

# Space artifact or Nazi weapon? Displaying the Smithsonian's V-2 missile, 1976–2011

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Debates over how or how not to display intrinsically controversial subjects in a museum setting have been part of museum life for decades. And the Smithsonian Institution on the National Mall in Washington, D.C., has more often than not been a 'flash point' [1] for episodes ranging from the interwar controversy over the Langley Aerodrome and Wright Flyer, to the so-called 'rerun of the Scopes trial' in a 1978 suit brought against the Smithsonian, to the *Enola Gay* affair of 1994–1995. Stakeholders from every conceivable walk of life have, at one time or another, expressed annoyance with the way some part of human culture, or the natural world, is portrayed. Accordingly, the Smithsonian has gone through cycles where it becomes very cautious about what it displays, and how it displays, social, cultural and scientific artifacts, notably since *Enola Gay* [2–8].

To be sure, in behaving this way, the Smithsonian is no doubt a reflection of larger forces that have tried to shape what it is and does, forces that reflect behavioral norms and values in a nation's constant search for identity. A case in point, for the purposes of setting the stage for this essay, is why the National Mall of the United States does not have an explicitly military museum, and how the Smithsonian has become, in effect, a surrogate agent in the process. Beyond a pervasive suspicion and antipathy toward showcasing the armed forces on the Mall, as Joanne London has argued, there were other forces, including 'the Smithsonian's exhibition traditions, personalities, bureaucratic obstacles, the military establishment's ambivalence about the value of museums, the United States' involvement in the Korean and Vietnam war and the general environment of the Cold War, and changes in museology...' [9, p. 259].

London traces the historical pathways through which military interests attempted to establish a presence on the National Mall, and how, in 1961, Congress attempted to control or moderate this drive by creating a National Armed Forces Museum Advisory Board to the Institution that would authorize some form of coverage. This fostered a debate centered on the question of whether the Smithsonian's newly established Museum of History and Technology (now the National Museum of American History) could better address the expressed desires of the military than could a wholly new museum bureau devoted to the subject. The Smithsonian resisted the idea of a new bureau, arguing in a position paper in about 1960 that it could better integrate 'the military exhibits into a museum

designed to cover the entire scope of the nation's history' to 'set into a proper context' for the nation's armed forces history [9, p. 167].

It was, indeed, the question of creating 'proper context' and educating its visitors and patrons to the place of the military in American society that drove the Smithsonian's agenda. As London points out, the postwar Smithsonian, led by Leonard Carmichael, its first Secretary from academia, and after him S. Dillon Ripley, consistently rejected the compelling desire to retain the museum 'as shrine' and fostered more 'critical and thematic approaches to exhibition' [9, p. 266]. But she also shows that the National Air Museum – which Congress had established as a Smithsonian bureau in 1946 to meld existing aeronautical collections with the Army Air Forces' World War II collection of foreign and domestic aircraft – resisted this trend at first, favoring galleries that celebrated achievements through overcoming technological obstacles. That trend continued even after the Air Museum became the National Air and Space Museum (NASM) in 1966 and received its own building on the Mall in 1976 [9,10].

Here we will look at some of these traditions and personalities as well as changes in museum practices to plot out how the National Air and Space Museum, as the most prominent surrogate for a military presence on the Mall, has over time altered its display of an artifact central to its collection and, to be sure, its very nature. First, we will portray how the NASM originally presented its captured German V-2 missile as a prominent and persistent symbol of the Space Age, the embodiment of what the historian Brooke Hindle has called the 'True Cross': the iconic original artifact, rather than a copy or representation [11]. Then we will outline how NASM later modified its exhibit to show the missile more as a military artifact manufactured by concentration-camp labor. And third, we will briefly compare how the evolution of NASM's treatment of the missile in its 1100 square meters Space Hall compared to treatments in other museums. That comparison will show that the transformation in NASM's V-2 exhibit beginning in 1990 was both a byproduct of an ongoing historical reevaluation of the artifact, and also the harbinger of the transformation of museum exhibits about the missile in North America and Western Europe, even if there is no evidence that it was a direct influence.

Overall, we hope here to convey our conviction that the survival of an historical artifact can be a stimulus to historical re-evaluation, and that at any one time in history, its interpretation is contingent upon norms and values of the day. In such manner, artifacts and how they are interpreted over time reflect changing societal and cultural values.

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### The V-2 ballistic missile

The V-2 (*Vergeltungswaffe 2* = Vengeance Weapon 2) was a revolutionary technological device when Nazi Germany deployed it to attack London, Paris, Antwerp and other western European cities in fall 1944. Originally known to its creators, the Germany Army engineering team led by Dr. Wernher von Braun, as the Aggregat 4 or A-4, its rocket thrust of 25 metric tons was two magnitudes larger than anything that had been developed in any other country. Its size was astonishing by the standards of the day: 14 m tall and weighing at liftoff 12.9 metric tons fully fueled with liquid oxygen and 75% alcohol. The V-2 could carry a one-metric ton warhead with 750 kg of high explosive at least 270 km in 5 min. It impacted at a supersonic velocity of over Mach 3, arriving before the sound of its fall. Yet this terror weapon – deployed by Hitler to demoralize Allied populations in the desperate hope that it could change the course of the war – was so inaccurate that it could barely hit a large urban area. It proved to be a very expensive and wasteful way to deliver bombs on enemy cities and ultimately had little impact on the Allied war effort [12,13].

Its true importance lay in its postwar influence on rocket development, most notably in the Soviet Union and the United States. The latter imported Wernher von Braun and his key engineers, as well as parts and components for a hundred missiles, ultimately launching over seventy of them, primarily from the White Sands Proving Ground in New Mexico. The majority were fired with instruments to characterize the upper atmosphere and near space, as well as to deploy the first exoatmospheric astronomical experiments. The missile and its component technologies proved influential on the development of American ballistic missiles and space launch vehicles. In the USSR, the Red Army also imported Germans and missiles, and copied the missile as the R-1, the first ballistic missile in the Soviet forces. It too proved to be a catalyst for missile and launch vehicle development. An early commitment to the technology by the Soviet government explains much of the stunning surprises of 1957: the launch of the world's first intercontinental ballistic missile (ICBM) and first satellite, Sputnik, fired into orbit by the same rocket, the R-7 [14,15].

In the aftermath of the war, the V-2 was remembered in the West in two primary ways: as a milestone on the road to space and as a military artifact of the V-weapons attack on England (with the V-1, a Luftwaffe cruise missile unrelated to von Braun's group). Thanks largely to the popularization efforts of von Braun and his friend, the ex-German science writer and early rocket experimenter Willy Ley (ironically an anti-Nazi émigré), the space narrative became the dominant one, especially after Sputnik. The ex-Germans celebrated the first successful launch, on 3 October 1942 at Peenemünde rocket center on the Baltic, as the first step on the road to space, and the V-2 as the first human object to reach space, which indeed it was. Von Braun and Ley's past as space enthusiasts in the Weimar Republic also became central to the V-2 narrative, while the fact that von Braun had been a member of the Nazi Party and SS, and that the missile had been manufactured by concentration-camp workers under murderous conditions, was on the other hand almost completely suppressed (Ley probably knew little about this, as he left Germany in

1935). Not much was publicly available about those stories until the 1960s in the Soviet bloc and the 1980s in the West. As a result of the forced departure from the United States in 1984 of one of von Braun's key associates, Arthur Rudolph, for his involvement in slave labor, scholarly and public understanding of the missile was fundamentally transformed, such that the V-2's military and National Socialist origins took center stage [16].

### The Smithsonian's V-2

In 1949, the U.S. Air Force (as the Army Air Forces were renamed after receiving independence two years earlier) formally transferred some 1366 enemy and Allied wartime objects to the National Air Museum, including the shell of a V-2 missile and an engine. This object, like most of the others, was stored at a former Douglas Aircraft plant at Park Ridge, Illinois (the later site of O'Hare Airport) and was displayed there in its original camouflage colors (Figure 1). The suite of V-2 objects were shipped from Park Ridge by train in late November 1954, and trucked to the museum's storage facility in Suitland, Maryland, in February 1955. The shell of the missile was formally accessioned in 1960.

Once Congress appropriated the \$40 million needed for the new NASM building in 1972, the staff went all-out to identify, collect and restore the major objects it hoped to display. V-2 restoration commenced in 1974, requiring some 2000 man-hours to complete. Part of it involved identifying needed components and securing them from other sources, notably the Marshall Space Flight Center of the National Aeronautics and Space Administration (NASA) in Huntsville, Alabama, and the Royal Air Force

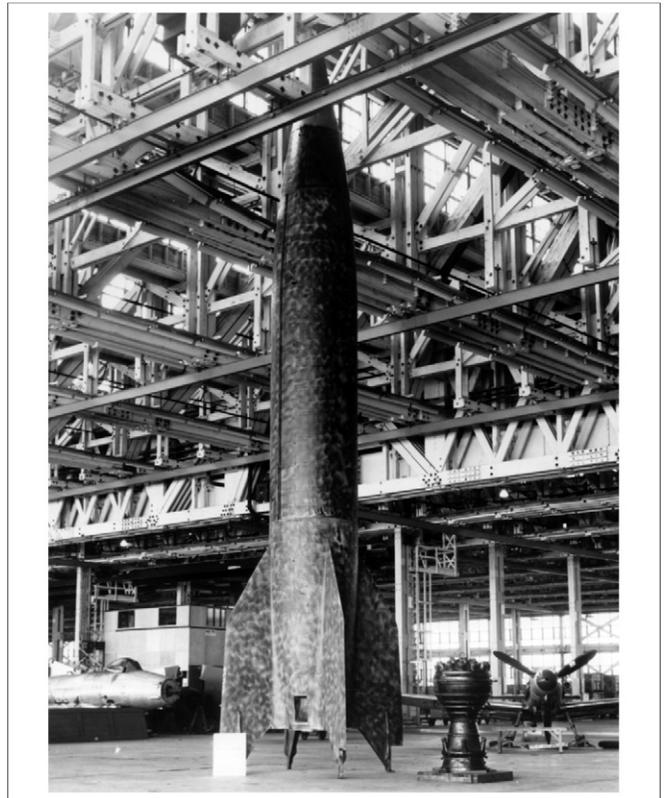


Figure 1. The NASM V-2 at Park Ridge, Illinois, c. 1950. Courtesy National Air and Space Museum Archives.

Museum at Hendon, England. The latter provided a thrust ring, graphite exhaust vanes, and other tail components to complete the missile, whereas Marshall contributed another V-2 and a launch stand [17].

In an annotated 'Thematic Concept Script' dated 2 January 1975, Frederick C. Durant III, Assistant Director for Astronautics, and therefore the chief curatorial architect of the new space wing, noted that the V-2 was now disassembled and that another was being shipped from Huntsville. The best parts would be utilized in the ultimate object. Little documentation has yet been located from the restoration, which took place from 1974 through early 1976. It appears likely that the Park Ridge V-2 became the fuselage of the final vehicle. With the restoration well underway, on 11 December 1975 Durant wrote in haste to the U.S. Army Ballistic Command at the Redstone Arsenal, also in Huntsville, asking to borrow the five-volume 'Report on Operation Backfire (British test launchings of V-2 missile at Cuxhaven, 1945)'. He needed it 'urgently' to properly restore the V-2 [18].

Before joining the Smithsonian in 1964 as first head of the Astronautics Department, Durant trained in chemical engineering and became a Navy officer, a rocket engineer, and a covert analyst of foreign rocket and space programs for the Central Intelligence Agency. While at the latter, he became president of the American Rocket Society in 1953 and of the International Astronautical Federation in 1955. He was also a close personal friend of Wernher von Braun after 1951. Durant oversaw a curatorial team led by Walter H. Flint, a former range officer at Cape Canaveral. Their 1975 Thematic Unit Script for what was to be Space Hall, one of the three large, main halls at NASM, flanked by some twenty discrete exhibit spaces on two floors, envisioned the V-2 standing at the entrance. 'The atmosphere of this gallery should retain or enhance the monumental aspects of the major artifacts', the narrative began. The first of five units would be called 'Guided Missiles and Space Launch Vehicles' in order to show that modern launch technologies derive from guided missiles. Nazi Germany would be depicted as 'orders of magnitude' more advanced in rocketry and the 'V-2... embodied the greatest sophistication of German World War II weapons placed in mass production'. It concluded that 'we cannot tell the story of modern space flight without presenting the legacy' of the guided missile [18].

Graphic panels would be placed around the vertically mounted V-2 depicting wartime scenes of testing and launching German V-2s. There would be schematics describing the design of the missile, and a video of launchings, both 'successes and failures', in living color, followed by footage extrapolating the technology into a future in space. Flint visualized the V-2 as the first stop of a walking tour. Visitors would encounter it with American descendants in the background, including a Jupiter C, Vanguard, Scout, Minuteman III and a Poseidon C-3. Other German missiles would hang overhead: a V-1, a Rheintochter, an Hs 298 and an X-4.

Durant well knew that they could not achieve either full continuity or 'precise chronological development' in the time and space available, but, he predicted, 'by virtue of the sheer size, strangeness, rarity and visual interest of the

artifacts, a strong impression will be made on the visitor'. The artifacts would be the primary evidence and the labels would be limited to describing what was being encountered. Any audio narrative would be linear and straightforward: the advance of the V-2 and everything based upon it, highlighting the launch of captured missiles at White Sands. The Thematic Concept Script of 2 January 1975 states that: 'This area represents, then, the technological basis upon which was developed postwar... concepts for long-range ballistic missiles and the feasibility of launching artificial satellites'. The artifacts embodied the strong message that the knowledge and practice acquired through building ballistic missiles were those that stood behind modern space launch vehicles. The labels would emphasize 'the commonality of the technology' ranging from rocket propulsion to aerodynamics to inertial guidance and instrumentation [18].

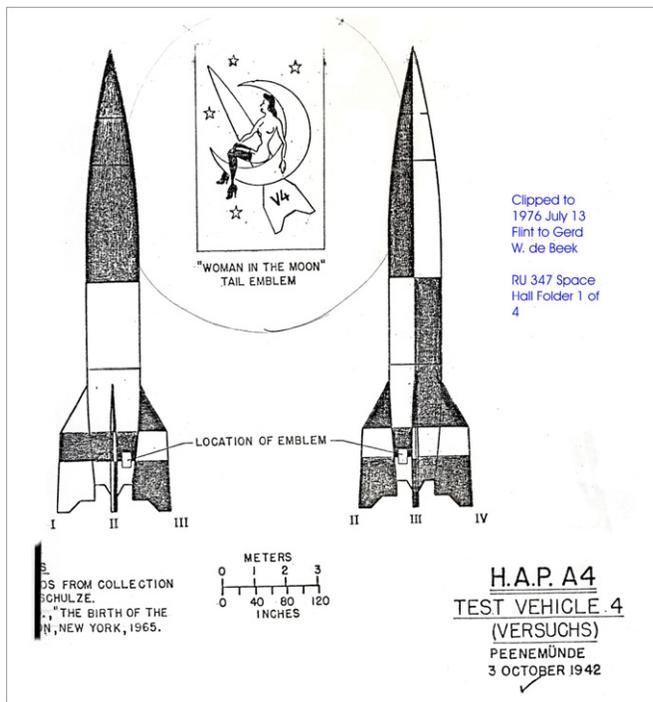
Durant sent the script to external reviewers including Eugene Emme and G. Harry Stine. Emme, chief NASA historian, referred the script to NASA Public Affairs. Stine, widely known for his popular writing on space technology themes and his promotion of model rocketry, had worked at the White Sands Missile Range and later headed the Range Operations Division of the Navy at Cape Canaveral. Stine rejected the curatorial decision to tie 'space to weapons' adding that the V-1, the Rheintochter, etc., were of 'historic interest but NOT space related!' The USAF Minuteman was also out of place as it was a 'WEAPON not space vehicle'. The V-2 was acceptable to Stine, apparently, if it were to be repainted 'either as first successful Peenemünde round or typical WSPG rocket sonde. I have paint patterns' [19].

A NASA Public Affairs officer responded very differently. Alex Nagy, in an 8 April 1975 message to the head of his office, John Donnelly, worried that the overall treatment lacked historical context of any kind:

The one thing that bothers me most is the absence of any perspective in the Space Hall regarding U.S. and world conditions at the time all this was happening... the thematic concept is presented as a scientific and engineering development with no relation to concurrent international and national political pressures, and their development ought to be put into proper context.

Nagy saw no mention of the social and political forces behind the space race, most pointedly the missile gap 'of the early 1950s' but most of all, 'the competition between the Army and a schizophrenic Navy on which would get the IGY satellite launching assignment'. And what about the Soviet Sputniks, the Senate hearings, NASA's establishment? 'None of these things occurred in an orderly fashion, based strictly on scientific merit or sound technological planning' [18].

Nagy's boss at NASA's Public Affairs did not strictly back up his staff member's opinions, but sent them on, indicating that he would send the draft as well to NASA leaders. Durant wrote back to Donnelly on 8 May thanking him for Nagy's comments, saying they were 'useful and appreciated.' However, 'As to the political story of inter-service rivalry, world conditions, etc. some treatment may



**Figure 2.** This original drawing from the Smithsonian Institution Archives shows the planned paint scheme for the 3 October 1942 vehicle, including the never-used logo.

Courtesy Smithsonian Institution Archives.

be given in labels to set the scene. However, the story of developing technology is usually given greater emphasis' [18].

Indeed, little came of this appeal from NASA. NASM did follow up Stine's suggestion to repaint the V-2 in test colors and not in its operational camouflage. Durant and Flint queried their contacts among the former Germans. Gerd W. de Beek and Konrad Dannenberg, among the American members of von Braun's diaspora who then worked in Huntsville, provided insignia used on Peenemünde test vehicles. The 3 October 1942 missile that made the first successful flight featured a beautiful woman dressed only in long black stockings and silver shoes, cradled in a crescent moon and looking to the heavens (Figure 2). It was to go on the repainted NASM V-2 but never did in the rush to get everything ready for the opening. After the opening, it was proposed again by Flint in November 1976 but was deleted without comment by Durant, presumably because it was too risqué for a family audience [18].<sup>1</sup> Even without that logo, the repainting of the rocket in the black-and-white scheme of 3 October 1942 effectively erased the military history of the vehicle and presented it as a space artifact (Figure 3).

The staff worked feverishly in the opening months of 1976, intent upon opening on 1 July all twenty galleries and three major halls. Label scripts for Space Hall that began appearing in the spring reinforced the technological linkages and progress narrative. The main label for Space Hall in the 14 May 1976 script proclaimed: "The modern strategic missile systems that form the backbone of our



**Figure 3.** The V-2 alone in Space Hall in 1979. The German V-1 cruise missile hangs above the rocket and the nose of the Poseidon missile sticks out to the left. Courtesy National Air and Space Museum Archives.

national defense also opened the way for mankind's entry into space'. The galleries of 27 May identified the V-2 as the 'first long-range ballistic missile' giving operational statistics and specifications, but the emphasis was on how it 'held the promise of much larger rockets which could fulfill the dreams of pioneers of space flight' [18].<sup>2</sup>

When the Museum opened, the V-2 stood alone. Cuts due to lack of time removed the video, shortened labels and reduced the number of images. One small case held the main label and an image for the V-2 presentation. Nowhere were Nagy's concerns addressed. There were other adjustments however. Even though NASM Director Michael Collins and curator Richard Hallion were 'not moved' by a plea from a reporter for *The Jewish Week* who insisted that there was 'no excuse to show off the swastika as a symbol of German genius,' records indicate that Flint and Durant removed the swastikas 'to avoid offensiveness' [18].<sup>3</sup>

The National Air and Space Museum opened to the public with much fanfare on 1 July 1976, and was linked to the nation's bicentennial celebrations by President Gerald R. Ford, who presided at the ribbon-cutting. Over one million visitors came in the first month, and NASM quickly became the world's most-visited museum. By the end of the year, Flint had received many suggestions from 'post-opening studies and inspections' by numerous individuals and groups. Some desired a restoration of some of the material left out in the press of opening, notably the

<sup>1</sup> 'Concept Script Space Hall', Flint and Robert Widder (designer), 21 November 1976.

<sup>2</sup> 'General Exhibits', 14 and 27 May 1976.

<sup>3</sup> 'The Jewish Week' and annotations, 17 June 1976.

missing V-2 insignia and at least one label and image about the 3 October 1942 launch.

Most criticism of Space Hall came, however, from solar astronomers and NASA. By far the largest artifacts were the giant back-up Skylab Orbital Workshop and its associated Multiple Docking Adapter. They occupied 40 percent of the floor. The Workshop's labels had images of astronauts living and working in space, but there was little on Skylab's major scientific facility, the Apollo Telescope Mount. Astronomers wanted some of the spectacular images of the Sun it obtained to be displayed, while NASA wanted attention to earth observations, biological experiments and materials processing. According to a 21 November 1976 concept script, NASA also suggested a new unit, 'Toward 2076' that envisioned a lunar base with 'hangar complex, refinery, civic center, automated farm, living units, lab and research centers' [18].

In partial response, additional images and labels were added to Skylab, and two curators, Tom Crouch and Walter Dillon, planned for early 1978 a contextual exhibit kiosk titled 'Explorer I: A Twentieth Anniversary Retrospect', in an attempt to plot the technological and social course from the V-2 to the Space Age. The V-2 was still the progenitor of all large-scale rocketry, but now at least, explicitly, there was an effort to state directly what it was designed to do: 'deliver a 1-metric ton warhead on targets in allied cities'. The small exhibit that appeared went on to plot out Wernher von Braun's own trajectory, 'selling space flight' and leading conceptual teams for the Army's proposal for an earth orbiting satellite during the International Geophysical Year. 'Wernher von Braun, his eyes still on outer space, pressed for authority to attempt a satellite launch' [18].<sup>4</sup>

Space Hall stabilized for several years; the first major change came in the spring of 1980 when the Poseidon C-3 submarine-launch ballistic missile and its associated exhibit were transferred to the Navy Museum in Washington, D.C. The Poseidon had taken up a great deal of floor space since it was displayed horizontally in sections [18].<sup>5</sup>

Whatever the reason for this major change, it opened up the space considerably, reduced congestion, and made short-term exhibits possible. By 1981, NASA had loaned a Space Shuttle pallet, which neatly filled that space for much of the year to symbolize the scale and payload capability of NASA's new post-Apollo focus.

More changes came slowly, and some further shrouded the V-2's historical context. In the early 1980s, the V-2 was joined by two sounding rockets: a Viking from the U.S. Navy's postwar program, and by an Army WAC Corporal from 1945. Both were removed from an adjacent gallery, *Satellites*, which had been replaced by *Looking at Earth*. Standing next to the V-2, the similar-sized Viking, the Navy's effort to duplicate the V-2's performance in the late 1940s, stood between it and the tiny WAC, which represented the American liquid-fuel rocketry contemporary to the V-2. This physical arrangement effectively clouded the fact that the V-2 represented a technological achievement much beyond Allied capabilities in 1945 (Figure 4).

<sup>4</sup> 'Explorer I: A Twentieth Anniversary Retrospect', Walter Dillon and Tom Crouch, 17 November 1977.

<sup>5</sup> Exhibit Unit Transfer, 16 April 1980.



Figure 4. The V-2, Viking and WAC Corporal as they appeared in the late 1980s. In the background is the Skylab Orbital Workshop, and above is the V-1. David DeVorkin photo.

In 1979 a scientist and NASA administrator, Noel W. Hinners, had become NASM Director. He reorganized and expanded the curatorial ranks, displaced Durant and some other veterans of the Museum, and reshaped the Astronautics Department as Space Science and Exploration, looking to expand and highlight the treatment of the space sciences. Hinners' return to NASA in 1982 meant that only the beginnings of that goal were realized. In 1981 he did hire two curators explicitly trained in the history of science to take over the space-science bailiwick: one of the present authors (David DeVorkin) and Allan Needell. DeVorkin grew up with images of the V-2 symbolizing, in both fiction and fact, the future of astronomy and spaceflight, thanks in large part to the promotional efforts of Ley and von Braun. DeVorkin found this spirit alive and well at NASM.

By the mid-1980s, as chair of the department, DeVorkin set about to inject more space science into Space Hall, focusing on the V-2. Not particularly concerned by its presentation as another sounding rocket like its neighbors, the Viking and WAC Corporal, he wanted to tell the story of how the V-2 was used for scientific investigation. A concept proposal in May 1985 focused entirely on V-2 science, describing the types of experiments the Germans wanted to conduct and ones that the Americans actually did conduct in solar physics, aeronomy, ionospheric physics and cosmic-ray physics.

This treatment reflected a general research program DeVorkin initiated in 1981 into the origins of the space sciences, specifically an assessment of the reality of the field as a discipline. This research goal soon revealed that

the field was less a coherent discipline, centered on intellectual problem areas and specific questions, than it was a field stimulated and defined by the vehicle itself. The very existence of the V-2 and its potential for carrying scientific instrumentation into realms heretofore completely inaccessible, coupled with the motives and priorities of military patrons hoping to master the new technology and to improve it, made for a compelling historical narrative, but one not easily shoehorned into an exhibit.

Later concept scripts were informed by discussions with the second author, Michael Neufeld, who came as a post-doctoral fellow in 1988 and was hired as a curator in 1990, as well as with colleagues attending an in-house history seminar (notably Paul Forman, Michael Dennis and Allan Needell), and with others at professional meetings. Those scripts still included some of the science, but concentrated more on the missile – who made it and why, the human cost of its manufacture, its impact as a terror weapon, and the aftermath of bringing it to the United States. At a September 1988 conference in Rome, DeVorkin presented a paper on how science was coordinated on White Sands V-2 flights by a panel of civilian scientists from military laboratories and universities. Audience reaction, prompted by Forman, questioned if this panel was acting as an agent of science. Was it a panel convened for science, or for the operational study of the V-2? This encounter and others later that year made it clear that placing science in the forefront of the rocket's history was misleading. Indeed, good science was done with the missile, but celebrating it as a vehicle for science was every bit as misleading as calling Charles Darwin's *HMS Beagle* a scientific vessel. Neither was built as a scientific instrument.

Two additional processes shaped the gradual rethinking of the way NASM should present the V-2. The first was the growing knowledge of the murderous character of the missile's production and of the Nazi compromises of its makers, and the second was a deep reorganization of the Museum itself.

### The Rudolph watershed

As noted earlier, Arthur Rudolph's return to Germany in 1984 fundamentally altered the understanding of the V-2's history, especially in the English-speaking world. When the Justice Department revealed his renunciation of U.S. citizenship under a voluntary agreement to avoid a probable denaturalization and deportation, it also released information about Rudolph's early Nazi Party membership and his role as production manager of the Mittelwerk underground V-2 assembly plant. The adjacent Mittelbau-Dora concentration-camp had supplied its unskilled and semiskilled labor; a large fraction of its twenty-thousand-plus dead could be attributed to the rocket program (Figure 5). The announcement provoked major stories in newspapers around the world in October 1984.

Half a year later the investigative journalist Linda Hunt published 'US Coverup of Nazi Scientists' in the *Bulletin of the Atomic Scientists* [20]. She provided new evidence on the SS membership of Wernher von Braun, as well as the Nazi records of several of his key associates. Von Braun's value to the United States as leading rocket engineer in the ballistic missile and space races, and that of his team, had



Figure 5. Two concentration-camp survivors in Nordhausen shortly after their liberation by the U.S. Army on 11 April 1945. U.S. Army photo.

motivated the U.S. government to keep damaging information about the former Germans classified. The media were not only kept in the dark, they also were complicit in ignoring new revelations about von Braun and Mittelbau-Dora that began leaking out in the 1960s as the result of a targeted campaign by East Germany, protests by camp survivors in France, and a war-crimes trial in West Germany. Von Braun's reputation as a heroic space visionary, notably after the Apollo 11 lunar landing in July 1969, as well as his personal friendships with members of the press, had made him nearly untouchable. That began to fade in the seventies, as the Moon landings receded, and as a rising consciousness of the Holocaust changed public attitudes. Von Braun died in 1977 before the storm really broke. The Rudolph revelations stripped away his remaining aura and provoked an outpouring, first of investigative journalism, and later of scholarship, on the V-2, Mittelbau-Dora and von Braun [13].

How then to recontextualize the V-2 at NASM? Rudolph, one of von Braun's senior men, was the project manager of the Saturn V launch vehicle that took the United States to the Moon. In 1969 he received one of NASA's highest honors for this achievement. As DeVorkin rewrote the script how could he ignore the Third Reich dimension of the his story, and that of his colleagues and von Braun as they designed the V-2? But clearly such a revision would have been impossible at the Museum in the 1970s, so closely tied was it to von Braun personally, and so wedded was it to the space narrative, nor for that matter was it possible for much of the 1980s.

### The Harwit era

In late 1986 the direction of the Museum again changed abruptly when Director Walter Boyne was forced out. In the ensuing deep reevaluation, the respected Cornell University astronomer Martin O. Harwit was named to take the lead. He arrived in August 1987. During an interview with staff in the selection process, Harwit bluntly observed: 'I do not see anything about Dresden' in the Museum's treatment of aerial bombing in World War II.



**Figure 6.** The scene in Antwerp, Belgium, shortly after a V-2 strike on 27 November 1944. The Germans fired more missiles at Antwerp than London in order to disrupt Allied use of the port.  
U.S. Army photo.

Harwit, a childhood Czech refugee from the Nazis and a scientific witness to H-bomb tests in the Pacific, brought his history to Washington, D.C. Primarily active in infrared astronomy from rockets and satellites, he was a strong contributor to NASA's Great Observatories series, and had fostered critical historical thinking among astronomers and historians alike, notably with his 1981 monograph *Cosmic Discovery*. Harwit wholly supported, and in fact urged, a rethinking of NASM's exhibits, invigorating a climate of change.

In 1988–1989, the Museum's budget allowed for small exhibit changes without recourse to fundraising (this is scarcely possible now). DeVorkin got some eight meters of existing railing space around three sides of the V-2 to tell the story. He ended up taking out the science done with captured missiles and treating that subject in a monograph published in 1992 [14]. The scripts he wrote, in consultation with Neufeld and others, focused on the missile's specifications and capabilities, manufacture in the Mittelwerk, military performance, capture by U.S. Army units, and testing at White Sands. Wartime effectiveness was illustrated by a scatter diagram of impact points in England, lending credence to the fact that it was an indiscriminate terror weapon. A photo of sick and dying Mittelbau-Dora camp prisoners, and one of a bombing scene in Antwerp with a noticeably mangled body (the first picture of war dead in the Museum), lent depth (Figure 6). Von Braun's role was illustrated in two images, first advising Wehrmacht officers, and then U.S. Army Ordnance officers. Now the V-2 symbolized not only the future of space travel, but also its origins in a militaristic fascist state, its impact on World War II and the Cold War, and its role in launching missile programs in the United States.

As an internal Museum initiative, the new exhibition opened without fanfare in late 1990 (Figure 7). Reaction to the changes was generally positive. Daniel Greenberg, editor of *Science & Government Report*, ran a full page review, and the *Washington Post* excerpted it for its 'op-ed' page. It also appeared in other papers. Greenberg had been pleasantly surprised when, visiting the museum for other



**Figure 7.** The second and third sides of the V-2 exhibit that opened in 1990.  
David DeVorkin photo.

reasons, he happened on the new unannounced exhibit, reporting that: 'Truth in labeling has achieved a rare breakthrough in an exhibit of military technology . . . where traditional practice has called for bland, antiseptic explanatory material on some of the most horrifying instruments of war' [21].

The only negative reaction came from the NASM docent corps, volunteers who carry out public tours of the building. The staff educator coordinating the docents reported serious discomfort and claims of distortion. Accordingly, DeVorkin contacted docent leaders and asked for a meeting. Some were sad that the V-2 had been relabeled a missile and not a sounding rocket, but the docents in fact did not object to the new treatment overall. It was the staff member who was disturbed, worried that showing body parts on a bombed-out Antwerp street was unsuitable for families.

The labeling and imagery underwent some revision in 1996–1997 when the Viking was removed and placed in the 'Missile Pit' – a hole in the floor that allowed especially tall rockets (Jupiter-C, Vanguard, Minuteman, and Scout) to sit at the parking garage level and just fit under the glass ceiling of Space Hall. This move allowed the juxtaposition of the WAC Corporal with the V-2 alone as a comparison of the states of U.S. and German rocket technology in 1945. The move came about as the result of a complete revision of the Hall. Industrialist and former presidential candidate Ross Perot purchased many Soviet space objects at a late 1993 auction and offered to loan them to NASM if they could be exhibited there. He subsequently donated funds for the new exhibit in Space Hall called *Space Race*. It put Soviet and American space artifacts side-by-side, but also allowed for a larger refashioning of the exhibitry around the Missile Pit in the gallery's center, telling the full story of the ballistic-missile arms race and how it led to the space race. The existing V-2 exhibit was easily incorporated into that narrative. The changes required for *Space Race* allowed the fourth side of the V-2 to be used to tell a fuller story about the WAC Corporal, but also meant that the third side of the original V-2 panels had to be given up for a main label for the whole exhibit. The V-2 story was condensed to two sides, but no major content was lost, so that the narrative was fundamentally the same as before.

Two years before *Space Race* opened in May 1997, Martin Harwit had himself been forced out as a result of the 1994–1995 battle over the exhibit about the *Enola Gay*, the B-29 bomber that had dropped the first atomic weapon on Hiroshima [7,8]. The huge national controversy provoked by draft scripts for an exhibition that never opened (a last-minute replacement display was substituted) produced a major chilling effect on NASM's ability to mount exhibitions about war, or any controversial subjects. It seems possible that at least some aspects of the V-2 exhibit, notably the Antwerp photo, would have faced internal resistance if the missile's reinterpretation had been initiated in the later 1990s. Nonetheless, the fundamental revelations about the V-2 and its Nazi past were no longer controversial in most quarters (although a hard core of von Braun fans and Rudolph supporters were unmollified), and thus there was no pressure to change the labels. In contrast, post-*Enola Gay* attacks by critics forced cuts in the ending of NASM's 1991 World War I exhibit, which had been implicitly critical of strategic bombing.

For more than a decade after 1997, the V-2 labels remained unaltered, although that is about to change again as a redesign of *Space Race* will allow the combined V-2/WAC Corporal exhibit to expand to all four sides of the enclosure. This time the second author, Neufeld, is using that extra space to include new color pictures of the working conditions at the Mittelwerk and a longer treatment of how the Soviet Union also captured and absorbed V-2 technology. The recontextualization goes on, but the fundamental interpretation has not changed since DeVorkin's original 1990 exhibit.

### Revising V-2 exhibitions elsewhere

Space does not allow us to elaborate on the reinterpretation of the missile in other museums, but a brief comparative survey is useful. To the knowledge of the current authors, no other museum in Western Europe or the United States overhauled its treatment of the V-2 before 1990, but there also is no evidence that the NASM exhibit exerted much influence afterward. However, the revelations about the Mittelwerk and the Nazi records of von Braun, Rudolph and others, combined with the end of the Cold War, compelled several museums to revise their labels, and profoundly shaped the exhibitions of two new museums created after 1990.

In Germany, a major influence was the country's reunification, which made the ruins of the Peenemünde rocket center and the Mittelwerk/Mittelbau-Dora complex now accessible to Westerners, also compelling the creation of new museums to treat those subjects (only a small camp memorial existed at Mittelbau-Dora in the Communist period; Peenemünde had been on a closed military base). A new exhibition and public access to parts of the tunnels was unveiled at Mittelbau-Dora in 1995, for the fiftieth anniversary of liberation. And after a long national and regional controversy, a professional and critical exhibition opened at Peenemünde in 2000, replacing a locally initiated museum that had been apologist in character [22]. Meanwhile, the Museum für Verkehr und Technik (Museum for Transportation and Technology) in Berlin, now

called the Deutsches Technikmuseum, was active in assisting the Mittelbau-Dora memorial and in reshaping its own presentation of V-2 history.

In northeastern France, near Calais, a never-completed V-2 storage and launch bunker opened in 1998 as La Coupole, a multilingual museum devoted to the V-weapons, World War II and the history of the German occupation. The museum forged a close relationship with one of the French Dora survivors' associations, and presented a critical view of its V-2, which it had restored after receiving a damaged shell from NASM (the one from NASA Marshall that had been used as a source for spare parts for the restoration of NASM's vehicle). That relationship led to an important exhibition, *Images de Dora*, which combined prisoner art and artifacts with startling new color photos of the underground plant that had been discovered in 1999. It opened at La Coupole in 1999 and in a German version at the Deutsches Museum in Munich in 2001 [23].

A modified version of *Images de Dora*, combined with a travelling exhibit from Mittelbau-Dora, eventually appeared at the University of Alabama Huntsville in 2010 (in marked contrast to the U.S. Space and Rocket Center in the same city, Marshall's visitor center, which studiously avoids the Nazi question). Long before that, the Kansas Cosmosphere, a regional space museum closely aligned with NASM, had completely reshaped the 'German Room' around its V-2 to take account of the new information. Clearly, many of the same forces that had acted upon NASM also compelled other museums to recontextualize their presentations of V-2 history.

### Conclusions

We have traced the transformation of NASM's presentation of the V-2 from a technological progenitor to a new form of military technology, manufactured in haste and desperation under morally corrupt conditions. We have tried to argue that its initial display was not exactly wrong, but certainly quite incomplete. And we do not want to suggest that it is now complete. As Brooke Hindle pointed out so long ago, and others like Willard Boyd after him, historical recontextualizing of artifacts will never cease. The very existence of this object reminds us that it represents a history, and it is our duty and the duty of those who follow to constantly reexamine that history in the light of new knowledge, new evidence, and new perspectives. In the thirty-five years since NASM opened its new building, one signal issue has emerged that characterizes the transformative treatment of the V-2 over the years: we have come finally to accept the fact that the museum, as a medium of expression, represents the specific 'times and spaces' of a self-aware staff, in the words of Roger Silverstone, and that, moreover, there is an emotional and psychological impact that influences not only how the object is displayed, but how it is received [24,25]. We hope that the V-2 will continually remind us to act accordingly, responding carefully and prudently, to continually strive to obtain further knowledge about the object and the history it represents, shedding light on the norms and values of our era as we reinterpret the past.

The artifact itself, the Smithsonian's V-2, has over this time remained inert, mute testimony only to the fact that

its parts were somehow created. Its various parts were, to be sure, built in the hellish tunnels of the Mittelwerk, but its embodiment is a reconstruction, and indeed, remains something of a cover-up. From the beginning, those who created the NASM object for display, following the sensibilities of their day, obscured its operational status and ignored the human cost. Repainting the object, reassembling the object from widely scattered parts, bowing to a form of correctness, this object is a construction, yet it carries the same symbolic power of Hindle's 'True Cross' [11] in that, inevitably, it will continue to 'buttress myths' and will act as a constant reminder to historians that our job is never done.

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