

“Space superiority”: Wernher von Braun’s campaign for a nuclear-armed space station, 1946–1956

Michael J. Neufeld*

Space History Division (MRC 311), National Air and Space Museum, Smithsonian Institution, P.O. Box 37012, Washington, DC 20013-7012, USA

Abstract

The literature on the history of spaceflight has depicted the early 1950s *Collier’s* articles mostly as a forerunner to the peaceful and scientific exploration of space. Yet the centerpiece of Wernher von Braun’s plan was a manned space station that would serve as reconnaissance platform and orbiting battle station for achieving “space superiority” over the USSR. One its roles could be the launching of nuclear missiles. When challenged as to the station’s defensibility, von Braun even posited pre-emptive atomic strikes from space as a response to the development of a hostile anti-satellite capability.

© 2005 Smithsonian Institution. Published by Elsevier Ltd. All rights reserved.

1. Introduction

Between 1952 and 1954 Wernher von Braun, the German–American rocket engineer, was the key participant in one of the most influential campaigns to sell spaceflight ever attempted, a series of articles in *Collier’s* magazine. The subsequent literature on the history of spaceflight, much of it written by von Braun enthusiasts or influenced by their accounts, has depicted this campaign mostly as a forerunner to later programs for the peaceful and scientific exploration of space [1]. Yet the centerpiece of von Braun’s plan for space travel, which he had been developing since at least 1946, was a manned space station which would not only serve as a base for further exploration, but also as an orbiting reconnaissance platform and battle station for achieving “space superiority” over the USSR. One its roles could be the launching of nuclear missiles. When challenged as to the station’s defensibility, von Braun even posited pre-emptive atomic strikes from space as a response to the development of a hostile anti-satellite capability. For von Braun, the space station was the “ultimate weapon” which could impose a *pax Americana* on the USSR (Fig. 1) [2].

Von Braun may in fact have been the first person to use the term “space superiority” in print, although the absence

of any historical literature about pre-Sputnik conceptions and fantasies of space warfare makes it impossible to say for sure. Obviously derived from “air superiority”, an air-power concept popularized in World War II, space superiority is now a normal term-of-art among the advocates of “space power” and “space control” centered on the US Air Force (USAF). Ironically, that makes Wernher von Braun a forgotten forerunner to space power theory—ironic because the Army-affiliated von Braun believed that his nuclear-armed space stations would make Air Force strategic bombers obsolete, much to the irritation of that service. Whether von Braun’s ideas affected early Air Force space policy discussions is unclear, but it is intriguing that in February 1957 Maj. Gen. Bernard Schriever, the head of the USAF ballistic missile program, gave a famous and controversial speech in which he stated that: “In the long haul our safety as a nation may depend upon our achieving ‘space superiority.’” [3].

When the age of intercontinental ballistic missiles (ICBMs) and robotic reconnaissance satellites finally arrived, however, von Braun’s orbital battle station quickly became a quaint and oft-forgotten relic of the pre-Sputnik age. His careful management of his public image, backed by his superiors and a sympathetic, cold-war-driven press, also reinforced its disappearance. After the US Army transferred his German-led rocket-engineering organization in Huntsville, AL to the National Aeronautics and Space Administration (NASA) in 1959/60, his focus shifted

*Tel.: +1 202 633 2434; fax: +1 202 786 2947.

E-mail address: NeufeldM@si.edu.



Fig. 1. Wernher von Braun “is shown with a model and painting from the *Collier’s* series taken at the time of his October 1955 filmed lecture to the Armed Forces Staff College. US Army photo courtesy of the National Air and Space Museum, Smithsonian Institution.

from weapons to peaceful space exploration. His early cold war past was sanitized by omission, just as was his Nazi one, as it conflicted with his public image and that of NASA. Only in recent years, as historians and political scientists went back and actually read von Braun’s publications of 1952–53, have they begun to take notice of the military and cold war theme, but except for Rainer Eisfeld’s and Johannes Weyer’s short books in German, these works do not mention pre-emptive strikes or the centrality of the military space station to von Braun’s early postwar spaceflight conceptions [4]. What has been lacking, in either English or German, is deep primary research into Wernher von Braun’s original correspondence and papers, which reveal the character and course of that campaign and its origins in earlier space advocacy [5]. This article attempts to redress that balance.

2. The origins of the space station as superweapon

Von Braun’s conception of the space station as a weapon for dominating the Earth had its origin in the works of the German–Romanian space visionary Hermann Oberth, whose groundbreaking 1923 mathematical treatise, *Die Rakete zu den Planetenräumen* (The Rocket into Interplanetary Space), launched the spaceflight movement in the German-speaking world. Oberth mentioned reconnaissance from orbit and first broached the idea of a giant mirror, up to 100 km in diameter, that could be used to modify the climate, light the polar regions, or set enemy ammunition dumps, troop concentrations and cities on fire. In response to reader enquiries, he also discussed the possibility of intercontinental rockets with poison-gas warheads in his 1929 book *Wege zur Raumschiffahrt* (Paths to Spaceflight) [6].

That same year, 1929, a book called *Das Problem der Befahrung des Weltraums: Der Raketenmotor* (The Problem of Space Travel: The Rocket Motor) appeared under the mysterious pseudonym Hermann Noordung. Noordung was actually Herman Potocnik, a former Austro-Hungarian officer who died about the time the book was published. His book offered no new military ideas beyond what Oberth had discussed in 1923, but it did provide an elaborate description of an inflatable, wheel-shaped space station that used a solar concentrator mirror to generate electricity. Although there is no explicit evidence that the then 17-year-old Wernher von Braun read Noordung’s book, in 1929/30 he wrote a plotless short story, “Lunetta,” about a trip to the space station that sounds very much like Noordung’s. Moreover, the similarity between von Braun’s post-World War II space stations and that of Noordung is too great to be coincidental. A further influence on von Braun may have been Weimar science fiction novels that depicted the space mirror and rocket as superweapons, although this is difficult to prove as he later spoke only in generalities about what fictional works he had read [7].

After von Braun surrendered to the Allies in May 1945, the 33-year-old *Wunderkind* responsible for the V-2 ballistic missile had his first chance in many years to formulate his space ideas on paper. His “Survey of the Development of Liquid Rockets in Germany and their Future Prospects,” written for his interrogators, was breath-taking in its audacity, discussing everything from intercontinental missiles to interplanetary expeditions. Yet his military space ideas had not advanced beyond those of Oberth and Noordung: space reconnaissance, the station and the mirror. Well acquainted with the underdeveloped Third Reich nuclear program, he no more anticipated a US atomic bomb than did the overconfident German physicists [8].

Several months later, von Braun was sitting in Fort Bliss in El Paso, TX, leading a group of about 120 former personnel from his rocket program. Their objectives included facilitating the transfer of V-2 technology to the US and developing a new rocket-boosted, ramjet-powered cruise missile. In April 1946, US Army Ordnance officers discussed with von Braun’s Germans the possibility of a nuclear warhead for that missile. When the US Army asked his opinion about the threat from the Soviet Union in June/July 1946, not surprisingly he played it up, suggesting the development of large, multi-stage rockets as missiles and space boosters.

The development of future space ships will necessarily lead to an extremely powerful new weapon. From a big rocket circling around the earth[,] bombs can be dropped or guided down to any point of the earth’s surface. Facing the existence of the atomic bomb and the fact that such a circling rocket represents an ever-present threat above the head of almost every nation, that nation which first reaches this goal

possesses an overwhelming military superiority over other nations [9].

The years in the southwestern desert, however, would prove frustrating for Wernher von Braun and his Germans, as President Truman's deep cuts to the defense budget meant they had only a much reduced experimental ramjet missile project, Hermes II, to keep them occupied once they had trained Americans to launch captured V-2s. Absorbing the democratic culture and political traditions of the USA, von Braun saw that he had to convince ordinary Americans of the feasibility of spaceflight, his true dream and obsession, before their leaders might take him seriously. "A bit reluctant at first," he began to search for a means to preach the gospel of space travel. His first public speech in the United States was to the El Paso Rotary Club on 16 January 1947. After discussing the basic principles of the rocket, he presented ideas much like those in his May 1945 memorandum, with more elaboration of his Noordung-like space station, an inflatable wheel 47 m (150 ft) in diameter which rotated to provide gravity. The station in turn could provide a "harbor" for space ships that could travel to the Moon and planets, but he apparently avoided the topic of its bomb-dropping capability, no doubt for security reasons. The speech won him a standing ovation, but could not readily be repeated, as the Army still restricted his movement and activities [10].

The question thus remained: how would he reach the American people? Sometime later in 1947 he decided to present an elaborate spaceflight feasibility study in the form of a science-fiction novel. It was not an original idea—already in the 1920s German space advocates had published a few stories with the same intent, and Oberth's ideas of a Moon trip were presented to the public through science-fiction novels and Fritz Lang's 1929 movie *Frau im Mond* (Woman in the Moon). The first popular science book on spaceflight published in the USA, David Lasser's *The Conquest of Space* (1931), had also included a fictional trip to the Moon, but we do not know what American science fiction authors von Braun read after arriving in El Paso, although Robert Heinlein seems likely [11]. In any case, the foundation of von Braun's novel was highly original: a fully worked out expedition to Mars based on chemical rocket technology. The choice of Mars shows how far ahead he was of almost everyone—he thought it was *too easy* to prove that humans could land on the Moon with extrapolations of existing technology. Mars, and all interplanetary travel, was on the other hand, widely viewed even by space advocates only as a distant future possibility if atomic rockets could somehow be perfected [12].

The calculations that undergirded his novel, "Mars Project," were mostly made in 1948, and were done in his spare time with no other tools than a slide rule. They were then drawn together in a "Technical Appendix" of over 120 pages in typescript, and later formed the entire content of the small book he published as *Das Marsprojekt* in 1952 and *The Mars Project* in 1953. The novel itself von Braun wrote

in 1948–49, a very substantial 482 typed pages in German; the whole manuscript was translated by an American friend of the von Braun family, Henry J. White [13].

The scale on which von Braun conceived his "Mars Project" was grand—or grandiose. For the very first expedition to the red planet, human or robotic, 10 "space ships" collectively weighing 82 million pounds would be assembled in Earth orbit and carry 70 men (and only men) to Mars. The total cost of the expedition he optimistically ventured at \$2 billion, roughly equivalent to the Manhattan Project (which built the atomic bomb). In the novel, the United Space Forces have to appeal to the president and congress of the United States of Earth in the world capital of Greenwich, CT. It was von Braun's projection of the American system over the whole globe [14].

How the planet got to that state is outlined in "Mars Project's" fascinating prologue, "AD 1980":

The final catastrophic conflict was over. The great Eastern Bloc, after five of the most frightful years in the history of the world, had finally succumbed to the last despairing blows of the almost exhausted Western Powers. Of the great Asiatic mass had become a group of smaller states, slowly digging out from under the ruins of the war.

The key to victory, after "the motorized forces of the Western Allies had ground to a solid stop in the vastness of the steppes of Asia," in "the dread winter of 1974/1975" had been the space station "Lunetta"—the name he still treasured from his teenage short-story of 1930. It had served as a battle station for dominating Earth, dropping atomic missiles on Soviet industrial and military facilities until the USSR collapsed [15].

This piece of cold war wishful thinking was rooted in von Braun's conservative anti-communism, which had only been strengthened by the Soviet domination of Eastern Europe, the Berlin Blockade and the ordeal of his parents and other relatives in communist hands. The German catastrophe had forced him to abandon the German nationalist parts of a conservative world-view he had inherited from his father, but he remained conservative by instinct, now transferring his allegiance to the USA as the "bulwark" of Western culture [16]. In the Preface to the novel, von Braun wrote regarding the military implications of rocket development: "My most earnest hope is that the world may be spared another conflict, but if such a conflict should be inevitable, as appears at times, I want the homeland of my free choice, America, to hold the weapon of rocketry against her adversaries, whoever they may be." [17].

It is interesting that, while von Braun could be a visionary in technologies he really cared about—basically spaceflight—with others he was no more farsighted than anyone else. He did not foresee thermonuclear weapons and the resultant escalation of destructive power to levels suicidal for the human race. Nor did he anticipate the age of ICBMs. The then conventional wisdom in the US military was that long-range ballistic missiles would be very

inaccurate and, at any rate, no technology yet existed for getting ballistic warheads through the heat of re-entry at the velocities needed for ranges over several hundred miles. As a result, the competing military services emphasized the development of cruise missiles (essentially unmanned, one-way, turbojet or ramjet-powered bombers) as an alternative to conventional bombers. Von Braun thought Soviet air defenses would defeat those threats, but as he later explained, his orbital nuclear missiles would glide hypersonically half way around the Earth on wings and would be guided from a manned orbiting platform situated 3700 km (2400 miles) ahead of the main station so as to keep the impact point of the missile in the line of sight [18].

From sketchy references in Wernher von Braun's correspondence, it is apparent that he completed the German draft of the novel by summer 1949, and he received the completed English translation a few months after that. Early the next year, the Defense Department cleared it for publication, as even his military space ideas were deemed too futuristic to infringe on classified matters. But his attempt to sell "Mars Project" to a publisher in 1950, just as the Army shifted his missile group to Redstone Arsenal in Huntsville, AL was a distressing failure because of his novel's wooden characters and their tendency to make long-winded explanations of scientific principles—rendering his feasibility study palatable to the public had been his primary purpose, overriding his attempt to write a gripping plot. His tome was rejected by something like 18 American publishing houses [19].

Only in early 1951 did he succeed in getting a small German publisher, Otto Bechtle, to accept it, on Bechtle's condition that a ghostwriter, Franz Ludwig Neher, redo the novel. This deal led to the separate publication of the calculations as *Das Marsprojekt* in early 1952 and to the novel's much-delayed appearance in mid-1953. Long before that time, von Braun became so exasperated by the changes and technical errors Neher introduced that he withdrew his name from the novel and only wrote an oddly distanced Foreword obliquely mentioning the "difficult birth" of the book. Retitled *Menschen zwischen den Planeten* (Men Among the Planets), it appeared under Neher's name alone. Although the early pages were simultaneously much expanded and toned down to suit a more pacifist, post-1945 German readership, the novel still opened with a cold war fantasy in which the A-bomb-equipped space station, through threats of nuclear attack (rather than actual bombings), forces the collapse of the USSR [20].

Just before moving to Huntsville, von Braun had given his first high-profile speech in the USA at an Air Force-sponsored academic conference on space medicine held in Chicago on 3 March 1950. His role was to justify the feasibility of space travel as a precursor to talks given by mostly German aerospace medicine experts who had been brought to San Antonio, TX under the same program that had imported von Braun. His lecture became his first American publication, "Multi-Stage Rockets and Artificial

Satellites," when the conference proceedings came out in August 1951. After explicating the basic principles of the rocket and of spaceflight, von Braun went on to describe a three-stage launch vehicle and a space station, one much more explicit than any earlier proposal and illustrated for the first time. His 63-m (200 ft)-diameter, bicycle-wheel-shaped station with many spokes would rotate to create artificial gravity and have a very large solar-concentrator mirror to generate electrical power. Not at all esthetically pleasing, this first visualization of von Braun's wheel space station would quickly vanish in favor of much more artistically polished versions that were shortly to appear in *Collier's* [21].

He began with its uses "as an observation station for both military and civilian purposes," and as a base for space astronomy, but went on to present the geostrategic argument to the wider public for the first time: "Our space station could be utilized as a very effective bomb carrier, and for all present-day means of defense, a non-interceptible one." In a near-polar orbit at an altitude of 1730 km (1075 miles), the station would circle the earth every two hours and cover all parts of the globe every 24, leading to "military omnipresence".

With the tremendous advances recently achieved in aerial defense, it appears to me that in the atomic age the nation which owns such a bomb-dropping space station might be in position virtually to control the earth. The political situation being what it is, with the earth divided into a western and an eastern camp, I am convinced that such a station will be the inevitable result of the present race of armaments.

After the book was published, this argument and the illustration made it into *Popular Science* and rather overshadowed von Braun's closing discussion of the station as jumping-off point to the Moon and the planets. According to the publisher, University of Illinois Press, the book sold extremely well for an academic work and generated "tremendous publicity all over the US in the daily newspapers." [22].

3. The *Collier's* series and the "A.V. Grosse Action"

Shortly after his speech appeared in print, the Air Force sponsored another conference, "Medicine and Physics of the Upper Atmosphere," this time in San Antonio in November 1951. Von Braun was not invited to speak, but did attend the first day or two, and it was there he met the *Collier's* magazine writer and editor, Cornelius Ryan, later more famous for his World War II books like *The Longest Day*. As has often been told, the magazine had sent Ryan down after the Hayden Planetarium's First Annual Symposium on Space Travel in New York convinced *Collier's* that there might be a hot issue in the feasibility of spaceflight, a topic still regarded as utopian or silly by many people. Von Braun, assisted by two prominent scientists, Fred Whipple and Joseph Kaplan, was able to

sell Ryan on the idea, leading to the first *Collier's* space issue, cover date 22 March 1952, with contributions from German émigré science writer Willy Ley, Air Force aerospace physician Heinz Haber, UN lawyer Oscar Schachter, von Braun, Whipple, and Kaplan. Chesley Bonestell, Fred Freeman and Rolf Klep were the artists and illustrators [23].

The *Collier's* issue was spectacularly bold, with a beautiful Bonestell painting of von Braun's winged third-stage rocket on the cover, separating from its second stage at dawn high over the Pacific Ocean. In the upper right corner was the teaser: "Man Will Conquer Space *Soon*: Top Scientists Tell How in 15 Startling Pages." Inside, the space section opened with an editorial "What Are We Waiting For?," followed by the feature piece, von Braun's "Crossing the Last Frontier." Another Bonestell—a stunning two-page spread of the winged ship in orbit over Central America with the space station and space telescope—graced the opening of his article. Other pieces included Ley on the space station, Kaplan on the upper atmosphere, Whipple on space astronomy, Schachter on space law, and Haber on space medicine. It was a milestone in the selling of spaceflight and one that made Wernher von Braun's wheel the iconic image of a space station for the next two decades [24].

Promotion of exploration and science certainly played a part in this first *Collier's* issue, but the predominant argument was the German engineer's militant cold war claim for the space station as superweapon. "Crossing the Last Frontier" opened thus: "Within the next 10 or 15 years, the earth will have a new companion in the skies, a man-made satellite that could be either the greatest force for peace ever devised, or one of the most terrible weapons of war—depending on who makes and controls it." From its 2-h orbit, the crew will employ "specially designed, powerful telescopes attached to large optical screens, radarscopes and cameras.... It will be almost impossible for any nation to hide warlike preparations for any length of time." Much later in von Braun's article, after elaborate descriptions of a trip into space on his three-stager, and how the space station worked, he mentioned the station as "a terribly effective atomic bomb carrier," explaining how nuclear missiles could be de-orbited from it. The magazine's editorial made his argument even more explicit: a new Manhattan Project was needed, an estimated \$4 billion expenditure to dominate space: "the U.S. must immediately embark on a long-range development program to secure for the West 'space superiority.' If we do not, somebody else will. That somebody else very probably would be the Soviet Union." [25].

Von Braun's speeches and media appearances in New York and Washington sounded the same hard-line theme. *Collier's* came out eight days before the cover date, so on 13 March, before the issue hit the newsstands, he appeared nationwide on NBC-TV's *Camel News Caravan*, a pioneering network news show with an estimated audience of 5.5 million. *Collier's* provided big, table-sized

models of his space station and launch vehicle, produced at its expense by the Huntsville Germans' graphic artist. The same night, he made another TV appearance and two on radio. The next morning he began on NBC's Today show with Dave Garroway and made several other broadcasts [26].

At the same time, *Collier's* publicity director Seth Moseley unleashed a major press release, 2800 "press and radio kits" to be handed out by sales representatives, window displays on Fifth Avenue in New York and in downtown Philadelphia, and a flood of copies to be sent to Senators, Congressmen and influential people. Von Braun did two more TV appearances the following week, gave two speeches, and ended his trip in Washington on Wednesday evening, 19 March, where he spoke on "Let's Tackle the Space Ship" for the American Rocket Society (ARS). Held at the Naval Ordnance Laboratory in suburban White Oak, MD, von Braun's appearance caused an enormous traffic jam. Three thousand cars had to be turned away, and 5000 people heard the lecture, many over loudspeakers outside the hall. Attendance exceeded his "wildest expectations," forcing him "to virtually fight my way into the building." Afterward, his mailbox was flooded with letters from enthusiastic children and adults, and from crackpots of all kinds. How many of these people were convinced by von Braun's cold war argument and how many were simply excited about the idea of space travel is a moot point, but the Korean war period was the apogee of the anti-communist fear and, as H. Bruce Franklin has pointed out, the idea of the superweapon had long intrigued the American imagination [27].

The most exciting, but strictly secret, byproduct of the *Collier's* issue was "the A.V. Grosse action," as von Braun dubbed it. Aristid V. Grosse, President of the Temple University Research Institute in Philadelphia, was a German-trained atomic chemist and member of the President Roosevelt's first committee to investigate the A-bomb. He was also friends with President Truman's personal physician. The 22 March *Collier's* spurred Grosse to ask the doctor if he could query Truman about the need to investigate the space station and the possible Soviet threat. The beleaguered president, whose poll numbers were terrible because of the Korean stalemate, of apparent corruption in his administration, and of McCarthyism run rampant, had just announced that he would not run again. According to Grosse, Truman said: "Sure, Wallie [the physician's nickname] you go ahead and have him write a report for me." After making arrangements through senior Army channels, Grosse then traveled to Huntsville in April to meet von Braun. The two immediately hit it off; von Braun found the visit "inspiring." Here was a chance perhaps to make his orbital battle station a reality, or at least get some money toward a less ambitious space project. With almost everything in the guided-missile field shielded behind classification, and with Grosse's personal experience of the Manhattan Project's origins in a secret

committee, it did not seem at all ludicrous to the two of them that this was exactly how a space program could start: as a secret, crash military project [28].

Grosse had some intriguing ideas of his own about what that project might be; he focused on robotic vehicles and the possibility of influencing the anti-communist struggle in Asia with a satellite he called “The American Star,” which could be a visible symbol of US prowess, or perhaps even broadcast propaganda or jam signals from Red transmitters. Von Braun conveyed these ideas and the news of the Grosse mission to one of the few people outside Huntsville he felt he could talk to about such potentially classified matters, Cdr Robert Truax, a Navy rocket specialist and long-time space enthusiast. Truax was also active in the ARS, which was increasingly divided between the space advocates and those who felt that it would bring practical rocket engineers into disrepute. During von Braun’s June trip to NAA in California, he flew up to Monterrey to see Truax and also talked to Karel “Charlie” Bossart, the Convair company’s chief engineer for Atlas, the Air Force’s still rather preliminary and underfunded ICBM project [29].

As von Braun told Grosse in a long 21 June letter, they agreed that the beginning step was to form a committee of influential scientists and engineers and try to get several million government dollars for a study of programs and launch vehicles. Von Braun explained:

It has been my experience that it is much simpler to sell a project which *eases* the burden of responsibility on men in the top echelons, than a project which puts an *additional* burden on their shoulders. To ask for hundreds of millions for a program that in many minds will [be] of rather dubious value (or at least nothing but an interesting technical and military gamble) would be tantamount to asking people to stick their neck way out. Nobody likes a thing like that. But to ask for a few millions to be invested in a modest program for the purpose of evaluating a new idea in the field of military science which is virtually “pregnant” with dreadful potentialities and could easily bring unpleasant surprises if some day a potential enemy should be discovered to have reached an orbit first—isn’t this really easing the burden of responsibility of policy makers, high-ranking officers and statesmen? [30].

Over the 4 July weekend, while on a new trip to Washington and New York, von Braun saw Grosse again at the resort town of Cape May, NJ; they agreed to invite several more insiders in the rocket and space business to participate in their committee. As von Braun told Prof. Maurice Zucrow of Purdue: “Grosse is well aware of the fact that during an election year no dramatic action may be expected. But he also feels we should have our plans and strategy ready when and if a new administration, regardless of what brand, takes over.” By this time the victory of Gen. Dwight Eisenhower seemed likely, but there was still a

possibility that Democratic nominee Adlai Stevenson could win. At any rate, there would be no quick decision from President Truman, as von Braun may have hoped in April, but the presidential connection, as tenuous as it was, tantalizing [31].

On 17 September Wernher von Braun’s campaign for a nuclear-armed space station reached its the high-water mark when he spoke before a blue-ribbon Washington audience on “Space Superiority as a Means for Achieving World Peace.” The Business Advisory Council of the Department of Commerce was loaded with leaders of giant corporations and, not coincidentally, its Executive Director was the brother of his translator, Henry J. White. As he proudly told his parents afterward, his speech at the Mayflower Hotel was attended by numerous corporate chieftains, two cabinet members, the Chief of Naval Operations, former ambassador Averell Harriman, and former German occupation governor Gen. Lucius Clay. Afterward he was up until 2.30 am with Clay at a cocktail party hosted by the President of Standard Oil of California. It was almost exactly 7 years since he had set foot on American soil as a quasi-prisoner [32].

His speech repeated all the arguments of the 22 March *Collier’s*, but most interesting was his discussion of the military superiority of the station and how it might defend itself against attack. In revising and extending his article for *Across the Space Frontier*, a book derived from the *Collier’s* issue, he had already elaborated his thoughts, probably in response to readers’ letters. One objection was that an enemy could merely launch a cloud of shrapnel into an orbit that intersected the station, wrecking it; he thought the guidance challenges so great, when combined with the station’s ability to maneuver, that that threat could be easily avoided. Dismissing the possibility of developing accurate, vertically launched nuclear missiles, he expected that the only real threat could come from armed, piloted space planes. His answer was radical:

If we can get our ground establishment set up and working and establish our artificial satellite with its space-to-ground missiles ready for action, we can stop any opponent cold in his attempt to challenge our fortress in space! The space station can destroy with absolute certainty an enemy space-craft prior to its launching. But far better would be if we can say to the enemy a determined, power-packed “NO” when he is beginning his development of manned space-craft! And still better if we can forestall his building of ground installations. I believe there is still time for us to accomplish this, and I urge that it be done!

In essence, he hoped threats would work, but he advocated pre-emptive strikes as the last resort to protect the station’s dominance of the skies—something he had already imagined in the opening to his ill-fated novel [33].

Using the Manhattan Project and the V-2 as examples of radical technological leaps that were not ahead of their

time, von Braun appealed to his elite audience for a \$4 billion, 10-year commitment to develop this “ultimate weapon” to enforce a *pax Americana* on Earth. The Air Force’s strategic bombers were doomed to failure in the face of the rapid development of Soviet jet fighters but if his launch vehicle and station system were developed before the Soviet ones, they would have no answer. Initial expenditure could be only a few million dollars for a study committee—the strategy he and Grosse had been advocating—but he expected that the “hardware stage” would come quickly. He ended his speech with: “We’ve got mighty little time to lose, for we know that the Soviets are thinking along the same lines. If we do not wish them to wrest the control of space from us, it’s time, and high time we acted!” [34].

Von Braun told Grosse after his speech that he had made one clear convert, Juan Trippe, the famous head of Pan-American Airways, but it was hard to tell what the impact of “Space Superiority” might be. He and Grosse exchanged more letters and met in Philadelphia, and they had longer exchanges with von Braun’s former military chief in Germany, Gen. Walter Dornberger, now at Bell Aircraft in Buffalo (maker of the X-1 and X-2 rocket planes). Von Braun even succeeded in winning over Dornberger’s boss, Larry Bell. After Eisenhower’s election on 4 November, Grosse wrote him that: “I have been busy on our problem since the elections, and have had some important discussions. Wise men, however, advise me to go slow for the next two months.” [35].

In fact, it was virtually the end of the “A.V. Grosse action,” as Grosse found that he had little or no influence in the new Republican administration. Eisenhower pushed through his “New Look” strategy of cutting back conventional forces, including the regular Army, in favor of more emphasis on strategic nuclear weapons, primarily in the Air Force. At the same time he replaced the Defense Department’s committee-ridden and often ineffectual Research and Development Board, which was supposed to coordinate the competing efforts of the services, with the office of the Assistant Secretary of Defense for Research and Development. It was probably because of this reorganization that Grosse did not finish the report originally intended for Truman until 25 August 1953, and only sent it to the new Assistant Secretary, Donald Quarles, a month later. His “Report on the Present Status of the Satellite Problem” discussed unmanned satellites as psychological weapons and possible scientific or reconnaissance vehicles, while explicitly leaving aside manned space stations as much more expensive and farther in the future. Although the brief, seven-page, double-spaced document explicitly thanked von Braun, and mentioned his immediate post-war rocket ideas, Grosse’s emphasis on the satellite and its psychological impact brings to light the essentially divergent aims of the two men, as much as the two might have agreed that the unmanned satellite would eventually lead to the manned station [36].

The most striking aspect of the report, however, is its prediction of the *Sputnik* shock of 1957:

If the Soviet Union should accomplish this ahead of us 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 it is worth. Of course, the probable reaction of the American people to a Soviet satellite circling about 300 miles above Washington, New York, Chicago and Los Angeles, would have to be considered.

It has not been demonstrated that the Grosse report had any impact at all on Eisenhower’s 1955 decision to launch a scientific satellite as a covert means for establishing the principle of “overflight” by reconnaissance satellites over the USSR. Nevertheless it seems likely that it was one of the documents, along with several more important RAND studies, that helped prepare the ground for the 1955 decision inside classified circles in the US government [37].

Wernher von Braun, meanwhile, continued his campaign for the military space station, as politically naïve as ever about the likelihood of selling such a multi-billion-dollar “pie-in-the-sky” idea to the administration. His “Space Superiority” speech appeared in the March/April 1953 issue of *Ordnance*, a publication closely associated with his employer, the Army Ordnance Corps, although it ended with the usual disclaimer that it only represented his views and not that of the Army or the Defense Department. Army Ordnance edited out one paragraph that dismissed the Air Force’s B-36 intercontinental bomber as vulnerable to Soviet jet fighters and future anti-aircraft missiles, no doubt because of the trouble it would have caused between the services. Yet von Braun’s basic argument for the vulnerability of manned bombers remained. It is not surprising that, even before the publication of this article, Dornberger was asking his former protégé why the Air Force was so “angry” with him [38].

Criticism of von Braun’s space proposals also grew inside the ARS, the professional organization of rocket engineers. At the Second Hayden Space Travel Symposium in October 1952 Milton Rosen of the Naval Research Laboratory argued that von Braun’s giant launch vehicle and space station were based on very optimistic numbers and would lead to a diversion of resources that would damage all existing guided-missile programs, and thus US national security as a whole. (As if to compound the problem, von Braun and Fred Whipple of Harvard presented a grand vision of a 50-man expedition to the Moon that same month in two *Collier’s* issues.) Rosen’s critique hit a nerve in part because of the way the ARS had minimized spaceflight since the mid-1930s to achieve respectability, and in part because of the way *Collier’s* presented von Braun’s proposals as flat-out assertions with all qualifiers removed and with no discussion of intermediate steps. Military security prevented von Braun from talking about how the 325-km-range Redstone ballistic missile he was developing in Huntsville, or other rockets,

might be adapted to launch a small satellite, although he or Grosse did mention the “American Star” idea to *Time* magazine. That publication devoted an unprecedented cover issue to space in early December, playing up the Rosen–von Braun controversy and quoting an anonymous “important missile expert” who accused the German engineer of “trying to sell the U.S. a space flight project disguised as a means of dominating the world.” Given von Braun’s romantic obsession with space travel and his record of opportunism in the Third Reich and after, it would be tempting to believe this cynical interpretation if he had not so consistently and insistently argued for orbital A-bombs since 1946 [39].

What particularly annoyed von Braun was *Time* writer Jonathan Leonard’s dichotomy between space true believers and “practical missile men.” He told an ARS meeting in Indiana in May 1953, after arriving and finding himself “the central figure in what seems to be a major controversy”: “Being a hard-boiled development man, who [has] had his ample share of setbacks and disappointments, I am *not* recommending to go off half-cocked and immediately embark on a hard-ware development program involving a 7000-ton[,] 3 stage rocket.” He had intended to give his standard speech on “space superiority,” but his off-the-cuff remarks did justify his plan in detail, coming back to the need to outstrip Soviet capabilities and not prop up the strategic bomber as a deterrent. It was the kind of performance that won him many new friends and adherents. Robert Kraemer, then a young engineer at North American Aviation’s Rocketdyne engine division, remembers another von Braun speech to an ARS meeting in Los Angeles 6 months later. He went armed with various criticisms of the *Collier’s* articles and came away a convert to von Braun’s cause [40].

In spite of these successes, von Braun’s orbital battle station seems to have gradually faded away in 1953/54. In part that was because the *Collier’s* issues on the Moon, followed by ones on astronaut training (February–March 1953), an unmanned satellite with monkeys (June 1953), and a Mars expedition based on the “Mars Project” (April 1954), all with von Braun’s participation or explicit by-line, tended to overshadow the first issue with its cold war emphasis. The focus shifted by default to the scientific and engineering problems of space exploration. This trend would be reinforced in 1955, when von Braun appeared in two Disney TV programs on space travel that avoided military topics except reconnaissance; they made him even more famous. Yet another factor was the shift in focus, both inside the rocket community and the US government, toward the near-term possibility of launching small, robotic Earth satellites. In June 1954, von Braun himself became involved in such a project, Orbiter, that ultimately lost out to Milton Rosen’s Vanguard proposal for the administration’s scientific satellite program in 1955. Yet, von Braun continued to advocate his atomic-missile-armed space station at least as late as fall 1956 [41]. The station as superweapon, a concept he took from Oberth and German

science fiction (perhaps reinforced from American sources), was clearly an *idée fixe* for von Braun, his own participation in the rapidly changing world of ballistic-missile development notwithstanding.

4. Conclusions

Indeed, by the mid-1950s the nuclear arms race was already rapidly changing. Concerned by Soviet progress in rocketry, Eisenhower and his Defense officials decided in 1953/54 to put urgent priority on the Air Force Atlas ICBM rather than on expensive and speculative programs like the space station. Breakthroughs in guidance and in the size and power of thermonuclear warheads promised a blockbuster weapon that, if not very accurate, was certainly capable of holding Soviet cities hostage, and could cover 8000 km in half an hour. Heavy, blunt-end, “heat sink” warheads would get the bombs through the atmosphere. (The more elegant technical solution of “ablative” heat shields, which erode away from the heat of re-entry, would come out of von Braun’s own Army laboratory.) In late 1955 the Huntsville group was tasked to develop an intermediate-range (2800-km) ballistic missile, Jupiter, for the Army and Navy in competition with the Air Force’s Thor, which would be based on Atlas [42]. Remarkable again is von Braun’s failure to foresee the imminent arrival of this world of ICBMs, which would make orbital bombs a poor second choice, stuck as they were in predictable orbits that would only pass over targets once or twice a day.

After the *Sputnik* shock predicted by Grosse, von Braun continued to push for “space superiority,” expecting like most observers that the cold war arms race would be extended into orbit and even to the Moon. Although he finally conceded the vulnerability of large space stations to enemy attack, he still argued for the superior accuracy of orbital nuclear bombs as late as mid-1958 [43]. The weaponization of space soon faded, however, as the two superpowers decided that it was not in their mutual interest to put bombs in orbit or to threaten each other’s military reconnaissance, navigation and communication satellites too explicitly—although at times each side did develop a limited anti-satellite capability. Thus the nuclear-armed space station quickly became forgotten, and after von Braun joined NASA in 1960, it was positively at odds with the agency’s mission of peaceful space exploration. He and his associates, who wrote many of the early histories of spaceflight, remembered the *Collier’s* series, if they remembered it at all, only as a precursor to NASA’s space station, Moon and Mars programs. Just as was the case with von Braun’s National Socialist past, the easiest solution was simply to omit inconvenient facts [44]. Von Braun’s rotating, wheeled space station had become iconic, yet his primary argument for building it effectively disappeared from the record.

Only gradually, as space history became more professionalized from the 1980s onwards, did scholars begin to read

von Braun's articles from the early 1950s for themselves, and notice both the cultural impact of the *Collier's* series and the cold war arguments embedded in them. Several have since discussed von Braun's military space advocacy, but only Rainer Eisefeld in Germany has really unveiled its Strangelovian aspect of A-bombs in orbit, pre-emptive strikes and the collapse of the USSR. Yet because of lack of time and access to von Braun's papers, Eisefeld has not delved very deeply into von Braun's military space advocacy, which, as this paper demonstrates, not only underlay all his space publications up to the mid-1950s, but was also rooted in Weimar space advocacy and his own postwar attempt to write a science fiction novel. While all due credit must be given to Wernher von Braun as a ground-breaking rocket engineer and space visionary, space historians and enthusiasts must adjust their image of him to accommodate the undeniable fact that he crusaded for a militant, anti-communist policy of nuclear bombs in space, with pre-emptive strikes on the USSR as a last resort to protect his space station's dominance of the Earth.

Nor, it may be added, do his military space ideas seem as irrelevant today as they did in the 1960s and 1970s: just as in the heyday of the Strategic Defense Initiative (SDI) in the mid-1980s, the weaponization of space is back on the agenda. The second Bush administration and military space advocates have asserted the need to dominate the "high ground" of orbit with armed satellites in order to protect the USA's space assets and assure American hegemony. Barring an explicit international treaty that bans all weapons from space, not just the "weapons of mass destruction" outlawed by the Outer Space Treaty of 1967, von Braun's "space superiority" concept will remain an issue of great importance, even as his specific proposals have faded into history.

Acknowledgements

The author wishes to thank David DeVorkin, Roger Launius, Dwayne Day and Asif Siddiqi for their comments. Irene Wilhite of the US Space and Rocket Center and the staff of the Library of Congress Manuscript Division provided helpful assistance with the Wernher von Braun Papers. Particular thanks are due to the US Space and Rocket Center for permission to quote from the Papers it owns. For the controversy over von Braun in the ARS, I am particularly beholden to my colleague Tom Crouch, who has provided me with documents. Portions of this article are drawn from draft chapters of my biography, *Von Braun: Dreamer of Space, Engineer of War*, scheduled for publication in fall 2007.

References

- [1] See Erik Bergaust. Wernher von Braun (hereinafter WvB). Washington, DC: National Space Institute; 1976. p. 171–8; Howard McCurdy. The space station decision. Baltimore: Johns Hopkins University Press; 1990. p. 6–7; Randy Liebermann in Frederick I. Ordway III, Randy Liebermann. Blueprint for space. Washington, DC: Smithsonian Institution Press; 1992. p. 39–41; Ernst Stuhlinger, Frederick I Ordway III. Wernher von Braun. Crusader for Space: A Biographical Memoir. Malabar, FL: Krieger; 1994. p. 106–15; T.A. Heppenheimer. Countdown. New York: John Wiley & Sons; 1997. p. 89–90; Adam L Gruen. The port unknown: a history of the space station freedom program (ms., c. 1995, NASA History Office file 17091). p. 9–11; William Burrows. This New Ocean. New York: Random House; 1998. p. 142–4; Tom D Crouch. Aiming for the stars. Washington, DC: Smithsonian Institution Press; 1999. p. 119–20; Roger D Launius. Space stations. Washington, DC: Smithsonian Books; 2003. p. 26–35. The Ordway-Liebermann-organized exhibition Blueprint for Space (which appeared in two different versions in New York and Washington, DC, in 1991–92), and the related book cited above, had much to do with reviving the memory of the *Collier's* series and its beautiful illustrations. Howard McCurdy. Space and the American Imagination. Washington, DC: Smithsonian Institution Press; 1997, then underlined its importance to space history, and as noted below in n. 4, also did discuss the military dimension to a limited extent. Earlier von-Braun-influenced accounts did not discuss *Collier's* much or at all because of a neglect of social and cultural history and a narrow focus on hardware and organizations: Wernher von Braun, Frederick I Ordway III, Dave dooling. Space travel: a history. New York: Harper & Row; 1985 (1st ed., 1967); Ordway, Mitchell R Sharpe. The rocket team. New York: Crowell; 1979; Willy Ley. Rockets, missiles, and space travel (revised ed.). New York: Viking; 1957; The first authorized WvB biography, by Bergaust, cited above, did mention his A-bomb dropping station but notably falsifies history by asserting that "he never promoted the idea": p. 177; the most recent hagiography, Bob Ward's Dr. Space. Annapolis, MD: Naval Institute Press, 2005. p. 90, falsely asserts that von Braun "quietly withdrew the scheme and never put it forward again." Adam Gruen in his unpublished history cited above, states that WvB later declared his idea "inane and silly," but offers no proof: p. 10.
- [2] See in particular WvB's lead article in the first *Collier's* space issue, "Crossing the Last Frontier," *Collier's* (22 March 1952). p. 24–8, 72–3, and the accompanying magazine editorial on p. 23, "What are we waiting for?"; and his "Space Superiority," *Ordnance*. March–April 1953; 770–5.
- [3] David N Spires, editor. Schriever speech. Orbital Futures. Peterson AFB, CO: Air Force Space Command, n.d [2004], I:20–26, quote, 24–25. This speech led to an order from the Eisenhower Administration not use the word "space" publicly in any military context. For the space power literature see, for example, Peter L Hays, et al., editors. Spacepower for a new millennium. New York: McGraw-Hill; 2000; and for analysis, Roger Handberg. Seeking new world vistas: the militarization of space. Westport, CT: Praeger; 2000; but both lack much historical context, especially pre-Sputnik. For contemporary use of the term, see the "space superiority" section of the Air Force Space Command journal *High Frontier* Winter 2005;1(3):3–31, available on-line.
- [4] Rainer Eisefeld. Mondsüchtig. Reinbek bei Hamburg: Rowohlt; 1996. p. 187–93; Johannes Weyer. Wernher von Braun. Reinbek bei Hamburg: Rowohlt; 1999. p. 92–6, 101–3; Rainer Eisefeld, Wolfgang Jeschke. Marsfieber. Munich: Droemer; 2003. p. 137–41. As noted above, McCurdy does discuss the bomb-dropping space station in *Space and the American Imagination*, p. 66–8, as part of Cold War proposals for the militarization of space, but the essay-like character of this important book tends to obscure the centrality of these ideas to von Braun's early space advocacy by isolating them. Burrows' general space history *This New Ocean*, cited above; Rip Bulkeley, Graham Spinardi. SDI-driven space weapons: deterrence or delusion? Totowa, NJ: Barnes and Nobles Books; 1986. p. 12–4; Dennis Piszkiwicz's poorly researched, error-ridden biography, *Wernher von Braun*. Westport, CO: Praeger; 1998. p. 73–7; De Witt Douglas Kilgore's valuable cultural study *Astrofuturism: science, race, and*

- visions of Utopia in space. Philadelphia: University of Pennsylvania Press; 2003. p. 67–8, do discuss WvB's military station ideas in a little more detail than earlier accounts, but because of lack of fundamental primary research do not present it as part of a long-term strategy developed after 1945 and pushed as central in 1952–53. While Eisfeld and Weyer have brought out the issue of preemptive nuclear strikes, they have done no more primary research than their American counterparts.
- [5] The Wernher von Braun Papers (hereinafter WvBP) are split; about one-third are in the Library of Congress, Manuscript Division (hereinafter LC), the remainder in the Archives of the US Space and Rocket Center, Huntsville, Alabama (hereinafter USSRC).
- [6] Hermann Oberth. *Die Rakete zu den Planetenräumen* (1923; reprint). Nuremberg: Uni-Verlag; 1960. p. 86–8; *Wege zur Raumschiffahrt*. (1929; reprint). Bucharest: Kriterion; 1974. p. 200, 338.
- [7] Hermann Noordung. *The problem of space travel: the rocket motor* (translated and edited by Ernst Stuhlinger and JD Hunley (NASA SP-4206). Washington, DC: NASA; 1995. p. xviii–xxii, 102–18, 122–3; WvB, “Lunetta,” *Leben und Arbeit* (1930–31). p. 88–92. Johannes Erichsen in “Prafigurationen. Die Rakete in technisch-politischen Phantasien der Weimarer Zeit,” in Erichsen, Bernhard M. Hoppe, editors. *Peenemünde: Mythos und Geschichte der Rakete 1923–1989*. Berlin: Nikolai; 2004. p. 23–34, gives a valuable overview of the idea of the superweapon in Weimar space and science-fiction literature.
- [8] WvB, “Survey...,” 15 May 1945, in Fritz Zwicky. *Report on Certain Phases of War Research in Germany*. Pasadena: Aerojet Engineering Corp.; 1945. p. 1:66–72; Mark Walker. *Nazi science: myth, truth, and the German atomic bomb*. New York/London: Plenum; 1995; Sir Charles Frank. *Operation epsilon: the farm hall transcripts*. Berkeley/Los Angeles: University of California Press; 1993.
- [9] Singles to Toftoy, 12 Apr. 1946, in USSRC, WvBP, 701–7, and “Briefentwurf an Los Alamos Laboratory, Dr. J.R. Oppenheimer,” in 701–11; WvB, “Questions and Answers on A-9, A-10 and A-11,” July 1946, in National Archives College Park (hereinafter NACP), RG156, E.1039A, Box 79, file “Ch.II New Material—Revision Material.”
- [10] WvB to Schmeer, 2.1.1959, in USSRC, WvBP, 208-2 (“a bit reluctant”); Rotary Club speech, 16.1.1947, in same, 101–3; Stuhlinger and Ordway, WvB, 82–3.
- [11] Frank H Winter. *Prelude to the space age: The Rocket Societies: 1924–1940*. Washington, DC: Smithsonian Institution Press for NASM, 1983; Michael J. Neufeld. *Weimar Culture and Futuristic Technology: The Rocketry and Spaceflight Fad in Germany, 1923–1933*. *Technology and Culture* 1990;31:725–52; David Lasser. *The Conquest of Space* (1931). Burlington, Ontario: Apogee Books; 2002. Robert Heinlein. *Space Cadet*. New York: Scribner; 1948, discusses A-bombs in orbit, while his *Rocket Ship Galileo*. New York: Scribner; 1947, has the scenario of backyard rocket builders von Braun denounces in the original Introduction to his book, *The Mars Project* (1953; reprint). Urbana/Chicago: University of Illinois Press; 1991. p. 1.
- [12] WvB. “Mars Project” typescripts: USSRC, WvBP. p. 204–7 [in German], p. 205–1 [in English]; see Vorwort/Preface; WvB, *Mars Project*. Preface to the 1962 Edition.
- [13] WvB. *Das Marsprojekt*. Frankfurt: Umschau-Verlag; 1952; WvB. *Mars Project*, xv, p. 7. In the “Mars Project” English typescript, The Technical Appendix is p. 440–567 (the novel text run to 439k, thus actually 450pp.). In the German original, part of the Appendix is lost. There are also a number of files of drafts, loose calculations and drawings for the “Mars Project” in box 206.
- [14] WvB. “Mars Project” English, USSRC; WvBP. p. 205–1, III–IV, 1–2, 19–23, 29, 137–62, 218–35. In the Introduction to the published calculations, he put the cost more vaguely as “no greater than those for a minor military operation extending over a limited theater of war.”; WvB. *Mars Project*, 4.
- [15] *Mars Project*. 1–2; p. 204–7, 1–3 [in German].
- [16] “Bulwark” appears in both WvB’s “Qualification Sheet for German Scientific Personnel,” 10.6.1945, in NACP, RG319, IRR Personal Name File WvB, Box 657A, and in his *Biographical and Professional Data form*, 10.2.1947, in RG330, Acc. 70A4398.
- [17] WvB. “Mars Project” English, USSRC, WvBP. p. 205–1, IV–V.
- [18] Kenneth P Werrell. *The evolution of the cruise missile*. Maxwell AFB, AL: Air University Press; 1985 [chapter 4]; Jacob Neufeld. *The development of ballistic missiles in the United States Air Force 1945–1960*. Washington, DC: Office of Air Force History; 1990. p. 26–33, 50–68; WvB draft talk to Air War College, 28.5.1953, in USSRC, WvBP. p. 101–17; WvB, “Space Superiority,” cited above, n. 2; WvB in Cornelius Ryan, editor. *Across the space frontier*. New York: Viking; 1952. p. 54.
- [19] Dornberger to WvB, 8 August and 21 November 1949, in USSRC, WvBP. p. 430–5; Layton JP to WvB, 19 November 1949, and WvB to Paul Reynolds, 7 Feb. 1950, in same, 612–1; Bergaust, WvB, 155–56.
- [20] Franz Ludwig Neher. *Menschen zwischen den Planeten*. Esslingen: Bechtle; 1953. p. 7–10 (WvB Foreword), 11–144; Eisfeld. *Mondsüchtig*, 189–90; the primary correspondence files of relevance are USSRC, WvBP, p. 400–7, and LC, WvBP, Box 43, “German Corr. 1949–54.” Helga Abret in “Literatur und Technik: Von Brauns Marsprojekt und Neher Menschen zwischen den Planeten,” in Hans Esselborn, *Utopie, Antiutopie und Science Fiction im deutschsprachigen Roman des 20. Jahrhunderts*. Würzburg: Königshausen & Neumann; 2003, discusses the connections between the two, but does not know that Neher’s novel was actually a rewrite of von Braun’s, a fact only revealed by reading the von Braun Papers.
- [21] WvB. Multi-stage rockets and artificial satellites. In: John P Marbarger, editor. *Space medicine*. Urbana: University of Illinois Press; 1951. p. 14–29; original 3 March 1950 speech and program of symposium in LC, WvBP, Box 46, “Speeches and Writings, 1949–50,” and in USSRC, WvBP, 101–6. Von Braun also presented the station idea in his first Huntsville lecture, to the Kiwanis Club on 23 June 1950: LC, WvBP, Box 46, “Speeches and Writings 1949–50.”
- [22] WvB. Multi-stage rockets, 25–9 (quote: 26); “Giant Doughnut is Proposed as Space Station,” *Popular Science* (October 1951), 120–21; Armsbary/UIP to WvB, 16 August 1951, in LC, WvBP, Box 44, “Publications.... 1949–53.”
- [23] Ordway, Liebermann. *Blueprint*. p. 128–29, 135–36; Stuhlinger, Ordway, WvB. p. 112–14; McCurdy. *Space and the American Imagination*. p. 37–8; San Antonio conference program and invitation in USSRC, WvBP, 134–3; WvB memoir of meeting Ryan in handwritten draft for 11 Feb. 1953 speech in LC, WvBP, Box 49, “Speeches and writings undated.”
- [24] *Collier’s*, 22 Mar. 1952, 22–36, 38–9, 65–7, 70–2, 74; Launius. *Space stations* [chapter 2].
- [25] *Collier’s*, 22 Mar. 1952, 22–36, 38–9, 65–7, 70–2, 74; Launius. *Space stations*. p. 23–6, 74.
- [26] *Collier’s* news release, 13 March 1952, WvB “Lantern-Slide Cue Sheet,” 11 March 1952, “Bill Slater Interview (TV)” notes, media appearance lists, WvB handwritten notes, and draft script for interview, in LC, WvBP, Box 42, “*Collier’s* corr., 1951–52”; WvB notes, c. March 1952, in same, Box 49, “Speeches and writings: across the moon.”
- [27] WvB-Moseley corr., March 1952, news release, media appearance lists and WvB handwritten notes. In: LC, WvBP, Box 42, “*Collier’s* corr., 1951–52”; “Von Braun Lecture takes 5,000 on interplanetary Rocket trip,” *Washington Star*, 20.3.1952, clipping in Box 55, *Scrapbook #7*; WvB to Schindler/NOL, 26.3.1952, in USSRC, WvBP, 101–9 (quote); McCurdy, *Space*, 29–39; 1952–53 fan mail in LC, WvBP, Box 14; May to WvB, 15.3.1952, in USSRC, WvBP, 207–1; WvB to Cleaver, in same, 400–2; Bruce Franklin. *War stars: the superweapon in the American imagination*. New York/Oxford: Oxford University Press; 1988.
- [28] Grosse to WvB, 24 Apr. Truax to WvB, 2 April, 1 May, 5 June, WvB to Truax, 2 June, and WvB to Grosse, 21 June 1952, in WvBP-LC, Box 42, “A.V. Grosse Action 1951–1957”; Grosse interview in Joseph J. Ermenc. *Atomic Bomb Scientists: Memoirs 1939–1945*.

- Westport, Conn./London, Meckler; 1989. p. 305–6 (Truman quote); Alonzo L. Hamby. *Man of the people: a life of Harry S Truman*. New York/Oxford: Oxford University Press; 1995. p. 564, 600–5; James T. Patterson. *Grand expectations: The United States, 1945–1974*. New York/Oxford: Oxford University Press; 1996. p. 232–42.
- [29] WvB-Grosse-Truax-Bossart corr., April–June 1952, in LC, WvBP, Box 42, “A.V. Grosse Action 1951–1957”; J. Neufeld. *Development*. p. 68–73.
- [30] WvB to Grosse, 21 June 1952, in LC, WvBP, Box 42, “A.V. Grosse Action 1951–1957.”
- [31] Grosse-WvB telegrams June–July 1952, and WvB to Zucrow, 11 July 1952, in *ibid.*; Patterson, *Grand Expectations*, 250–6.
- [32] WvB to parents, c. 18. September 1952, in Bundesarchiv Koblenz, N1085 (Magnus von Braun Papers), Nr. 84; WvB to Grosse, 25 September 1952, in LC, WvBP, Box 1, “1952 A to Z”; “Space Superiority” speech and related corr., September 1952, in USSRC, WvBP, 101–12; printed speech also in National Air and Space Museum, Archives Division, WvB bio. file.
- [33] WvB “Space Superiority” speech in NASM, WvB bio. file; WvB, “Race of armament” ms., in USSRC, WvBP, 225–14, and WvB to Ryan, 15 May 1952, referring to same, in 207–1; WvB in Ryan, editor. *Across*, 55–6.
- [34] WvB “Space Superiority” speech in NASM, WvB bio. file.
- [35] WvB to Grosse, 25 September 1952, in WvBP-LC, Box 1, “1952 A to Z”; WvB-Grosse corr., September to November 1952, and Dornberger to WvB, 20 October 1952, in WvBP-LC, Box 42, “A.V. Grosse Action 1951–1957.”
- [36] G. Pascal Zachary. *Endless Frontier: Vannevar Bush, Engineer of the American Century*. Cambridge, MA: MIT Press; 1999. p. 336–7, 364–7; Patterson. *Grand expectations*, 286–7; Walter A. McDougall. *..the Heavens and the Earth*. New York: Basic; 1985. p. 105–7; Grosse report, 25 August 1953, copy in NASA History Office, HRC 945, excerpt in John Logsdon, editor. *Exploring the unknown*. Washington, DC: NASA; 1995. p. I:266–9.
- [37] Grosse report cited above; Logsdon. *Exploring*. p. 266–7; McDougall. *..the Heavens*. p. 101–10, 118–9.
- [38] WvB. “Space Superiority” (article cited above, n. 2); clearance paperwork for publication, September–November. 1952, in NACP, RG156, E.1039A, Box 72, “Project von Braun;” Dornberger to WvB, 7 Dec. 1952, in USSRC, 430–5.
- [39] WvB, “Man on the Moon: The Journey,” *Collier’s*, 18 October 1952, 51–8, 60, and Fred Whipple, WvB, “Man on the Moon: The Exploration,” *Collier’s*, 25 October 1952, 38–40, 42, 44–8; *Time*, 8 December 1952, p. 62–4, 67–70, 73.
- [40] WvB to Leonard, 9 October 1953, in LC, WvBP, Box 1, “1953 A to H”; WvB “ARS-Luncheon” handwritten talk, 6 May 1953, in same, Box 46, “Speeches and writings, 1951–1955”; Edler to WvB, 23 Nov. 1953, re: LA ARS speech, in same, Box 12, “Invitations, 1952–April 1954”; Kraemer oral history interview by Neufeld and Winter, 21 November and 12 December 2000, NASM.
- [41] WvB AOA speech, Washington, DC, 26 Oct. 1956, in USSRC, WvBP, 101–30; “Challenge of Outer Space,” 20 Oct. 1955, DOD film of a WvB lecture to the Armed Forces Staff College; Eisfeld, *Mondsüchtig*, p. 186–9.
- [42] McDougall. *.. the Heavens*, 105–7; J. Neufeld, *Development*, 93–147.
- [43] WvB. “The meaning of space superiority,” ms., c. January 1958, in USSRC, WvBP, 200–21, published in modified form as “How satellites will change your life,” *This Week* (8 June 1958), p. 8–9, 36–7.
- [44] For a review of the evidence about his role in the Third Reich, see Michael J Neufeld. *Wernher von Braun, the SS and Concentration-Camp Labor. Questions of moral, political and criminal responsibility*. *German Studies Review* 2002;25:57–78, and my subsequent exchange with Ernst Stuhlinger in the same journal, *German Studies Review* 2003;26:121–6. For the muckraking and heavy-handed literature that broke through the previous silence, see Linda Hunt, “US Coverup of Nazi Scientists,” *Bulletin of the Atomic Scientists* 1985;16–24, and *Secret agenda*. New York: St. Martin’s Press; 1991; Tom Bower. *The paperclip conspiracy*. London: Michael Joseph; 1987.