was confirmed by the Soviet National Committee for the IGY which described the scientific mission as measurement of atmospheric pressure and temperature, cosmic rays, micro-meteorites, the geomagnetic field and solar radiation. 12/

U. S. Arms Control Policy in the United Nations

U. S. policy on preventing rockets from being used as weapons in outer space, and limiting the new environment to peaceful uses, was being pursued in the United Nations and in diplomatic channels with the Soviet Union. In a memorandum to the United Nations on January 12, 1957, the U. S. called attention to the development of rockets and that it was "clear that if this advance into the unknown was to be a blessing rather than a curse, the efforts of all nations in the field need to be brought within the purview of a reliable armaments control system." On July 22, 1957, Secretary of State Dulles emphasized the opportunity to formulate in advance a system for ensuring beneficial scientific uses rather than destructive weapons. 13/

On November 14, 1957, the UN General Assembly passed Resolution 1148 (XII) calling for study of "an inspection system designed to ensure that sending objects through outer space shall be exclusively for peaceful and beneficial purposes." On January 12, 1958, President Eisenhower wrote Soviet Premier Bulganin proposing "that we agree that outer space be used for peaceful purposes ... Let us this time, and in time, make the right choice, the peaceful choice. 14/

By the time the Congressional committees began deliberations on future U. S. organization for space activities, the high priority objective had become peaceful purposes for the benefit of all mankind.

National Aeronautics and Space Act of 1958

While the House and Senate committees had been investigating the impact of Sputnik on the United States and the future for space development, analytical studies were under way in the Executive Branch. The President's Special Assistant for Science and Technology and the Science Advisory Committee combined their assessments with those of the Department of Defense, Department of State, the Bureau of the Budget and the National Advisory Committee on Aeronautics as a basis for recommendations on legislative proposals. 15/ On April 2, 1958, President Eisenhower sent his message to the Congress with draft legislation 16/ which was referred to the House Select Committee on Aeronautics and Space Exploration and the Senate Special Committee on Space and Aeronautics. There was agreement by the committees with three main issues: that a new civilian space agency be created; that NACA should be the nucleus for transfer to the new agency; and that the Department of Defense should have jurisdiction over projects primarily associated with military requirements. However, as legislative

inquiries progressed, it became apparent that there were differences between the Congress and the Executive Branch on some of the major problems of organization that required solution.

The draft proposal assumed that all agencies would cooperate without overall coordination; NASA was to have an internal advisory board which met infrequently and had no authority over other agencies with space and space-related programs and budgets. If a question arose as to whether an activity was military or civilian, it was proposed that NASA "may act in cooperation with, or on behalf of, the Department of Defense." Although the draft preamble provided that NASA should cooperate with nations and groups of nations", there was no provision implementing this objective in the draft bill. 17/

The House Committee favored solution of the problem of overall coordination by civilian/military liaison committees of cooperation at the staff level with disputes settled by the President. The House Committee also recommended an internal Aeronautics and Space Advisory Committee of 17 distinguished members to advise the President. The Senate Committee, however, realized that the total U. S. space program involved coordination of a number of agencies and recommended a National Aeronautics and Space Board. This was changed by the Conference Committee to the National Aeronautics and Space Council whose function was to advise the President on the following duties: to survey all significant aeronautical and space activities, develop a comprehensive program, allocate responsibility, ensure effective cooperation and resolve differences. The Council was provided with a small staff. 18/ The objective of Congress was to ensure that all U. S. space activities would be handled at the highest Presidential level. The bill as finally enacted required the President to send Congress an annual report.

Both House and Senate Committees emphasized the necessity for international space cooperation. On January 14, 1958, Senator Johnson called for world leadership by the United States in the new dimension offered by space exploration: 19/

We should, certainly, make provisions for inviting together the scientists of other nations to work in concert on projects to extend the frontiers of man and to find solutions to the troubles of this earth... it would be appropriate and fitting for our Nation to demonstrate its initiative before the United Nations by inviting all member nations to join in this adventure into outer space together.

On May 13, 1958, Congressman McCormack introduced a House Concurrent Resolution calling for the Peaceful Exploration of Outer Space and expressing the sense of the Congress -- 20/

That the United States should seek through the United Nations or such means as may be most appropriate an international agreement providing for joint exploration of outer space and establishing a method by which disputes which arise in the ~~future~~ in relation to outer space will be solved by legal, peaceful methods, rather than by resort to violence.

The Concurrent Resolution was passed by the House on June 2, 1958 and by the Senate on July 23, 1958.

Emphasis on international space cooperation was further provided in the NASA Act by the Declaration of Policy and Purpose:

The Congress hereby declares that it is the policy of the United States that activities in space should be devoted to peaceful purposes for the benefit of all mankind. (Sec. 102 (a)).

Furthermore, the aeronautical and space activities shall be conducted so as to contribute materially to --

Cooperation by the United States with other nations and groups of nations in work done pursuant to this Act and in the peaceful application of the results thereof. (Sec. 2 (c) (7)).

Section 2 of the Act provides for international cooperation:

The Administration, under the foreign policy guidance of the President, may engage in a program of international cooperation in work done pursuant to this Act, and in the peaceful application of the results thereof, pursuant to agreements made by the President with the advice and consent of the Senate.

When President Eisenhower signed the NASA Act on July 29, 1958, he stated that 21/

I regard this section merely as recognizing that international treaties may be made in this field, and as not precluding, in appropriate cases, less formal arrangements for cooperation. To construe the section otherwise would raise substantial constitutional questions.

When the Senate Committee issued its Final Report, it recommended that the

Congress should be kept informed of progress being made in studies undertaken by the United Nations Ad hoc Committee on the Peaceful Uses of Outer Space... Particular attention should be paid to preserving and extending the patterns of cooperation which were formed during the International Geophysical Year... The special committee commends the National Aeronautics and Space Administration for establishing an Office of International Cooperation... and recognizes the need of the Administration to provide for various types of cooperation as approved by the President. 22/

Thus the way was open for NASA to engage in many kinds of scientific bilateral and multilateral projects with other nations, leading to hundreds of projects with over 100 nations and international organizations.

Senator Johnson was determined that outer space activities receive continuing priority at all governmental decision levels. On August 21, 1958, two appropriation bills, one on military construction and the other on supplemental appropriations, were amended to provide for an annual authorization of funds for NASA. The requirement was at first temporary but became a permanent feature of the legislative process for NASA's activities: 23/

Notwithstanding the provision of any other law, no appropriation may be made to the National Aeronautics and Space Administration unless previously authorized by legislation hereafter enacted by the Congress.

Congressional Organization 1958 24/

The work of the Senate and House Special and Select Committees ended with the passage of the NASA Act and it was necessary to consider how Congress should be organized for jurisdiction over future space legislation. Four options were examined: (1) to create a new joint committee; (2) to divide jurisdiction among existing committees; (3) to refer space legislation to the Joint Committee on Atomic Energy; and (4) to create new standing committees in the House and Senate. The fourth option was chosen and the House Committee on Science and Astronautics was established on July 21, 1958. The Senate created the Committee on Aeronautical and Space Sciences on July 24, 1958. This action was unusual and underscored the intent of Congress that all space activities must receive specific unified attention according to the bicameral system.

The United States and United Nations

In little more than a month after creating NASA with the strong statement of U. S. policy in favor of international cooperation, President Eisenhower asked the United Nations General Assembly to include on its agenda a draft U. S. resolution calling for the establishment of an Ad hoc Committee on the Peaceful Uses of Outer Space. This Committee was to report on United Nations' resources and organizations which could advance cooperation among nations to avoid national rivalries and preserve outer space for peaceful uses; including identification of legal problems that might arise. The resolution advocated continuation on a permanent basis of the scientific research being carried on by the International Geophysical Year.

President Eisenhower invited Senator Lyndon B. Johnson to address the United Nations and lend his influence for adoption of the U.S. resolution. This occasion, when the President sent a plane to Texas to fly Senator Johnson to the United Nations, is a dramatic event in American history, demonstrating the unity of the Government when the Republican President joined with the Democratic leader of the Senate for international action on a critical U. S. foreign policy.

On November 17, 1958, Senator Johnson urged the United Nations to adopt the U. S. proposal for the Ad hoc Committee: 24A/

... if nations proceed unilaterally, then their penetrations into space become only extensions of their national policies on Earth. What their policies on Earth inspire -- whether trust or fear -- so their accomplishments in outer space will inspire also... Today outer space is free. It is unscarred by conflict. No nation holds a concession there. It must remain this way... We know the gains of cooperation. We know the losses of failure to cooperate. If we fail now to apply the lessons we have learned

or even if we delay their application, we know that the advances into space may only mean adding a new dimension to warfare. If, however, we proceed along the orderly course of full cooperation, we shall by the very fact of cooperation make the most substantial contribution yet made toward perfecting peace....

Nineteen other nations joined the United States in sponsoring the resolution 1348 (XIII) which passed the General Assembly on December 13, 1958. Membership on the 18-nation Ad hoc Committee was chosen on the basis of those most advanced in space technology and other nations representing fair geographical distribution. The U.S.S.R. (joined by Czechoslovakia, Poland, India and the United Arab Republic) would not participate because of opposition to majority voting. This hurdle was overcome, however, when agreement was reached on making decisions by consensus.

On December 12, 1959, the General Assembly adopted Resolution 1472 (XIV) creating the permanent United Nations Committee on the Peaceful Uses of Outer Space (COPUOS) whose membership has now grown to 61 nations. COPUOS established two subcommittees: the Scientific and Technical Subcommittee analyzes and reports on technical subjects which are then taken up by the Legal Subcommittee. This is the organization and process by which five space treaties have been formulated. The Conference on Security and Cooperation in Europe made a useful definition of the consensus process: 25/

Consensus shall be understood to mean the absence of any objection expressed by a representative and submitted by him as constituting an obstacle to the taking of the decision in question.

After attending many sessions of COPUOS and the Legal Subcommittee, this author observed: 26/

It is evident that consensus is a highly desirable way of achieving international accord because (1) the process of seeking agreement continues with patience and is not cut off suddenly by a vote which may defeat what might have come to fruition had more time been taken with the give and take process of consensus; (2) the situation may be such that a majority vote could not result in the adoption of a course of action, particularly if implementation of the decision in terms of funding, personnel and technological expertise, depended upon nations which had voted against the measure; and (3) group solidarity in decisionmaking ensures maximum compliance in establishing and maintaining an activity of general benefit. There is also a positive psychological effect when members of a group feel together with sympathy for differing viewpoints, motivated by a desire to bring about harmony in their collective judgment. If a member has not objected, a proposal can be adopted but this unspoken consent should not be interpreted as negativism; there is a positive willingness to settle the issue in question.

The creation of COPUOS as a permanent space organization within the United Nations advanced the movement toward international space cooperation for protecting outer space from conflicts. The method of establishing the facts of operational

space technology as a basis for formulating legal principles, and the process by which consensus was obtained on decisions by political representatives strengthened compliance with essential guidelines. The United Nations became the forum for coalescing action at a critical time in history. Strong agreement on the objective of maintaining outer space for beneficial uses kept nations negotiating with patience until their disagreements were overcome. Within this UN context which the United States worked with dedicated leadership to establish, the UN COPUOS formulated the basic Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and Other Celestial Bodies, 27/ now ratified by 93 nations which comply with its science/technology oriented guidelines. From the provisions of this treaty, and to keep abreast of changing conditions of space science and technology, four more treaties have been spun off: the Agreement on the Rescue of Astronauts, the Return of Astronauts and the Return of Objects Launched into Outer Space 28/, Convention on International Liability for Damage Caused by Space Objects 29/, Convention on Registration of Objects Launched into Outer Space 30/ **Agreement Governing the Activities of States on the Moon and other Celestial Bodies.** 31/

In addition, Principles were adopted on four subjects: The Declaration of **Legal Principles Governing the Activities of States in the Exploration and Use of Outer Space**, with outstanding U. S. leadership, was adopted in 1963; the Principles Governing the Use by States of Artificial Earth Satellites for International Direct Television Broadcasting in 1982, Principles Relating to Remote Sensing of the Earth from Space in 1986 and Principles Relevant to the Use of Nuclear Power Sources in Outer Space in 1992.

All the treaties except the Moon Agreement have gained acceptance and compliance, so evidently the Moon situation requires more definition before there is movement toward acceptable solutions.

During the past 40 years we have been successful in extending international law into outer space, and to such an extent that we have created a special branch of space law. We do not need a police force to ensure compliance with these ratified legal provisions because they have been shaped to conform with the operational imperatives of space technology.

On December 31, 1958 the Senate Special Committee on Space and Astronautics published "Space Law: A Symposium" which was an expression of continuing concern with legal guidelines for orderly conditions in outer space. 32/

Conclusions

If the Vanguard had been orbited before the Sputnik, we would not have been able to establish a coordinated national and international framework for developing the beneficial uses of outer space as quickly and successfully as we did; instead, we might have drifted into a period of instability without decisiveness on creating the conditions essential for maintaining outer space for peaceful uses. Vanguard first would have been an historical event hailed by engineers and scientists as tools for their projects, and it would have made front page news. But it would not have electrified the world, the U. S. public, in particular, would have taken for granted that we would be first in rocketry; and most of all, it would not have aroused the fear of orbiting Soviet weapons that galvanized political decisionmakers to take immediate action for achieving

U. S. preeminence in outer space. Had the second Sputnik of 1,120 pounds been orbited after Vanguard, it would have aroused fear of those responsible for U. S. national defense, but information falling on the public in pieces over a period of time would not have had the same psychological impact on all groups simultaneously as happened with the timing of Sputnik.

The Sputnik was launched at exactly the right time, when space rocketry was in its earliest stages, to alert nations to the necessity for containing this global mechanism within the bounds of civilization. By striking such a complete lightning blow, the Sputnik had a unifying effect, drawing together all the societal elements needed for finding ways to establish conditions to ensure peace and prevent war in this pristine environment. Groups that were working separately on space missions, national defense, arms control, and within national and international organizations, immediately fused on one objective: to maintain outer space as a dependable, orderly place for beneficial pursuits. They were strengthened by the nature of space science and technology which produces benefits only when operating under normal conditions. No one wanted any disruption of space communications, which became a multi-billion dollar industry, weather predictions which saved lives and property, disaster relief, and the many practical uses of remote sensing.

The quickened pace of political action in 1957-1958 launched a regime that preempted outer space for the peaceful exploration and uses that we have enjoyed for 40 years.

In 1957 the United States had all the resources needed for developing a superior space program.

First, there was a thriving aviation industry ready to expand into aerospace.

Second, the NACA, a government agency already working on problems of flight and outer space, could be expanded into a new civilian space agency. NACA already had excellent relations with the Department of Defense and the aviation industry, and there was agreement that the Department of Defense could not develop all the civilian applications but needed jurisdiction over military space matters.

Third, the International Geophysical Year was organized by scientists and engineers working on outer space projects, and with a strong U. S. contingent.

Fourth, political leadership rocketed immediately on the day after Sputnik was launched. Senator Lyndon B. Johnson began planning for the full-scale investigation "Inquiry into Satellite and Missile Programs" which began in November 1957. He was a driving force for speeding U. S. space objectives. On January 31, 1958 the U. S. orbited Explorer I, the satellite whose data led to the significant discovery of the Van Allen radiation belts.

Fifth, there was harmony between the Executive and Legislative Branches of the government; between the Republican President and the Democratic Congress on national and international space objectives.

Sixth, to implement space policies, organizations were quickly formed in the Executive Branch by dividing civilian and military uses and providing overall coordination, in the Congress with new standing committees, and in the United Nations by establishing the Committee on the Peaceful Uses of Outer Space.

National and international organizations expanded to use space technology to improve functions they were already performing, i. e., the International Telecommunication Union (ITU), the World Meteorological Organization (WMO), and their counterparts in national governments.

During four decades of space development, some institutions made changes in their organization charts, but the general framework for achieving overall goals continued. Such changes are not unique to outer space and often occur because different managers like to alternate between centralization and decentralization practices.

As long as rules and regulations are effectively coordinated with scientific and technical facts, we can expect to maintain peaceful non-violent conditions. Difficulties could develop, however, if special groups were allowed to promote political and economic philosophies which ignore physical facts.

We have succeeded in expanding international law into outer space so that a new branch of international space law has been formed. Space law is remarkably self-enforcing because engineers and scientists have contributed to its formation by specifying the conditions they must have in order to operate and communicate between the Earth and outer space.

* * * * *

Dr. Eilene Galloway retired from the Congressional Research Service as Senior Specialist in International Relations (National Security). Following the launching of Sputnik, she was Special Consultant to Senator Lyndon B. Johnson in 1957-1958 when he was Chairman of the three Senate committees that held hearings on the missile-satellite situation and the NASA Act of 1958. She continued as Special Consultant to the Senate Committee on Aeronautical and Space Sciences. She was Consultant to Hon. John W. McCormack, Chairman of the House Committee on Astronautics and Space Exploration during the hearings on the NASA Act of 1958. She has been U. S. Delegate to the United Nations Committee on the Peaceful Uses of Outer Space and its Legal Subcommittee, and as Observer for the International Astronautical Federation. She received the NASA Public Service Gold Medal Award in 1984. She is Honorary Director of the International Institute of Space Law and Trustee Emeritus of the International Academy of Astronautics. She is a Fellow of the American Institute of Aeronautics and Astronautics and the American Astronautical Society. She is at present a member of the NASA Advisory Committee on the International Space Station. Her biography and list of publications are in Who's Who in America and those including American Women and Science and Engineering.

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Biographical Note is at the end of text on page 11.





Sputnik. A Political Symbol & Tool in 1960 Campaign Politics

Paper Proposal: "Reconsidering Sputnik: Forty Years Since the Soviet Satellite"
A Symposium Sponsored by NASA, the Smithsonian Institute,
the Woodrow Wilson Center, & George Washington University
30 September-1 October, 1997

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It is commonplace in the United States for presidential candidates and opposition parties to criticize intensely the policies of the incumbent president and party. This tactic is often used to garner support for the challenger and opposition party; moreover, it provides a basis on which the party can formulate its platform and a foundation on which the individual, if elected, can develop and implement new policies. This is precisely what the Democratic Party--and its prospective presidential candidates--did in the late 1950s in preparation for the 1960 presidential election. A major focus of the Democrats was U.S. national security and American power, prestige, and leadership in the international system. In fact, the 1957 Sputnik launching became the primary symbol of the Democrats' argument that Eisenhower administration defense policies had allowed a missile gap to develop that favored the Soviet Union and had precipitated a supposed decline in American power, prestige, and leadership in the international arena.

This paper will examine how and why the Democratic Party in the late 1950s used the Sputnik launching, and thus subsequent questions about the missile gap and American power and prestige, to raise national attention about American national security and national leadership for the 1960 presidential campaign. It will investigate the Party's efforts--including those of individual members within and outside of Congress--to articulate a new approach to national defense with the expressed purpose of regaining the White House in 1960. Specifically, it will study the role of the Democratic Advisory Council (which published the Party's pamphlet on national defense in 1959), the Congressional Democrats' use of budgeting and oversight authority (which served as a stage to promote their version of national security and defense), the conflicting interpretation of intelligence data by Eisenhower administration personnel and the Democrats (which fueled the Democrats' allegations about national defense), and John Kennedy's merging of the missile gap and American power and prestige questions during the 1960 campaign (which allowed him to establish his legitimacy as a potential national leader). As a result, this paper will clearly demonstrate how Sputnik 'launched' a political battle that ultimately caused a shift in national defense policy: from Eisenhower's massive retaliation strategy to Kennedy's flexible response.



*Abstract for the Proposed Paper for the Symposium
"Reconsidering Sputnik: Forty Years Since the Soviet Satellite"*

Opening the Space Age: A Legacy of the International Geophysical Year

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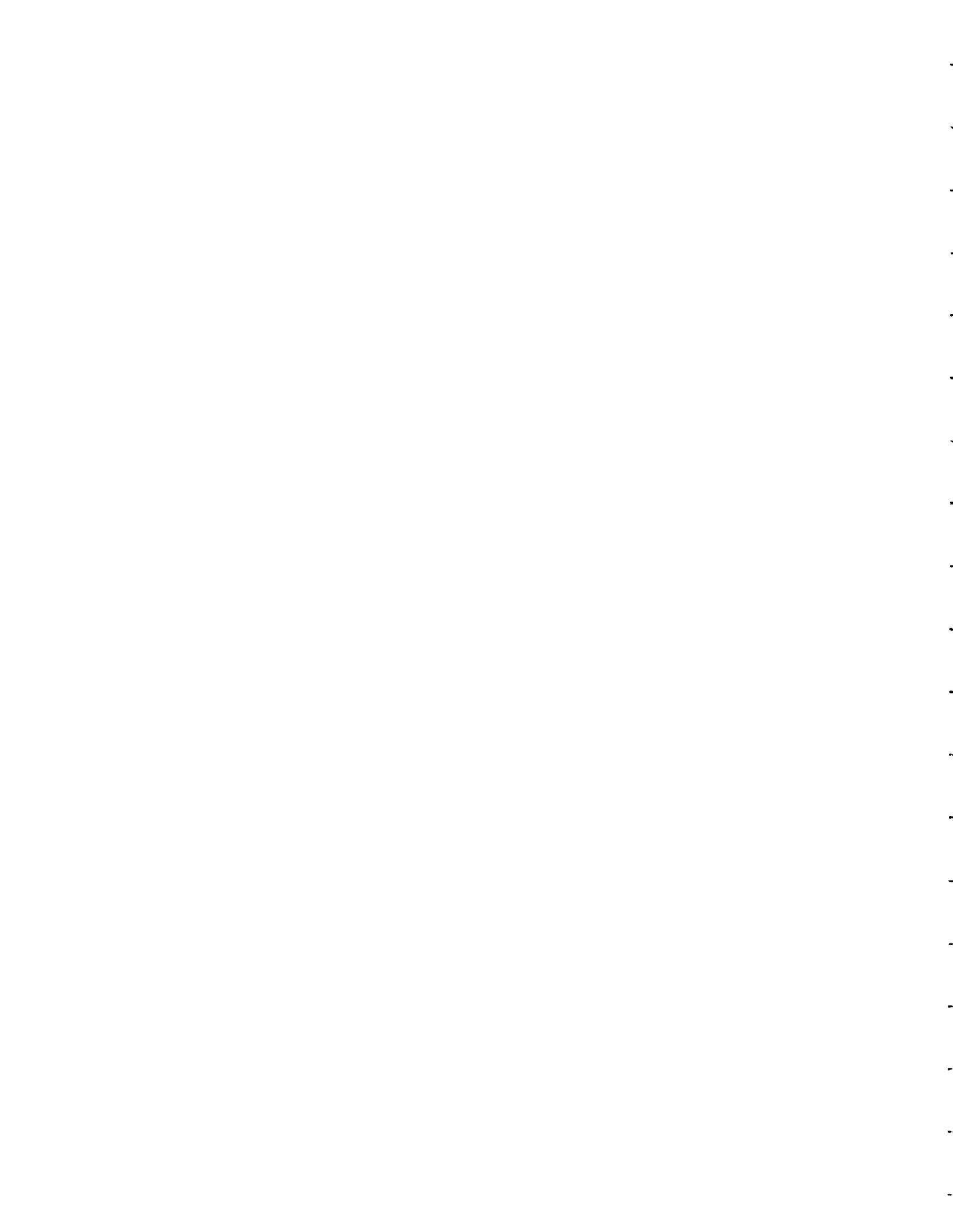
ABSTRACT

The 1954 meeting in Italy of the organizers for the International Geophysical Year (IGY) was crucial for both:

- a) the agreement to include interplanetary, cosmic radiation and solar-terrestrial research as part of the IGY program, and;
- b) the decision of the Soviet Union to join the IGY.

At this meeting the author of this historical account became one of the twelve leaders/organizers of the various scientific programs for the 67 nations in the IGY. This paper is a brief, personal account of key events leading up to the launch of *Sputnik*. Included are accounts of meetings and decisions--both scientific and political--that led the United States and the U.S.S.R. to declare the launching of satellites as one of the goals for the IGY.

The United States should not have been surprised by the launch of *Sputnik* since a year prior to its launch the Soviet leaders gave full and correct information on the orbit, frequency, fall quarter 1957 launch plan and other details to the author in Barcelona, September 1956. Efforts to inform U.S. officials proved futile.



Building a Third Space Power: Western European Reactions to Sputnik at the Dawn of the Space Age

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The dawn of the space age is commonly identified with the launch of Sputnik by the Soviet Union on October 4, 1957. For the United States that dawn was a particularly traumatic one. This was not simply a Soviet scientific and technological first. It was also a warning that "the evil empire" would soon be technologically capable of striking American targets from Soviet bases using intercontinental ballistic missiles. It was seen too as a sign of the economic strength and even political superiority of state socialism, the triumph of rational planning over laissez-faire liberal democracy. Sputnik turned space from a realm of dreams and fantasies into a locus of superpower rivalry, a major battlefield in the technological cold war.¹

If the US was able to move so quickly to transform space it was because the institutional, technological and industrial infrastructure was already in place when Sputnik was launched. Out of the missile programme came the launchers. Scientific and applications satellites for civilian or military purposes were on the drawing boards if not already built. Within months of Sputnik being launched the properties of the Van Allen radiation belts were being probed with Explorer. Within a year the Department of Defence's communications satellite SCORE (Signal Communication by Orbiting Relay Equipment) was aloft. Film-capsule recovery from the first mixed civilian-military Discovery series of reconnaissance satellites, under development since 1955, occurred in August 1960. The Air Force's SAMOS (Satellite Military Observation System) satellite followed a few months later. Tiros I, the first of a series of meteorological satellites was launched on April 1, 1960.² And of course in April 1961 manned space flight began with Yuri Gagarin. In short within three or four years space had become a region to be researched, exploited and dominated, the new world which the United States and the Soviet Union raced to conquer.

Yet if this was the meaning that space quickly assumed for the two superpowers, matters were different in western Europe. Here there was excitement and admiration for the

¹ The classic account is of course W. A. McDougall, ...*The Heavens and the Earth: A Political History of the Space Age* (New York, 1985).

² On these applications satellites programmes see A. J. Butrica (ed), *Beyond the Ionosphere. Fifty Years of Satellite Communication* (Washington DC/ NASA-SP4217, 1997), P. E. Mack, *Viewing the Earth. The Social Construction of the Landsat Satellite* (Cambridge: MIT Press, 1990), and F. Nebeker, *Calculating the Weather. Meteorology in the 20th Century* (San Diego: Academic Press, 1995).

scientific and technical achievement.³ But there was not the same drive for conquest, nor the same level of fear, of feeling militarily vulnerable to attack. More than a decade after the war Western European governments had adapted themselves to the 'communist threat' on their doorsteps or, indeed, in their homes if not under their beds. Through NATO their security was intimately tied up with the presence of US troops on European soil and the shelter provided by the American nuclear umbrella. Of course Sputnik reinforced doubts that the United States would be prepared to retaliate 'massively' to defend Western European cities from a Soviet attack: could one really expect New York to be sacrificed to save Paris?⁴ But the Suez crisis in 1956 had already shaken any blind faith in the US's willingness to support the military adventures of their European allies. Indeed six months before Sputnik the British Minister of Defence, Duncan Sandys, had confirmed that the country would develop its own nuclear deterrent based on its V-bomber force equipped with hydrogen weapons and an intermediate range ballistic missile called *Blue Streak*.⁵ At the same time negotiations were under way with the US early in 1957 for the installation of *Thor* IRBMs on British soil and cooperation had already begun on nuclear submarines. In short, while people operating everything from amateur radios to the giant radiotelescope at Jodrell Bank enthusiastically tracked the passage of Sputnik over British soil, the newly elected government of Prime Minister Harold Macmillan had already taken steps to redress the technological imbalance of power in the European theatre.⁶

There was, then, no 'Sputnik crisis' in Britain. On the contrary, the UK government welcomed the event as a renewed opportunity for them to draw closer to the USA. For a decade the British had been smarting under what they felt was the cruel injustice of the Atomic Energy (or McMahon) Act, passed by Congress in July 1946. This bill prohibited the passing of nuclear information to foreign nationals, so effectively putting a halt to Anglo-American nuclear collaboration which had been so valuable to both partners since 1941. Minor modifications were made in 1954, when the US authorities were permitted to supply information on the external characteristics of atomic weapons, though sharing information on warhead design was still prohibited.⁷ Sputnik changed all that. A few days after Sputnik II was launched, Duncan Sandys told the House of Commons that "the Sputniks [...] have helped to precipitate closer collaboration with the United States [...] the new impetus towards unrestricted collaboration [...] offers new prospects which we dared not hope for a few

³For the 'euphoria' in Britain over the tracking of Sputnik I, whose orbital inclination near 65° carried it over the British isles, see H. Massey and M.O. Robins, *History of British Space Science* (Cambridge University Press, 1986), pp.39-41.

⁴ On NATO see typically L.S. Kaplan, *NATO and the United States. The Enduring Alliance* (Boston: Twayne Publishers). Kaplan quotes Secretary of State Herter in April 1959 as saying that he could not "conceive of any president engaging in all-out nuclear war unless we were in danger of all-out devastation ourselves" (p. 80). See also A. J. Pierre, *Nuclear Politics. The British Experience with an Independent Strategic Force 1939-1970* (London: Oxford University Press, 1972).

⁵ For general political developments in the UK see A. Sked and C. Cook, *Post-War Britain. A Political History* (Penguin Books, 1980), chapters 5 and 6.

⁶ On Jodrell Bank see e.g. J. Agar, "Moon Relay Experiments at Jodrell Bank and references cited therein, in A. J. Butrica, *Beyond the Ionosphere. Fifty Years of Satellite Communication* (Washington DC: NASA History Series, NASA SP-4217, 1997), 19-30.

⁷ On the Anglo-American 'special relationship' see, e.g. J. Baylis, *Anglo-American Defence Relations 1939-1984* (London: Macmillan, 1984), I. Clark, *Nuclear Diplomacy and the Special Relationship. Britain's Deterrent and America, 1957 - 1962* (Oxford: Clarendon Press, 1994), and M. Gowing, "Nuclear Weapons and the 'Special Relationship'", in W.M. Roger Louis and H. Bull (eds), *The 'Special Relationship'. Anglo-American Relations Since 1945* (Oxford: Clarendon Press, 1986), chapter 7, and A. Pierre, op. cit.

months ago". Indeed the British felt that it was just this kind of shock that the US needed to alert to them to the value of working together with their friends. The Americans, one internal Whitehall minute noted patronisingly in December 1957, "need Pearl Harbours from time to time, and perhaps it is just as well that the Russians are capable of delivering them in this relatively harmless way".⁸ Indeed in 1958 the McMahon act was revised to permit the exchange of information about the design and production of nuclear warheads and the transfer of fissile materials to countries that "had already made substantial progress in the development of atomic weapons", meaning Britain above all. There were further relaxations in 1959.⁹ The 'Sputnik shock' in the US had then just the opposite effect in Britain. It was seen as being to Britain's advantage, as breathing new life into the faltering Anglo-American "special relationship" in the nuclear field just when the UK was developing new technologies for its independent deterrent.

Britain's coolness in the face of the new Soviet triumph also reflected its relative impotence, its knowledge that it had neither the institutional, technological or industrial infrastructure to confront Khrushchev on his own terms. And what was true for Britain was even more so for France, whose science base was only just beginning to show real signs of post-war recovery and whose crumbling IVth Republic was embroiled in a bitter war in Algeria.¹⁰ "The victory of the Soviet engineers (techniciens)", wrote *Le Monde* a couple of days after the news of 'Spoutnik' broke, "can be seen to be purely scientific". The editorial recognized that missiles and satellite launchers originated in the same technology of course, but it insisted on maintaining a strict divide between the objectives of the two. Sputnik was a small, temporary star which would soon disappear like an inoffensive meteorite and "it would need the extrapolation of a pessimistic novelist to furnish it already with a thermonuclear explosive or with the eye of a mechanical spy". The Soviet satellite was then above all a symbol of scientific and technological progress: "There is no cause for alarm for the moment", *Le Monde* reassured its readers.¹¹

In 1957 then, Sputnik and space meant very different things on opposite sides of the Atlantic. In the United States they were charged with layers of meaning, the new focal point of the titanic confrontation between the two world systems at every level. Their significance in Europe was quite other, far thinner, far more restricted. My aim in this paper is to explore that other, to show how space was perceived in western Europe, in contrast to the USA, at the end of the 1950s and early 1960s. I shall concentrate on Britain because she was the leading western European power of the day, because my source material is extensive, and because I can benefit from a number of recent other studies relevant to my problematic.

⁸ These two quotations are from N. Whyte and P. Gummett, "Far Beyond the Bounds of Science: The Making of the United Kingdom's First Space Policy", *Minerva* (1997), 139 - 197, where the original sources can be found.

⁹ See Gowing, op. cit., p. 124.

¹⁰ This paper will concentrate on Britain, though some reference will be made to the French and German situations at the end. For the former see W. A. McDougall, "Space-Age Europe: Gaullism, Euro-Gaullism, and the American Dilemma", *Technology and Culture* (1985), 180-203; C. Carlier and M. Gilli, *Les trente premières années du CNES, L'Agence française de l'espace* (Paris: La Documentation française, 1994); L. Sebesta, "La science, instrument politique de sécurité nationale? L'espace, la France et l'Europe", *Revue d'histoire diplomatique*, n° 4, 1992, pp. 313-41. For Germany see P. Fischer, *The Origins of the Federal Republic of Germany's Space Policy 1959-1965 - European and National Dimensions* (Noordwijk: ESA HSR-12, 1994).

¹¹ *Le Monde*, Bulletin de l'ÉError! Bookmark not defined.tranger, 6-7 octobre 1957.

What I want to do in this microhistory is to trace in some detail how, for British scientific and political elites alike, the meaning of space changed in the two or three years immediately following the launch of Sputnik. Originally seen above all as a domain for conducting scientific research and gaining national prestige, space gradually came to assume new functions, functions more congruent with those that it had in the US (and the USSR), yet functions which were expressed in a form specific to a Europe of medium-sized powers. It was the launcher above all (though not only) that sparked this change, a change that turned space from a realm controlled by scientists into a platform for governments to unite against the communist threat, to build a European industrial base and to create the foundations of a 'third space power' between the United States and the Soviet Union.

From upper atmosphere research to space research¹²

If the launch of Sputnik created a sense of 'euphoria' in parts of the British scientific community it was not simply because of the scientific and technological achievement that it represented. It was also because they could, literally, hardly believe their eyes or their ears. When Eisenhower announced in July 1955 that the USA planned to launch an earth satellite in the framework of the International Geophysical Year (IGY), to be held in 1957-1958, the UK had not yet officially embarked on a sounding rocket programme for upper atmosphere research. Indeed, meeting in April 1956, the British members of the IGY National Committee "were very sceptical about earth satellites ever appearing and if they did, that anything of real interest would result". Massey, the leader of the British scientific community in this field, was thus as 'surprised' and 'greatly amazed' as everyone else to hear of the launch of Sputnik at the reception which he and three other British delegates (the only representatives from Western Europe) were attending at the Soviet Embassy in Washington D.C. in October 1957. Six weeks later on November 13, 1957, after eight months of tests, Britain's first scientific experiments began using their sounding rocket *Skylark*.

The British sounding rocket programme, like that in other European countries and in the USA, benefitted enormously from military interest and support.¹³ Indeed, according to Massey, the initiative for launching an upper atmosphere research programme came not from the scientists themselves but from the ministry responsible for the UK's guided missile R & D programme at the Royal Aircraft Establishment in Farnborough.¹⁴ It is worth quoting

¹² This section is based on H. Massey and M.O. Robins, *History of British Space Science* (Cambridge University Press, 1986) and N. Whyte and P. Gummert, "Far Beyond the Bounds of Science: The Making of the United Kingdom's First Space Policy", *Minerva* (1997), 139 - 169. Some of the key papers cited in this article are easily accessible as published appendices in Massey and Robins. A fully researched history of the UK's sounding rocket programme remains to be written.

¹³ For Europe see D. Pestre, "Studies of the Ionosphere and Forecasts for Radio Communications. Physicists and Engineers, the Military and National Laboratories in France (and Germany) after 1945", *History and Technology*, 13(3) (1997), 183-205, and O. Wicken, "Space Science and Technology in the Cold War: The Ionosphere, the Military and Politics in Norway", *History and Technology*, 13(3) (1997), 206-232. For the US see D.H. DeVorkin, *Science with a Vegeance: How the American Military Created the Space Sciences in the V-2 Era* (New York: Springer-Verlag, 1992), D.H. DeVorkin, "The Military Origins of the Space Sciences in the American V-2 Era", in P. Forman and J.M. SâError! Bookmark not defined.nchez-Ron, *National Military Establishments and the Advancement of Science and Technology* (Dordrecht: Kluwer Academic Publishers, 1990), 233-260, and B. Hevly, "The Tools of Science: Radio, Rockets, and the Science of Naval Warfare", in Forman and SâError! Bookmark not defined.nchez-Ron, op. cit., 215-232.

¹⁴ For a full account of that programme see S. Twigge, *The Early Development of Guided Missiles in the United Kingdom, 1940 - 1960* (Chur: Harwood, 1993).

Massey's account in full. In its quaint, unpretentious simplicity it reveals the gulf in values that separated British researchers at this time from their ambitious, driving, entrepreneurial colleagues in the United States:

"On the morning of 13 May 1953 [Massey] was just preparing to depart from his office in the physics department of University College London to take part in the annual departmental cricket match between staff and students, when he received a telephone call from an official at the Ministry of Supply asking whether he would be interested in using rockets available from the ministry for scientific research. Without hesitation he said 'yes' and this really marked the beginning of the British scientific rocket programme".¹⁵

Subsequent negotiations led to a request for £100,000 for rocket research in the upper atmosphere to be spread over four years. Half of this money was to be paid to the Royal Society who would distribute it to university groups for building scientific instruments. The remainder would be paid to the Ministry of Supply to cover the cost of the rockets and other facilities.¹⁶ In the absence of a safe launching ground in a small country like Britain, this meant sending the *Skylarks* aloft from the Anglo-Australian rocket range in Woomera, near Adelaide, with the rather perverse effect that the British experiments measured conditions in the southern hemisphere and observed the southern sky.¹⁷ The Treasury agreed to this request in 1955 telling the Ministry of Supply that its principal reason for doing so was not because the Royal Society thought it to be "a good piece of pure research" but because there was "a defence interest in the widest sense".¹⁸

With the sounding rocket programme getting into its stride in 1958, and with the conviction that the data that UK scientists needed could be obtained from US satellites, there was little enthusiasm at senior levels in the Royal Society or in the Ministry of Supply for a British satellite programme. However, Bernard Lovell, the director of Jodrell Bank, pleaded strongly for Britain to have its own satellite and his newly won prestige and public visibility obliged both the Royal Society and the Ministry to look into the matter. The result was two virtually identical papers produced in October 1958, and essentially drafted by Massey.¹⁹ They embodied a comprehensive statement of what a British space programme should involve, and as such imbued space with a new significance, with new meanings, which it had not previously had in the United Kingdom.

In his paper Massey made a strong plea on scientific grounds for UK participation in space research with artificial satellites. Satellites, he insisted, had two advantages over sounding rockets. Firstly, whereas the former took useful data for "only a few minutes", the latter could carry out as many observations in a month as "several thousand vertical sounding rockets". Secondly, satellites could rise beyond the atmosphere, and so study radiation which was not accessible to sounding rockets because absorbed by the air. Starting from these advantages he then went on to list eleven foreseeable scientific uses of satellites, selected

¹⁵ Massey and Robins, op. cit., p. 16.

¹⁶ Massey and Robins, op. cit., pp.16 et seq.

¹⁷ P. Morton, *Fire across the Desert: Woomera and the Anglo-Australian Joint Project, 1946-1980* (Canberra: Australian Government Publishing Service, 1989).

¹⁸ Quoted in Whyte and Gummett, *Minerva*, op. cit., p. 145.

¹⁹ One version of Massey's paper is reproduced as Annex 3 in Massey and Robins, op. cit. The next four paragraphs are based exclusively on it, and all quotations can be found there.

specifically to bring out the possibilities for systematic study, continuous observation, and world-wide coverage opened up by this new technology. To blunt the criticism that everything would have done by the time the satellites were built, Massey insisted that the variety and the extent of the data were so great, and the likelihood of making unforeseen discoveries so high, that "there is no risk at all that the usefulness of the satellites will be confined to a few years only".

Massey was emphatic that this programme would only produce the desired benefits if it was an independent, purely British effort, a "Thoroughgoing British enterprise" as he put it. Could one not simply build instruments and include them in the payload of an American satellite? No said Sir Harrie. There was in the UK "a long tradition of scientific research and the British approach to scientific problems contains something unique born of this long tradition and experience". If British instruments were flown on American satellites, they "have to conform very largely with American designs in order to be acceptable. This would destroy the main advantage of a different approach to the experimental problems".

Granted that Britain should build her own satellites, could she not then ask another country to launch them? Massey felt that only one line was needed to dismiss this possibility. Such an option, he wrote "seems to offer no advantage at all, quite apart from the obvious loss of prestige". He also considered the possibility of western European collaboration in the launching of satellites, only to rule it out immediately on the grounds that Britain's lead was so great that "there would seem to be big disadvantages in the collaboration at this stage".²⁰

We shall discuss the launcher issue more carefully in a moment. Now let us simply remark that these arguments for an autonomous British space programme are so quick, even superficial that one imagines that Massey was convinced, on independent grounds, that his government would be willing to support a national space programme using not only all-British satellites but also home-built launchers. And indeed he and the Ministry of Supply recommended "adapting military vehicles to launch useful satellites [...]", as Massey's paper put it. What Massey had in mind here, although his paper did not mention this, was the possibility of developing a British launcher by combining the IRBM *Blue Streak* with *Black Knight*, a rocket initially developed to test the re-entry of warheads into the atmosphere, plus a small third stage.²¹ This was technically possible and was presented as being relatively cheap. Massey assumed that the development costs of these weapons would not be carried over from the military budget into the civil space programme. Thus British science could have a launcher capable of putting satellites weighing one ton into orbit "for the cost of adaption" only, which he estimated at £9 million for the first five satellites.

What of the use of space for other than scientific research? Massey very briefly considered three 'applications' satellites. The first was meteorological, to be used for the possible development of "methods for long-range weather forecasting, arising from the availability of regular systematic world-wide observations of atmospheric cloud and other conditions of meteorological importance". Secondly, there were telecommunications, though narrowly defined, i.e. "the use of satellites as repeater stations for long distance transmission

²⁰ We suspect that this is a reference to a US proposals to build a European IRBM under NATO auspices -- see later.

²¹ For a description of *Black Knight*, a highly successful rocket first launched in 1958, which later served as an upper atmosphere research tool for both civil and military science, see Morton, op. cit., chapter 21. That Massey had in mind this combination of launchers is from Whyte and Gummett, *Minerva*, op. cit. p. 148.

of short radio waves". Finally, and even more briefly, Massey spoke of the "use of satellites revolving in high orbit, undisturbed by atmospheric drag, for navigational fixes". None of these ideas were developed, nor were they included for anything more than completeness, Massey arguing that it was still too "difficult to predict" the potential of such "practical benefits".

What of the military dimension? Massey explicitly excluded a discussion of military aspects from his review. The debate on this issue in Britain has, however, recently been analysed in some depth by Whyte and Gummett.²² Their overall conclusion is that, at least for the period covered by this paper, the British government was never convinced of the military importance of space, systematically refused to use the military argument to justify a space programme and, which amounted to the same thing, was not willing to spend significant amounts of defence money on satellites or launchers. The reactions of the Chief Scientists of both the Ministry of Supply (Wansborough-Jones) and of the Ministry of Defence (Brundrett) to Massey's paper of October 1958 are typical in this respect. The former had serious doubts about the military interest of space, was convinced that a military space programme would be far beyond Britain's means, and suspected that the military information she might need could be acquired from the US anyway. Brundrett, for his part, recognized that there might be military benefits in the future, especially in the reconnaissance, meteorology and telecommunications areas, but he felt that these applications were "unpredictable" and that the Americans had made exaggerated claims for them. Early in 1959 the Pentagon called a joint meeting of American, British and Canadian military R & D officials to facilitate collaboration in defence research projects in the space area. US representatives stressed the "value and importance" of a military space programme. Brundrett briefed the British delegate to the talks to "try to keep space out of the defence field [...]".²³ Although of course this view was contested, it did summarise the general attitude that prevailed at this time: for Britain at the end of the 1950s space (unlike the upper atmosphere) was not a domain of military importance.

Let us now take stock. At the end of 1958 Britain had a sounding rocket programme which was just getting into stride. Funded 50-50 by the civilian science and the defence budgets, its aim was to study the properties of the upper atmosphere over the south Australian desert. A debate was also under way on the nature and scope of a British space programme. This programme was perceived primarily as a non-military scientific research effort which would extend a unique British tradition in upper atmosphere research and which would contribute to British scientific prestige (Massey specifically excluded the launch of small satellites weighing a few pounds on the grounds that they would be outmoded scientifically once they were built, and would have no prestige value). The proposed programme had one other important feature: it was to be a "Thoroughgoing British enterprise". This independence was only possible because, hovering in the wings of the space programme was the IRBM *Blue Streak*, one lynchpin of Britain's independent nuclear deterrent whose importance had been reaffirmed in the Defence White Paper published on 5 April 1957. Massey, and the Ministry's idea was that *Blue Streak* could be "adapted" to a space programme, so ensuring British autonomy -- and its status as a significant world power. That status had been badly shaken by the Suez crisis in November 1956. Sir Pierson Dixon, Britain's representative to the UN,

²² N. Whyte and P. Gummett, "The Military and Early United Kingdom Space Policy", *Contemporary Record* 8(2), Autumn 1994, pp. 343-369.

²³ For this material see Whyte and Gummett, *Contemporary Record*, op. cit., pp. 345-7.

wrote soon after that "[...] at the time I remember feeling very strongly that we had by our action reduced ourselves from a first-class to a third-class power".²⁴ In 1958 Lovell and the Foreign Office played on the same fears -- Britain would be "classed as an underdeveloped country" -- to argue that it was essential that she launch her own satellite with her own launcher.²⁵ In the minds of scientists and policy makers alike, then, at the end of 1958 space was a place where Britain would harvest scientific data and gain scientific prestige, but also a place where she would confirm, to herself and to others, that she was still a major power to be reckoned with.

The changing fortunes of *Blue Streak* in 1957 and 1958 and the place of Massey's proposals in that context

Blue Streak was a liquid-fuelled missile using kerosene and liquid oxygen based on certain designs of the US *Atlas* intercontinental ballistic missile. It was powered by two Rolls Royce engines built under licence from North American Aviation's Rocketdyne division and its range was specified as 1,500 miles initially but capable of development to 2,500 miles.²⁶ Embarked upon in 1954 with strong American support and help, the British missile was soon overtaken by the parallel development in the US of the *Thor* and *Jupiter* IRBMs intended for deployment in the European theatre. In March 1957 British and American negotiators meeting in Bermuda agreed in principle to instal *Thors* on British soil (*Jupiter* was destined for Italy and for Turkey) under a dual-key arrangement, a decision which immediately raised fears of duplication inside Britain and doubts about the need to continue with a costly and slower indigenous programme.

Blue Streak weathered this storm predominantly because the Air Ministry, supported by the Minister of Defence Sandys and his Chief Scientist Brundrett were emphatic that the missile was the cornerstone of Britain's independent deterrent and the necessary symbol of great power status. As one memo put it, "unless we are to become a second-class power we must make an independent contribution to the deterrent; the ballistic rocket is the only weapon likely to last and therefore we must have it".²⁷ But *Blue Streak* was never safe. Parts of the Air Ministry interpreted the claim that *Blue Streak* was the only durable weapon system as a threat to the V-bomber force. The Admiralty saw it, and rightly so, as the major obstacle to the development of a *Polaris*-type submarine nuclear deterrent. And they had a strong argument in their favour: the question of vulnerability. *Blue Streak* was a fixed-site land-based missile and very expensive measures would have to be taken to protect the missile from destruction by incoming enemy nuclear weapons. Submarine-launched weapons were not, of course, subject to the same danger. Finally the Treasury was concerned about rising costs. Estimates of the total cost of developing the missile excluding the warhead amounted to between £160-200 million, double the original figures. What is more the *Thor* deal was linked

²⁴ Quoted in Sked and Cook, op. cit., p. 153.

²⁵ See Whyte and Gummett, *Minerva*, op. cit., p. 152.

²⁶ For the birth of *Blue Streak* see J. Krige, "What is 'Military' Technology? Two Cases of U.S.-European Scientific and Technological Collaboration in the 1950s", in F.H. Heller and J.R. Gillingham, *The United States and the Integration of Europe. Legacies of the Postwar Era* (New York: St. Martin's Press, 1996), pp. 307-338. See also Twigge, op. cit.

²⁷ The quotation is from Clark, op. cit., p. 165. This section relies heavily on his detailed analysis of *Blue Streak's* political fortunes in chapter 5.

with the withdrawal of US financial support for *Blue Streak* which had amounted to some \$8 million by mid-1958.²⁸

Sputnik, indirectly at least, changed the terms of this debate. As we saw earlier it quickly led to amendments to the McMahon Act and to important relaxations in the restrictions on the transfer of sensitive information from the United States to the United Kingdom. One immediate result of this was that, in November 1958, Sandys could report that the Americans would be willing to supply full details of the design of the *Thor* warhead, which was also "entirely suitable for *Blue Streak*".²⁹ In addition the Americans had let it be known that they regarded *Thor* as a technologically inferior first-generation system, which would ultimately have to be replaced in any case. Thus by the end of 1958 the Minister of Defence was satisfied that *Thor* was no substitute for *Blue Streak*. However, he had to admit that *Polaris* might be, simply by virtue of its advantages in terms of mobility, flexibility and invulnerability, as well as its reducing the risk to the British Isles which a land-based IRBM dotted all over the country would entail. Since *Blue Streak* was far more advanced than *Polaris* at this stage, however, it was decided to go ahead with the development of the missile on a provisional basis, keeping a watchful eye on the progress of the latter. Prime Minister Macmillan decreed a pause of a year or so in the hope that matters would become clearer and a working party chaired by Sir Richard Powell was set up to review the future of the British deterrent.

It is into this context that Massey and the Ministry of Supply's memoranda were inserted recommending an independent British (civilian) space programme. That recommendation, it will be remembered was made in October 1958. In November Sandys was, to quote Clark, "rallying his Cabinet colleagues in support of a reprieve for *Blue Streak*". This is surely why Massey reinforced his argument for a space programme with an appeal to the independence that would come from using a nationally built launcher. He was at once confirming the importance of *Blue Streak* for non-military purposes, adding an additional argument for its reprieve, and creating the foundations of an all-British space science programme. With that agenda it is hardly surprising that Massey gave such short shrift to alternative solutions, above all the use of American launchers.

For completeness we should add that collaboration with the US was not the only alternative in the air in 1958. Indeed various kinds of European solutions were also being floated, both as regards satellites and launchers. Regarding the former, in mid-1958 the British Foreign Office suggested that Britain might take the lead in proposing the joint development of a western European satellite as a sign of its "solidarity" with countries across the Channel and to show that she was not only interested in collaborative schemes with the USA.³⁰ Around the same time some people in NATO had the idea that a second generation of solid-fuel medium-range missiles should be produced in Europe under NATO auspices. The British were most reluctant about this scheme, fearing that it might enable both France and Germany to acquire an independent missile capability.³¹ Was Massey referring obliquely to these initiatives in his October 1958 paper when he wrote: "As almost all the experience on large rockets and their use in scientific research is at present confined almost entirely to

²⁸ These figures are from Clark, op. cit., pp. 161, 163.

²⁹ Ibid., p. 172.

³⁰ See Whyte and Gummett, *Minerva*, op. cit., p. 152-3.

³¹ Clark, op. cit., pp. 175, 178-9.

Britain, among Western European countries", he said, "there would seem to be big disadvantages in collaboration at this stage."³²

1959. Two new possible contexts emerge for conducting the British space programme

Even as Massey was drafting his recommendations the context in which he would think about a British space effort began to shift. Indeed by April 1959 what was said to be inconceivable only a few months before -- collaboration with the USA -- now looked distinctly attractive.

Two considerations pushed Massey in this direction. Firstly, there was the reaction to his paper in February and March 1959 by the Advisory Council on Science Policy (ACSP). This body, which was chaired by Sir Alexander Todd, reported directly to the 'science minister'. It supported Massey's suggestion for a scientific space programme. But it backed off from using a British launcher for this purpose on the grounds of cost and the complications arising from the military connection. Better, said the committee, to make "an immediate approach" to the authorities in the USA "to ascertain the terms under which suitable rockets could be supplied".³³ Only if this avenue proved unsatisfactory should one consider adapting *Blue Streak* to a satellite launcher. In sum the ACSP felt that the civil science budget could not afford the £2 million per annum needed to modify Britain's IRBM. The Ministry of Defence, for its part, had made it quite clear that it would not finance the changes. That left collaboration as the only alternative.

In making its recommendations, the ACSP was doubtless aware that there were moves afoot in the US to foster closer ties with Britain. A first gesture in this direction was made in September 1958 when the United States suggested launching British instruments on American satellites from Woomera more or less free of charge. Then, in October 1958, the US government released a report praising British achievements and extolling the virtues of international collaboration in space. Six months later this suggestion was given definite shape at a meeting of the newly established COSPAR (Committee on Space Research) which had been set up in 1958 to take over space research matters with rockets and satellites after the IGY. At its meeting in The Hague on March 14, 1959 the American delegate announced that the US would be prepared to launch "suitable and worthy experiments proposed by scientists of other countries". NASA was prepared to consider single experiments to be inserted along with others into larger payload or groups of experiments comprising complete payloads weighing from 100 to 300 lb, which could be placed in an orbit ranging from 200 to 2000 miles in altitude. In the former case the collaborator would be invited to work in a US laboratory on the "construction, callibration, and installation" of the equipment in the spacecraft. In the latter case NASA was "prepared to advise on the feasibility of proposed experiments, the design and construction of the payload package, and the necessary pre-flight environmental testing". And although the official letter did not explicitly say so, during the public announcement it was said that NASA intended to use its newly developed Scout rocket, and that the launching would be free of charge.³⁴ Within six weeks the British National Committee on Space Research (BNCSR), established at the end of 1958 with Massey as

³² This is the penultimate paragraph in Massey's paper of October 1958 which is reproduced in Massey and Robins, *op. cit.*, Annex 3.

³³ Quotes from Massey and Robins, *op. cit.*, p. 68. See also Whyte and Gummert, *Minerva*, *op. cit.*, pp. 155-160.

³⁴ From Massey and Robins, Annex 4, which reproduces the US offer, and pp. 67-69.

chairman, had established working groups to define the experiments which could be proposed to NASA.

What was behind the NASA offer? The wish to encourage international scientific collaboration, of course. But not just that: the road to space was paved with Cold War intentions. This was already obvious when the first US offer was made six months before to fly British experiments on American satellites launched from Woomera. The idea, said the State Department, was to ensure that the next nation to enter space was from the 'Free World' not the communist bloc, and it wanted the British equipment to be ready within about six months.³⁵ That was far too precipitate for the British scientists, but Massey and his colleagues did what they could to comply. The ad hoc working groups set up by the BNCSR to react to the NASA proposal in April 1959 were asked to formulate lists of experiments under three headings. One of them was "Experiments which could be prepared quickly for launch".³⁶ In doing so they, perhaps unwittingly, became a pawn in power politics, were sucked into a definition of space which placed space science at the heart of superpower rivalry.

There is a further political dimension to the NASA offer that bears discussing. As I argued earlier, the US/NASA offer, in the context of the Ministry of Defence's and the ACSP's refusal to fund the adaptation of *Blue Streak* from military missile to civilian satellite launcher, knocked out at a stroke the hope, the plan, the dream of a "thoroughgoing British enterprise" in space. Collaboration was now the *sine qua non* of a British space effort. What is more one argument for developing Britain's independent deterrent was sabotaged i.e. the supplementary argument that *Blue Streak* was not simply an IRBM for hitting Soviet targets but could also serve, with relatively minor modifications, to preserve Britain's freedom of action in space. Conspiracy theorists might see in this an attempt by the US to cripple the technological autonomy of the leading European nation of the day, to force her to accept the new balance of power of the postwar era, a deliberate attempt to reduce the UK to a "second-class" -- or let us rather say medium-sized -- world power.

This reductionist argument is surely too simple. But the grain of truth in it should not be ignored. For there is no doubt that in the late 1950s, with negotiations under way over the deployment of *Thor*, the US was increasingly impatient with *Blue Streak*, cutting off financial support for the project and arguing that Britain was wasting money by duplicating American effort. In parallel, as we mentioned a moment ago, there were the plans inside NATO to encourage a European MRBM programme. And these dovetailed neatly with steps being taken in NATO in 1959 to establish the Organization as an umbrella for a European space effort.

In December 1957, in the wake of Sputnik, the NATO heads of government decided to set up a Science Committee to ensure that science and technology flourished, this being essential "to the culture, to the economy and to the political and military strength of the Atlantic community". Within a year this committee had proposed to launch "a satellite for peaceful outer space research, bearing the emblem of the Atlantic community and circling the earth by 1960". NASA's proposals in March 1959 rendered this option redundant. However, Fred Seitz, who took over as NATO Science Committee Chairman from Norman Ramsey in June 1959, was not prepared to leave matters at that. He was strongly against the

³⁵ From Whyte and Gummett, *Minerva*, op. cit., p. 153.

³⁶ Massey and Robins, p. 69.

development of a European space organization then being widely discussed (see below). He thought that the possibility of such a body coming into being was "improbable and, in fact, impracticable". Instead he wanted NATO to establish a space agency in western Europe resembling NASA and which would collaborate with the US agency in planning the utilization "for scientific purposes of the best missiles available for space research in the NATO family". One potential member of that family was the new, second-generation solid-fuelled 'European' IRBM produced under NATO auspices which the United States was promoting at the time, and for which it was prepared to offer technical and financial support.³⁷ In sum, in 1959, intentionally or not, the US, through NASA and through NATO, was systematically cutting the ground away beneath an autonomous space effort in Europe. After all he who controlled the launcher controlled access to space.

* * *

The US was not the only possible partner for Britain. Another option was beginning to take shape in 1959, doubtless spurred on by the NATO and NASA initiatives. In April that year two scientific statesmen and cosmic ray physicists, Edoardo Amaldi and Pierre Auger, began to promote the idea that European nations should pool their resources in a collaborative, civilian, scientific space effort. They launched their idea officially in December 1959 in an article published under the title *Créons une organisation européenne pour la recherche spatiale*. It was accompanied by positive statements by a number of influential European science administrators. And its timing was not coincidental. The month before CERN, the first European organization for scientific research, had just commissioned the most powerful particle accelerator in the world. The month after COSPAR was to hold its first general assembly in Nice.

These ideas were discussed further in the early months of 1960. On April 29 about twenty European space research scientists from ten western European countries met formally for the first time in the rooms of the Royal Society, London. A survey was made of the plans afoot in the various countries for space research. The British, however, went further. They had not only hosted the meeting to inform their colleagues about what they were doing but also to get a feel for their interest in supporting a European research programme based on the use of *Blue Streak* as a satellite launcher. Indeed just two days before the meeting in the rooms of the Royal Society the Macmillan government had announced to a vociferous parliament that it had officially decided to cancel the missile project.

We shall not pursue here the further development of the collaborative European scientific research programme, institutionalized in ESRO (the European Space Research Organization), which was officially established in 1964. An accompanying paper at this symposium by Arturo Russo handles this in depth.³⁸ There are two points that I want to stress for my purposes, however. Firstly, that the British space science community, led by Massey,

³⁷ This paragraph is based on J. Krige and L. Sebesta, "US-European Cooperation in Space in the Decade after Sputnik", in G. Gemelli, *Big Culture. Intellectual Cooperation in Large Scale Cultural and Technical Systems. An Historical Approach* (Bologna: Clueb, 1994), pp. 263-297, where detailed references may be found. See also Clark, op. cit. who explicitly discusses the conspiracy theory regarding the US's desire to abolish *Blue Streak* in chapter 5.

³⁸ For the launch of ESRO see J. Krige and A. Russo, *Europe in Space, 1960-1973* (Noordwijk: ESA, 1994). See also M. de Maria, *Europe in Space: Edoardo Amaldi and the Inception of ESRO* (Noordwijk: ESA HSR-5, 1993) and J. Krige, *The Prehistory of ESRO* (Noordwijk: ESA HSR-1, 1992).

were enthusiastic supporters of the European programme, seeing in it a supplementary source of government funding and of scientific opportunity to the NASA option. What is more it was one in which, given their leading position in the field and their experience, they could hope to play a preponderant role. Secondly, their promotion of this option was intimately linked to their government's reassessment of the military *Blue Streak* programme, and the initiatives being taken in Whitehall to build a parallel European launcher development organization.

1960/61 Towards building a 'Third Space Power'

We left off the *Blue Streak* story at the end of 1958 with its future in the hands of the Powell Committee. By February 1960 its fate was sealed, essentially on military grounds. The main objection to it was its vulnerability. Because the missile was liquid fuelled, and so took some time to prepare for launch, and because it was land-based in fixed sites, it was vulnerable to pre-emptive attack. Thus as the interim report of the Powell committee, recently declassified, put it, "It would therefore only be efficient if it were fired first, for example, in reply to a Soviet attack with conventional weapons".³⁹ The new Minister of Defence, Harold Watkinson (Sandys was now Minister of Aviation) found this militarily and politically impossible. As he was to put it later to his French counterpart Messmer, it was always difficult in a democracy to take an irreversible, 'push-button' type of decision.⁴⁰ The Chiefs of Staff and the Prime Minister concurred, only Sandys defending the missile to the bitter end. On 13 April 1960 the government decided to eliminate *Blue Streak* from its military arsenal and to replace it with two mobile deterrent systems: *Skybolt*, to be fired by the V-bombers, and *Polaris*, to be launched from submarines.

Blue Streak was down but not out. For in cancelling the missile the Macmillan government announced that it would consider recycling the launcher for a civilian space programme in collaboration with suitable western European countries. This would be a way of turning the millions already spent on the missile to good account. It would also keep the engineering teams at Farnborough and in industry intact, and available if later in the decade Britain decided to develop her own independent deterrent. Finally it would serve as an important gesture towards Europe, a sign of the UK's goodwill to her partners across the Channel.⁴¹

Britain was not a signatory of the treaties establishing the European Economic Community (EEC) and Euratom in 1957 signed by Belgium, France, Germany, Italy, Luxembourg and the Netherlands. Unconvinced of the economic interest of the arrangement, and desirous to protect her privileged arrangements with the Commonwealth, she mounted instead a rival scheme with the Scandinavian countries, Austria, Portugal and Switzerland to form a European Free Trade Area. EFTA, unlike the EEC, had no supranational component

³⁹ Cited in Clark, *op. cit.* p. 180.

⁴⁰ See report on meeting between them on 12-13/4/61 in Box 62, *Affaires Error! Bookmark not defined.trangers, Secretariat General, Entretiens et Messages 1961*, Quai d'Orsay, Paris.

⁴¹ For the full *Blue Streak* story from 1960 onwards see J. Krige, *The Launch of ELDO* (Noordwijk: ESA HSR-7, 1993), J. Krige, "Politicians, Experts and Industrialists in the Launch of ELDO: Some Pitfalls and how to Avoid Them", in J. Krige and A. Russo, *Reflections on Europe in Space* (Noordwijk: ESA HSR-11, 1994), and M. de Maria and J. Krige, "Early European Attempts in Launcher Technology: Original Sins in ELDO' Sad Parable", in J. Krige (ed), *Choosing Big Technologies* (Chur: Harwood, 1993), 109-137. See also Krige and Russo, *Europe in Space. 1960-1973*, *op. cit.*

and nor did it apply to agricultural products.⁴² Yet even as its convention was signed in January 1960 Macmillan began to have doubts about the wisdom of the move. Economically the EEC was making rapid progress in bringing down internal tariff barriers. Politically Britain had moved away from her allies on the continent, to the distress of many, including the United States. Thus the Prime Minister felt that some gesture of solidarity, some symbol of Britain's good neighbourliness was needed. *Blue Streak* was to be such a symbol.

France was the most important continental power to be seduced into the scheme. She was not only the leader of the European community at the time. She also had a major interest in space science and rocket technology. De Gaulle, ever-distrustful of 'les Anglo-Saxons', and determined to maintain French sovereignty in security matters, had authorized the development of an independent nuclear *force de frappe*, which included missile development. The National Assembly adopted the project in December 1960. A year later, in December 1961 it also adopted the law establishing the French national space agency, the CNES, with Pierre Auger as President and a military general, Robert Aubinière, as Director General.⁴³

Throughout 1960 the British tried to woo the French on board. Their initial proposal was that France contribute to the cost and development of a three-stage launcher called *Black Prince*, which had *Blue Streak* as its first stage, *Black Knight* as its second, and a small third stage. The French objected: they wanted the second stage to be built in France. They also wanted, in exchange for collaboration, technical knowledge on the re-entry cone and on the inertial guidance system of *Blue Streak*. Britain easily agreed to the first request; she could not accept the second. Before embarking on the European project she had promised the United States to strip the missile of its military characteristics -- just those technologies that the French now said they wanted.

Towards the end of 1960 the British were becoming desperate. It was costing hundreds of thousands of pounds a month to keep the engineering teams at work on *Blue Streak* in anticipation of its reconversion into a civilian rocket. Invitations had been sent to European governments to attend an interministerial meeting in Strasbourg at the end of January 1961 where the British hoped positive steps would be made towards a collaborative launcher project. But the French had dug in their heels and were increasingly unwilling to show support. Then, just a few days before the meeting the entire atmosphere changed. And at Strasbourg the representatives of Britain and France agreed to build together a three stage European launcher combining *Blue Streak* with a French second stage and a third stage also to be built on the continent (above all by Germany who saw in space a way to build her industrial strength in high technology).

Why this change of heart in Paris? On January 28, 1961 de Gaulle and Macmillan had one of their regular meetings at the Châteaueau de Rambouillet. Here in a wide ranging discussion of the current political situation they emphasized three points. Firstly that the communist menace was mounting, notably in the Far East and that the western alliance seemed incapable of taking joint action against it. As de Gaulle put it, "When the west withdraws, the communists arrive, because there is only one really organized system in the

⁴² For a recent overview of Macmillan's European policy see J. Tratt, *The Macmillan Government and Europe. A Study in the Process of Policy Development* (London: Macmillan Press, 1996).

⁴³ For institutional details see G. Ramunni, "La mise en place d'une politique scientifique", in *Institut Charles de Gaulle. De Gaulle et son siècle. Tome III. Moderniser la France* (Plon: La Documentation Française, 1992), pp. 654-742. See also McDougall, *Technology and Culture*, op. cit.

world, the communist system. All the rest is dispersion."⁴⁴ Secondly, both de Gaulle and Macmillan felt that the United States could not be counted on to stand by Europe at this time. The Kennedy administration which would soon take office would have its hands full dealing with communism. What is more it represented a new generation, unknown to the old guard, and its policies towards Europe were still not known. Thirdly, as de Gaulle put it, "at such grave moments in history solidarity must take precedence over short-term political considerations". Despite the persisting differences between France and Britain over the Common Market, it was in the interests of the entire world that Britain and France acted in concert. Walking in the gardens of the Châteaueau that afternoon de Gaulle told Macmillan that "he was attracted by the idea of Europe becoming 'the third space power'. He would take a constructive line about Blue Streak at Strasbourg. He did not mention the military aspect".⁴⁵ *Blue Streak* was reprieved again. And six months later Macmillan deposited his government's request for membership of the EEC.⁴⁶

* * *

The changing physiognomy of the British space effort between 1957 and 1960 was intimately linked with the fluctuating fortunes of *Blue Streak*, and so intimately linked to the progressive recognition by British scientists and politicians alike of the painful truth that, in the context of the technological Cold War between the USA and the USSR, the UK's resources were those of a medium sized power. Hoping first for entirely national, civil scientific effort (which made use of military technologies of course), it was soon realized that the science budget could not bear the cost and that the military were not interested in space (though they continued to fund upper atmosphere research) and were not prepared to sink any money in it. Collaboration was thus essential. NASA's offer in 1959 to fly scientific instruments from other countries in US satellites, and to provide the technical help required to do so, created a new scientific opportunity, dealt a further blow to the increasingly vulnerable *Blue Streak*, and inserted British space science squarely in the context of Cold War rivalry. This politicization of the scientific space programme was furthered with the decision to recycle *Blue Streak* as the first stage of a European launcher built along with France and Germany. Space, as seen from Britain had become a symbol of European cooperation or, more precisely of European solidarity. Outer space was a place alongside the politico-economic geographic space being forged between 'the Six' in which to reinforce the bonds between the three major European powers against the communist threat, to be sure -- but also against 'the American threat'. Each of the partners in this alliance sought to protect its autonomy in the long term -- Britain by keeping its missile teams intact, France by building an alternative to US hegemony, Germany by building its industrial strength -- by collaborating in the here-and-now. Space policy was no longer simply a question of science policy, but above all of industrial and foreign policy.

⁴⁴ From the report on their meeting in the Quai d'Orsay archives, Box 62, *Secretariat General, 1945-1965, Entretiens et Messages, 1961*.

⁴⁵ Memo "Record of a conversation at Rambouillet between the Prime Minister and President de Gaulle during a walk at 4.15 pm on Saturday January 28, 1961", File PREM11/3513, Public Record Office, London.

⁴⁶ For Macmillan's account of this period see his autobiography, *Pointing the Way, 1959-1961* (London: Macmillan, 1972), chapter XI.





Sputnik and France: A "Mission to Civilize?"
Abstract for the Symposium on
"Reconsidering Sputnik"
Sept. 30-Oct. 1, 1997

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In this paper I propose to review and analyze the impact of Sputnik I on the French between October 1957 and May 1958, when General Charles De Gaulle came to power and redirected the country's scientific and military agendas. Although France's initial reaction to "bébé lune" (baby moon) was one of amused admiration for the technical feat, the creation within four years of a space agency to match Soviet and American efforts suggests that other factors were at work, some of which existed already as the Fourth Republic (1944-1958) was coming to an end.

As Walter McDougall pointed out some 12 years ago, the French space effort was but another manifestation of technological "Gaullism" in which General Charles De Gaulle, President of France from 1958 to 1969, strove to maintain France's independence from both superpowers by embarking the nation on a series of high profile projects. De Gaulle's success in pursuing such a policy, however, relied in part on successful efforts made in the 1950s prior to his coming to power. What requires clarification, then, is whether there was any reaction to the Sputnik launch that would denote French interest in "catching up" in the rocket race prior to President De Gaulle's assumption of power.

The answer differs from the US case on four basic points. First, France was under protection of the US through the NATO umbrella, and, like the rest of Europe, was already a potential target of the Soviet Union long before Sputnik was launched. The French government, uncomfortable with relying solely on the US for protection, was already working in 1957 on developing a nuclear capability combined with the means to deliver it. The Sputnik launch, then, was less a matter of recognizing a new threat than of establishing a proper counterbalance to an already existing one.

Second, there was no sense of a scientific lag in France comparable to the American experience, at least not in the school system (France even participated actively in the 1958 International Geophysical Year through its scientific research center and several universities). Even a series of rocket experiments based on German technology had occurred since 1945. The problem, rather, was one of funding and of organizational structure that prompted, for example, governmental factories to compete with one another for meager state budgets rather than cooperate on a common goal.

Third, the political party structure of France at the time, which included a strong Communist party, helps explain the milder reactions to the Soviet success, especially in view of the awkward relationship with NATO allies. To many observers, the event served as a way to make fun of the United States rather than ponder the implications of the orbiting "baby moon".

Finally, and most important in this case, the apparently disinterested attitude reflected in French newspapers across the political spectrum is to be explained by France's colonial crisis in Algeria, which drew the attention of the entire nation and threatened the very fabric of the state. The French "mission to civilize" was failing, but the very nature of the crisis, happening so close to France and shaking its democratic constitution, made it difficult for the nation to turn immediately to other endeavors.

In relation to this colonial and political crisis, the orbiting Sputnik thus became an entertainment topic rather than a symbol of impending doom. Once the crisis subsided, however, and with the formation of the Fifth Republic, new possibilities appeared. With General De Gaulle's interest in reaffirming France's global importance, a dual response in the space and nuclear fields became essential. Existing programs in the field of aerospace and nuclear research were given a new boost, exemplified by the new organization of the French space program under a specialized agency (the CNES), and the detonation of a French nuclear bomb, both of which occurred within the four years following Sputnik I's launch. As one minister explained in 1962, "... the country of Montgolfier and Bleriot should be among those powers engaged in space exploration."

The Impact of Sputnik on NATO

"Reconsidering Sputnik: Forty Years Since the Soviet Satellite"
NASA symposium
September 30-October 1, 1997

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It is unlikely that the Soviet launch of an earth satellite on October 4, 1957 alone was responsible for schisms within the alliance. French bitterness over America's role in Indochina in 1954, and both France's and Britain's anger over America's stance on the Suez crisis in 1956 had fed centrifugal forces that were already present. As Europe revived and groped toward unity there was understandable resentment over America's dominant role in the alliance. It was the smaller powers that most clearly expressed frustration over inadequate consultation by the senior ally in the appeal of the "Three Wise Men" in 1956.

The specter of a Soviet satellite circling the earth every ninety-five minutes, with two special passes over Washington, DC, however, raised a question that had not needed to be asked before: Would America's new vulnerability to a Soviet attack by means of an intercontinental ballistic missile affect its commitment to the defense of Europe? For skeptics about the future of the Atlantic alliance Sputnik could be the coup de grace to a failing institution.

What was obvious to the Eisenhower administration was a recognition that both diplomatic and military action had to be taken to restore the apparently forfeited confidence in America. These took a number of forms. One would be modernization of the weaponry of the European allies, primarily in surface-to-surface and surface-to-air missiles. The secretary of defense on

October 28th encouraged the Army and Navy to look for ways to promote common production or coordinated production in Europe of a variety of short-range weapons.¹ This point was taken up by Secretary of State John Foster Dulles the next day following a meeting with Prime Minister Harold Macmillan. Dulles spoke of interdependence, a not unfamiliar subject of American colloquy with Europeans. It usually meant greater burden-sharing of expenses for the common defense. But on this occasion the secretary seemed to imply an interdependence based less on sharing production of nuclear weapons than on an assurance that the United States in an emergency was still willing to use them.²

That confidence-building was necessary was made clear by Deputy Secretary of State Christian Herter's appraisal of the foreign policy implications of Sputnik's launching. While he professed to be hopeful about the reaction of allies, "...even the best of them require assurance that we have not been surpassed scientifically and militarily by the USSR." He concluded on a somber note, saying that the United States would have to exert itself to counteract negative reactions.³

How confidence was to be reinforced was another matter. Part of the answer would be to communicate clearly to the allies that the United States was attentive to their concerns. France had opened a path in its proposal at the NATO meeting in Bonn in May 1957 to build a nuclear arms stockpile for NATO in Europe. It can be done, Dulles informed reporters at a news conference on November 5th, within present laws. He cited arrangements with Canada as an example. Intermediate nuclear weapons were already in Europe, but they had been hitherto exclusively for the use of U.S. forces.

"These would become so situated, "according to Dulles, that "they would also be available to the forces of our allies." Frederick Nolting, deputy chief of mission to NATO, enthusiastically endorsed the concept of a "NATO stockpile as a means of soothing Europeans."⁴

The prospect of a NATO stockpile was on the agenda of U.S. planners preparing for the December meeting of the North Atlantic Council in Paris, as were mechanisms for coordinated production of advanced weapons. The difficulty would be in determining how to make available warheads and missiles to Europeans without violating the McMahon Act limiting distribution of nuclear technology. This was a major issue for the American agenda. As W. Randolph Burgess, chief of the U.S. delegation, proposed, the United States would be prepared to deploy atomic warheads from the NATO atomic stockpile that would be released from U.S. custody in the event of hostilities "to the appropriate Supreme Allied Commander for employment by the nuclear-capable forces of NATO in accordance with appropriate NATO defensive plans." In return for this largess NATO allies, such as Britain, having available technical data involving manufacture of nuclear weapons systems would be expected "to make such data available to other nations as required."⁵

But the most urgent message to be sent to Europe, in the view of American diplomats was the certainty that the United States was prepared to accelerate and expand the deployment of its intermediate range ballistic missiles (IRBMs). While these would not have the dramatic impact of an ICBM, they were less expensive, more numerous, and more effective in striking potential targets in the Soviet Union. Secretary of Defense Neil McElroy noted at a

meeting with the secretary of state that the Defense Department was in a position to have ready 16 squadrons of 16 missiles each, to be delivered late in the current calendar year through 1963. The Defense Department was not as anxious for their use as State was. When the sea-based Polaris and the ICBMs came off the assembly line, the IRBMs would lose their present importance. But it was a political and psychological imperative to say something now, as Supreme Allied Commander (SACEUR) Lauris Norstad demanded. Dulles understood Defense's concerns about costs but concluded that "the need to reassure our NATO allies regarding US capabilities in the missile field," should override other considerations.⁶

Accordingly, the U.S. delegation encased the issue of IRBMs in two concrete steps: 1) to make available under the United States Military Assistance Program several squadrons of IRBMs to SACEUR, with an understanding that such deployment would be agreed upon between the supreme commander and the countries concerned, and 2) to make available "under appropriate safeguards blueprints and other necessary data relating to the IRBM delivery systems."⁷

Britain and Turkey responded quickly to the offer to place missiles on their soil. In fact, Britain had made a preliminary agreement earlier that year at Bermuda. Italy accepted on February 5, 1958 when the Italian Chamber of Deputies approved the deployment of IRBMs, although it was not until September that a formal agreement was concluded.⁸

If Sputnik's success energized American foreign policy in the form of nuclear sharing, even on a limited scale, it perversely promoted movement in arms

control. Until October 1957 it was the United States that had taken the initiative. At London in the summer of 1957 Dulles presented an American proposal for a two-year suspension with the understanding that the Soviets would agree to a future cut-off in nuclear weapons production. The Soviets rejected the plan and broke off negotiations in August. But once Sputnik had been launched the situation was reversed. The United States now held back as it attempted to cope with the Soviet achievement, and it was the Soviet Union that talked of a test ban while it appeared to enjoy the lead. Soviet shrewdness in declaring a voluntary moratorium on nuclear testing forced the United States to follow suit. The path to a test ban agreement suddenly appeared more promising than it ever had been in the past.⁹ The American could not allow the Soviets to walk away with a propaganda victory, no matter how cynically it was conceived.

The Soviets made the most of the advantage that Sputnik gave them. First, Premier Nikolai Bulganin asked Eisenhower for a summit meeting early in 1958, proposing a pledge by the U.S., the U.S.S.R., and the U.K. to refrain from all nuclear tests for two to three years. Although the U.S. failed to accept this plan, unless it was accompanied by a ban on production of nuclear weapons, Moscow in February 1958 persisted in its effort to hold a summit meeting on a test ban. The Soviet leaders hoped that the pressure of world opinion would force Americans to accept a test ban unaccompanied by any plans for verification and without reference to continued nuclear production.

A final by a panel of American scientists, headed by Hans Bethe of Cornell University, made it possible for President Eisenhower to accept the next

Soviet ploy: namely, a unilateral suspension of tests. Bethe's panel claimed that America's overall superiority in nuclear weaponry justified a test ban, and that a network of control stations, including some on Soviet soil, could detect a nuclear blast as low as two kilotons. Prodded too by his newly appointed science adviser, James Killian of MIT, the president on April 28, 1958 agreed to separate the issues of testing and production, and to join the Soviets in a moratorium. As Secretary Dulles put it, "Wholly apart from the true merits of the argument, the Russians were winning world opinion, and we were losing it."¹⁰

Delegations of Soviet and American scientists met for six weeks at Geneva, and by mid-August 1957 had reached agreement on establishing 180 control posts. Although the mutual moratorium did not last beyond 1961, it did provide an infrastructure for negotiations that produced the limited test ban treaty of 1963.

If Sputnik inadvertently pushed the superpowers along the path of nuclear arms limitation, it also set in motion a massive American campaign to build an intercontinental ballistic missile armory that led to greater arms competition in the next decade. The objective was to fill the "missile gap" which Sputnik supposedly revealed. Although new intelligence technology revealed that the gap was essentially a fiction promoted by Khrushchev's rhetoric to divide the alliance, this information was not fully understood in 1959. Nor was it understood by the public or Congress that even if the Soviets might have had missiles in place, they lacked the means of delivering them to their targets. Accordingly, the Eisenhower administration was pressed by public opinion to admit that with a gross national product only one-third

that of the United States, the Soviet Union was matching the nation's expenditures in heavy industry. Estimates of overwhelming Soviet superiority in ICBMs were circulated, with figures ranging from 100 to 300 missiles, according to leaks from McElroy's testimony before the Senate Foreign Relations Committee. Although the secretary of defense asserted at a news conference on January 2, 1959 that the figure of 300 was an exaggeration, he was convinced that a gap did exist even if its size may have been exaggerated. Eisenhower in effect confirmed the gap's existence when he informed the public a week later that the gap was being closed. His assurance did little to calm critics when he explained the problem in terms of a one-year's head start on the part of the Soviets.¹¹

Given this background it was hardly surprising that the missile issue became campaign fodder in the presidential election of 1960. In August Senator John F. Kennedy warned about dangerous days ahead "as the missile gap looms larger and larger."¹² Over the next two months of campaigning he repeatedly demanded a crash program for missiles to accompany a complete reevaluation of the national defense organization. His first State-of-the-Union address in which he "instructed the Secretary of Defense to reappraise our entire defense strategy," echoed this particular campaign theme.¹³

The new secretary of defense, Robert S. McNamara, followed the president's instructions and came up with the surprising findings that there was no missile gap in the Soviet favor. The United States, he noted, possessed strategic military capability twice that of the Soviet Union's. It was only in the numbers of the mix, specifically in ICBMs, that the Soviets held a lead, and it was a narrow one at that. Technically, the gap was meaningless. The real

issue, as McNamara put it, was the "destruction gap," the differences in the respective nation's ability to inflict greater damage on the other. In this competition the United States held a commanding lead in long-range bombers at a time when the Polaris intermediate range missile and the Minuteman intercontinental missile programs had been placed on an accelerated production schedule.¹⁴ It appeared that Khrushchev's reckless boasting sparked a new arms race that counteracted whatever gains might have been made in banning nuclear tests.

The increased flow of the administration's adrenalin following the appearance of Sputnik inevitably produced unanticipated side effects. The administration's assumption that hyperactivity in support of the alliance-- increased spending on ICBMs, deployment of IRBMs and the build-up of nuclear stockpiles in Europe-- would invigorate the alliance and revive confidence in the United States was not wholly warranted. From the United States came unmistakable signs of discontent with the shouldering of new defense burdens. At a meeting with Secretary General Paul-Henri Spaak in October 1957 Dulles explained that the proportionate American share in NATO costs was increasing, and that this trend had to stop.¹⁵

From the European side came a counterpart complaint: namely that the United States was undercutting its profession of support by reducing its troop strength in Europe. Just a few days after the appearance of Sputnik were expressing concern that the United States intended to reduce its forces in that country under the ambiguous concept of "streamlining." This was actually a

longterm consequence of the "New Look" of 1953 whereby nuclear weaponry would allow for smaller ground forces. Similarly, the Dutch journal, *Het Vaderland*, expressed dismay over Dulles's use of "partial" dissociation from the rumors, which had sent out alarm bells even before October 4th. To the French ambassador in Washington Deputy Secretary of Defense Donald Quarles had dismissed any idea of a U.S. withdrawal, but did admit to "some downward adjustment."¹⁶ In the Kennedy administration European fears of new reductions in U.S. forces became reality under McNamara's cost-conscious rationalizations of his defense budgets.

Aside from the foregoing alarms the Eisenhower administration was sending other conflicting signals in the wake of Sputnik. The major thrust of its policy was to show full support of Europe despite the apparent new vulnerability of the United States to missile attack. The promotion of coordinated production of weapons, the willingness to build nuclear stockpiles in Europe, and the offer of intermediate range missiles to NATO allies were all earnest of this intention. But it did not escape the notice of European members that there were significant strings to these commitments. The Joint Chiefs of Staff made it clear that in giving American know-how and hardware they were not including nuclear warheads in their packages. These would remain in American hands. The JCS, along with most of the administration, were concerned that IRBMs under allied control might lead to a dangerous nuclear proliferation. Although American caveats were understandable, the interest of America's European allies in seeking their own individual or collective nuclear capability was equally understandable.

The end result of American efforts to reassure their partners led to more tension and less confidence. In the early Kennedy years France was distressed over American obstacles to its *force de frappe*; Britain was upset over American handling of the Skybolt crisis in 1962; and Germany was anxious about its place in the nuclear programs. Each ally expressed its dissatisfaction with American leadership, particularly when Secretary McNamara raised doubts about the utility of nuclear weaponry in general. With varying degrees of enthusiasm the United States turned to a potential panacea in the Multilateral Force (MLF), touted by SACEUR Norstad as a means of making NATO into a fourth nuclear power, armed with MRBMs and enjoying equality with the United States. The MLF never achieved this status, partly because the nuclear warhead gain would remain exclusively American. But for a time in the mid-1960s the MLF quieted discontent and represented a solution to troubled European-American relations.

In retrospect, Sputnik energized the alliance and shattered American complacency. It also exacerbated fissures in within NATO. But it did not produce fundamental changes. These were not to be made until another decade had passed. If NATO survived into the Harmel era of detente, credit may be given to Soviet-generated crises-- Berlin and Cuba, in particular-- which periodically fostered unity which might not have been possible without the goad of a Soviet threat.

ENDNOTES

1. Donald Quarles, Deputy Secretary of Defense, memorandum for Secretary of the Army, Secretary of the Air Force, 28 October 1957, Sub: Production of Modern Weapons in Europe, 330-78-141, Box 2, RG 330, NARA.
2. Secretary of State News Conference of 29 October 1957, Department of State *Bulletin*, XXXVII (18 November 1957): 786-787.
3. Memorandum of Discussion at the 339th Meeting of the National Security Council, Washington, , 10 October 1957, *Foreign Relations of the United States: United Nations and General International Matters*, 1957, XI: 762; see Walter A. McDougall, ... *The Heavens and the Earth: A Political History of the Space Age* (New York: Basic Books, Inc, 1986), pp. 240-241.
4. Secretary of State's News Conference, 5 November 1957, Department of State *Bulletin*, (25 November 1957), XXXVII: 825; Secretary of State's News Conference, 19 November 1957, *ibid.*, (9 December 1957), XXXVII" 917; Frederick E. Nolting, Deputy Chief of U.S. Mission to NATO, memorandum to Benson Timmons, Director, Office of European Regional Affairs, 5 November 1957, 740.5/11-557, Box 3147, RG 59, NARA.
5. W. Randolph Burgess, memorandum for the record, 3 December 1957, Sub: Preliminary United States Views and Proposals for the December NATO Meeting, 61 A1672, Box 8, RG 59, NARA.

6. Memorandum of meeting of Secretary of State and Secretary of Defense, White House, 22 November 1957, Sub: IRBMs for NATO, 740.5/11-2257, Box 3148, RG 59, NARA
7. Burgess memorandum 3 December 1947; text of North Atlantic Council communique, 19 December 1957, Department of State *Bulletin*, (6 January 1958), XXXVIII: 12-15.
8. See Larry Loeb, "Jupiter Missiles in Europe: A Measure of Presidential Power," *World Affairs*, 139 (Summer 1976): 28-29.
9. Robert A. Divine, *Eisenhower and the Cold War* (New York: Oxford University Press, 1981), pp.126-128.
10. Quote in Divine, *Blowing in the Wind* (New York: Oxford University Press, 1978), p.212.
11. Chronology of a Two-Year Dispute: "Missile Gap," *New York Times*, 9 February 1961; see Robert J. Watson, *Into the Missile Age, 1956-1960, History of the Office of the Secretary of Defense, Vol. IV* (Washington, DC: Historical Office, OSD, 1997), pp.314-315.
12. Chronology of a Two-Year Dispute.
13. State of the Union Address, 30 January 1961, *Public Papers of the Presidents: John F. Kennedy*, 1961, p.24.

15. Burgess memorandum to Secretary of State, 28 October 1957, Sub: U.S. Contribution to NATO, 740.5/10-2857, Box 3147, RG 59, NARA.

16. American Embassy, Bonn, 7 October 1957, cable to Secretary of State, No. 620, 740-5/10-757, Box 3146, RG 59, NARA; American Embassy, The Hague, No. 516, 13 September 1957, cable to Secretary of State, 740.5/9-2357, Box 3146, RG 59, NARA; Notes of conversation held by Deputy Secretary of State Quarles with French ambassador to United States, 30 October 1957, Box 3146, RG 59, NARA.

Roald Sagdeev

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From Icon to Artifact:
The Historiographical Journey of the Simplest Satellite

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From the point of view of an historian and curator, the world's first man-made satellite of the Earth is extremely problematic. In either profession Sputnik is all but impossible to describe. The archival evidence of its existence has not yet seen the light of day. The actual object ceased to exist in January 1958. Judged by the strict standards of either profession, Sputnik does not exist. Of course, that conclusion is absurd, but it does point on the very peculiar historiographic legacy of this satellite. Just as October 4, 1957, marks the beginning of the Space Age, it also marks the beginning of a historiographical dilemma that has plagued historians and curators for the last forty years. Without the traditional reference points for studying the object, the pattern of its study has been the reverse of what historians and curators have been trained to expect. Instead of beginning with the study the material object and its manufacture, the field of Sputnik studies has begun with the legacy and global political impact of the satellite and have slowly moved inward toward the actually satellite. It has been as though the ripples that Sputnik has left have been studied from the outermost inward, with the farthest reaching implications being studied first. It is now the business of historians and curators to explain the history this icon as an artifact of the last half of the 20th century was, who made it, where it fits within the material history of post World War II Soviet Union. Answers to these question also promise to shed light on the historiography of Sputnik as an icon.

The use of the word icon does take on a double meaning within

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the context of Soviet history. The word icon means an image, representation, simile or symbol¹ of a human or event(s). But that image is an object (or class of events) in its own right. Over the last 40 years, Sputnik has played the role as a icon representing the spark that marked the beginning of the space age and the space race that transported U.S. and Soviet military and strategic competition to space. Historians have also offered an interpretation of Sputnik as an icon of the efforts of two men, Korolev and Khrushchev, to increase the political profile of their work. Korolev used the launch of the satellite as political currency to maintain support for his own aspirations for the development of a space program. Khrushchev used the launch on the international level as political currency to demonstrate the technological prowess of the Soviet Union. Here in the United States, Sputnik eventually came to symbolize the political wake-up call to end the inter-service rivalry that plagued American ICBM development.²

As an object, Sputnik has a material history that has not been fully explored. Although we have good theories on why it was made we know relatively little about who made it and how. By definition it is an artifact of the political, military, social, economic, and scientific and technological circumstances that surrounded it.³ While the political and military circumstances of Sputnik have attracted attention over the years, we still know very little about its social and economic circumstances. We have good indications as to who designed it, but little of the details on whose hands

actually made the satellite, and what methods were used. Much of the scientific and technological culture of Sputnik has been dismissed as insignificant, because the scientific results of the American Explorer satellite overcame the political shock of the launch of Sputnik. Nevertheless, the earliest scientific and technological evidence about the plans for Sputnik is important to understanding how the object came to be. From that we can ascertain the degree to which manufacture of the satellite was a technological continuation or departure from the past.

Of course the line between icon and artifact is not precise. The same is true for the line between the material and archival evidence of each iteration of Sputnik. But the broad delineation between the two lies in the region in which discussion of the object turns from the implications of the object's existence to the actual material object. To find the true evidence about Sputnik as an object, the historian must look for information that answers traditional questions about the material object and the technology that it represents: who made it, how, and why? This requirement places the historian of Sputnik (the object) in an awkward situation of not being able to experience Sputnik as an artifact, while being responsible for reconstructing the object. In order to reconstruct the object, the historian and curator must rely on the memoirs and official pronouncements and look for the material judgements about the artifact, teasing them out from the larger, iconic meaning of the object.

The first published sources about Sputnik predate the launch

of the satellite, and probably predate the object itself. During the Summer 1957 a series of articles about plans for a Soviet satellite launch during the IGY appeared in the journal Radio. Among these articles was one in which the Soviet Academy of Sciences' Institute of Radio Engineering and Electronics made the first call for assistance in tracking the satellite by amateur radio enthusiasts. This first, discrete announcement appeared on July 7, 1957.⁴ The Institute called on radio amateurs to report on the "preparation for the reception of signals of satellites launched in the USSR."⁵ The announcement accompanied other more detailed articles outlining proposals for and theories about the hypothetical launch of a satellite during the International Geophysical Year. If anything, the initial appearance of Soviet-authored articles of the subject indicate that a considerable amount of thought had been applied to the plans to launch a satellite. The solution to the difficulty of tracking such an object had was the call for ham radio operators to assist in tracing the orbital path of the satellite once in orbit.

After this specialized flurry of information, the absence of initial Soviet comment about the Sputnik right after its launch is striking. Other historians have speculated on the meaning of this silence. But this initial period is a particular choke point of primary information and access to hardware that has shaped the historiography of Sputnik more than any other. As stated before, the normal development of the historiography would begin with detailed technological and material studies of the object and then

grow and develop into studies of the larger ramifications of the object. But the primary information necessary to study the satellite at that level did not materialize at that time.

Given the peculiar situation of Sputnik, the historiography has developed in the opposite direction. The vacuum of documentation has attracted rumors, innuendo, and outright falsehoods, leaving western historians to make critical judgements about motivations and accuracies on most every official and private statement. From the beginning, western historians have had to innovate: piecing together histories from disparate and often questionable sources. A new dimension to this problem appeared soon after Sputnik when the Soviet Union embarked on a controlled plan of hardware display for western inspection, allowing western experts to make comparisons between the encased Soviet hardware and the well-documented space hardware of the United States. Even with limited access to the material culture of the Soviet space program, historians remained dependant on official Soviet statements, rumors, suppositions, and a steady stream of émigré memoir materials as a substitute for the archival evidence that historians are trained to use. The absence of archival materials has been a doubled edged sword. On one side, professionally trained historians outside of the Soviet Union have shunned the field, leaving the history to technically astute amateurs. On the other side, the comparison of the objects has dominated the field, making it unique within the discipline of space history.

On the Soviet side, the situation for historians has been

similarly stifling. Scientists, politicians, and engineers governed the Soviet spaceflight historical community. They set political agendas, and settled personal and professional scores on the pages on historical publications. Soviet historians of science and technology have copiously published pre-packaged internal histories of space science, technology, and rocketry that rely heavily on equations and sketches, but few detailed photographs of actual objects. Held hostage by the ideological role that space was playing in the Soviet Union, Soviet historiography of space did not go through a revival of archival research that many historical fields experienced during the late Soviet era. Memoir materials have remained the most prolific source of information in the field, while still demonstrating the inherent weaknesses of this type of source.

Nikita Khrushchev's example of this memoir literature and its use of the iconic Sputnik is most illustrative of this phenomenon. His two-part memoirs, which began with Khrushchev Remembers have set the tone for subsequent Soviet memoirs on the topic, placing Sputnik firmly within the realm of the politico-military arena.⁶ Khrushchev's recollections of Sputnik begin with his initial involvement in rocket development took place after Stalin's death, as a consequence of Khrushchev's appointment as First Secretary. At this point, even according to Khrushchev's own account, the decision had already been made to turn away from the long-range bomber (Maya-4, Bison) to the development of the ICBM. By his own account, Khrushchev's involvement in selecting this strategic

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technology was his promotion of a competition among design bureaus to make the most efficient ICBM. In his memoirs, released after the Glasnost era, Khrushchev justifies his decision, "Thus we would have a choice of the best design for the mass production of an ICBM, and we could have a way of delivering a retaliatory strike against the potential enemy. That would keep the enemy from attacking the USSR."⁷ It is worth noting that by his own admission the design that ultimately won the competition was not the design that Khrushchev favored. The design that won was the R-7 ICBM that was designed under Sergei Korolev. The R-7 design was the simplest, relying on a set of seven identical liquid-oxygen fueled engines. Korolev's design completed the first successful tests, before the longer-range ramjet prototypes completed any successful flights. Khrushchev had preferred the longer-ranged options.⁸

Khrushchev's initial use of rockets was for propaganda purposes, as a warning to all adversaries of Soviet technical capabilities. In 1957, the Soviet Union had a single successful intercontinental ballistic missile, the R-7. The first test of the R-7 took place in August, thus demonstrating Soviet capability to deliver a nuclear warhead onto the territory of the United States. The second R-7 was launched the first man-made satellite into orbit on 4 October 1957. The second, more publicly acknowledged launch, was technologically redundant to the first, and yet it provided a more impressive political effect. The U.S. had recently failed to launch a satellite of its own. Almost immediately, the word Sputnik became synonymous with American failure in science and

technology and American weakness in the military competition with the USSR. This early, developmental success of Khrushchev's strategy of political preemption deterrence fostered a popular politically significant impression that the Soviets could develop strategic weapons and win a military conflict with the U.S. Khrushchev linked the space firsts and the development with nuclear weapons closely in his memoirs:

But we were the first to launch rockets into space; we exploded the most powerful nuclear devices; we accomplished those feats first, ahead of the United States, England and France. Our accomplishments and our obvious might had a sobering effect on the aggressive forces in the United States, England, France, and of course, inside the Bonn government. They knew that they had lost their chance to strike at us with impunity.

The use of rockets for propaganda purposes was successful, in that the launch of Sputnik and other Soviet space firsts laid the ground-work for the popular and politically beneficial illusion of Soviet technological parity that was to outlive Khrushchev. Khrushchev's political successors continued to keep this essential illusion alive. While enhancing the role of nuclear weapons and related propaganda in the fight to discourage a western attack on the USSR, Khrushchev was able to actually reduce the size of the Soviet military. This was a reduction necessitated by economics, and yet made difficult by the post-war strategic situation.

Khrushchev's strategy was, in many ways, similar to Japanese strategy against the U.S. in 1941.¹⁰ At the time of Pearl Harbor, Yamamoto had planned the attack as a one-time preemptive attack, which would prevent American expansion in the Pacific. Khrushchev's strategy differed from its Japanese counterpart in its

basic focus. Instead of a military raid on the United States, he proposed a political and psychological Pearl Harbor, which would sabotage American resolve to fight before actual mobilization. However, Khrushchev's strategy resembled Yamamoto's in the manner of its execution. Khrushchev conducted a series of political strikes with no plan for ending the struggle. Instead of miscalculating the ability of American industry to mobilize for war, as had the Japanese, Khrushchev underestimated American political resolve and commitment. At the same time, Khrushchev was taxing Soviet economic and technological abilities to their limits. He failed to maintain a balance of military and political forces, allowing his political ambitions to exceed the military and technical capabilities of the Soviet armed forces and economic potential.

Since the final years of the Soviet Union, the potential in the field has changed dramatically. The recent publication of other, less politically (and personally?) invested individuals are beginning to lead us back to the Sputnik artifact.¹¹ Engineers and managers have published unofficial memoirs and diaries. These memoirs provide a critical mass of personal accounts that will allow legitimate comparisons between individual perspectives. Design bureaus, manufacturing establishments, and individuals have recently sold hardware and memorabilia to offset the new harsh financial reality. These sales have placed Soviet-era hardware in the hands of western curators to allow detailed comparison to American and other Soviet hardware. The Russian government has

recently opened a new Space Archive, offering the hope for new archival revelations. Nevertheless, as historians look upon the flood of objects and first-person accounts questions remain about the nature of the sources. Do these changes demand a shift in methodology? Or has the political and economic unraveling of the Soviet space establishment provided historians with more artifacts that require the same critical interpretation that has characterized the field for the last 40 years?

What is the potential significance of further historical and material study of Sputnik? We now possess a multifaceted understanding of Sputnik the icon. But we lack an understanding of the material object and its historical context. We can recount what Sputnik did, but not who made it, how and why. not fully understand what Sputnik really means. Sputnik represents a deliberate use of technology in international competition. In order to understand the function of using technology in politics, we have to better understand the capabilities and origins of the technology. We now have a good idea that Sputnik (the object) was not the first choice of Soviet engineers and technicians, but a was a simplest, fall-back proposal for the mission.¹² The fact that the engineers were not able to complete the more desirable and complex problem indicates that there were signs of technological and economic weaknesses in the space program that predated the Soviet efforts to land a man on the moon. But there remain other questions about the origins of Sputnik. Sputnik is an artifact of the social, economic, scientific, and technological community that

created it, but historians have still not been able to make an historical connection between the seeming simplicity of the satellite and the complexity of its legacy.

1. William Morris, ed. The American Heritage Dictionary of the English Language. Boston: Houghton Mifflin, 1976.
2. The image of Sputnik as a political wake-up call is itself best symbolized by the famous political cartoon of Uncle Sam being stirred from a sound sleep by the "Beep, beep, beep." of the satellite.
3. American Heritage Dictionary.
4. Radio, No. 7. July, 1957. Cited in Kreiger, p. 333.
5. Kreiger, p. 333.
6. Talbott, Strobe, trans. and ed., Edward Crankshaw, intro. and commentary. Khrushchev Remembers. Boston: Little, Brown and Company, 198?, and Khrushchev, Nikita S. Khrushchev Remembers: The Glasnost' Tapes. Boston: Little, Brown and Company, 1990.
7. Nikita S. Khrushchev, Khrushchev Remembers: The Glasnost' Tapes, Boston: Little, Brown and Company, 1990, p. 187.
8. Steven J. Zaloga, "Most Secret Weapon: The Origins of Soviet Strategic Cruise Missiles, 1945-60," Journal of Soviet Military Studies, vol. 6, no. 1 (June 1993), pp. 262-273.
9. Khrushchev Remembers, p. 517.
10. The similarity between Sputnik and Pearl Harbor was first pointed out by American Lt. Gen. James M. Gavin: Steven J. Zaloga, Target America: The Soviet Union and the Strategic Arms Race, 1945-1964, Novato, Calif.: Presidio, 1993, p. 148. For a description of Japanese strategy vis-a-vis the U.S. during World War II, and its shortcomings, see: D. Clayton James, "American and Japanese Strategies in the Pacific War," in Peter Paret, ed. Makers of Modern Strategy from Machiavelli to the Nuclear Age, Princeton, N.J.: Princeton University, 1986, pp. 707-708.
11. These memoirs include those of Vasili Mishin and Boris Chertok.
12. Harford's interviews on the Sputnik 3 and Sputnik design.

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Panel: The Long-term Consequences of Sputnik

Sputnik and the Creation of the Soviet Space Industry

by

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The Sputnik project, and the tumultuous world reaction to it, led to the creation of a space industry unlike anything in the West. Accustomed as we are to an industry composed of aerospace giants whose revenues are still primarily derived from the aircraft industry, it is difficult to make sense of the bureaucratic maze of space design bureaus, state research and production centers, scientific-production associations, and other industrial organizations that have outlived the Soviet space program. The fundamental difference is that the Russian Federation and the Ukraine do not have an “aerospace” industry.² Instead, the USSR bequeathed its successors with a distinct “space” industry. This industry’s unusual organization, habits of behavior, and high level of involvement in the space policy making process are a result of long-standing traditions in Soviet research and development (R&D) combined with the unique events leading to Sputnik, and the reaction that followed it.

Soviet Research and Development

Sputnik, and the industry it spawned, were products of the Soviet weapons R&D process. As in all Soviet industry, weapons research, development, and production was organized under specialized industrial ministries; e.g., the Ministry of Aviation Industry. All ministries followed the same highly compartmentalized approach to R&D. From the early 1930s onward, the Soviet R&D process was divided among three distinct types of organizations. Basic research was carried out by Scientific-Research Institutes (Nauchno-Issledovatel'skii Institut or NII). Series production of the final product was carried out by industrial plants or factories. The critical bridge between research and production was supplied by the Design Bureau (Konstruktorskoe Biuro or KB). The task of the design bureau was to develop new designs or applications of technology in light of basic research information (from the NII), the limitations and capabilities of

¹ The views expressed in this paper are those of the author. This paper does not necessarily reflect the views of the Air Force Academy, the US Air Force, or the US Government.

² Approximately eighty percent of the Soviet space industry was located in the Russian Federation, and inherited by it, after the dissolution of the USSR. The Ukraine remains home to several important scientific and industrial facilities. Although the other successor states inherited a number of facilities important to the operation of space systems (e.g., the Baikonur Cosmodrome in Kazakstan), only Russia and the Ukraine have retained a substantial space research and production capability.

industry, and the needs of the “customer.”³ Major KBs had the capability to produce experimental prototypes both for testing purposes and to prove the feasibility of production. (In some cases the design bureau was co-located with the factory that was assigned to produce its designs.) The most important design bureaus were distinguished by the title OKB (Opytno-Konstruktorskoe Biuro); meaning Experimental Design Bureau.

OKBs were led by an individual who was perhaps the closest thing to an entrepreneur that existed in the Soviet Union - the chief designer. These larger-than-life figures gave their organizations a distinct personality. OKBs were often simply referred to by the chief designer's name. In the aviation industry these include such famous organizations as the Tupolev and MiG (Mikoyan and Gurevich) bureaus. The space industry has its own honor roll of famous chief designers; including, Korolev, Glushko, Yangel, and Chelomei. These chief designer not only had to lead the development of new technologies, but had to succeed in "selling" their new proposals to higher authorities. Failure on a project, or the inability to win new "contracts" could lead to dismissal of the chief designer and, in some cases, the elimination of his bureau.

Despite such pressure on chief designers, head-to-head competition among design bureaus was not the norm in Soviet industry.⁴ However, the Soviet leadership did deliberately establish competition in parts of the weapons R&D complex. This expensive approach had its origins in aviation R&D of the 1930s. As a result of the relatively poor performance of Soviet aircraft during the Spanish Civil War, Stalin purged and restructured the aviation industry. The leading Soviet aircraft designer, Andrei Tupolev, was imprisoned and many new design organizations were established under the control of promising young engineers.⁵ Aircraft R&D was no longer entrusted to these experts, but became more tightly controlled by the political leadership. For the technically unschooled political leadership, competition between aircraft designers proved extremely useful. Competition, combined with intrusive oversight by state security organs, was highly effective in forcing the creation of the kind of Air Force the leadership wanted. Later, these control mechanisms were applied to some other high priority, high technology weapons programs; including missiles. The missile program chief designers were well aware of the high price that Tupolev, and others, had paid for failing to please the political leadership.⁶ In such top priority weapons programs chief designers lived a high-pressure life frequently characterized by ruthless political maneuvering.

Steps Toward Sputnik

In the post-war era the Soviet leadership had no intention to waste resources on space projects. Yet, despite the tight controls, missile chief designers were able to turn their energies to starting the Soviet space program. Remarkably, early Soviet space enthusiasts had been rather successful in developing rockets in the 1930s, but this line of research was snuffed out in the pre-

³ The “customer” could be another ministry (e.g., the Ministry of Defense in the case of weapons), the producing ministry, or the political leadership.

⁴ In fact, traditional Marxist economic thought holds that such competition is a tremendous waste of resources.

⁵ Tupolev and his many associates were released from prison near the end of World War II. For a very interesting personal account of this period, see: L. L. Kerber, Stalin's Aviation Gulag: A Memoir of Andrei Tupolev and the Purge Era, ed. and trans. by Von Hardesty, Washington DC: Smithsonian Institution Press, 1996.

⁶ Missile chief designer Korolev had studied under Tupolev, and wound up working for him in the “aviation gulag.”

war purges. Virtually all of the leading rocket engineers were arrested and sentenced to forced-labor camps for various crimes. Some were lucky enough to work in prison design bureaus until they were released late in World War II. As the war ended, many of the earlier rocket enthusiasts were put to work analyzing German missile developments. Thus, the Soviet post-war missile effort had a strong core of native talent with a theoretical background in rocketry, some practical experience, a great enthusiasm for space exploration, and considerable caution about expressing the later.

In early 1946 the Soviet leadership formally established a ballistic missile development program.⁷ There were a number of important parallels with the US ballistic missile program of the time. In both cases, the programs began by exploiting German wartime developments and relied heavily on the talents of captured German rocket developers.⁸ Both countries also pursued ballistic missiles as part of a three-pronged delivery system development effort. Long-range nuclear capable aircraft and winged (cruise) missiles were the other two lines of investigation. In the Soviet Union, as in the US, ballistic missiles were the least favored option, since success in building a reliable long-range ballistic missile seemed far in the future.⁹

However, there was a crucial difference between these US and Soviet post-war weapons projects. In the US, R&D for the three delivery system projects was largely conducted by aircraft companies. In the USSR these projects were assigned to two separate industrial ministries. Aircraft and winged missile projects went to the Ministry of Aviation Industry. The liquid-fueled ballistic missile program was assigned to the Ministry of Armaments. The logic behind this decision is deceptively simple. Missiles do not have wings, and as ballistic projectiles are more like artillery than aircraft. Thus, the artillery industry under the Ministry of Armaments was given control of long-range ballistic missiles. This was not unprecedented, for the Ministry of Armaments had earlier been involved in the development of solid-fuel projectiles like the "Katiusha" rockets. However, it is highly likely that there was more to the decision than simple logic, for the Minister of Armaments was the highly ambitious and effective Dmitrii Ustinov.¹⁰ Nevertheless, this was a fateful decision. Unlike the US, the Soviet ballistic missile program was an outgrowth of the artillery industry, rather than the aircraft industry.

Within a few years the native Soviet space enthusiasts came to dominate the ballistic missile program. The German rocket specialists worked largely in isolation from, and apparently in competition with, their Soviet counterparts. However, the Soviet designers were able to take full advantage of German technical and missile manufacturing experience. Within two years the Soviet missile team displaced the Germans by rapidly producing and testing more advanced missiles. By 1950 only about fifty of the original four hundred German rocket specialists

⁷ This was accomplished through Council of Ministers Decree No. 1017-419ss, dated 13 May 1946. (See: I. D. Sergeev, et al., *Khronika Osnovnykh Sobytiĭ Istorii Raketnykh Voisk Strategicheskogo Naznacheniiia*, Moscow: TsIPK, 1994, pp. 227-234.)

⁸ Although the "brains" of the German rocket program were snapped up by the West, the Soviets inherited most of the German rocket facilities. In October 1946, the Soviets rounded up several hundred of the remaining German rocket workers and shipped them to various locations in the Soviet Union.

⁹ In fact, Soviet nuclear weapons were built only for delivery by aircraft until 1953.

¹⁰ Political maneuvering is also suggested by the fact that responsibility for solid-fuel missiles was assigned to yet another ministry (the Ministry of Agricultural Machinebuilding - formerly known as the Commissariat of Munitions). This ministry was controlled by another major industrial leader, Boris Vannikov, who later became a major figure in the nuclear weapons program.

remained in the Soviet Union.¹¹ The Soviet rocket team's rise was the result of a number of factors. Political maneuvering at the highest levels of government appears to have been a factor once again. However, more importantly, the Soviet rocket team proved extraordinarily fast and effective.

One of the keys to the success of the Soviet rocket team was an organization known as the Council of Chief Designers. Although the bulk of the initial missile program was concentrated in a research institute under the Ministry of Armaments (NII-88), crucial subsystems were developed by other NIIs and KBs in other ministries. The leading missile designer in NII-88, Sergei Korolev, called a meeting of the other five major chief designers in November 1947. (see Table 1) The "Big Six" began to meet regularly in Korolev's office to coordinate their work, to discuss technical details, and to forge agreements about the overall course and direction of the missile program. This unofficial working-level organization allowed the leading missile engineers to present a "united front" to their overseers; this gave them greater control over key technical decisions.¹² At least two of the chief designers had an agenda that went well beyond ballistic missiles. Korolev, the driving force in the Council of Chief Designers, had been a leader among the pre-war rocket enthusiasts and had spent the war in a prison design bureau. Valentin Glushko, the chief designer of rocket engines, was an even earlier space enthusiast who had worked with Korolev in the 1930s and suffered the same fate. Thus, the Soviet missile program came to be led by a highly effective group of space enthusiasts who were able to coordinate their efforts outside the usual bureaucratic channels.

Chief Designer	Institution	Product	Ministry
S.P. Korolev	NII-88/OKB-1	Long-range Missiles	Armaments
V.P. Glushko	OKB456	Rocket Engines	Aviation Industry
V.I. Kuznetsov	NII-944	Gyro Instruments	Shipbuilding Industry
N.A. Piliugin	NII-885	Internal Control Systems	Means of Communication
M.S. Riazanskii	NII-885	Radio Control Systems	Means of Communication
V.P. Barmin	State Specialized Design Bureau (GSKB)	Ground Equipment	Machine and Instrumentbuilding

Table 1: The Council of Chief Designers (prior to 1953)

Under the tight supervision of Stalin's secret police the missile designers were limited in the pursuit of their space ambitions; however, after Stalin's death (March 1953) the situation changed dramatically. The most important change came with the arrest of Lavrentii Beria; the man who oversaw Stalin's secret police. Following Beria's arrest in June 1953, police oversight of weapons R&D largely evaporated. Ironically, weapons R&D became even more politicized as a result. Stalin's top lieutenants had been given responsibility for various weapons programs and the behind the scenes struggle for political succession appears to have involved arguments over the future of these weapons systems. Nikita Khrushchev's emergence as the champion of ballistic

¹¹US Central Intelligence Agency, National Intelligence Estimate Number 11-6-54: Soviet Capabilities and Probable Programs in the Guided Missile Field, (Top Secret) Washington DC, 5 October 1954, as declassified 29 June 1993 by CIA Historical Review Program, pp. 5-6. (Those that remained were guidance and control specialists, most of whom returned to Germany by the mid-1950s.)

¹²B. Chertok, "Lider," Aviatsiia i Kosmonavtika, No. 1, January 1988, p. 31.

missiles was clearly a part of this struggle.¹³ With Khrushchev's victory over his main political rivals in mid-1957 the missile program found itself with an extremely powerful ally.

However, the first two Soviet space projects had actually been started three years earlier. Although the evidence on the first project is still sketchy, it appears that a researcher in a Ministry of Defense NII convinced his superiors to start a reconnaissance satellite research effort in 1954. Interestingly, the researcher's argument for the project was built on evidence that the US military was secretly pursuing a spy satellite project.¹⁴ At about the same time, Soviet space enthusiasts (Korolev, in particular) began to lobby for a scientific satellite through the USSR Academy of Sciences.¹⁵ Apparently, the scientific satellite idea was prompted by a call for satellite proposals from the International Geophysical Year (IGY) organizing committee.¹⁶ Korolev's proposals were not enthusiastically received in the USSR. Nonetheless, the Soviet government did approve an IGY satellite proposal about a year later, in the summer of 1955. This was the same time that the US announced that it would support an IGY satellite project.

Both Soviet satellite projects were rather low priority. The top priority for the missile chief designers was to develop an ICBM. Since the end of World War II the Soviet leadership had focused on breaking the US monopoly in nuclear weapons. Although the nuclear program had been remarkably successful, the Soviets had been unsuccessful in countering the US delivery advantage. The US could launch a nuclear strike from a ring of bases surrounding the USSR. However, the Soviets still needed a long-range delivery system in order to be able to strike the US. Khrushchev came to favor the ICBM, and from 1953 onward the Soviet government made the R-7 (SS-6) missile a top priority. In fact, Korolev's organization, which became a design bureau known as OKB-1 in 1950, "spun-off" shorter range and naval missiles to other design bureaus (see Attachment 1). Among these new organizations was a design bureau and plant in Dnepropetrovsk, Ukraine, that became the primary Soviet missile facility under the leadership of chief designer Mikhail Yangel. Unlike the satellite projects, the missile program had little problem acquiring the resources it needed.

The satellite projects might well have died on the vine if Khrushchev had not visited Korolev's design bureau in January 1956. Early that month, the Kremlin leadership was given a personal tour of OKB-1. Korolev seized the opportunity to sell Khrushchev on the IGY satellite project. Khrushchev appears to have approved the idea largely because Korolev promised him that he could quickly perfect the ICBM and then use it to beat the US into space; and with a much larger satellite to boot.¹⁷ A decree issued on 30 January 1956 grafted the Soviet IGY satellite project onto the top-priority ICBM program. Such brazen lobbying was a well-established tradition among the top chief designers, but in this case it had far-reaching consequences. Khrushchev was so taken by Korolev that he granted him direct access. For the next few years, Korolev was able to bypass the usual oversight mechanisms and lobby the leader of the Soviet Union directly.

¹³ William P. Barry, "How the Space Race Began: The Origins of the Soviet Space Program," paper delivered to the Society for History in the Federal Government conference, 3 April 1997.

¹⁴ N. Dombkovskii, "Oktiabr - April' - Vselennaia," *Sovetskaiia Rossiia*, 12 April 1989, p.3.

¹⁵ Korolev was one of the many weapons designers who had become corresponding (junior) members of the Academy of Sciences in the post-Stalin thaw.

¹⁶ See the paper by Asif Siddiqi, "Korolev, Sputnik, and the International Geophysical Year," presented at this conference.

¹⁷ Sergei N. Khrushchev, *Nikita Khrushchev: Krizisy i Rakety*, Vol. 1, Moscow: Novosti, 1994, p. 111.

Even with their powerful sponsor, the nascent Soviet space industry was still hampered by problems. Perfecting the R-7 ICBM was the pre-requisite to launching any satellite, and the chief designers' energies were focused on this until they succeeded in August 1957. Nonetheless, Korolev still found time to work on his pet satellite project. Unfortunately, by January 1957 it was clear that the IGY satellite would not be ready in time to beat the US. With characteristic boldness Korolev proposed substituting two "simple satellites" for the IGY satellite. This substitution was apparently approved in January 1957. Thus, the satellites we now know as Sputnik and Sputnik 2 were born. (The Soviet IGY satellite was not successfully launched until May 1958; it was known as Sputnik 3.)

The Reaction to Sputnik

After Sputnik the Soviet government asserted that their space program was a well thought-out, long-term program of peaceful exploration. In fact, the Soviet space program started as an official afterthought - attached to the ICBM program only at the behest of its developer. The first satellite was "a result of the intensive work, by research institutions and design bureaus"¹⁸; not the product of a fully developed state industry. Like the program it supported, the Soviet space industry was really born in the aftermath of Sputnik. It developed in fits and starts that reflected the preferences of the Soviet political leadership and long-standing feuds within the space industry.

Khrushchev appears to have been both surprised and delighted by the impact that Sputnik had on the world.¹⁹ He had originally pinned his hopes for impressing the world on the creation of a Soviet ICBM. However, the unprecedented announcement of the first successful R-7 (SS-6) test in August 1957 went virtually unnoticed outside the Soviet Union. Only after Westerners could see Sputnik whizzing overhead did they take notice of the military potential of Soviet missiles. Khrushchev became an ardent proponent of space spectacles as evidence of the superiority of Soviet communism. Korolev was happy to oblige by putting his long-suppressed ideas into practice with a series of ever-more astounding space launches.

The push for space spectacles led to major changes at OKB-1 and in the missile industry. Korolev's OKB-1 re-directed much of its attention away from missile work and toward the string of space missions. Not only was OKB-1 the home of the R-7 (SS-6) launcher, but it soon acquired the key personnel from other organizations that had been involved in satellite R&D. This included the bulk of the Ministry of Defense NII that had been conducting research on reconnaissance satellites. OKB-1 was quickly metamorphosing from a missile KB into a "space" design bureau. Further evidence that the core mission of OKB-1 had changed is suggested by the fact that in 1959 two new subsidiaries of OKB-1 were created to handle missile design and production. The first of these (Filial #2) was set up in Krasnoiarsk to handle Korolev's newest ICBM design - the R-9.²⁰ Further development work, and production supervision for the R-7 was given to an organization (Filial #3) in Kuibyshev (now, Samara).²¹ Korolev's space and missile

¹⁸ This quote taken from the remarkably low-key TASS press release announcing Sputnik's launch, 4 October 1957.

¹⁹ James Harford, Korolev: How One Man Masterminded the Soviet Drive to Beat America to the Moon, New York: John Wiley & Sons, Inc., 1997, p. 121.

²⁰ This organization later became known as NPO Applied Mechanics. See Appendices 1-3.

²¹ This organization became known as TsSKB-Progress. See Appendices 1-3.

empire had grown dramatically, but clearly his personal interests and energies were devoted to the space work at OKB-1.

Unfortunately for Korolev and the emerging space industry, Khrushchev's attention returned to ICBMs. Although the R-7 (SS-6) eventually met the design requirement of being able to deliver a nuclear warhead to the US, it turned out to be a very poor Cold War weapon. In response to Soviet rhetoric, the US had rapidly escalated its nuclear posture - building forces capable of an immediate and massive strike. The Soviet military successfully argued that the R-7 was much too slow to respond to such a threat (it took hours to fuel and prepare for launch). The one weapon that could strike the US was, therefore, too easily pre-empted by the hair-trigger US forces. To the surprise of Western intelligence, the USSR deployed just a handful of R-7 (SS-6) ICBMs.²² Soviet efforts turned instead to developing a second-generation of ICBMs. More interested in space than missiles, Korolev devoted relatively little attention to new ICBMs. However, one of the organizations that had spun-off of OKB-1 in the early 1950s was already hard at work on this problem. Mikhail Yangel, chief designer of OKB-586 in Dnepropetrovsk, was much more attuned to the demands of the military. He had already begun work on a storable fuel ICBM, the R-16 (SS-7), in 1956. It was ready for testing in 1960. Thus, Korolev's position as the chief designer in the missile and space fields began to erode.

Failure to take strategic demands seriously was not the only thing that led to a decline in Korolev's status. The "united front" provided by the Council of Chief Designers began to break up shortly after the success of Sputnik. Disagreements over technical details soon turned to bickering about control over space projects, resources, and who would get credit for the successes. In particular, the chief designer of rocket engines, Valentin Glushko, took umbrage at Korolev's dominance of the space program. In keeping with the traditional behavior of weapons chief designers, the feud between Korolev and Glushko grew so bitter and personal that each demanded the other's removal from the space and missile programs. Khrushchev's unsuccessful personal efforts to mediate this dispute contributed to his loss of enthusiasm for Korolev and the other missile chief designers.

By the Spring of 1960 Khrushchev was ready to take dramatic steps to shake up the space and missile industry. The precise reason why Khrushchev acted when he did is still unclear, but the problems he faced had been growing for several years. In addition to strategic nuclear problems and his frustration with the Council of Chief Designers, it appears that he also lost faith in the political leadership that was supposed to supervise the defense industry. Leonid Brezhnev, the Central Committee Secretary overseeing the defense industry (and one who had benefited greatly from his connections to Korolev), was "promoted" to the ceremonial post of President of the USSR. At around the same time Khrushchev decided to set up new competition for the space and missile industry.

As mentioned above, the use of competition between weapons design bureaus was not a new idea. However, Khrushchev put a new twist on it. In 1960 he not only established a new missile and space design bureau, but he set it up in a different ministry. Both Korolev and Yangel

²² See: US Central Intelligence Agency, National Intelligence Estimate 11-8/1-61 Strength and Deployment of Soviet Long Range Ballistic Missile Forces, (Top Secret) Washington DC, 21 September 1961, as declassified by the CIA Historical-Review Program.

faced a new competitor, and so did their ministry. The competition was part of the aviation industry, not the armaments industry.²³

Strangely enough, Khrushchev did not give this assignment to one of the major aircraft design bureaus. Instead, a winged (cruise) missile design organization was authorized to start work on both ICBM and space projects. OKB-52, under chief designer Vladimir Chelomei, had been created in 1955 to develop the P-5 (SS-N-2) cruise missile for the Soviet Navy. Chelomei was no stranger to political maneuvering. He had led the post-war effort to build an analog of the German V-1 “buzz bomb.” However, Chelomei failed to produce a useable weapon. He was dismissed, and his design bureau was handed over to the MiG KB.²⁴ Only by lobbying the Navy brass and Khrushchev himself, did Chelomei finally regain control of a design bureau.²⁵ Three years later, in 1958, Chelomei hired Khrushchev’s only surviving son, Sergei. This connection helped Chelomei to gain access to the Soviet leader so that he could lobby for new projects.

OKB-52 clearly needed more resources to carry out the space and missile projects that Khrushchev authorized in early 1960. The first major expansion came quickly, when the Miasishchev aircraft design bureau (OKB-23) and its associated production facility were subordinated to Chelomei.²⁶ (See Appendix 2) In 1962, Chelomei also won control of OKB-301, the design bureau that had been headed by Lavochkin until his death in 1960.²⁷ Chelomei’s missile and space empire grew so quickly that he was reported to have claimed that he was “the most expensive man” in the Soviet Union.²⁸ Despite the wealth of resources devoted to Chelomei’s projects, they did not bear fruit immediately.

Korolev’s OKB-1 continued to run the manned space program since it was the only organization capable of building and launching such missions. However, Korolev’s dominance over space and missile programs declined dramatically. His plans to build much larger booster rockets and new manned spacecraft were slowly starved of support. The R-9 missile was canceled and Filial #2 in Krasnoiar’sk was spun-off as OKB-10. (See Appendix 2) By mid-1962 this organization was tasked to develop a satellite project that had originated in Yangel’s OKB-586.²⁹ In fact, Yangel had begun to take on the bulk of unmanned earth-orbital missions in 1961 with the advent of the Kosmos series of satellites.³⁰ Thus, Korolev’s early dominance of the space industry dissipated rapidly with the rise of alternatives and competitors.

²³ During the 1950s the names and some of the functions of the defense industrial ministries changed several times. In 1960 the Ministry of Aviation Industry was known as the State Committee on Aviation Technology (GKAT). The Ministry of Armaments had become the State Committee on Defense Technology (GKOT).

²⁴ Nikita S. Khrushchev, Khrushchev Remembers: The Last Testament, ed. and trans. by Strobe Talbott, Boston: Little, Brown & Co., 1974, p. 35.

²⁵ S. N. Khrushchev, Nikita Khrushchev: Krizisy i Rakety, Vol. 1, pp. 371-2; N. S. Khrushchev, Khrushchev Remembers: The Last Testament, pp. 44-5.

²⁶ OKB-23 was the organization responsible for the “Bomber Gap” scare in 1953 when its M-4 “Bison” bombers were miscounted by Western attaches. The Miasishchev production facility was subsequently named the Khrunichev plant; in honor of the post-war Minister of Aviation Industry.

²⁷ Semen Lavochkin had been a highly successful designer of fighter aircraft. After World War II he turned his attention to building a long-range supersonic cruise missile. Successes with ballistic missiles led to the cancellation of this program.

²⁸ Roald Z. Sagdeev, The Making of a Soviet Scientist, New York; John Wiley & Sons, Inc., 1994, p. 202.

²⁹ OKB-10 later became a major communication satellite developer.

³⁰ Kosmos satellites were not all designed by Yangel’s bureau. The name was used as a cover for a number of unsuccessful missions developed by Korolev.

Unfortunately for Chelomei, his efforts were just beginning to pay off when his sponsor fell from power. A prototype of his UR-500 launcher (Proton) and the "Polet" satellite were first launched in November 1963. A second launch was carried out on Cosmonautics Day (12 April) the next year. Six months later, in October 1964, Khrushchev was ousted from power. For the space industry, the change of political leadership had huge consequences.

After Khrushchev was deposed there was a major reorganization and reprioritization in the space and missile industry. Rejecting the two-ministry approach, the new leadership created the Ministry of General Machinebuilding (MOM) and placed all of the space and missile industry under its control. Within two years the major KBs were confusingly renamed; OKB-1 becoming the Central Design Bureau of Experimental Machinebuilding (TsKBEM) and Chelomei's OKB-52 becoming the Central Design Bureau of Machinebuilding (TsKBM). More importantly, the new Soviet leadership, headed by Korolev's old ally Leonid Brezhnev, began a relentless attack on Chelomei's empire. A number of Chelomei's projects were canceled, or turned over to other design bureaus.³¹ Chelomei's Filial #2 was made independent, renamed KB Lavochkin, and given responsibility for developing planetary probes (a duty previously held by Korolev's organization). (See Appendix 2)

With the support of the new leadership, Korolev once again focused on manned space missions. Not only did Korolev have the support of Brezhnev, but his former minister, Dmitrii Ustinov, became the top Communist Party supervisor of the defense industry. Ustinov, who had his own reasons to dislike Chelomei, was the key figure in dissecting the empire that had been built around OKB-52. In short order Korolev gained control over the Soviet manned lunar landing program, and the separate circumlunar program that Chelomei had controlled. Although Korolev died in January 1966, his organization carried the manned lunar programs forward under the control of his long-time deputy Vasilii Mishin.

Chelomei's organization survived largely due to support from the Soviet military. The Soviet General Staff favored a number of Chelomei's projects and was able to keep them going for quite some time. The UR-100 (SS-11) and UR-100N (SS-19) ICBMs were major Chelomei missile programs that survived. The ICBM version of the UR-500 was canceled, but it remained as a space launch vehicle (Proton). One of the reasons to keep the UR-500 alive was that it was to be the launcher for Chelomei's manned military space station. This was a program started as a counter to the US Manned Orbiting Laboratory (MOL); which was also to be a manned reconnaissance platform. Although the US canceled MOL in 1969, the USSR kept their military space station alive for nearly another decade. However, Chelomei lost considerable control over this program. Most importantly, after the US won the race to the moon Ustinov commandeered Chelomei's space station design (and much of the hardware) to turn it into a scientific space station. This project was handed over to Korolev's bureau; TsKBEM. The military version of the space station did fly three times under the cover names of Saliut 2, 3, and 5.³² Yet, this project came to an end in 1977, when the last of these stations was de-orbited.

There were few major changes to the structure of the Soviet space industry from the late 1960s until the USSR collapsed in 1991. The changes that did occur reinforced the traditions and

³¹ For example, Chelomei's space-plane project (analogous to the US Dyna-Soar) was turned over to the MiG OKB.

³² One of the best discussions of the military Saliuts can be found in: Phillip Clark, The Soviet Manned Space Programme: An Illustrated History of the Men, the Missions and the Spacecraft, London: Salamander Books, Ltd., 1988, pp. 66-75.

practices that had begun with Sputnik. The most significant change came in the mid-1970s when much of the Soviet R&D complex was re-organized into Science-Production Associations (NPOs). (See Appendix 3) A number of the space design bureaus and industrial plants were unified under design bureau control as NPOs. The designation of the design bureaus as leading organization in the NPOs reinforced the power and perquisites of the space chief designers. They were now formally responsible for production, as well as R&D.

The NPO unification was also used as an excuse to dispose of Korolev's successor as chief designer. Vasilii Mishin, who was still focused on putting a man on the moon, was "retired" when TsKBEM was merged with Glushko's engine design bureau to create NPO Energiia. Glushko took this opportunity to push his own agenda; part of which included re-writing space history so as to downplay Korolev's role and enhance his own.³³ The influence of Glushko and NPO Energiia were substantially enhanced in 1976 when he won a position on the powerful Communist Party Central Committee. This occurred at the same time that Dmitrii Ustinov became a member of the ruling Politburo and Minister of Defense. Although Ustinov died in 1984, Glushko's influence continued until his death in 1989. After Glushko's death, the two great design bureaus went their separate ways. Glushko's engine design organization became known as NPO Energomash, while Korolev's former organization retained the name NPO Energiia.

Most of the other significant changes in the Soviet space industry relate to the continuing assault by Ustinov and Glushko on Chelomei's empire. Throughout this period, Ustinov continued to show favoritism for the OKBs that he had supervised as Minister of Armaments in the 1950s. Thus, Yangel's organization, renamed KB Iuzhmash in 1966, came to dominate the field of missile production while remaining involved with space work.³⁴ The other successors and spin-offs from Korolev's design bureau consolidated their control of the space industry. A landmark step in this process happened in 1981 when Chelomei's Filial #1 (the former Miasishchev design bureau) was handed over to NPO Energiia.³⁵ As can be seen in Appendix 3, Chelomei's former Filial #1 was subjected to frequent changes and reorganization that coincide remarkably with changes in the political leadership.³⁶ By the end of the Soviet period the design bureau (KB Saliut) had been separated from the production facility (the Khrunichev Machinebuilding Plant). Recently, these two organizations were reunited. In June 1993 the "Khrunichev State Rocket and Space Center" was created. In this case, however, the plant director (Anatolii Kiselev), and not the chief designer, was put in charge.³⁷

³³ One of the more egregious examples of this is the Gas Dynamics Laboratory Museum in St. Petersburg. Another example, that caused considerable semi-public acrimony was the publication of the Encyclopedia of Cosmonautics in 1985. (V. P. Glushko, ed., Kosmonavtika Entsiklopediia, Moscow: Sovetskaia Entsiklopediia, 1985.)

³⁴ NPO Iuzhnoe, located in the Ukraine, remains an important producer of launch vehicles; notably the Zenit booster.

³⁵ This was after the military space station program had been terminated, so Filial #1 was primarily building space station hardware for Energiia and continuing work on the Proton launch vehicle.

³⁶ Ustinov's promotion to Minister of Defense and Glushko's promotion to the Central Committee coincide with Chelomei's loss of control over Filial #1. Note also that Chelomei and Ustinov's deaths in 1984, and Glushko's death in 1989, coincide with other changes.

³⁷ "Khrunichev State Research and Production Space Center," International Launch Services homepage, http://www.lmco.com/ILS/text_html/facts_KhSC.html, downloaded 16 October 1996.

Conclusions

From its very beginnings the Soviet space industry was an unusual hybrid. Space industries were born within the defense industrial complex and remained subordinated to it throughout the Soviet period. However, the space program was never merely a military program. It was, originally, a special state propaganda program; overseen and coordinated at the very highest levels of government. This uncomfortable military-political duality prevented the creation of a separate civil space organization on the model of NASA. Although the USSR tried to create the appearance of having a civil space agency (pretending first, that the Academy of Sciences ran the space program, and later setting up Glavkosmos), the Soviet space industry remained subordinated to defense industrial ministries. Even in the post-Soviet period this did not change. Although the Russian Space Agency (RKA) was “spun-off” of the Ministry of General Machinebuilding in February 1992, control over the space industry remained in the hands of the Ministry of Defense Industry until it was abolished in Spring 1997.³⁸ Within a month (notably around April 12th - Cosmonautics Day), it was announced that the Russian Space Agency (RKA) would assume oversight of the space industry.³⁹

Although direct military influence over the Russian space industry declined throughout the last thirty years, the habits of secrecy that characterized the defense industry did not. The tight Soviet secrecy about space programs, objectives, and industry was probably unavoidable due to the overlap between the missile and space programs. However, maintaining security also served other purposes. Most importantly, the habit of announcing intentions only after success had been achieved allowed the very small handful of leaders at the top to carry out their program with no real oversight. Thus, people who rose to positions of power could pursue their personal agendas with little fear of repercussions. This habit of behavior was evident throughout the Soviet period and, only now, is it starting to change due to the glare of media and international scrutiny.

Members of the Politburo and the Central Committee were not the only ones who tried to treat the space program as their personal fiefdom. The pattern of behavior of Soviet space chief designers was also remarkable in its ruthless pursuit of power. Starting with Korolev, the most politically successful chief designers shamelessly exploited their connections to top political leaders to win approval of the all-important government decrees that drove major programs.⁴⁰ Moreover, the chief designers developed a reflexive aversion to competition. This may have been a reaction to their personal experiences under Stalin. Yet, whatever the cause, space chief designers were not merely content to win a “contract.” They seemed compelled to try to destroy their rivals. This was evident in battles over programs, the struggles over control of R&D resources, and even in writing the history of the space program.

One of the most important distinctions between the former Soviet space industry and its counterpart in the West is that the Soviet industry was largely the outgrowth of design groups with no real connection to the aviation industry. The Korolev and Yangel OKBs were originally part of the artillery industry. The largely eclipsed Chelomei design bureau may have been subordinated to the aviation industry (until 1965), but its leader was an outsider. OKB-52 was

³⁸ In March 1997, the Russian Ministry of Defense Industry was abolished and its responsibilities were assumed by the Ministry of Economics.

³⁹ Interfax report (in English), Moscow, 12 April 1997.

⁴⁰ The hiring and rapid promotion of relatives of Politburo members was a particularly notable habit. Although Chelomei was the first to do so, other space chief designers (including Mishin and Glushko) followed suit.

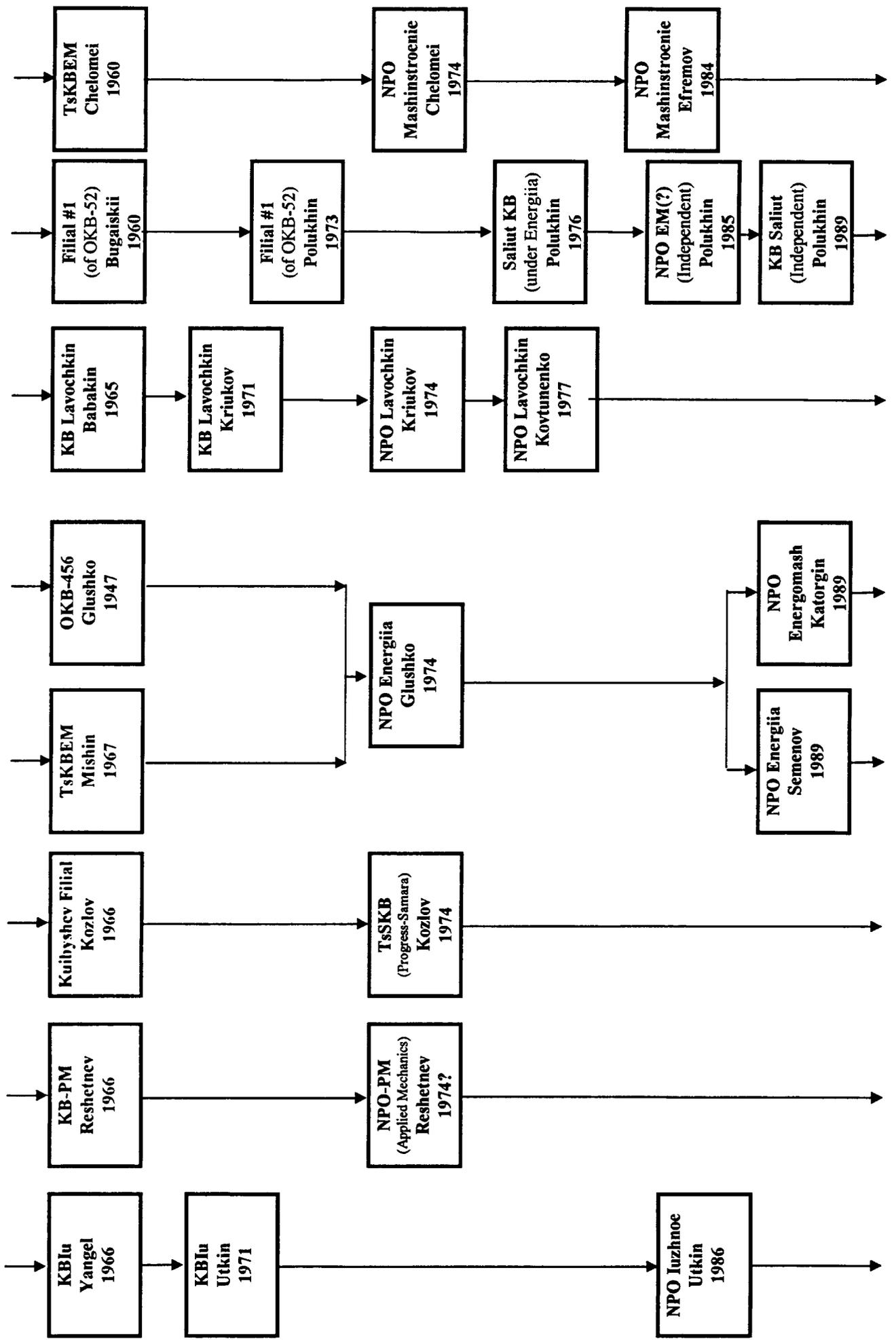
established and expanded through Khrushchev's intervention. Moreover, Chelomei had been a cruise missile designer, not an aircraft designer. The non-aircraft roots of these organizations has had major implications for their approach to rocket and spacecraft design. This is especially evident in manned spacecraft, which tend to rely much less on pilot intervention than Western designs.⁴¹

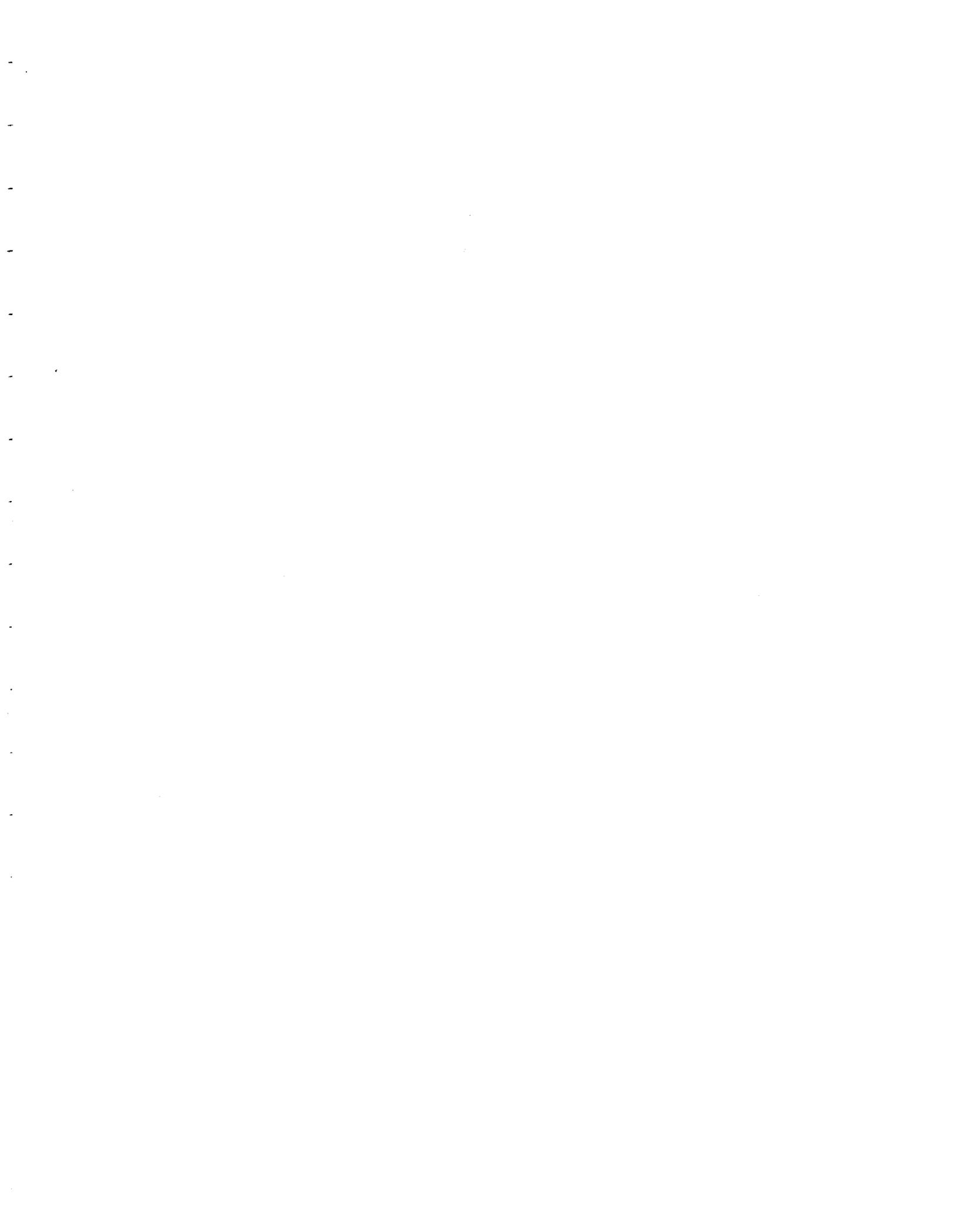
For the former Soviet space industry the legacy of Sputnik has been long-lasting. Although the structure of space industry is rooted in the traditions of Soviet weapons R&D, the approval process for Sputnik and the leadership handling of space as a political program established patterns of behavior that have had powerful influences. These influences are clearly evident in the structure of the former Soviet space industry, and in its current behavior. The restructuring of the Russian space industry announced in April 1997 may herald the opening of a more Western-style approach to organizing space R&D. Yet, it is probably no accident that all of the organizations selected to remain as the "powerful core" of the Russian space industry are the ones tied most closely to the original Korolev design bureau.⁴² The echoes of Sputnik still ripple through the Russian space industry.

⁴¹ There were some space projects that were developed by aircraft design bureaus. However, none of these efforts have been put into operational use.

⁴² The 12 April 1997 announcement of RKA control over the space industry stated that, after restructuring, the core space industry organizations would be Energiia, Energomash, the Khrunichev space center, and the Samara space center (TsSKB-Progress). (Interfax report (in English), Moscow, 12 April 1997.)

Appendix 3: Evolution of Soviet Space Design Bureaus 1968-1991





“A Certain Future: American Higher Education and the Survival of a Nation”

Abstract for "Reconsidering Sputnik: Forty Years Since the Soviet Satellite" Conference

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The nation's ascendance as the major military and economic power in the post-World War II period helped to make the cult of the sciences pervasive in American society. As explained by Daniel Yankelovich, science and technology "were almost universally credited with a decisive role in gaining victory in war, prosperity in peace, enhancing national security, improving our health, and enriching the quality of life. In the late 1950s, Americans took comfort in the fact that they were the champions of this rational and mechanical art. Sputnik shattered that vision, not only creating the image of an enemy capable of launching missiles of massive destruction. Sputnik also generated a widespread fear that America had failed to nurture the sciences and build advanced technologies, with potentially horrifying implications.

To a large degree, American popular opinion credited the Soviet educational system with Sputnik's success. Here was the source for its scientists and research. Conversely, the reason for America's apparent second place position in both the arms and space races was its faltering schools and universities. "For several years independent observers have been warning us about what the Soviets were doing in education, especially in science education, explained Thomas N. Bonner in the *Journal of Higher Education*," but they were crying in the wilderness until October 4, 1957, when the Russians punctured our magnificent conceit by making it clear that in a number of related areas of basic research and applied technology they have already outdistanced us . . . Science and education have now become the main battleground of the Cold War.

Bonner was not alone when he pronounced his belief that, "It is upon education that the fate of our way of life depends." The quick conclusion of many was that America's system of education was disorganized, that it failed to provide sufficient training and research in the sciences, and that it catered to mediocrity at the expense of the promising student.

The proposed paper will discuss the impact of Sputnik on American higher education, and specifically the changing nature of federal funding and programs intended to elevate the role of the research university in a new Cold War framework. Three general themes will be investigated:

-- One, the translation of Sputnik as a scientific and political event into policymaking, and the subsequent expansion of the federal role in supporting key aspects of American public education in general, and the research university in specific.

-- Two, the distribution of a virtual tidal wave of federal funds to research universities, and general impact of federal monies on the development of state systems of higher education using California as a case example. In the post-Sputnik age, leaders within the higher education community engaged in a sometimes worrisome discussion of the new federal role on the research university. As Clark Kerr remarked in 1964, it was perhaps ironic that America's universities, "which pride themselves on their autonomy . . . which identify themselves either as `private' or as `state' should have found their greatest stimulus in federal initiative . . . that institutions which had their historical origins in the training of `gentlemen' should have committed themselves so fully to the service of brute technology." Kerr and others talked of an ever expanding federal influence and the costs and benefits to the university, and society in generally.

-- And three, a review of the impact of the post-Sputnik era on the research university and subsequent importance of the university on economic growth of the nation (for example, did the vision of a "federal research university" come into being?). The paper will attempt to point to the changing nature of the research university in the post-Cold War era, as well as the implications of a paradigm shift in the perceived role of government in American society.

SPUTNIK AND TECHNOLOGICAL SURPRISE
(draft)

Glenn Hastedt
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paper presented at "Reconsidering Sputnik: Forty Years Since the Soviet Satellite," Smithsonian Institution, Washington D.C., September 30-October 1, 1997.

Sputnik was launched on Oct 4, 1957. It was not a small satellite. Twenty two inches in diameter and weighing 184 pounds it dwarfed the six inch, three and one-half pound satellite that was scheduled to be launched by the American Vanguard missile. Sputnik II was even larger, weighing 1,121 pounds, and went into orbit on November 3 carrying a live dog. The Eisenhower administration put forward a low keyed response. Eisenhower was at Gettysburg for a weekend of golf when the announcement of Sputnik's successful launching was made. He left it to White House Press Secretary James Hagerty and Secretary of State John Foster Dulles to put forward the administration's response. They informed the press that the administration had not been caught by surprise by Sputnik's success and that Eisenhower was being kept abreast of events because they were of "great scientific interest." Hagerty also offered the opinion that the administration had "never thought of our program as one which was in a race with the Soviets." In the following weeks Secretary of Defense Charles Wilson would dismiss Sputnik as "a nice scientific trick" and trade advisor Clarence Randall called it a "silly bauble."¹

The measured and condescending response of the Eisenhower administration was a stark contrast to the highly agitated response of the media and public. As Walter McDougall notes the public's response to Sputnik poured forward in a series of chaotic waves whose crests and troughs overlapped to "reinforce alarm one week and confused inertia the next."² Frequent comparisons were made to Pearl Harbor. *Time* and *Newsweek* placed Sputnik squarely into a cold war context of competition with the Soviet Union. The *New Republic* likened Sputnik to Columbus' discovery of America and the *U.S. News and World Report* compared it to the splitting of the atom. Eisenhower's efforts to minimize the significance of Sputnik failed. By early November 1957 his standing in public opinion polls had fallen twenty two points from a high of 79% in January 1957 to 57%.³

The loss of public confidence in Eisenhower was not due simply to the actions of circulation-hungry press or opportunistic political opponents who wished to make Eisenhower look bad. Sputnik touched a raw nerve that both excited and frightened the American public in a way that the Eisenhower administration had not anticipated. Robert Devine states that "at the heart of the problem was the popular belief in American supremacy in science and technology." Sputnik set off a highly public and visible debate on education, science, space exploration, national security, and fiscal policy that continued on into the 1960s. McDougall writes that with Sputnik, "a new political symbolism had arisen to discredit the old verities about limited government. Local initiative, balanced budgets, and individualism."⁴

The Eisenhower administration's protests notwithstanding, it was caught by surprise by Sputnik. The question examined here is why? Was it the product of forces

¹ Robert A. Devine, *The Sputnik Challenge* (New York: Oxford University Press, 1993), xiii-xv.

² Walter A. McDougall, *The Heavens and the Earth: A Political History of the Space Age* (New York: Basic Books, 1985), 142.

³ Devine, p. 44-45.

⁴ McDougall, p. 226.

that have produced other surprises or was the failure to predict Sputnik the product of a unique constellation of forces. That possibility exists because where existing studies of surprise have focused on military or diplomatic surprise, Sputnik --while it contains elements of each-- is more accurately seen as a case of technological surprise.

Technological surprise is seldom studied. This in spite of the fact that one of the defining features of scientific and technological research is the search for new ways of doing things; new insights into how and why things work; and an unwillingness to accept the limits of the present as the boundaries of the future. Barry Hughes notes that one reason few studies of the future specifically address technological change is that "as difficult as forecasting population growth or energy demand over the next twenty years might be, such forecasts are trivial compared to the difficult task of anticipating technological developments."⁵ Hughes then adds that "the rate of technological change is both largely unmeasurable and uncertain."⁶

The lack of attention to technological surprise is unfortunate given the increasingly important role that technology plays in world politics today. Not only does technology shape the traditional strategic agenda of states and shape the language in which strategy is discussed, it is also central to the dynamics of many of the issues that occupy positions of prominence on the post cold war agenda. By studying the surprise surrounding the launching of Sputnik we can begin to lay a foundation for studying technological surprise as an integral and distinct part of world politics.

WHY SURPRISE

Studies of surprise approach the subject from a variety of perspectives. Some address the basic nature of surprise; some seek to uncover underlying forces that produce surprise or are at least conducive to it; some examine the actions of the "attacker" where others focus on the "defender;" still others are concerned with particular types of surprise such as military surprise or diplomatic surprise. In order to better grasp the extent to which the surprise induced by Sputnik was unique we need to place it within the context of these broader theoretical and practical concerns.

The Nature of Surprise

On any given day foreign and national security policy makers have few reasons to expect surprise. Bureaucratic inertia, vested personal interests, domestic political pressures, and international system constraints conspire to prevent much more than incremental change from usually taking place. Yet surprise does happen. What is important about surprise is not that happens, but that sometimes when it happens a surprise will fundamentally alter the strategic context within which future decisions are made. In these cases surprise invalidates the assumptions on which diplomatic initiatives were premised and defense plans based. It exposes states to vulnerabilities that they had not anticipated and are not prepared for. As Richard Betts notes, intelligence makes its impact through its "jolting originality" as policy makers are suddenly confronted with the realization that events are moving in an unexpected and dangerous direction.⁷

⁵ Barry B. Hughes, *World Futures: A Critical Analysis of Alternatives* (Baltimore: Johns Hopkins University Press, 1985), p. 145.

⁶ Hughes, p. 151.

⁷ Richard Betts, *Surprise Attack* (Washington, D.C.: Brookings, 1982).

Several different frameworks exist for classifying surprise. At the most general level they can be grouped under two headings. One school of thought emphasizes causation. Surprises are defined in terms of the defender's unreadiness. Potential dimensions of unreadiness include whether the opponent would attack; when the opponent would attack, where it would attack, how it would attack, and why it would attack.⁸ A second school groups instances of surprise in terms of their impact on world politics. Minor surprises are those which are unexpected moves that change the course of relations between states but do not alter the underlying balance of power in the international system. Major surprises are unanticipated moves that have a considerable impact on the real or expected division of power either at the regional or global level.⁹

Why Surprise Succeeds

Surprise is never total; bolts from the blue do not happen. There is always some warning. The repeated instances in which surprise takes place in spite of warning has caused researchers to look closely at the problems that the victim state encounters in trying to correctly anticipate the moves of its adversary. Michael Handel suggests that they might be grouped under three headings.¹⁰

First, are problems deliberately caused by the enemy. Foremost among these is deception. Those contemplating a surprise move often seek to cloak their actions behind a veil of secrecy. States contemplating surprise find deception to be an attractive strategy because it is relatively cheap and because it is virtually impossible to maintain prolonged secrecy for major diplomatic initiatives or military campaigns.¹¹ For example, in World War II the allies made no serious attempt to hide their intentions of invading Europe. Instead, they sought to deceive Hitler as to where the invasion would take place. Allied intelligence was so successful in focusing Hitler's attentions on Pas de Calais and away from Normandy that Germany still had most of its forces there even after the invasion of Normandy was well underway.

Deception is most effective when it seeks to reinforce a belief already held by the intended victim rather than when it tries to change a policy maker's mind. Such was the case when Stalin refused to believe the warnings of Hitler's pending invasion. A paradox also presents itself here. Findings suggest that the more alert a state is to the potential of deception, the easier it is to deceive it. The acknowledged possibility of deception provides a rationale for both dismissing as bogus all incoming pieces of information that do not fit with current expectations and for being skeptical of all information that does fit. The result is that policy makers are free to indulge their biases or engage in wishful thinking.

Quite apart from any planned program of deception, the actions of the attacker also complicate the task of anticipating a surprise move. The attacker always has the option of changing its plans. Warnings of an attack, therefore, may be correct even if no

⁸ Betts, p. 11 and Katrina Brodin, "Surprise Attack: The Case of Sweden," Journal of Strategic Studies 1 (1978), 99.

⁹ Michael I. Handel, The Diplomacy of Surprise: Hitler, Nixon, Sadat (Cambridge, MA: Harvard University Press, p. 1-6.

¹⁰ Michael I. Handel, "Avoiding Political and Technological Surprise in the 1980's," in Roy Godson (ed.), Intelligence Requirements for the 1980's: Analysis and Estimates (Washington, D.C.: Consortium for the Study of Intelligence, 1980), 85-111.

¹¹ Barton Whaley, Codeword BARBAROSSA (Cambridge, MA: MIT Press, 1974).

attack materializes. Japanese plans called for aborting the attack on Pearl Harbor if its attack fleet was discovered. Indecision on the part of the attacker similarly complicates the problem of predicting an attack or diplomatic breakthrough. On more than one occasion in the period leading up to the surprise announcement of President Nixon's trip to China contradictory signals were sent by China to the United States because of conflicts within the Chinese Communist Party.

A second set of problems that stand in the way of anticipating surprise are inherent in the task of predicting the future. Major events simply do not come in nice neat packages. It is only with twenty-twenty hindsight that the correct interpretation of data is obvious. Most commonly cited as obstacles to the correct assessment of information are noise and the ambiguity of evidence. Noise is the opposite of deception. Where deception succeeds by increasing the adversary's certainty about the validity of false interpretations of data, noise confuses the adversary through the clutter of extraneous information that its intelligence services are picking up.¹² The problem at Pearl Harbor was not too little information but too many irrelevant pieces of information. Moreover, on the eve of the attack a great deal of evidence existed supporting all the wrong interpretations of the last minute signals being received. A chronology of over 100 events can be strung together pointing to the culminating announcement of Nixon's breakthrough trip to China. But the picture was far less clear as events unfolded. Diplomatic feelers often went unanswered because they were too subtle; sometimes more than one month separated the sending of a signal and the response to it. And, building on points raised above, because neither side fully trusted the other, ambiguity was often purposefully inserted into messages in order to allow for an orderly diplomatic retreat.

Faced with this barriers, some intelligence analysts and observers argue that a distinction needs to be drawn between forecasting and fortunetelling. Too often intelligence is asked to engage in fortunetelling where they are asked to predict the occurrence of a particular event. Former Israeli intelligence officer Shlomo Gazit argues that intelligence organizations should only be tasked with producing estimates on three situations: 1) decisions already taken; 2) possible reactions to a certain situation combined with speculation on the most probable one; and 3) analyzing the outcome of a developing situation in terms of milestones, turning points, and possible outcomes.¹³

A final set of problems in anticipating surprise are self-generated. One obstacle to the ability of policy makers to appreciate and respond to warning intelligence stem from the blinding effect of current policy-maker preoccupations. Policy makers do not sit back and passively take in information. They interact with it, picking and choosing which pieces are relevant to their needs and which are not. One of the most important perceptual filters that determines what is seen and what is not are the immediate concerns that dominate the policy maker's thoughts (the evoked set)¹⁴. Policy makers in Washington were doubly blinded to Japanese war plans. Not only were they absorbed with events in Europe but they were convinced that Japanese aggression would first take

¹² Roberta Wohlstetter, *Pearl Harbor: Warning and Decision* (Stanford: Stanford University Press, 1962).

¹³ Shlomo Gazit, "Estimates and Fortunetelling in Intelligence Work," *International Security* 4 (1980), 36-56.

¹⁴ Robert Jervis, *Perception and Misperception in International Politics* (Princeton: Princeton University Press, 1976), pp. 203-216.

place in the Western Pacific. Secretary of the Navy Knox responded to news of the attack on Pearl Harbor by asserting "this can't be true... [it] must mean the Philippines." Communications between Washington and Pearl Harbor also show the impact of the evoked set on reading intelligence. Policy makers in Washington assumed their immediate concerns about a Japanese attack were shared by their counterparts at Pearl Harbor. This was not the case. Officials at Pearl Harbor were primarily concerned with the possibility of internal sabotage and they read the warnings from Washington in this light.

Contingency plans have the same blinding effect. Having spend considerable time and energy into putting together a contingency plan, the tendency is for it to color one's perceptions to the point where all future events are seen as being consistent with its assumptions. Committed to stopping the spread of communism, U.S. policy makers needed little information to "see" communism in Third World revolutionary movements. The response was highly predictable with the United States either coming to the aid of the threatened government or committing itself to overthrowing the newly installed regime. Given this pattern of response, many observers have concluded that the failed 1960 Bay of Pigs invasion of Cuba to overthrow Fidel Castro was in a sense inevitable because in carrying out covert operations against communist regimes the United States had come to rely too heavily on responses that had been successful in Iran (1953) and Guatemala (1954) and had stopped paying close attention to the unique features of each situation.

Also promoting surprise is a policy maker's commitment to a given course of action and the problems it creates for integrating intelligence and policy. Selecting a course of action and building support for it is an expensive undertaking and once adopted personal and institutional prestige become attached to its success. Into this setting walks the intelligence professional. To be effective intelligence must know the policy maker's concerns and plans otherwise the intelligence they provide is likely to be found irrelevant. However, if intelligence is brought into close contact with policy it runs the risk of being corrupted. Intelligence will be expected to support policy and not allowed to perform its intended function of presenting policy makers with warning. This tension between intelligence and policy was evident in the period preceding the fall of the Shah. The complete confidence that the United States had in the ability of the Shah to survive skewed U.S. intelligence efforts. Analysts complained that "you couldn't give away intelligence on the Shah.

At times the tunnel vision preventing policy makers from accurately reading the intelligence available to the grows out of biases deeper than the attachment to a line of policy or being preoccupied with a problem. It may also stem from a false set of assumptions which are widely held throughout the policy making process.¹⁵ For Israelis in 1973 it was the assumption that Egypt would not go to war until it could control the air space over the battlefield; for the Arabs in 1967 it was that war would not begin until negotiations proved fruitless; for Stalin it was that Hitler would issue an ultimatum before attacking; and in 1950 the United States was surprised that North Korea attacked because it was assumed that this would only happen as part of a more general war.

In a similar vein, surprised states also mistakenly assume that other states are conducting their foreign policy on the basis of the same set of assumption under which

¹⁵ William Ascher, *Forecasting: An Appraisal for Policy Makers and Planners* (Baltimore: Johns Hopkins University Press, 1978).

they are operating. They are especially likely to overestimate the value placed by others on maintaining the status quo. The United States failed to understand that Japanese leaders had posed their predicament in such a way that an attack on Pearl Harbor appeared reasonable. In 1973 Israeli leaders failed to appreciate the fact that Sadat found a continuation of the status quo to be so unacceptable that he was will to start (and lose) a war in hopes of breaking the Middle East stalemate. Under these circumstances, the state carrying out the surprise is able to exploit “the logic of craziness.” The more extreme the action, the more unbelievable is, the less likely is it be adequately defended against or prepared for. As such the possibility of success is often better than if the state pursued a more “reasonable” course of action.

Given the forces of inertia that have been noted above, massive amounts of information are often needed to make policy makers reconsider their position. At the same time it is possible to be overwarned. Individuals and organizations cannot stay at high levels of alert indefinitely. The more often one is warned, the more accustomed one becomes to the situation. Familiarity causes one’s response to warning to become routine as a “cry wolf” syndrome takes hold. Pearl Harbor was warned once in 1940 and twice in 1942. Israel counted on the numbing effect of routine to aid their surprise in 1967 and fell victim to the deadening impact of repeated mobilizations and demobilizations in 1973. The cry wolf problem is especially difficult to overcome in dealing with terrorism. In speaking to the problem of intelligence regarding bomb threats preceding the October 1983 attack on the Marine barracks in Beirut, one officer told a congressional committee that “since we have been here, we have, I think, counted over a hundred car bomb threats.” Another noted that once a threat was received regarding a blue Mercedes and added “there are quite a few blue Mercedes over in Lebanon.”

Types of Surprise

In addition to laying out the fundamental tenets of why surprise happens, attention has also been given to developing a better understanding of the two major types of surprise: military surprise and diplomatic surprise. As Michael Handel observes, there are significant differences between them.¹⁶ First, where military surprise is an inherent part of military planning, diplomatic surprise is not. In military affairs, surprise is treated as a force multiplier. In diplomacy continuity and predictability are valued, not the ability to surprise an ally.

Second, military surprise and diplomatic surprise present intelligence organizations with different types of problems. Due to their large size and need for long lead-time, military operations emit many signals and are difficult to “keep secret.” At the same time, however, military actions present intelligence officials with multiple challenges in predicting the where, when, and how of possible activity. Because it involves fewer participants, and may even be unilateral in nature, diplomatic surprise is easier to keep secret. Anticipating it involves understanding leader’s perceptions more than it does comprehending organizational behavior. Moreover, in trying to anticipate the moves of an adversary those concerned with military surprise must pay attention to both intentions and capabilities. Those concerned with preventing diplomatic surprise need only focus on the adversary’s intentions since capabilities are not a significant limiting factor in the ability to carry out diplomatic surprise.

¹⁶ Handel, *Diplomacy of Surprise*, p. 13-24.

Third, the impact of military surprise is immediate because the national security challenge to the attacked state is direct and real. The impact of diplomatic surprise may be immediate or delayed because the consequences of the surprise may not place the state in immediate danger. Fourth, military surprise is always a hostile and negative act. Diplomatic surprise may be positive and cooperative in nature. Fifth, from the point of view of the initiating state military surprise offers only advantages since it serves as a force multiplier increasing the power of its existing military forces. Diplomatic surprise involves a trade-off for the initiating state. Its action may alienate allies, provoke protests from domestic groups, or negatively impact on the achievement of other foreign policy goals.

SPUTNIK

The Soviet Story

Soviet leaders made little attempt to keep the impending launch of Sputnik a secret. Public signs of growing official Soviet interest in putting an artificial satellite into orbit around the earth began to mount following Stalin's death. Responding to the call of organizers of the International Geophysical Year (IGY) for the international community to work together to place launch a satellite in earth orbit in 1957 the Soviet Academy of Sciences created a blue ribbon commission whose purpose was to "organize work concerned with building an automatic a laboratory for scientific research in space." This was followed by the Soviet Union's July 30, 1955 official announcement that, like the United States, it planned to launch a satellite during the IGY. Radio reports spoke of teams of scientists being formed to build such a satellite and Leonid Sedov, who chaired the blue ribbon panel, predicted a satellite launch in 1957 using a multistage rocket. At the First International Conference of Rockets and Guided Missiles in 1956, Soviet scientists spoke openly about high altitude experiments and launching dogs into space.

McDougall notes that once the IGY began on July 1, 1957, "Soviet predictions of a satellite became a weekly occurrence."¹⁷ The first test rocket exploded in failure in spring 1957 and it was not until August 3 that a successful launch took place. After a second success, the Soviet Union announced to the world on August 27 that it now possessed an operational intercontinental ballistic missile (ICBM). Sergei Korolov, one of the key figures in the design and testing of Soviet missiles, states that it was only at this point that Soviet leaders gave final approval for launching Sputnik. Moscow made its intentions public on September 17 and on October 1 it informed the world of Sputnik's radio frequency.

After Sputnik's successful launch Soviet leaders were quick to exploit its propaganda value in the cold war competition with the United States. However, it is worth noting that even prior to Sputnik high ranking party members and military officials had begun to emphasize the Soviet ICBM capability and its significance for world politics.¹⁸ Between 1955-1957, Nikita Khrushchev, Nikolai Bulganin, and Anastas Mikoyan all made public comments which either extolled the virtues of long range missiles or denigrated the military significance of long range bombers. At the twentieth party congress in 1956, Defense Minister Marshall Gerogi Zhukov made reference to long range

¹⁷ McDougall, 60.

¹⁸ John Prados, *The Soviet Estimate: U.S. intelligence and Soviet Strategic Forces* (Princeton: Princeton University Press, 1982), pp. 55-57.

and “mighty” missiles. And a 1957 article cited the strategic virtues of ICBMs: it could take off from mobile launchers; it could operate under all types of weather conditions; and it would permit its possessor to launch surprise attacks.

Soviet interest in rocketry and space flight predated Stalin’s death. The September 17 announcement coincided with the one hundredth anniversary of Konstantin Tsiolkovsky’s birth. Tsiolkovsky was one of the founding fathers of Soviet rocketry having written a 1903 treatise on the mathematics of orbital mechanics and designed a rocket powered from liquid oxygen and liquid hydrogen. Where under the Tsar’s Russian advances in rocketry were primarily in the areas of theory and design rather than testing and building this changed with the Communist Party’s ascent to power. In 1924 it created a Central Bureau for the Study of the Problems of Rockets. By 1934, McDougall notes that the link between rocketry and revolution had become institutionalized as the drive for technological supremacy had become a major goal of the Soviet state.¹⁹

Step by step rocket research was “swallowed up in the belly of Stalin’s leviathan.” The Academy of Sciences was accused of counterrevolutionary activity and placed under the direction of the Council of Peoples Commissars. The first Five Year Plan established research and development priorities which replaced individual goals and visions as the driving force in rocketry. During the 1930s, the entire Jet Scientific Research Institute fell victim to Stalin’s Great Purge. Still, by the end of the 1930s, Soviet scientists had managed to test air to surface missiles, surface to air missiles, surface to surface missiles, and launch the world’s first two stage rocket. Soviet advances in rocketry were such that for them, the German V-2 contained few technological breakthroughs.

Not only did the end of World War II produce a surge of Soviet activity directed toward the development of an atomic bomb, it also brought forward renewed interest in rocketry. The Chief of the Soviet Air Forces observed that merely building more V-2 rockets would not be enough to ensure Soviet security in a future war. “They were good to frighten England, but should there be an American-Soviet war, they would be useless; what we really need are long range reliable rockets capable of hitting target areas on the American continent.” The head of the Aerodynamics Laboratory of the Moscow Military Air Academy echoed these thoughts: “we have no intention of making war on Poland. Our vital interests is for machines that can fly across oceans” By the end of 1947, almost two years prior to the detonation of the Soviet atomic bomb, “everyone wanted to design a trans-Atlantic rocket.”²⁰ By 1949 results were beginning to appear. The first all-Soviet upgrade of the V-2 with a range of 550 miles was in production. An intermediate range ballistic missile (IRBM) was under construction by 1952 and the blueprints for the ICBM which the Soviets used to launch Sputnik were approved in 1954.

The American View of the Soviet Story

Lawrence Freedman notes that early postwar estimates of the Soviet strategic threat to the United States were little more than guesses.²¹ The focus of these estimates was the current and future size of the Soviet bomber force. Intelligence information was scarce and came primarily from two sources. The first of these were official Soviet

¹⁹ McDougall, p. 27.

²⁰ McDougall, pp. 52-53.

²¹ Lawrence Freedman, *U.S. Intelligence and the Soviet Strategic Threat* (Princeton: Princeton University Press, 1977), p. 64.

government statements which were distrusted and often dismissed as propaganda. The second was personal observation. The main opportunity for viewing Soviet bomber strength were air parades such as the 1955 May Day parade in which the Soviet's appeared to fly more Bison bombers overhead than intelligence estimates suggested they possessed. Where the 1954 estimate predicted that full production of the Bison bomber would not begin until 1956, by the end of 1955 intelligence estimates were now predicting that by the end of 1956 twenty five bombers would be produced each month with the total Soviet inventory reaching 600-800 by 1969 or 1960.

The "bomber gap" became the focus of a short-lived but highly charged political debate pitting congress against the president, and the air force against the other members of the intelligence community. The issue was resolved largely through the development and deployment of a new intelligence collection system: the U-2 reconnaissance plane. The first flight took off from Weisbaden on July 4, 1956 and overflew Moscow, Leningrad, and the Baltic Coast. Two additional missions were each flown on July 5 and July 9 before Soviet protests caused the flights to be called off for several months.²² These five flights produced conclusive proof that Soviet bomber production was not preceding at an alarming rate and a downward revision of the bomber threat began in December 1956.

What the U-2 flights did reveal was a growing Soviet commitment to ICBM testing and production with the construction of a second missile testing site at Tyuratam. The intelligence community had been aware of the Soviet's first missile testing facility at Kapustin Yar since 1947. Information on its activities was provided by defectors, returning German scientists, and aerial reconnaissance. In 1952 the CIA set up an Office of Scientific Intelligence and in 1954 it was predicting that the Soviet Union would be capable of launching an earth satellite by the end of 1957 but that it would not possess an operational ICBM before 1960. As with the bomber gap, the air force disagreed and made use of its close ties with key congressional supporters to press the Eisenhower administration to do something about the growing "missile gap."

Information gathered from U-2 overflights of the Tyuratam missile testing site in 1957 led CIA analysts to conclude that the Soviets were preparing to launch a satellite into space using an ICBM. And, a U-2 overflight in the summer produced pictures of an ICBM sitting in its launching pad. The status of the Soviet ICBM program was brought to Eisenhower's attention a May 10, 1957 National Security Council Meeting. Public attention was directed to the rapidly progressing Soviet ICBM program by a May article in *Aviation Week* and a July column in the *New York Times* by Steward Alsop in which he stated that the Soviets had tested an experimental long range missile. Between May and August 1957, eight long range missile firings were observed. On September 12, 1957 the Office of the Army Chief of Research and Development estimated that the Soviet Union would launch a satellite within 30 days.²³

The American Story

Control over air power (both from a strategic and bureaucratic perspective) was a major focal point of U.S. military policy in the immediate post war period. The weapon of choice was the manned bomber with rocketry and its accompanying satellites running a

²² Jeffrey Richelson, *American Espionage and the Soviet Target* (New York: Quill, 1987), pp. 143-48.

²³ Vernon Van Dyke, *Pride and Power: The Rationale of the Space Program* (Urbana: University of Illinois Press, 1964), p. 15.

distinct second. Not only was the manned bomber a known and trusted commodity to military officers and strategists but real doubts existed over the ability of a rocket to deliver atomic bombs given their size. The case for the manned bomber was buttressed further by the desire of the Truman and Eisenhower administrations to limit funding for nonessential programs in pursuit of a balanced budget.

During the war the Army Air Force Services division tasked the Special Weapons Group at Wright Field to do work on guided missiles. As the potential of the V-2 became recognized by the military competition to control this program mushroomed and in 1944 the decision was made to give the Army Air Force control over all missiles dropped from planes and the Army Services Unit control over ground-launched ballistic missiles. Upon his return from Potsdam President Truman authorized an increase in aviation research and development spending. Air Force spending on missiles went from \$3.7 million in FY1945 to \$38.8 million in FY1946. No sooner had this emphasis on missile research and development begun than ended. Instead of a projected FY1947 budget \$75.7 million on missiles, the Air Force's outlays were cutback to \$22 million. Eleven programs were canceled including the MX-774, a 5,000 mile ballistic missile.

This reversal of field reflected four key assumptions that were widely shared among American policy makers.²⁴ First, funding military programs ranked third in priority behind domestic spending and overall fiscal conservatism. Second, it was assumed that the United States was ahead of the Soviet Union in aviation technology. Third, "blue sky" air force officers favored the manned bomber over missile. And, fourth, there was a general air of scientific pessimism surrounding the development of an ICBM.

Research and development in the field of satellite technology fared little better. Just days after their surrender German scientists had briefed some of their American counterparts about the possibilities of missiles and satellites. The Navy was first to seize the initiative establishing an Earth Satellite Vehicle Program in 1945. In 1946 it approached the Army Air Force about the possibility of collaborating on a joint project. Rebuffed by Vannevar Bush, Director of the Office of Scientific Research and Development, the Army Air Force commissioned the RAND Corporation for a study of the value of earth satellites. Its report released on May 2, 1946 made the following three points. First, satellites would become one of the most potent scientific tools by the end of the century. Second, the launching of a satellite would have repercussions comparable to that of the atomic bomb. Third, "the nation which first makes significant achievements in space travel will be acknowledged as the world leader in both military and scientific techniques. Still, 1948 proposals for funding by the Navy and Air Force were rejected and the project canceled because of a failure to establish "either a military or a scientific utility commensurate with the presently expected cost of a satellite vehicle."

New life was breathed into the U.S. missile program in by a series of events in the early 1950s. The (unexpected) Korean War led Truman appointed K.T. Keller to the newly created post of special advisor on missiles and in 1951 he authorized funds for work on a new Air Force ICBM that would become the Atlas missile. The successful detonations of hydrogen bombs by the Soviet Union and the United States put an end to the debate over whether such a weapon could be delivered by missiles. Evidence was

²⁴ McDougall, p. 98.

now also mounting that the Soviet Union was making significant advances in missile research and development.

A 1950 RAND study released on October 4, 1950 also kept a spotlight on satellite research and development by directly addressing their military significance. It noted that while satellites were not weapons they did possess great military utility because they could gather data not available from other sources. RAND predicted that their unconventional nature would also guarantee that satellites would become a factor in the global balance of power and thus have significant political-psychological effects as well as military ones. RAND also felt that the primary political problem that satellites would pose centered on the reaction of other states to the loss of sovereignty that resulted from their overflights.

A further boost to the U.S. missile and satellite programs was given by the findings of the Killian Report that was commissioned by President Eisenhower in 1954 to study the problem of surprise attack on the U.S. The Killian Report identified the period from late 1954 until 1955 was one of American air-atomic advantage but one in which it was vulnerable to a surprise attack due to the lack of an early warning system. The following period, from 1956-57 until 1958-60, was anticipated to be one in which the United States would hold a great offensive advantage but one in which the Soviet Union would be testing new missiles and bombers. The Killian Report noted that the "single most important variable" in its scenarios was the Soviet development of an ICBM. It recommended that the U.S. give highest priorities to the development of an ICBM, and an early warning system. It was especially important noted committee member Edwin Land that the U.S. find ways of increasing the number of facts on which our intelligence estimates are based.

Three different satellite programs emerged almost simultaneously in the mid 1950s. One, put forward in secret was the development of an advanced and technologically sophisticated earth reconnaissance satellite, WS-171L, was a direct outgrowth of the Killian Report. The second was a joint Army-Navy proposal, Project Orbiter, which was to be a "no-cost" satellite using existing technology. The third was a proposal from the scientific community that the U.S. launch a scientific satellite to commemorate the IGY. Assistant Secretary of Defense Donald Quarles oversaw a study to evaluate these proposals from a military perspective. His staff recommended launching a small scientific satellite in the near future and acknowledged that the Soviet Union was now working on a satellite program of its own. The scientific satellite was recommended as a way of testing the principle of "freedom of space" and the legality of satellite overflight. The report also insisted that care needed to be taken so that nothing done would prejudice U.S. satellite efforts outside the scope of the IGY.

In July 1955, the Eisenhower administration publicly committed itself to a scientific satellite as part of the IGY. It was agreed that the IGY National Committee should take responsibility for work on the satellite and that the Defense Department would provide the missile that would be used in its launching. The choice was between the Army missile which was to be used in Project Orbiter and a Naval Research Laboratory proposal. Project Vanguard, which involved designing a new four-stage Viking missile. Work on Vanguard got underway in fall 1956. In May 1957, the National Security Council approved a launch schedule that included flight testing of the three Vanguard stages in the remainder of 1957 with a fully instrumented test satellite to be launched in

March 1958. Testing of Vanguard was on schedule when Sputnik went into orbit on October 4, 1957. The first launching of a U.S. satellite was set for December.

SPUTNIK AS A CASE OF SURPRISE

Why Surprise

When placed within the context of the literature on surprise, a review of the events leading up to the launching of Sputnik points to the conclusion that the major reasons for surprise were self-generated within the United States. There is little evidence of Soviet deception. Soviet leaders made no effort to hide their commitment to launching a satellite. Vernon Van Dyke goes so far as to argue that there were “relatively abundant and open reports concerning developing Soviet capabilities.”²⁵ The principal problem lay in getting top level officials in the United States to believe these reports. The successful Soviet deception with regard to the bomber gap led many American observers to dismiss Soviet statements about their progress in missile and satellite technology as nothing more than propaganda-inspired boasting. Only in one sense did the actions of Soviet leaders directly contribute to surprise. This was the relatively late date at which a firm commitment to launch a satellite was made. It was only after the successful August 27 test firing of the ICBM was that decision made. Given the secrecy of the Soviet system this did not permit the intelligence community much time to warn American leaders of the actual launching of Sputnik.

The second frequent cause of surprise noted earlier are problems inherent in the task of predicting the future. Here too, these problems were only of secondary importance in the case of Sputnik. According to Gazit, one of the three legitimate tasks that can be assigned to an intelligence agencies is that of analyzing the outcome of a developing situation. Not only did the CIA manage to accurately see future developments in the Soviet missile and satellite program but so too did other elements of the national security bureaucracy. Furthermore, RAND correctly saw the political and psychological significance of launching the first satellite into space.

One can speculate that they were able to do so in part because as specialists concerned primarily with developments in Soviet missile and satellite research they were not as affected by the “noise” surrounding the many signals that Soviet leaders were sending regarding their intentions as were officials with more general areas of foreign policy responsibility. Soviet statements and actions regarding such early 1950s cold war hot spots as Berlin, the Middle East, Central America, and Korea were far less likely to distract them or negatively color their evaluations of Soviet missile and satellite activity.

In identifying self-generated problems within the United States as the primary source of surprise, the case of Sputnik is not unique. It falls well within the confines of that body of literature which emphasizes that surprise occurs despite warning. The picture which emerges is one of knowledge of Soviet activity but an absence of any sense of urgency. At least four factors contributed to this false sense of security.

First, was the problem of mirror imaging –assuming that the Soviet Union was making decisions on the same set of assumptions that were guiding American policy. The most crucial assumption dealt with the continued superiority of the manned bomber as the vehicle for delivering long distance air strikes on the enemy. Freedman notes that in the

²⁵ Van Dyke, p. 15.

1940s American officials had come to dismiss the ICBM as a delivery vehicle for reasons of cost and accuracy, and had assumed that Soviet officials would reach a similar conclusion.²⁶ They were not totally wrong. For a time Korolev agreed with the assessment that “winged rockets” and not missiles were destined to be the delivery vehicle of choice in the space age and Soviet leaders expressed early interest in the Sanger project, a wartime German plan for constructing a piloted bomber with intercontinental capabilities.²⁷ What they failed to recognize was the shift in Soviet thinking away from the bomber to missiles, a shift signaled in Soviet publications and official statements.

Second, American officials were blinded to the significance of Sputnik by their own policy priorities. For the Eisenhower administration speed was not of the essence. If it had been the Army’s Project Orbiter would have been given the nod in 1955 over the untried Vanguard as the delivery vehicle since as Army officials noted before and after Sputnik, would have been ready to launch as early as January 1957. By choosing the Vanguard the Eisenhower administration made its decision in virtually total disregard for the speed and direction of the Soviet space program. Top priority was given to its goal of establishing the legal precedent that space was international territory and not the property of sovereign states.²⁸ Given the secrecy of Soviet society and pending advances in military reconnaissance satellites (****) this precedent was seen as essential to the continued U.S. ability to gather information on Soviet military capabilities. Eisenhower felt that this would be best realized if the first satellite put into earth orbit was scientific and not military in nature.

Third, American officials failed to respond to evidence of a growing Soviet satellite program due to the overriding influence of budgetary considerations. Van Dyke correctly notes that the “general air of conservatism and the stress on economy under Eisenhower and Secretary of Defense Wilson were not propitious to boldness pertaining to space or for that matter imaginative research.”²⁹ The power of this commitment to limit government spending to serve as a restraining force on the U.S. space program comes through even after Sputnik is sent into orbit as Eisenhower fought doggedly to limit the funds that would be directed at space research. He continued to view excessive government spending and a weak economy as far greater threats to American national security than a nascent Soviet ICBM force.

Finally, an unstated American belief in its presumed technological and scientific superiority over other states seems to have blinded policy makers to Soviet advances. In spite of warnings that the Soviet Union was moving steadily toward launching a satellite no serious consideration appears to have been given by the Eisenhower administration to the possibility that the United States was in a race with the Soviet Union or that it might lose such a race. This sense of technological superiority was the basis for Eisenhower’s “New Look” deterrence posture was maintained in the face of two jolting challenges: the Soviet A and H bomb tests.

Sputnik as Technological Surprise

²⁶ Freedman, p. 68.

²⁷ McDougall, pp. 52-53.

²⁸ McDougall, p. 123.

²⁹ Van Dyke, p. 13.

The ability to explain the surprise surrounding the launching of Sputnik is significant because it does not fit neatly into either of the two dominant categories of surprise that form the basis for theorizing. Strictly speaking it is neither a case of military surprise (although Sputnik had great military significance) nor of diplomatic surprise (although it had great propaganda value to the Soviet Union for its cold war diplomacy). Sputnik is best seen as a case of technological surprise and its defining characteristics are drawn equally from those Handel uses to define military and diplomatic surprise.

Using Sputnik as a point of departure, technological surprise shares with military surprise the following characteristics. First, surprise is an inherent part of technological activity. Where diplomacy values consistency and predictability, technology values innovation and experimentation. Thinking in terms of technological surprise does not require developing new concepts or new ways of thinking on the part of scientists or engineers. Second, technological surprise poses many of the same types of forecasting challenges as does military surprise. Like military surprise the scale of activity involved makes it difficult to maintain 100% secrecy surrounding one's efforts. At the same time because of the wide variety of ways in which the surprise might occur correctly predicting all of the details of a technological breakthrough is difficult. Sputnik, for example, did not surprise U.S. observers so much in terms of the timing of its occurrence as it did in its size. Third, anticipating technological surprise requires an attention to both capabilities and intentions. In the case of Sputnik the capability existed in both the United States and Soviet Union. What differed was the political commitment to make use of this technology. Writing more generally on the nature of technology and public policy Dorothy Nelkin notes that "perhaps [the] overriding factor shaping priorities for science and technology is the convergence of technological opportunity... with political readiness to accept technological change."³⁰

Technological surprise also shares certain characteristics with diplomatic surprise. First, as with diplomatic surprise the significance of technological surprise does not have to be immediate. The Eisenhower administration correctly judged that Sputnik did not present a short term challenge to American national security interests. Both sides in the cold war, however, realized that Sputnik did foreshadow the possibility of a fundamental shift in the global balance of power in the years ahead. Second, where military surprise only offers advantages to the initiating side, technological and diplomatic surprise may also offer advantages to the surprised state. In the case of Sputnik, the Eisenhower administration saw in the world's reaction to Sputnik an affirmation of the principle of free skies that it hoped to establish with the launching of a scientific satellite. Finally, technological surprise does not have to be a hostile, negative act. It can also produce positive results. Sputnik produced a mixed bag of consequences in the United States. On the negative side it set off an often bitter partisan political debate over whose fault it was that the United States was surprised and what to do about it. On the positive side it shocked the United States out of a sense of complacency regarding its technological prowess and led to a burst of creative activity (and funding) for science education, and research and development.

³⁰ Dorothy Nelkin, "Technology and Public Policy," in Ina Spiegel-Rossing and Derek de Solla Price (eds.), *Science Technology and Society* (London: Sage, 1977), p. 399.

SUMMARY

The forces which helped create an environment in which surprise was possible with regard to Sputnik are consistent with those found in other studies of surprise. Sputnik was not a bolt from the blue. There was warning. What was absent on the part of senior officials in the Eisenhower administration was an appreciation of the political significance of Sputnik. Convinced of their own technological superiority, committed to a policy of fiscal conservatism, and focusing on the narrowly defined issue of how to establish the legality of overflights, the administration felt no sense of urgency in moving ahead with its own space program.

The manner in which the United States was surprised by Sputnik should be of interest to those concerned with the evolving dynamics of the post cold war international order. The agenda of the post cold war international system gives a prominent place to issues such as the environment, health, and economic growth, and arms control in which technology plays a central role. Technology is also one of the foundations of "soft power" which Joseph Nye and other commentators hold to be the key to the international politics of the next century.³¹ And, as in the 1950s, it is assumed by many that the United States is a leading source (if not the leading source) of technological change and innovation. If technology and technological change are among the primary driving forces behind issues and a key ingredient of power that is brought to bear on solving them, then preventing technological surprise ought to be a prime concern of policy makers.

The events leading up to Sputnik suggest two facets of technological surprise which appear to guarantee that technological surprises will continue to be experienced. First, technological surprise is characterized by an abundance of "routine" information. Overwarning rather than deception or secrecy appears to be a dominant motif. Second, policy makers are not well-educated or sensitive to the larger implications of technological breakthroughs therefore they do not act on the warning intelligence they receive. As with military surprise, the most prudent course of action open to policy makers may be that of coupling a concern for preventing surprise with an increased capacity for responding to it and minimizing its consequences, something the Eisenhower administration failed at in the case of Sputnik.

³¹ Joseph S. Nye Jr., Bound to Lead: The Changing Nature of American Power (New York: Basic Books, 1990).

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