

## Orbiter, Overflight, and the First Satellite: New Light on the Vanguard Decision

*Michael J. Neufeld*

The August 1955 decision to choose the Navy's Vanguard over the Army's Orbiter as the first U.S. scientific satellite project remains one of the most controversial episodes in the history of the United States space program. There seems little doubt that it was the critical decision on the American side that led to the Soviet Union's Sputnik surprise of October 1957. In the wake of that shock, the success of the Army's reactivated project, now called Explorer, in putting up a satellite after an embarrassing Vanguard failure, confirmed the opinion of many that a terrible mistake had been made in 1955.

It was only in the 1960s, after the immediate recriminations had passed and more information became available, that R. Cargill Hall and official Vanguard historians Constance Green and Milton Lomask formulated more nuanced and balanced explanations of that decision. Among the factors they noted were: 1) the superior electronics, scientific experiment capacity and growth potential of the Vanguard proposal of the Naval Research Laboratory (NRL); 2) the likelihood that its launch vehicle, based on the Viking and Aerobee sounding rockets, would interfere less with high-priority military missile programs; 3) the greater ease of declassification of aspects of the program as a result, in keeping with the International Geophysical Year (IGY) of 1957-58, under which the satellite was to be launched; and 4) the possibility of anti-German prejudice in the selection committee against the Orbiter's design team, led by Wernher von Braun at Redstone Arsenal in Huntsville, Alabama. Hall, Green and Lomask also deepened our knowledge of how close and contested that decision had been in the

so-called Stewart Committee—named for its chairman, Homer Joe Stewart of the Jet Propulsion Laboratory, who ironically had led the opposition to the decision of his own committee.<sup>1</sup>

The publication of Walter A. McDougall's Pulitzer-prize-winning *The Heavens and the Earth* in 1985 launched a new historiographical phase. McDougall was able to show, based on declassified National Security Council (NSC) documents, that there was a hidden agenda behind the Eisenhower Administration's May 1955 decision to support the concept of an IGY satellite. Establishing the precedent of "freedom of space" with a peaceful scientific satellite would smooth the way to overflying the Soviet Union with military reconnaissance satellites. How important "overflight" was in the decision is still somewhat debatable—as evidenced by the contributions of Kenneth Osgood and Dwayne Day to this volume—but McDougall was able to show that it had considerable influence at least from the level of Donald A. Quarles, Assistant Secretary of Defense for Research and Development, upwards to the President himself. This has been confirmed by further research by Cargill Hall and by Day.<sup>2</sup>

As a corollary of this thesis, McDougall speculated that the decision of the Stewart Committee was heavily influenced and perhaps predetermined by this hidden agenda. The choice of the NRL's sounding-rocket-based Vanguard assured "the strongest civilian flavor" in the first U.S. satellite, in contrast to the Army's Orbiter, which used the Redstone ballistic missile as the first stage and Army solid rockets for the upper stages. Going further out on a limb, McDougall also speculated that establishing "freedom of space" was so important to the Eisenhower Administration that it consciously decided to risk the USSR launching first, which would be another way to establish the principle of overflight. This possibility was "less desirable, but it was not worth taking every measure to prevent."<sup>3</sup>

While the latter hypothesis has found few backers because of a dearth of positive evidence, the idea that Vanguard was virtually certain to win the support of the Stewart Committee because it looked "more civilian" for overflight purposes has been influential.<sup>4</sup> But newly declassified documents, combined with research into neglected sources from the Stewart Committee, reveal that overflight had little or no influence on the Vanguard decision; moreover, that decision was even closer than previous accounts suggest. Recently

declassified minutes of Quarles' Research and Development Policy Committee show that this key advocate of the hidden agenda of overflight almost overturned the decision on August 16, 1955, by arguing for an interservice program in which the Army launch vehicle would inject NRL's satellite into orbit—a fact revealed here for the first time.

In order to better explain why the heavily favored Orbiter actually lost, I will also closely examine the history of that proposal, which arose months before Vanguard, and a third, weaker competitor from the U.S. Air Force. The Army project, which was in fact an interservice collaboration with the Office of Naval Research (ONR), helped bring forward the concept of a satellite in the scientific community and the secret counsels of the Administration. Yet it was ultimately undermined by its very origins as a low-cost, "quick and dirty" way to beat the Soviets into space.

#### ORBITER'S ORIGINS

As is well known, Project Orbiter began in June 1954, when Lt. Commander George Hoover of ONR's Air Branch initiated a practical study of how a minimal satellite could be injected into orbit around the Earth. The background for Hoover's initiative was the growing advocacy for military and scientific satellite concepts, both in the classified world and in the public arena, although it must be remembered how outlandish spaceflight still appeared to many only a few years before Sputnik.<sup>5</sup> The advocates were a heterogeneous group, including hard-core space enthusiasts like rocket engineer Wernher von Braun and International Astronautical Federation (IAF) President Frederick C. Durant III, upper-atmosphere scientists like astronomer Fred L. Whipple and physicist S. Fred Singer, and far-sighted officers like George Hoover. Given the Cold War interpenetration of American science, engineering and the military in the national security state, the communities of space advocates, scientists and officers actually overlapped a great deal.

A prime example is Fred Durant, who played a crucial role in Orbiter's origins. In mid-1954, Naval Reserve officer and rocket engineer Durant was not only IAF President and Past President of the American Rocket Society (ARS), he was also secretly working for

the scientific intelligence unit of the CIA. Until the CIA declassifies its documents on the early satellite projects, we cannot get much past informed speculation, but this much is clear: Durant was not only advocating space travel in the public arena through ARS and IAF, he may also have been using the IAF to gather intelligence on foreign rocket programs for the CIA at a time when concern over Soviet missile development was rising rapidly. Durant was apparently the middleman who brought Hoover together with Wernher von Braun, for a meeting on June 25 in Washington that also included Fred Whipple, Fred Singer and a few others. Durant continued to coordinate with von Braun in the months ahead, and was a central figure on the informal Orbiter committee from its origins until the end, which indicates that the CIA was interested in a scientific satellite months earlier than has been previously recognized. Confirming that supposition is this statement from a January 1955 Army-Navy proposal to the Secretary of Defense: "The Central Intelligence Agency has shown intense interest in Project ORBITER. The Agency apparently thinks considerable psychological warfare value and scientific prestige will accrue to the United States if we launch the first artificial satellite."<sup>6</sup>

Von Braun came to Hoover and Durant's meeting armed with a ready-made proposal for a minimal satellite launcher based on the 200-mile-range Redstone missile and three upper-stages of clustered, unguided Loki anti-aircraft rockets. Loki clusters had actually already been built by William Bollay's Aerophysics Development Corporation for the Air Force's Hypersonic Test Vehicle program. After an August 3 visit by Hoover and a superior officer to Huntsville to further confer on a joint program, von Braun and his associates, notably Gerhard Heller, produced a formal proposal dated September 15, 1954. In it, they stated: "The establishment of a man-made satellite, no matter how humble, would be a scientific achievement of tremendous impact . . . . It would be a blow to U.S. prestige if we did not do it first." This remark reveals von Braun's Cold War concerns about the Soviet Union, but undoubtedly also those of Durant and others interested in the "psychological warfare value" of a satellite.<sup>7</sup>

Von Braun's proposal soon acquired the informal name "Project SLUG" because he contemplated putting merely an inert 5 lb. body into

orbit using the Redstone/Loki combination. (The formal codename came only in January, after a brief interlude as "Project ORBIT.") The primary reasons for choosing this bare minimum approach to a satellite appear to be: 1) beating the Russians; and 2) keeping the budget to a minimum in view of the Eisenhower Administration's parsimonious approach to defense spending, strategic nuclear forces aside. In misilery, only the USAF intercontinental ballistic and cruise missile programs carried maximum priority in 1954, in part because of the growing Soviet capability in missiles. Thus von Braun's September proposal mentioned an added cost of only \$100,000 for the next fiscal year, to be financed by ONR, and took for granted considerable built-in expenditures by the Redstone missile program. It is noteworthy that von Braun did not consider developing a more powerful upper stage like the upgraded Aerobee the NRL later used, as that did not fit with the minimum development approach.<sup>8</sup> Contributory reasons for this approach likely included the difficulty of interservice projects—ironic in view of ONR's central role in Orbiter—and the relative isolation of the Huntsville Germans from the upper atmospheric rocket community, the users of Aerobee and Viking.

Von Braun and company apparently assumed that a 5 lb. minimal satellite was too small to carry even a radio beacon, a decision that would later prove damaging. Tracking the body, using its orbit to measure the Earth's gravitational field and extreme outer atmosphere—even proving it went into orbit—thus became a central concern, since only optical means could detect it. Von Braun's group proposed that the satellite be a balloon or a mechanically unfolding sphere about twenty inches in diameter, and there was also discussion of the use of flares and other means of increasing visibility. Considerable effort was expended from fall 1954 to July 1955 to show that such a body could be spotted and tracked, since it still would be at the limit of naked-eye detection. Centrally involved were Fred Whipple, the Harvard astronomer and meteor expert, and Clyde Tombaugh, the discoverer of Pluto. Tombaugh, who was employed in optical missile tracking at the Army's White Sands Missile Range in New Mexico, was convinced that optical determination of the satellite's orbit would be much easier if that orbit was nearly equatorial. Huntsville wanted an equatorial launch too in order to achieve the maximum velocity from the rotation of

the Earth, since the rocket's payload capacity was so marginal. But this approach meant that the launching would have to be done from a remote Pacific island chain, or from the Navy's experimental missile ship *USS Norton Sound*, which had earlier fired a Viking.<sup>9</sup>

While "SLUG" was being defined and refined over the fall and winter of 1954–55, it periodically intersected a second track of satellite advocacy. Key members of the U.S. scientific community, notably Lloyd Berkner, Joseph Kaplan and Fred Singer, had set out to engineer the international scientific unions' endorsement of the idea of launching satellites during the IGY, with the ultimate objective of gaining U.S. government support. The complex details of that campaign are adequately treated elsewhere, but it is noteworthy that after an Orbiter meeting in Washington on September 6, Fred Whipple, Gerhard Heller of Redstone Arsenal and J.B. Kendrick of Aerophysics (the Loki cluster contractor) attended a meeting of the Upper Atmosphere Rocket Research Panel on September 8–9, also in Washington. The first day was classified at the SECRET level, the same level as Orbiter, so formally or informally they must have briefed the space scientists on the project.<sup>10</sup>

As the Orbiter proposal moved forward to the Secretaries of the Army and Navy in December, and to Defense Secretary Charles E. Wilson in January, those individuals in the scientific community with security clearances and knowledge of Orbiter, notably Whipple, no doubt used that information to back the feasibility of a satellite in discussions of an IGY satellite in the National Academy of Sciences (NAS) and National Science Foundation (NSF). A second channel was the CIA, which was supportive of Orbiter and was receiving reports from Durant, and then endorsed the IGY satellite proposal of the NAS and NSF in spring 1955 from the very top, in the person of Director Allen Dulles. The CIA's primary rationale was again the psychological warfare value and prestige of a satellite if the U.S. was first—and the damage it would cause if the USSR did it instead. A third channel was the enormously influential "surprise attack study" of the Technological Capabilities Panel (TCP) led by James Killian of MIT, which delivered its report on Valentine's Day 1955. Among its recommendations was the launching of a scientific satellite specifically because of its value as a

precedent for later reconnaissance vehicles, i.e. overflight.<sup>11</sup> We do not know what impact Orbiter might have had on that Panel, but as the only practical satellite proposal on the table in the winter of 1954/55, it was certainly known to TCP members. It at least made the case that a satellite was feasible.

#### COMPETITION EMERGES

In Orbiter documents from that period, the assumption is plain that it would soon become the official and only interservice satellite project. From the beginning the two main sponsors, the Army Ordnance Corps and the Office of Naval Research, had attempted to bring the Air Force into the project to sew up a tri-service basis for it. Von Braun wrote to Durant on September 10, 1954: "Airforce [*sic*] cooperation would be highly desirable, but [Gen. Leslie] Simon [Chief of Ordnance R&D] said that he would go along even [if] the Airforce doesn't feel like joining us." When Orbiter was pushed up to the highest levels in December-January, similar offers were always mentioned. They may, of course, have been mere political gestures. Since World War II, interservice conflict over "roles and missions" in the guided missile field had already led to great bitterness. USAF suspicion of the Army's motives in the Korean War era "verged on paranoia," according to the Air Force's own history of its ballistic missile program: "Everywhere, it seemed, there was evidence of a conspiracy." Yet Orbiter advocates were doubtlessly honest in their desire to bolster their proposal with Air Force participation.<sup>12</sup>

It was to no avail. The Air Force representative tried to undermine the joint Army-Navy Orbiter proposal in the meeting of Assistant Secretary Quarles' Committee on General Sciences on January 20, 1955, in part by objecting to the cost. Four days later, a RAND Corporation scientist told an Army representative that "Rand has recently advised the Air Force that a minimal satellite should not be attempted at this time for the reason that it would alert the Russians to the possibility of a military satellite useful for reconnaissance"—ironically almost in exact contradiction to the overflight logic that the TCP Report and Quarles would soon use to justify the IGY satellite. And at the end of March, the head of the USAF ballistic missile program, Maj. Gen. Bernard A.

Schriever, advised his superior, Gen. Thomas Power, that he wanted nothing to do with the scientific satellite, which he saw as deliberately underrated in difficulty by its advocates, not militarily useful, a hindrance to the crash ICBM program, a management headache if a tri-service program, and (by implication) aid to the enemy—i.e., the Army missile team in Huntsville, which was also working on a concept for a 1,500 mile missile that he wanted to thwart.<sup>13</sup>

Schriever's attitude meant that Air Force advocates who wished to jump on the scientific satellite bandwagon found themselves without adequate support even within their own service. The "World Series" proposal first floated in April actually came out of the USAF research center at Holloman Air Force Base, New Mexico. Interestingly, von Braun's former guidance chief in Germany, Ernst Steinhoff, was one of the principal architects of the Holloman proposal, which planned to mount a modified Aerobee on top of an Atlas to launch a much bigger payload than that of Orbiter or Viking/Vanguard. But it received only lukewarm support from Air Research and Development Command because of Schriever's opposition to any interference in the ICBM program. Reflecting USAF priorities, on March 16 that service did however formalize its requirement for a military reconnaissance satellite under the rubric Weapons System 117L.<sup>14</sup>

April also saw the emergence of what would become the real threat to Orbiter, the proposal of the Naval Research Laboratory's Milton Rosen, chief engineer of Viking. He had been present at the September 1954 Upper Atmosphere Rocket Research Panel meeting and had become involved in the satellite studies of the American Rocket Society and U.S. National Committee for the IGY. Rosen thus had intimate knowledge of Orbiter and its weaknesses, and decided that he could create his own plan for a more efficient system that was also more closely suited to the scientific community's IGY research interests. Since NRL was responsible to ONR, his project also had the effect of undermining the Navy's backing for Orbiter.<sup>15</sup>

The sudden surfacing of two rival proposals in April 1955 ended any possibility that the all-important Quarles would quickly give his blessing to Orbiter as the official U.S. IGY satellite. He had been officially informed about the project on December 21, 1954, when E. R. Piore, Chief Scientist of ONR, notified him of \$68,000 in study

contracts it would soon let. Army Ordnance's Los Angeles representative, James B. Edson, reported a month later that:

Dr. Quarles is favorably disposed and a briefing for him was scheduled 19 January 1955. The key item in obtaining budget justification was determination of the density of the upper atmosphere for use in intercontinental ballistic missile trajectory calculations. [This argument is not present in other documents, but is implicit in the interest in upper atmosphere science.] Prestige and propaganda aspects were also recognized.<sup>16</sup>

Faced, however, with multiple proposals, Quarles threw the matter back into his Committee on General Sciences for further study, while also putting the entire satellite matter on the agenda of his highest advisory body, the tri-service R&D Policy Council.

At the April 18 meeting of the latter, Quarles told the members that the request of the National Science Foundation and the U.S. National Committee for the IGY for federal government support for a satellite would proceed: "If the NSC [National Security Council] feels there is justification for supporting [this project] (and there are certain persons in high places in our Government who think it would be disastrous if another Government did this first) and asks Defense to do so—Defense will undertake the venture on a tri-service basis." Quarles apparently did not mention the highly secret agenda of overflight as a precedent for space reconnaissance, which other documents show was much on his mind because of the TCP report, but seized rather on the Soviet threat. Only two days earlier, Moscow Radio had announced the existence of a Soviet spaceflight commission. That announcement doubtlessly aided Quarles in his swift engineering of NSC resolution 5520 of May 20, 1955, approved six days later, which made the satellite official policy—a process described elsewhere by McDougall and Hall, and in this volume by Osgood and Day.<sup>17</sup>

Meanwhile, Quarles' Committee on General Sciences had reported on May 4; the results of its deliberations did nothing to discourage Orbiter's advocates from believing that the official blessing of their project was inevitable. The Committee Chairman noted that the Secretary of the Navy had formally sent an Orbiter proposal document to Quarles on March 23, estimating a satellite launch by

fall 1957 for \$8.5 million, followed on April 15 by a further Navy proposal for a Viking-based system (i.e. Vanguard) for \$7.5 million, and an Air Force proposal for Atlas-Aerobee with a larger payload, but at a cost of \$50–100 million at a later date. Intriguingly, the Navy presented the second project as a “backup for ORBITER I and a possible second phase of a scientific satellite program”—not as a competitor. The Committee recommended that all three be pursued—Orbiter as the program for \$6 million, Viking/Vanguard as a \$5.5 million backup with “procurement of selected long lead-time items,” and the Air Force project only as a design study for \$1.25 million. The Technical Appendix to NSC 5520 of May 20, which presumably was prepared by Quarles’ staff in the intervening weeks, shows the strong influence of Orbiter on the satellite concept, although the Financial Appendix mentions both Orbiter and “Viking” as viable candidates, but in a way that could be consistent with the Committee recommendation.<sup>18</sup>

#### THE STEWART COMMITTEE

Quarles, however, did not feel he could justify the relatively extravagant approach of parallel programs, perhaps because he rightly did not believe the low cost estimates he was being given. By June 1 he and his staff had formulated a plan to create an Advisory Group on Special Capabilities (the term Ad Hoc was soon added, but then removed again in the fall), another body with a deliberately opaque name. As Chairman he chose Homer Joe Stewart, a leading engineer-administrator at the Jet Propulsion Laboratory in Pasadena. Stewart sat on the Air Force Scientific Advisory Board, but his institution, although a part of the California Institute of Technology, was virtually an Army arsenal. He had been drawn into Orbiter planning by April, when he had completed a study of von Braun’s September 1954 proposal for JPL Director W. H. Pickering, who was looking for a way into the Huntsville-ONR project. Stewart thus was not an unbiased observer, but at the time virtually all rocket engineers or upper-atmosphere scientists had a service affiliation or connection to one of the proposals, so small was the community and so intertwined was it with the military.<sup>19</sup>

The Stewart Committee was to have eight or nine members, with two being nominated by each service and two by Quarles’ office. In the

end there were eight; but one, astronomer-engineer Robert C. McMath, scarcely participated because of illness. The available documents still do not allow us to know who was appointed by whom, but reasonable guesses can be made for most members; this issue is important because service orientations appear to have contributed to the Committee’s ultimate split in favor of Vanguard. Stewart and chemical engineer Clifford C. Furnas, Chancellor of the University of Buffalo, both had strong Army affiliations, and would form the ultimate pro-Orbiter minority. Charles C. Lauritsen, a physicist and colleague of Stewart at Caltech, had been intimately associated with Navy rocket development since 1940. Orbital mechanics specialist George Clement worked for the RAND Corporation, a USAF think tank, and J. Barkley Rosser, a Cornell mathematician, was affiliated with RAND. UCLA physicist Joseph Kaplan was Chairman of the U.S. National Committee for the IGY, and was thus a likely appointee of Quarles to oversee the important issue of which proposal would become the IGY satellite. That leaves two, one of which must have been a Navy nominee: either McMath, who ultimately cast his vote for Orbiter in a letter too late to affect the deliberations, or General Electric rocket engineer Richard W. Porter.<sup>20</sup>

Porter may be the most interesting case. He had been the head of the Army-sponsored GE Hermes rocket project begun in 1944, had played a central role in bringing the core of von Braun’s “rocket team” from Germany, and had been associated with the Germans when they were based in the Texas/New Mexico desert until 1950. But the Army had cancelled Hermes in 1954, in part because the GE leadership was uninterested in being a military missile contractor. Whatever his Army connections, Porter had a vested interest in the NRL project: Milton Rosen proposed to use the Hermes GE X-400 27,000 lb. thrust liquid-fuel engine in the upgraded Viking that was the first stage of his booster. In addition, Porter had participated in the American Rocket Society panel, chaired by Rosen, that led up to the scientific community’s approach to the Administration in the spring.<sup>21</sup>

Whether Porter actually leaned toward Viking/Vanguard before the Committee met is unknown, but we do know that Kaplan had a definite preference for the NRL project. In his May 6 letter to the Director of the National Academy of Sciences, Kaplan gave political

rather than scientific reasons, although the larger scientific payload (10–40 lb.) Rosen promised must have influenced him. Open sponsorship by the U.S. National Committee plus the “Viking and Aerobee” combination would, he stated, “clearly establish ... the civilian character of the endeavor.” In addition, the NRL system would create “no security classification considerations”—an assertion that was certainly exaggerated. The competitor Redstone missile Kaplan referred to only obliquely as “German V-2 developments,” indicating that he thought the German connection of the Orbiter project would be a liability in the international arena. Viking/Aerobee, on the other hand, presented the best face for multi-national science and American foreign policy. Further evidence that bias against the Huntsville Germans might have influenced the vote of a Stewart Committee member is lacking, but it is noteworthy that Fred Singer wrote to Wernher von Braun on August 24 expressing his dismay at the “rather antagonistic feelings” about von Braun and Redstone Arsenal he had encountered recently among “some people,” including “members of the IGY group.”<sup>22</sup>

Could the hidden agenda of overflight also have influenced Kaplan’s preference? It cannot be ruled out, given his high-level connections to the decision-making process as Chairman of the U.S. National Committee for the IGY, something no other member had. This access might have allowed him insight into the thinking of Quarles and others, but Kaplan had many other compelling reasons to prefer the “more civilian” Vanguard because of his role as U.S. representative to an international enterprise, his interest in science, and his possible anti-German bias.

The question remains whether Quarles’ mandate to the Stewart Committee tilted the process towards Vanguard specifically for overflight purposes. Stewart stated in a recent telephone interview that at an initial briefing for his Committee, one of Quarles’ staffers did mention that Vanguard “might have a more civilian aspect,” which could indicate that the Assistant Secretary leaned slightly to the NRL at this stage. At some point, although possibly not in this meeting, the overflight issue was mentioned, Stewart stated; it was not a new issue as he had himself discussed satellites and the legal limits of air space in a 1946 Army meeting. “Freedom of space” was a known issue in the rocket community, which is not the same thing

as saying that anyone knew it was important to the Administration’s rationale for a scientific satellite. Stewart also asserted that overflight “had no bearing on the Committee’s discussions” and was never mentioned there, which is consistent with the surviving documents.<sup>23</sup> Of more consequence was Quarles’ specification that the satellite project not interfere with existing missile programs, although Orbiter’s advocates could plausibly claim that the impact of their project on Redstone would be virtually nil.<sup>24</sup>

Why then did Orbiter find itself on the losing side when the Committee met in Washington July 6–9 and in Pasadena July 20–23? To understand this we must look not only at the known positive attributes of Vanguard—innovative, miniaturized electronics, a larger scientific payload, and a more efficiently designed launch vehicle—but also at Orbiter’s deficiencies and why they were not much remedied before the presentations to the Stewart Committee. The hindsight induced by the Explorer success of 1958 has blinded many to the fact that Orbiter was not Explorer: it was inferior.

Most fundamental was the limited capacity of the basic Orbiter launch vehicle <sup>1/2 m</sup> only a 5 lb. payload, whereas the later Explorer I had a 17 lb. payload attached to a 14 lb. burnt-out fourth stage. Orbiter had a lengthened Redstone 1st stage; Explorer had the same, but used a special hypergolic (self-igniting) fuel combination that boosted first-stage thrust from 75,000 to 83,000 lb. The basic Orbiter proposal had 37 Loki solid rockets in three stages (30/6/1) spun up before launch for stability; the Explorer Jupiter-C vehicle used 14 scaled-down six-inch-diameter Sergeants (11/3/1) in a similar arrangement. It is true that the proposal Wernher von Braun and Col. John Nickerson presented to the Stewart Committee on July 7 and 9 did discuss optional, as yet untested seven inch Sergeant rocket stages differently arranged (7/1/1) than the later Explorer. Homer Joe Stewart had first proposed the scaled-down Sergeants to Pickering in April, and JPL pitched the idea to von Braun at a Pasadena meeting shortly thereafter. Yet attacks by opponents against the Lokis had a lingering effect. The Loki I (the version in production) did not have a great reliability record, the larger the number of rockets the greater the odds that one would fail, and even one failure could prevent the satellite from reaching orbit. Critics in the Air Force and elsewhere seized on this argument, and in spite of reassurances by the manufacturer, Orbiter advocates could never convince the skeptics

that its vehicle was highly reliable. In the end the Stewart Committee preferred the Sergeant option and scarcely discussed the reliability issue in its final report, but the damage had been done: the Orbiter launch vehicle entered the competition without the reputation of being much more reliable than the development-intensive Viking/upper-stage combinations.<sup>25</sup>

The 5 lb. inert sphere was also the subject of criticism, as we have seen, notably from scientists who wanted some real capacity for IGY experiments, and from opponents in the other camps who doubted that the body could be optically tracked. The imaginative use of a transistorized light-weight transmitter in the NRL satellite, combined with the proposed "Minitrack" tracking system, in the end forced von Braun and company to concede the idea in their July 1955 proposal that the NRL radio system could be carried in its satellite, or alternately, it could carry a radar reflector designed by another Army laboratory that supposedly could have a small power source that would allow data transfer by modulating the reflected signal. In mid-July von Braun also became very interested in a new lightweight JPL transmitter, part of the later "Microlock" system. Yet the scientific return from the Orbiter satellite remained confined to tracking its orbit to measure the Earth's gravitational field and extreme outer atmosphere, as long as the payload was only 5 lb. In contrast, the 17 lb. Explorer payload included both Minitrack and Microlock transmitters, plus James Van Allen's cosmic ray experiment that led to the discovery of the radiation belts.<sup>26</sup>

Why did von Braun and the Army stick to the minimal approach, with Loki clusters and an uninstrumented or barely instrumented satellite as their first choices, in face of criticism even before the Stewart Committee met? (Summer 1955 documents indeed treat it solely as an Army project; George Hoover of ONR had been forced to pull back because his superiors had switched Navy backing to Milton Rosen's project.)<sup>27</sup> First and foremost, Orbiter's advocates apparently continued to believe that the satellite's primary purpose was to beat the Soviets into space as quickly and cheaply as possible. In reality, the situation had become much more complicated: the scientists' wanted good IGY science, which was compatible with the agendas of Quarles and his superiors to have

the satellite set an overflight precedent and generate international prestige, while not slowing down ballistic missile projects deemed more crucial to the Cold War. Everyone wanted the United States to be first, but nobody wanted to compromise their other agendas in the process.

The conviction of von Braun and Army Ordnance that their program concept was correct contributed to an overconfidence that bordered on arrogance. At a July 16 meeting in Los Angeles, one week after the first-round presentations, von Braun talked as if the go-ahead order would be received shortly. And on July 22, James B. Edson, who had been transferred from Pasadena to the Pentagon, stated that "OCO [Office of the Chief of Ordnance] personnel expect, because of the excellence and soundness of the Ordnance presentations, that the Ordnance system will be recommended."<sup>28</sup> The roots of this overconfidence included the self-confidence of the Huntsville Germans, who saw themselves as the world's most experienced rocket group, plus the fact that Orbiter had been the dominant player in the field for so long that it advocates found it hard to take the other projects seriously. Homer Joe Stewart described one of his most "vivid memories of that period" was Clifford Furnas' statement in a JPL parking lot after one of the meetings: "You know, these Vanguard people are serious with their proposal.' It just hadn't occurred to him up to that point that they really thought of this as something that might be done. This was kind of a shock to me too, although I'd recognized it a little earlier."<sup>29</sup>

By the time that Furnas and Stewart realized the seriousness of the Vanguard proposal, the fate of Orbiter already hung in the balance. Kaplan, Porter and Lauritsen all leaned toward the Navy, leaving the two RAND-affiliated and presumably Air-Force nominated members, Clement and Rosser, with the potential deciding votes. In letters summarizing their position after the first round of meetings, neither Clement nor Rosser was enthusiastic about Orbiter or Vanguard, which they saw as marginal in payload and unlikely to meet the IGY deadline of a successful launch by the end of 1958. Clement leaned slightly toward the Air Force "World Series" proposal, but in a position consistent with RAND advice to the Air Force months before, was unenthusiastic about any small scientific satellite program. Rosser advocated using the rocket booster of the Navaho cruise missile



together with an Aerobee-Hi second stage and unspecified third stage, an idea that came out of Air Force and North American Aviation people in the Los Angeles area.<sup>30</sup>

This position was odd and irrelevant, and Clement's view had scarcely more impact, given that the other members of the Committee wanted an IGY satellite, but did not see "World Series" as a serious contender for launching it, although they were very interested in an Atlas-based "Phase II" satellite as a follow-on. For the IGY, however, the time factor for Atlas was even more doubtful, the USAF gave the proposal little support, and it was a certainty that it would interfere in the ICBM program. It might be the case, as is traditionally asserted, that Clement and Rosser fell into line with the majority by pleading lack of expertise in rocket engineering, but it is striking that both ended up in a position consistent with Air Force attitudes—namely, that in the missile business the Army was a bigger threat to USAF "roles and missions" than the Navy; the Army also was a competitor for some of the same components, notably rocket engines.<sup>31</sup> In general, it is again noteworthy that it was the two most identifiably Army oriented Committee members, Stewart and Furnas, who formed the losing side. Service loyalties and interservice rivalry clearly cast their shadow over the outcome.

The hard core of pro-Viking/Vanguard support was thus Kaplan, Porter and Lauritsen. Kaplan's motives have already been described, and Lauritsen's career was closely tied to the Navy. Porter, however, did explain his position in a July 14 letter, and it is very consistent with the majority position in the Committee draft report of July 22, and in the official report of August 4.<sup>32</sup> A lengthy explication is unnecessary because the available evidence confirms the original interpretations of Hall, Green and Lomask, as against McDougall and others: the key factors were the majority's belief that the NRL Viking-based vehicle would require little more development than Orbiter, would be a more efficient design with one less stage (and hence would be more reliable), would carry a larger and more scientifically useful payload, and would be more easily declassified for international cooperation purposes. The good track record of NRL's Viking program was another plus. The fact that Orbiter would interfere in the Redstone missile project was barely mentioned in the majority's rationale because the argument was so weak. Beyond what

was best for IGY, the Committee did not address political concerns at all, although at least Kaplan was predisposed to believe that Vanguard's "civilian" appearance would be better for prestige and propaganda purposes than a military rocket with German roots. The newly available and declassified documents show no evidence that the Stewart Committee had a predetermined agenda to pick Vanguard, or that overflight entered into its deliberations. What the new evidence does more clearly reveal is the impact of service loyalties on the Committee split.

#### A NEAR RUN THING

The Committee's report shocked a complacent Army Ordnance, and galvanized its service leadership to try to get Assistant Secretary Quarles to overturn the recommendation. Before the R&D Policy Council meeting on August 16, Ordnance's Assistant Chief for R&D, Maj. Gen. Leslie Simon, wrote a counter-proposal based on a week of feverish calculations in Huntsville, Pasadena and Washington. This memorandum, dated August 15, attempted to sway the decision with renewed evidence of Soviet competition. Just over two weeks earlier, in an unexpected turn of events, President Eisenhower had announced the IGY satellite project to the nation, possibly because of intelligence reports that the Soviets might announce first. Uncoincidentally, the Sixth International Astronautical Federation Congress was to convene on August 2 in Copenhagen, and Soviet delegates were to appear for the first time. Immediately after the opening, which was chaired by IAF President Fred Durant, the Congress passed a Swiss resolution to send a cable of congratulations to Eisenhower. Not to be outdone, Soviet delegate Academician Leonid Sedov held a news conference at his embassy soon thereafter, announcing a Soviet program to launch a satellite. Some media reported that he said that the launch would be in eighteen months (i.e., six months before the IGY began on July 1, 1957), and although this was allegedly withdrawn the next day, it had an impact in Washington.<sup>33</sup>

Simon's August 15 memo offered two possibilities: an upgraded Redstone first stage using North American Aviation's 135,000 lb. thrust engine in place of its 75,000 lb. one, making a satellite of 162 lb. possible, or a reduction in the weight of the original long-tank version

of the Redstone by 1700 lbs., leading to a payload of up to 18 lbs. "The first orbital flight for this [latter] configuration can be scheduled for January 1957 if an immediate approval is granted. 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 ... at this time." He also asserted that the project would have no impact on Redstone missile timetables, expressed doubt about NRL's ability to complete its projected rocket development on time, and indicated a willingness to let NRL build the heavier satellites.<sup>34</sup>

The next day the Donald Quarles' R&D Policy Council met at the Pentagon with Stewart present. After the Air Force and Navy gave their preference for the NRL proposal and the Army delegate summarized Gen. Simon's arguments, there was an extensive discussion. Quarles put forth a surprising tri-service compromise that essentially accepted Simon's offer and overturned the Stewart Committee recommendation: the Army would be given \$20 million to run the program and would provide the booster, the NRL would provide the satellite and tracking, the Navy would fund the development of the Aerobee-Hi as an alternate second stage, and the Air Force would work toward a backup based on its military satellite (i.e., WS-117L) and provide launch support. Perhaps by sheer force of personality, Quarles got the Council to approve, conditional upon the sanction of the Stewart Committee, which was to report in a week on the practicality of the weight reduction, the feasibility of December 1956 as first launch date, and the impact on other missile programs of diverting 135,000 lb. engines. At the end of the meeting, Quarles announced what everybody knew, namely that it would be his last meeting, as he had just been sworn in as Secretary of the Air Force.<sup>35</sup>

Along with desire for interservice collaboration, which Quarles explicitly stated, it is apparent that beating the Russians must have led him to support the Orbiter booster. However, nowhere in the minutes or in the supporting documents did he or anyone else discuss the overflight factor—so closely held was the secret. Even key actors were apparently excluded; Army Ordnance documents show no awareness that it was a crucial rationale for the IGY satellite. One thing is clear: if Quarles had had a strong preference for Vanguard because it looked "more civilian" for overflight

purposes, or for propaganda purposes, or even because it interfered less in missile programs, he never would have made his (hitherto unknown) August 16 proposal. He could simply have endorsed the Stewart Committee report, backed as it was by two out of three services.<sup>36</sup>

The August 16 meeting produced another week of feverish studies. Huntsville and Pasadena, with renewed hope, worked out calculations for the various combinations of Quarles' concept, and the NRL sought countervailing arguments to stop the threat to its recent, and even to its staff members, surprising victory. The Committee met again in Washington on August 23 to hear new presentations by von Braun and Rosen, among others, but Quarles' concept could not break the existing deadlock. The vote was four to two (we do not know who was missing), the two presumably being Stewart and Furnas. The Committee concluded that the weight savings were feasible, but only with extensive redesign, and that the December 1956 goal was doubtful and could be met "only with extraordinary effort and unusual organizational arrangements." Even the minority expressed this skepticism while supporting the revised, Army dominated proposal. Moreover, both sides had little faith in the ability of such a project to overcome interservice barriers.<sup>37</sup>

As for the upgraded Redstone, the Air Force stated that it could supply 135,000 lb. engines in mid-1957 "without interference with priority military programs," but the majority already had discussed the idea in the August 4 report, and was unimpressed because it added development time and effort that cancelled out any apparent advantage for the Orbiter vehicle. The August 23 majority of four also restated its preference for the more efficient staging and the guided second stage of the Viking-Aerobee combination. Equally important was the ultimately illusory promise made by the prime Viking and Vanguard contractor, Glenn L. Martin Company of Baltimore, to deliver the vehicle in eighteen months—the same as the Army. When the R&D Policy Council convened the next day, chaired by Quarles' former deputy, the compromise plan was dead. The battle was over: Vanguard had won. On September 9, 1955, Deputy Defense Secretary Reuben Robertson issued the formal instruction to the services.<sup>38</sup>

## CONCLUSIONS

The near-reversal of the Vanguard decision in the R&D Policy Council brings home again how close and contingent that decision was. If Quarles had still chaired the Council on August 23, would it have made a difference? If Robert McMath, the third pro-Orbiter member of the Stewart Committee, had participated in July, could the three-three tie have influenced the two "fence-sitters," as Green and Lomask have speculated? If one or two members of those originally picked had been different, would Orbiter have won? We can never know. But the newly discovered and declassified records do show fairly conclusively that Quarles did not set up the Committee with a pre-determined agenda to choose the NRL proposal—whether because of Vanguard's "more civilian" appearance for overflight purposes, as McDougall has argued, or because it would not have interfered in military missile programs, as others have argued. It is true that the pro-Vanguard majority used the non-interference and ease of declassification issues to bolster their arguments. Yet the core of that majority—Kaplan, Porter and Lauritsen—also had personal agendas that inclined them to the NRL proposal, were genuinely impressed with some of the superior aspects of the Vanguard launch vehicle and satellite as compared to Orbiter, and perhaps as a result, managed to convince themselves that the development effort would not be much greater.

With hindsight we know that the latter judgement was wrong, that von Braun's Huntsville group probably could have made a satellite launch attempt by the end of 1956. But hindsight has also obscured the fact that Orbiter was not Explorer, that the minimal development and payload approach chosen by von Braun, and supported by Army Ordnance, ONR and others, contributed to its demise. If they had promised the instrumented payload carried by the later Explorer things might have turned out differently. Only after losing in the Stewart Committee did they change their conservative strategy, but it was too late.

In both the original and revised strategies for Orbiter, as well as in the Administration's satellite decision of April 1955, the Soviet factor played a critical role; it is perhaps in this area that the new documents yield the most interesting insights. Beating the Russians for prestige and psychological warfare reasons was the CIA's primary reason for supporting Orbiter and then NSC 5520—and it was

a concern that the space enthusiasts like Wernher von Braun shared. Making sure that the U.S. put up the first satellite in a fiscally restrained environment led logically to von Braun's minimum-development approach. But the scientific community's parallel advocacy effort complicated matters, because it created a new, powerful constituency for an instrumented IGY satellite, and unwittingly fed into the hidden agenda of overflight that emerged out of the TCP Report.

In this environment, the Soviet announcements of April and August 1955 had interesting effects. They set off shock waves in the classified deliberations of the Administration, reminding everyone that the Soviets could be first. Quarles, for one, seems to have reacted both times by underlining the need to prevent that possibility. Yet the net effect was never to overturn all the other agendas at work in the satellite decision-making process, which included interservice rivalry, overflight, science, international cooperation, prestige, and the desire to create a rational, fiscally conservative program. Only after Sputnik, in hindsight, did the overriding importance of beating the Russians at any cost seem obvious; beforehand American elites may have had a hard time believing that the U.S. might lose, no matter how often they were reminded of it. And in any case, the Stewart Committee majority saw the Vanguard project as delivering a better satellite on a similar timetable to Orbiter; thus the latter would not have been the automatic choice even if being first into orbit had been the sole priority.

In sum, all monocausal and deterministic arguments regarding the Vanguard decision fail. Multiple, often conflicting factors led to this chain of events, which in turn did much to set up the Sputnik shock of 1957. It is a powerful reminder of the contingent nature of history.

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1. R. Cargill Hall, "Origins and Development of the Vanguard and Explorer Satellite Programs," *Airpower Historian* 11 (Oct. 1964), pp. 101-12; Constance McLaughlin Green and Milton Lomask, *Vanguard: A History* (Washington, DC: NASA SP-4202, 1970), Chap. 3; Charles Lindbergh's Introduction to the latter book also pithily summarizes these factors

- on p. vi. For purposes of convenience, I will use the Vanguard label for the NRL project even though it was not officially so named until fall 1955.
2. Walter A. McDougall, ... *The Heavens and the Earth: A Political History of the Space Age* (New York: Basic Books, 1985), chap. 5; R. Cargill Hall, "The Eisenhower Administration and the Cold War: Framing American Astronautics to Serve National Security, *Prologue* 27 (Spring 1995): 58–72, and "Origins of U.S. Space Policy: Eisenhower, Open Skies, and Freedom of Space," in *Exploring the Unknown: Selected Documents in the History of the U.S. Civil Space Program*, edited by John M. Logsdon, et al. (Washington, DC: NASA SP-4407, 1995), 1:213–29; Dwayne A. Day, "A Strategy for Space: Donald Quarles, the CIA and the Scientific Satellite Programme," *Spaceflight* 38 (September 1996): 308–312, and "A Strategy for Reconnaissance: Dwight D. Eisenhower and Freedom of Space," in *Eye in the Sky: The Story of the Corona Spy Satellites*, edited by Dwayne A. Day, John M. Logsdon and Brian Latell (Washington, DC: Smithsonian Institution Press, 1998), pp. 119–42.
  3. McDougall, *Heavens and the Earth*, pp. 123–24.
  4. Notably, three recent popular histories take the thesis for granted: Curtis Peebles, *The Corona Project: America's First Spy Satellites* (Annapolis, Md.: Naval Institute Press, 1997), pp. 23–24; Helen Gavaghan, *Something New Under the Sun: Satellites and the Beginning of the Space Age* (New York: Copernicus, 1998), p. 27; Thomas A. Heppenheimer, *Countdown* (New York: John Wiley & Sons, 1998), pp. 99–100. Robert A. Divine's *The Sputnik Challenge: Eisenhower's Response to the Soviet Satellite* (New York: Oxford University Press, 1993), pp. 4–5, 8, asserts that a combination of overflight and non-interference in military missiles predetermined the outcome. Dwayne Day has offered various explanations, but his contribution to this volume seems to accept the non-interference factor alone as decisive.
  5. Hall, "Origins and Development," pp. 101–105; Green and Lomask, *Vanguard*, chap. 1, and for a broader view, RIP Bulkeley, *The Sputniks Crisis and Early United States Space Policy* (Bloomington: Indiana University Press, 1991), esp. chaps. 4–9.
  6. That Durant was working for the CIA either directly, or as a consultant from Arthur D. Little, Inc., has been made known to me by a number of independent sources, and is confirmed by one document, Durant's memo to the CIA Assistant Director of Scientific Intelligence regarding a meeting on UFO's in January 1953; see Logsdon, ed., *Exploring the Unknown*, 1:201–11. For Durant's role in Orbiter, see the sources cited in the previous note, plus Durant to von Braun, September 4, 1954, and reply, September 10, 1954, in the Wernher von Braun (hereinafter WvB) Papers, Durant correspondence file, U.S. Space and Rocket Center, Huntsville, Alabama (hereinafter SRCH), and pictures of the Orbiter meetings in Washington in March 1955 and in Huntsville and Cape Canaveral in May: Green and Lomask, *Vanguard*, p. 20, and "ORBITER (File #1)," in National Archives College Park (hereinafter NACP), RG 156, E. 1039A, Box 91. The January 1955 statement comes from "Proposal to the Secretary of Defense for the approval of PROJECT ORBITER," attached to Maj. Gen. Leslie Simon to Chief of Naval Research, January 27, 1955(?) in the file just cited. Cargill Hall and Dwayne Day have shown that the CIA supported the idea of satellite in the spring of 1955 and later put money into Vanguard when it was running into trouble. See the articles cited above in fn. 2.
  7. Von Braun notes on call to Hoover and preparation for meeting, June 17, 1954, in WvB desk calendar, January 4–November 2, 1954, in WvB Papers, SRCH; typewritten agenda and handwritten notes to the June 25, 1954 meeting in Durant "Orbiter" folder, Durant personal papers (copies made with the permission of Fred Durant); 1972 oral history interview (hereinafter OHI) of Homer Joe Stewart by James H. Wilson, Jet Propulsion Laboratory (JPL) Archives, part 11; WvB, "A Minimum Satellite Vehicle: Based on Components Available from Missile Developments of the Army Ordnance Corps," September 15, 1954, copy in NASA History Office, WvB Bio. file, text reprinted in Logsdon, ed., *Exploring the Unknown*, 1:274–81.
  8. Von Braun's desk calendar notes for June 17, 1954, show that he did consider other rocket engines, including the GE motor later used in Vanguard, and upgrading the Redstone from 75,000 lb. to 130,000 lb. thrust, an idea that would resurface a year later. See desk calendar of January 4–November 2, 1954, WvB Papers, SRCH. For "SLUG" see 1954–55 documents in "ORBITER (File #1)," NACP, RG 156, E. 1039A, Box 91. On the Air Force ICBM program after 1954, see Jacob Neufeld, *The Development of Ballistic Missiles in the United States Air Force 1945–1960* (Washington, DC: Office of Air Force History, 1990), chap. 4.
  9. WvB, "A Minimum Satellite Vehicle," September 15, 1954, in Logsdon, *Exploring the Unknown*, 1:279–280; "Feasibility of Observing and Tracking a Small Satellite Object" by Varo Manufacturing Company, Inc. (Davis, Whipple and Zirker), June 25, 1955, NACP, RG156, E.1039A, Box 88; Orbiter reports of J. B. Edson, Jan.–Mar. 1955, "OUTLINE OF CONFERENCE IN THE PENTAGON 5 MAY 1955 ON OBSERVATION OF PROPOSED ARTIFICIAL SATELLITE—PROJECT ORBITER," Tombaugh trip report of June 2, 1955, and "OUTLINE OF CONFERENCE IN LOS ANGELES 16 JULY 1955 ON PROPOSED ARTIFICIAL SATELLITE PROGRAM—PROJECT ORBITER," NACP, RG156, E.1039A, Box 91, "ORBITER (File #1)." See also the folder on Tombaugh's project "Search for Natural Satellites of the Earth," 1952–55, in the latter box. The only ambiguous reference to a transponder being too heavy ("& too expensive") is contained in Fred Durant's notes to the September 6, 1954, Orbiter meeting in the Durant "Orbiter file," but it appears implicit in all of the documents cited above. The only other alternative—passive detection by radar—was viewed as infeasible given the satellite's small size.
  10. Because the previous Panel meeting on April 29 had indicated that a classified meeting would be held on September 8, it is likely that a covert campaign had been launched among the scientists to put satellites on the agenda of the international unions' meetings in the fall. Lt. Cdr. Hoover's initiative in June to start a practical study may well have been a reaction to that campaign. See "Minutes of Meeting of the Upper Atmosphere Rocket Research Panel," April 26 and September 9, 1954 (September 9 is Part II only, Part I for September 8 classified and not yet found), copies from Homer Newell, National Air and Space Museum (NASM) Archives; WvB notes, August 3, 1954, in WvB desk calendar, January 4–November 2, 1954, and Durant to WvB, September 4, 1954, Durant Corr. file, both in SRCH, WvB Papers; Durant notes, September 6, 1954, Orbiter meeting, Durant "Orbiter" file. Durant's letter states that it was Whipple who pointed out the September 8 meeting on June 25. For the history of the scientists' campaign, see Bulkeley, *The Sputniks Crisis*, pp. 95–99, 125–33; McDougall, *Heavens and the Earth*, pp. 119–21; Allan Needell, *Cold War Science and the American State: Lloyd Berkner and the Balance of Professional Ideals* (forthcoming, Harwood Academic Publishers), chap. 12; and the previously cited contributions of Hall and Day.
  11. On the CIA and the TCP, see NSC 5522, June 8, 1955, Dwight D. Eisenhower Library, White House Office, Office of the Special Assistant for National Security Affairs: Records, 1952–61, NSC Policy Papers, Box 16; McDougall, *Heavens and the Earth*, pp. 115–20; Hall, "Origins of U.S. Space Policy," in Logsdon, *Exploring the Unknown*, 1:218–20, and the contributions of Osgood and Day in this volume.
  12. Orbiter documents, Dec. 1954–Mar. 1955, in NACP, RG156, E.1039A, Box 91, "ORBITER (File #1)"; WvB to Durant, September 10, 1954, in WvB Papers, SRCH; Neufeld, *Development of Ballistic Missiles*, pp. 86, 88, 91–92.
  13. Minutes of the January 20, 1955, meeting of the CGS of the OASD(R&D), January 24, 1955, attached as an appendix to the R&D Policy Council minutes of April 18, 1955, in NACP, RG319, E.39, Records of the Office of the Chief of [Army] R&D, Records Relating to the R&D Policy Council, Box 2; J.B. Edson to Lt. Col. Nickerson, January 25, 1955, transmitting "Memorandum Report RAND Information on Project SLUG—By H. Morris," in NACP, RG156, E.1039A, Box 91, "ORBITER (File #1)"; Schriever memo to Gen. Power, March 30, 1955, "SUBJECT: Redstone—Scientific Satellite,"

- in Schriever Papers, microfilm roll 3524, frames 407-408, Air Force History Support Office, Bolling AFB, DC.
14. The only substantive document from the "World Series" proposal so far available is Appendix B to the "Report of the Ad Hoc Advisory Group on Special Capabilities," RD 263/9, August 4, 1955 (hereinafter Stewart Comm. report), copy in NACP, RG156, E.1039A, Box 95, and microfilm copy in JPL Archives, roll 10-3. See also Hall, "Origins and Development," p. 107; McDougall, *Heavens and the Earth*, p. 121. Cargill Hall believes that Quarles not only orchestrated the whole IGY satellite decision, but also forced the Air Force to submit a proposal over the objection of its leadership (private communication with the author). Presumably Quarles' intent was to ensure that the competition had a tri-service character.
  15. "Minutes of Meeting of the Upper Atmosphere Rocket Research Panel," September 9, 1954, copies from Homer Newell in NASM Archives; Technical Panel on Rocketry documents, January-March 1955, in Logsdon, ed., *Exploring the Unknown*, 1:297-301; Green and Lomask, *Vanguard*, pp. 26-27; Naval Research Laboratory (NRL) Rocket Development Branch, "A Scientific Satellite Program," April 13, 1955, copy supplied by J. Tugman, NRL; Milton Rosen oral history interview with the author, transcription in process.
  16. Piore to Quarles, December 21, 1954, attached to the R&D Policy Council minutes of April 18, 1955, in NACP, RG319, E.39, Records of the Office of the Chief of R&D, Records Relating to the R&D Policy Council, Box 2; quotation from J.B. Edson, "Fourth Status Report Week Ending 21 January 1955 PROJECT SLUG", in NACP, RG156, E.1039A, Box 91, "ORBITER (File #1)."
  17. R&D Policy Council minutes of April 18, 1955, as cited in the previous note; extract from "Scientific Intelligence Digest OSI 55-10, 9 May 55, CIA," on the April 16 Moscow Radio announcement, and Stewart Alsop, "Debate on The Satellite," May 26, 1955, *Durham Morning Herald* (clipping), in NACP, RG156, E.1039A, Box 91, "ORBITER (File #1)"; *Washington Post* article, April 17, 1955, and NSC 5520 in Logsdon, ed., *Exploring the Unknown*, 1:308-13; McDougall, *Heavens and the Earth*, pp. 120-21; Hall and Day as cited in fn. 2; and in this volume, Day and Osgood, and for the Soviets, Siddiqi and Gorin.
  18. Robert W. Cairns, Chairman, Coordinating Committee on General Sciences, memo to ASD (R&D) [Quarles] on "Scientific Satellite Program for the Department of Defense," May 4, 1955, in NACP, RG156, E.1039A, Box 91, "ORBITER (File #1)"; NSC 5520 in Logsdon, ed., *Exploring the Unknown*, 1:310-311. In this and a March document attached to the R&D Policy Council April 18 minutes, there is mention of an "ORBITER II" with a bigger, instrumented payload, but it was not proposed for funding even by Orbiter's Army/Navy backers, thus the designation "ORBITER I."
  19. Attachments, June 1, to the R&D Policy Council Minutes of meeting June 7, 1955, in NACP, RG319, E.39, Records of the Chief of R&D, Records Relating to the R&D Policy Council, Box 2; Stewart memo to Pickering, April 19, 1955, in JPL roll 10-3, frames 547-561. This microfilm roll is Stewart's file on the Stewart Committee, 1955-58, a declassified photocopy of which has been deposited in its entirety in the NASM Archives. The frame numbering is from the photocopy. The microfilm was originally cited in Clayton R. Koppes, *JPL and the American Space Program* (New Haven: Yale University Press, 1982), which describes JPL's relationship with the Army. For the origins of the intertwining of the military and upper atmosphere rocketry, see David H. DeVorkin, *Science With a Vengeance* (New York: Springer Verlag, 1992).
  20. Athelstan Spillhaus of the University of Minnesota was also named as alternate to Kaplan, but did not participate. Green and Lomask, *Vanguard*, pp. 35-36, 48; attachments to the R&D Policy Council Minutes of meeting June 7, 1955, in NACP, RG319, E.39, Records of the Chief of R&D, Records Relating to the R&D Policy Council, Box 2; Furnas notes on February 28, 1955, meeting of the Army Ordnance Advisory Committee, in Dwight D. Eisenhower Library, Furnas Papers, Box 1, "Army. Ordnance Advisory Committee, 1955"; Albert B. Christman, *Sailors, Scientists, and Rockets* (Washington, DC: Naval History Division, 1971), pp. 86ff.; Droessler to Stewart, June 27, 1955, with attached draft charter and Committee list for nine members, official charter, July 13, Rosser to Smith, July 12, Rosser to Stewart, July 25 (both from RAND), and McMath to Stewart, August 1, 1955, in JPL roll 10-3, fr. 19-22, 72-74, 565-566, 576-577, 683-684; Appendix C to Vanguard report, in U.S. Congress, House of Representatives, Committee on Appropriations, Subcommittee on Department of Defense Appropriations, *Hearings on Department of Defense Appropriations for 1960*, part 6, 86th Congress, 1st Session, April 14, 1959, pp. 81-82.
  21. Porter OHI by David DeVorkin, 1984, in the NASM Archives; ARS report, November 24, 1954, in Logsdon, *Exploring the Unknown*, 1:281-83.
  22. Kaplan to Waterman, May 6, 1955, in Logsdon, ed., *Exploring the Unknown*, 1:302-303; NRL, "A Scientific Satellite Program," April 13, 1955, copy from J. Tugman, NRL; Singer to WvB, August 24, 1955, copy in Ordway Collection, folder "Project SLUG/ORBITER: AMBA Documentation, 1954-1955," SRCH. For the anti-German issue see also Green and Lomask, *Vanguard*, p. 48. It should be noted that von Braun and over a hundred Peenemünde veterans and family members had just become American citizens in a highly publicized ceremony in Huntsville on April 15.
  23. Stewart telephone interview by M.J. Neufeld, December 18, 1997, notes on file; Stewart's files on the Committee on JPL roll 10-3.
  24. Supplement, June 14, 1955, minutes to the R&D Policy Council meeting of June 7, in NACP, RG319, E.39, Records of the Office of the Chief of R&D, Records Relating to the R&D Policy Council, Box 2; Stewart Comm. report, C-10.
  25. Hoover memo to Fortune/ONR, March 28, 1955, about the March 17, 1955 Orbiter meeting, Durant personal papers; Stewart memo to Pickering, April 19, Thackwell/Grand Central Rocket Co. to Los Angeles Ord. District, May 11, Grand Central Rocket Co., "Reliability History of Loki Rockets Manufactured by JPL and the Grand Central Rocket Co.," June 27, Stewart to Smith/OASD(R&D), July 13, 1955, in JPL roll 10-3, 23ff., 30ff., 547-561, 568-574; J.B. Edson reports of January 21 and March 28 (latter incl. USAF criticism) and Maj. Williams' notes on April 25 meeting at JPL, in NACP, RG156, E.1039A, Box 91, "ORBITER (File #1)"; JPL Publication No. 47, "A Feasibility Study of the High-Velocity Stages of a Minimum Orbiting Missile," July 15, 1955, History Collection Doc. 3-593, JPL Archives; Stewart Comm. report, 10, 14, C-6, C-8; Stewart OHI by Wilson, JPL, part 11; for the Explorer Jupiter-C, see WvB, "The Redstone, Jupiter and Juno," in Eugene M. Emme, ed., *The History of Rocket Technology* (Detroit: Wayne State University Press, 1964), pp. 107-21, esp. 111-13.
  26. Stewart Comm. report, A-9 to A-11, C-12; Green and Lomask, *Vanguard*, pp. 43-48; "OUTLINE OF CONFERENCE IN LOS ANGELES 16 JULY 1955 ON PROPOSED ARTIFICIAL SATELLITE PROGRAM—PROJECT ORBITER," NACP, RG156, E.1039A, Box 91, "ORBITER (File #1)." Von Braun and his group also remained fixated on the equatorial launch concept, and discussed using the Galapagos or Gilbert Islands. Unbeknownst to them, this ran against the grain of NSC 5520 itself, which stated a preference for a launch from Cape Canaveral into an orbit of thirty-five-degrees inclination to minimize launch costs, but presumably also to increase the number of foreign countries that would be overflown, without directly overflying the USSR. Since both sides in the Stewart Committee rejected the equatorial launch expedition, however, for reasons of cost, better geophysical coverage and tracking assistance from allies, it is not clear that it had any effect on the decision. NSC 5520 Technical Appendix in Logsdon, ed., *Exploring the Unknown*, 1:279-80, 312; Stewart Comm. report, 8, C-11.
  27. Milton Rosen oral history interview by the author, July 1998, transcription in process.

28. "OUTLINE OF CONFERENCE IN LOS ANGELES 16 JULY 1955 ON PROPOSED ARTIFICIAL SATELLITE PROGRAM—PROJECT ORBITER," NACP, RG156, E.1039A, Box 91, "ORBITER (File #1)"; and Edson to Hirshhorn/White Sands, July 22, 1955, in same box, file "Search for Natural Satellites of the Earth."
29. Stewart OHI by Wilson, JPL, part 11. Note that we cannot take the words he puts in Furnas' mouth too literally, because the term Vanguard is anachronistic.
30. Green and Lomask, *Vanguard*, p. 48; Rosser to Smith, July 12, and Clement to Smith, July 13, in JPL roll 10-3, fr. 576-577, 586-587. For the North American proposal see also Albert E. Lombard, Jr., Scientific Advisor, Directorate of Research and Development, Deputy Chief of Staff, Development, USAF, to Stewart, July 14, 1955, in JPL roll 10-3, fr. 47. C. C. Furnas discussed the split vote of the Committee in "Why Did U.S. Lose the Race? Critics Speak Up," in *Life* (October 21, 1957), pp. 22-23, but mistakenly increased the number of members from seven to nine and the "fence-sitters" from two to three. A 1969 Furnas account of the decision was published obscurely and posthumously as "Birthpangs of the First Satellite," *Research Trends* (Spring 1970): 15-18. It is even more inaccurate, but gives a distorted version of Quarles' near-reversal of the decision in August—something I have found nowhere else in the published literature.
31. Porter to Smith, July 13, 1955, in JPL roll 10-3, 579-584; Stewart Comm. report, 3; Hall, "Origins and Development," pp. 107-108; Green and Lomask, *Vanguard*, pp. 41, 48-49. For six months after the Vanguard decision there was serious, but hitherto virtually unknown classified discussions in the Stewart Committee and the R&D Policy Committee about a USAF-launched "Phase II" heavy scientific satellite. Ultimately the concept died in spring 1956 because of lack of Air Force and Administration interest. See the September 1955-February 1956 materials in JPL roll 10-3; the Air Force proposal of January 1956 in NACP, RG156, E.1039A, Box 88; "Policy Council Meeting 15 Dec 1955," in RG 319, E.39, Records of the Chief of R&D, Records Relating to the R&D Policy Council, Box 2.
32. Stewart to Smith, July 13, draft report documents, July 22, in JPL roll 10-3, fr. 568-574, and 50-70, and Stewart Comm. report, August 4, 1955.
33. Untitled 8 Aug. document by Stewart(?) in JPL roll 10-3, fr. 87; Simon to Stewart, August 15, 1955, quoted (with redactions) in Vanguard report, *Hearings... for 1960* (see fn. 20), 58-59; Green and Lomask, *Vanguard*, pp. 36-39, 52-53; Frederick C. Durant, III, "Impressions of the Sixth Astronautics Congress," *Jet Propulsion* (December 1955): 738-39, copy in Durant bio. file, NASM Archives; contribution of Asif Siddiqi in this volume. Cargill Hall has pointed out that Eisenhower's announcement of the IGY satellite immediately followed the President's return from the Geneva summit where the Soviets had rejected his "Open Skies" proposal. He may also have decided to announce suddenly because the overflight logic of the program—a scientific satellite as a stalking horse for a reconnaissance satellite—seemed more urgent than ever. R. Cargill Hall, private communication with the author. Documentary evidence as to why the President made the announcement decision is, however, still lacking.
34. Simon to Stewart, August 15, 1955, quoted in Vanguard report, *Hearings... for 1960* (see fn. 20), pp. 58-59, and in Green and Lomask, *Vanguard*, pp. 52-53. I have not yet been able to find a declassified original.
35. Minutes of R&D Policy meeting of August 16, 1955, in NACP, RG319, E.39, Records of the Office of the Chief of R&D, Records Relating to the R&D Policy Council, Box 2.
36. In fairness, it must be pointed out that the Air Force delegate, Lt. Gen. Donald Putt, expressed only a mild preference for the NRL proposal, based on the common sources for rocket engines and components that the Army and USAF drew on for their missile programs; he was more interested in the Atlas-based "Phase II" satellite. See *ibid.*
37. WvB desk calendar entries, August 15, 19 and 22, 1955, in WvB desk calendar, 1954-56, SRCH, WvB Papers; Nickerson teletype to Stewart, August 19, and Stewart to Chairman, R&D Policy Council (J.B. Macauley), August 24, 1955, in JPL roll 10-3, 86-87, 90-95; Furnas, "Why Did U.S. Lose the Race?" pp. 22-23; Hall, "Origins and Development," pp. 108-109; Green and Lomask, *Vanguard*, pp. 53-54.
38. Stewart to Macauley, August 24, 1955, in JPL roll 10-3, 86-87; R&D Policy Council minutes of August 24, 1955, in RG319, E.39, Record of the Office of the Chief of R&D, Records Relating to the R&D Policy Council, Box 2; Stewart Comm. report, pp. 9-14; Green and Lomask, *Vanguard*, pp. 53-57.

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## Reconsidering Sputnik

### Forty Years Since the Soviet Satellite

Edited by

**Roger D. Launius**

National Aeronautics and Space Administration  
Washington, DC, USA

**John M. Logsdon**

George Washington University  
Washington, DC, USA

and

**Robert W. Smith**

University of Alberta  
Edmonton, Alberta, Canada



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