A Selection from

Smithsonian at the Poles

Contributions to International Polar Year Science

Igor Krupnik, Michael A. Lang,
and Scott E. Miller
Editors

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Preserving the Origins of the Space Age: The Material Legacy of the International Geophysical Year (1957–1958) at the National Air and Space Museum

David H. DeVorkin

ABSTRACT. In July 1966, the 89th Congress (H.R. 6125) laid out the charge defining the new Smithsonian National Air and Space Museum: to " memorialize the national development of aviation and space flight; collect, preserve, and display aeronautical and space flight equipment of historical interest and significance; serve as a repository for scientific equipment and data pertaining to the development of aviation and space flight; and provide educational material for the historical study of aviation and space flight." Under this umbrella statement, the Museum has been actively collecting artifacts and documentary evidence in the area of the earth and space sciences, as well as in astronomy, that helps to preserve the social, cultural, intellectual, and material legacy of the enterprise. The paper examines the holdings pertaining to the IGY era (1957–1960) presently in the NASM collection. It discusses how some of these items were identified, selected, and collected, as a means of offering a preliminary appraisal of the historical value of the collection. It highlights a suite of objects built by James Van Allen's Iowa group and discusses their historical significance.

THE IGY

The International Geophysical Year (IGY) of 1957–1958 was conceptualized at a small dinner party in April 1950, held at the home of James A. Van Allen in Silver Spring, Maryland. As Walter Sullivan recorded at the time, and as Fae Korsmo and many others have reminded us more recently (Sullivan, 1961; Korsmo, 2007; this volume), out of this meeting grew a plan to coordinate observations relevant to the geosciences over all parts of the globe, and, for the first time, conduct significant soundings of the upper reaches of the earth's atmosphere and ionosphere. Considering that three members of the party, notably Van Allen, Lloyd Berkner, and Sydney Chapman, later to become key players in IGY, were primarily concerned with studying the ionosphere, it is not surprising that they organized the means to pursue its global characteristics using all available technologies (Needell, 2000). Their plan was aided and abetted by Cold War priorities for developing the capabilities of space flight to aid global reconnaissance, and in fact became driven by those priorities, modified in complex ways by the foreign policy and national security strategies of the major participating nations (McDougall, 1985; Bulkeley, 1991).

David DeVorkin, National Air and Space Museum, Smithsonian Institution, P.O. Box 37012, MRC 311, Washington, DC 20013-7012, USA (devorkind@si.edu). *Accepted 29 May 2008.*

Out of this complex mixture of scientific and national security priorities, both the Soviet Union and the United States announced plans to orbit artificial satellites during the IGY, and both made good on their promise, though in a manner, and especially an order, that surprised and deeply disturbed a large portion of world's media and propelled a space race between the two superpowers that fuelled the first decade of what has been called the Space Age.

A substantial historical literature exists recounting the IGY and the origins of the space age (Pisano and Lewis, 1988; Marson and Terner, 1963; McDougall, 1985) Our purpose here is not to recount this history nor to delineate the Smithsonian Institution's participation in space research, but rather to describe holdings at the National Air and Space Museum (NASM) pertaining to space flight activities during the International Geophysical Year (1957–1958). This paper discusses specifically how the Smithsonian National Air and Space Museum (NASM) has participated in preserving the material heritage of this legacy—a legacy that might be seen someday as a major factor leading to the existence of the Museum itself. We begin by situating the act of cultural preservation within the mission of the Smithsonian, and then conclude with an assessment of efforts to preserve the material legacy of the IGY.

ON MUSEUM PRESERVATION

Institutions like the NASM collect for a variety of purposes, both immediate and long term. One can only speculate about why, precisely, a material legacy will be important for our descendents, say 400 years from now; whether they are specialists in science and its history, or whether they are educated and inquisitive nonspecialists. Will they think well of us for making the effort to preserve a material legacy, one that can be "read" without the intervention of media-specific technologies? Or will they possess technologies undreamt of today for seeking out the answers to historical questions that transcend the material legacy, and regard our efforts as ultimately futile?

The mission, defined by legislation that brought the NASM into existence, claims that the Institution has a responsibility to "memorialize the national development of aviation and space flight" (U.S. House of Representatives, 1946). That is what we indeed do, and as I have argued elsewhere, the survival of a physical artifact will, in and of itself, help to stimulate questions about our times someday, and may even, conceivably, help to answer questions about our lives and times (DeVorkin, 2006a; 2006b). As more than one observer has noted recently, commenting about the significance of objects displayed in museums and the motives for the curators to put them on display; "Their presence there is the message. . . . It is still all about visibility." (Kennicott, 2007:C1)

From the beginning, NASM's charge has been to "serve as the repository for, preserve, and display aeronautical and space flight equipment and data of historical interest and significance to the progress of aviation and space flight, and provide educational material for the historical study of aviation and space flight and their technologies" (U.S. House of Representatives, 1946) Since this is a formal process with oversight, NASM curators periodically create and review collections plans that rationalize the effort. But curators are also keenly aware of the fact that they are, in some way, making choices and hence are filtering history. After all, taking the existentialist's point of view, as Oxford's Jim Bennett and others have observed from time to time "museum collections . . . show you not what there was but what was collected." (Bennett, 2004),

This statement is a simple fact of life, of means, motives, and of circumstance. Unlike the natural history disciplines, whose collections stand at the very core of their research interests, and in fact define them, forming the data banks from which they ask questions and draw conclusions, collections of space history reflect something rather different. They reflect cultural and institutional needs to preserve the material heritage of ourselves, a very recent past still very much alive in its human participants and in its institutions, and of which we are part, our contemporary national heritage. Deciding what to collect and preserve, then, involves as much issues of a symbolic nature, the need to memorialize, as it does intellectual issues relating to any disciplinary goals, past, present, or future, and so the questions historians ask about culture transcend the specimens they preserve. Collections are not comprehensive of their culture and are the result of choices, personal preferences, biases, and both political and financial limitations.

So what is it that institutions like museums do when they collect and preserve? The economic anthropologist tells us that the act of collection by institutions is a formal method of removing objects from the commodity sphere—the sphere of use, speculation, and trade—and placing them into a singularized and sacralized sphere (Kopytoff, 1986). This is definitely what we try to do at the Smithsonian and it is reflected in our Collections Rationales, our arguments over what to collect. Indeed, over the past years, some curators have repeatedly worried that if we do not maintain control of objects deemed to be of historical value coming out of the Nation's space program, relics bought and paid for by taxpayers, they will be sold as excess property and become commodities for speculation by collectors and agents. In more recent times, as our ability to collect has met serious financial, personnel, and storage limitations, this concern has diminished somewhat and there is now healthy consideration of establishing a means to distribute the responsibility of preservation. This includes establishing a "national strategy" of sharing the responsibility for preserving the heritage among many institutions. But ultimately, we generally accept the view that what it is we are doing by collecting is making this material heritage accessible to future generations in a manner that will stimulate interest and remembrance of an historical era or event.

A clear symptom of this rationale for sacralization and protection from the commodity sphere comes from a unique agreement the Smithsonian Institution maintains with NASA, the "NASA/NASM Transfer Agreement" (Agreement, 1967). This document asserts that any object on NASA's inventories that is deemed by a select committee of NASA program managers and specialists to be historic and excess to present agency needs must be offered first to the National Air and Space Museum for its collection. The NASM will then deliberate and decide upon collection. If it agrees, the object is transferred to the Smithsonian inventory. If not, it goes on the normal "excess property" listings and can be transferred to other agencies, or sold to the public. It is the existence of this agreement that gives the Space History collection at NASM its special responsibility. Even though the IGY-era collections predate the agreement, many came to the Museum as a result of its existence, well after the close of the era.

There is yet another aspect of collecting in Space History that warrants attention here that adds to its unique character and will help us evaluate our IGY-era collections. Many of the most important objects, those responsible for the actual science performed, are not available for collection and never will be. They were launched, and were either consumed through use or by re-entry, or are now in orbits that make them inaccessible. What we can collect, therefore, are surrogates for the "real thing." They may be very close in form and function, like flight backups, but they are not the actual objects that made the historic observations or performed the historic feats, such as the first soft landing on the moon, Mars, Titan, or an asteroid. There are exceptions, of course, such as the panoramic camera from *Surveyor* III that was returned to Earth by *Apollo* 12 astronauts (NASM Catalogue number I19900169001; hereafter, just the alphanumerical code will be used: "I" for incoming loan, "A" for accession). There are objects returned from Shuttle missions, as well as objects that returned to earth by design, like the particle collectors aboard *Stardust*, and interplanetary probes that were launched and might someday be captured and returned, like the third *International Sun-Earth Explorer* (ISEE-3).

In addition to its special relationship with NASA, and its unique responsibilities, NASM must still justify what it collects both internally and externally. Individuals rarely rationalize why they collect what they collect but institutions, especially public ones, must provide clear and cogent rationalizations in order to gain the support to identify, collect, and preserve. One need only consider the large costs involved in collection and preservation, and the long-term commitment an institution or a culture is willing to make in supporting such efforts. Thus, given this mandate, and limitations, how representative is "what was collected" to "what there was"?

THE TIME BOUNDARIES OF THE IGY LEGACY

The legacy of the International Geophysical Year (IGY) of 1957–1958 predates NASA, of course, though many of the objects that one can describe as belonging to the IGY era came from NASA, which inherited the legacy upon its formation in August 1958 and retained much of it for years at its visitor centers and in storage. We can roughly limit the IGY-era legacy in space by establishing its beginning as the material legacy growing out of planning for the IGY since the early 1950s (see Korsmo, this volume), to the launch of *Explorer VII* in October 1959, *Vanguard III* in September 1959, and two *Discoverer* launches (VII and VIII) through 20 November 1959 (Green and Lomask, 1970). *Explorer VII* was the last Army Ballistic Missile Agency (ABMA) satellite and was transferred to NASA. It represents the end of the legacy started by *Sputnik* 1 and *Explorer* 1 and the IGY context, even though transfer of all programs to NASA took place with NASA's creation in the fall of 1958 via the National Aeronautics and Space Act. The major American programs linked to the IGY era include *Vanguard* (I–III), *Explorer* (I–VII), *Pioneer* (I–IV), and the military programs known as Project *SCORE* and *Discoverer* (I–VIII). Russian programs included *Sputnik* (I–III) and *Luna* (I–III).

THE NASM COLLECTION

More than 200 objects in the national collection can be associated with IGY-era space-related activities. These reside in several NASM sub-collections, including rocketry and propulsion, the space sciences, memorabilia, international, and social and cultural collections. There are partial-scale and full-scale models, replicas, engineering models, components, medals, badges, and ephemera (collectibles). In this review, we consider only the artifact collections, not flat materials in our library and archives, including monographs, serials, technical publications, print and film resources, as well as extensive manuscript collections or oral histories (see http://www.siris.si.edu/ and http://www.nasm.si.edu/research/arch/collections.cfm).

IGY-Related Collections: Preparing for the IGY

In addition to numerous examples of early sounding rocket payloads for both atmospheric and space research—such as ultraviolet spectrographs, X-ray detectors, magnetometers, varieties of halogen quenched particle flux counters, mass spectrometers, temperature and pressure sensors, and cameras built for V-2, Viking, Aerobee and ARCAS flights from the late 1940s through the 1950s—the NASM collection preserves objects intended specifically for use during the IGY, such as a visual Project Moonwatch telescope (A19860036000) (Figure 1) and the first Baker-Nunn satellite tracking camera (A19840406000) mounted in Arizona. The most curious object, symbolic of the aspirations of S. Fred Singer, one of the original members of the group that conceived the IGY, is MOUSE (Minimal Orbital Unmanned Satellite, Earth), a full-scale design concept model for an artificial satellite (A19731670000). It carries two Geiger counters for cosmic-ray studies, photocells, telemetry electronics, and a rudimentary magnetic data storage element (Figure 2). The rocketry collection has examples of small sounding rockets derived from barrage ordnance technology, such as the Loki-Dart (A19750183000; 0184000), and various combinations that were used in the 1950s for atmospheric measurements and as payloads under Skyhook balloons for extreme high-altitude soundings by the University of Iowa and by the Navy.

FIGURE 1. Project Moonwatch telescope (A19860036000), preserved and on display at the NASM's Hazy Center. Amateurs and commercial organizations alike built thousands of instruments of this type; they exist in many forms. The Smithsonian Astrophysical Observatory created and coordinated the Moonwatch program to produce preliminary orbital elements of the first satellites. (NASM photograph)

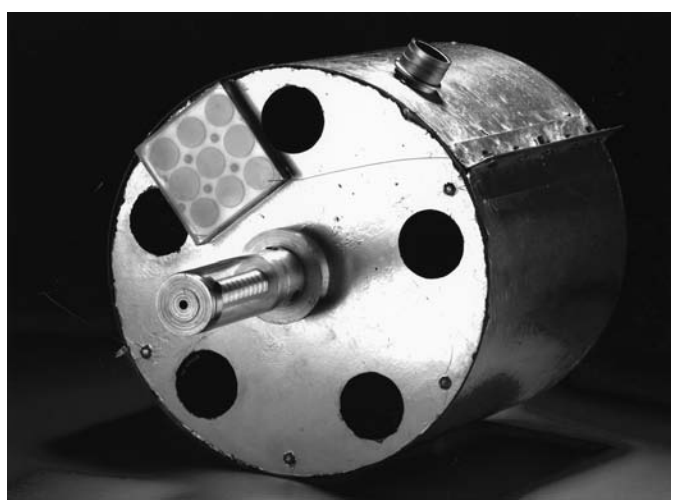

FIGURE 2. S. Fred Singer's full-scale concept model for an artificial satellite (A19731670000). (Eric Long photograph, NASM)

IGY-Related Collections: *Sputnik*

In addition to one of the first full-scale models of *Sputnik* 1 on loan to the Smithsonian from the Soviet Union/Russia (I19900388002), as well as the original electrical arming pin removed from the flight unit just before launch (I19971143001), the Museum holds six objects relating to the flight, all in the collectible category and ranging from a cigarette lighter and commemorative pin to medals and a music box. There are no holdings relating to, or informing, the technical characteristics of any of the early

Sputniks. There is nothing in the collection pertaining to Project *Luna*.

IGY-Related Collections: Project Vanguard

The NASM collection has seven objects identified as Vanguard 1 backup models, test models, replicas, and display models (A19580115000 through A19830244000). Among these is the original test vehicle TV-3 (Figure 3), which was recovered after the launch vehicle crashed onto the launchpad on 6 December 1957 (A19761857000). The object was acquired from John P. Hagen (1908–1990), the former Project Vanguard manager, in the spring of 1971 and placed on exhibit in the Smithsonian's Arts & Industries Building. After NASM opened in July 1976, visitors encountered it in the outstretched hand of an unhappy and concerned 12-foot tall "Uncle Sam." It now resides in a case near the Museum's Vanguard rocket, a TV-2BU (Figure 4, center) that had been prepared for launch by the Martin Company on 3 September 1957 but was delayed and then cancelled. Vanguard 1 was launched on a near duplicate rocket; the markings on the NASM version were changed to be identical to those of the flight vehicle by the Naval Research Laboratory, which then donated the rocket to the Smithsonian Institution in 1958 (A19580114000). There are also three elements of various stages of the

FIGURE 3. Examination of the original TV-3 satellite in March 2008, by members of the Naval Research Lab team who designed and built it, on the eve of the fiftieth anniversary of the first successful Vanguard flight. The object was opened to allow inspection for identification of components, search for undocumented experiments, and to assess its state of preservation. Martin Votaw, left, Roger Easton, right. (Photograph courtesy Judith Pargamin)

FIGURE 4. Vanguard launch vehicle TV-2BU on display at NASM in the "Missile Pit." (NASM photograph by Eric Long)

Vanguard propulsion system in the collection, as well as a set of 18 electrical and electronic radio instruments used in a Vanguard Minitrack station (A19761036000). There is one instrumented replica of the Vanguard Lyman Alpha satellite, also called SLV-1, that failed to orbit in May 1958, and two versions of Vanguard III, including Vanguard 3, also called Magne-Ray Satellite, and finally the Vanguard Magnetometer satellite that did fly, designated SLV-5 or Vanguard 3a (A19751413000; 1407000; 1412000). It was placed in orbit in December 1959 and was equipped with two X-ray detectors and micrometeoroid detectors.

The instrumented Vanguards do preserve many of the technical parameters of the early flight objects. They were built generally by the same people, using the same jigs and materials, which produced the flight objects at the Naval Research Laboratory. Some of the craft have Lyman alpha and X-ray detectors identical to, or very similar to those used by NRL scientists in sounding rocket flights throughout the 1950s (DeVorkin, 1996).

IGY-Related Collections: Explorer

There are more than two dozen objects in the collection relating to some form of Explorer satellite between Explorers I through VII, and dozens more UV and X-Ray detectors identical to those flown by groups at NRL, Iowa and elsewhere. This collection contains objects with a high degree of historical accuracy and significance, and preserves some of the most detailed technical characteristics of the first flight objects. Of great historical significance is a suite of objects recently acquired from George H. Ludwig, one of James Van Allen's graduate students at the time the Iowa group became engaged in preparing for the first Explorers. The primary object Dr. Ludwig donated was built as an engineering model for the payload for the first fully instrumented Vanguard flight (Figure 5), and then became the template for the redesign effort at the Jet Propulsion Laboratory after Army Ordnance was given the green light to proceed with a launch after the failure of the Vanguard TV-3 launch (A20060086000). As both Van Allen and Ludwig have noted in various recollections (Van Allen, 1983:55–57), the package was designed for a 20-inch Vanguard sphere but was within parameters easily adaptable to a 6-inch diameter cylindrical chamber compatible with the dimensions of the scaled-down Sergeant solid rocket of the sort that ABMA had been placing on Jupiter test flights. So when a flight on a Jupiter-C became possible in the wake of the Vanguard failure, and after Von Braun promised Eisenhower that the Army could orbit something useful within 90 days, Ludwig packed his bags and his family and brought their Vanguard payload to JPL for modification into what would be called at first "Deal 1." The object in the collection includes electronic and mechanical elements of the initial "Deal" payloads designed and built by the University of Iowa. In addition, Ludwig donated versions of the separate electronic components before they would have been "potted" or electronically sealed for flight. All of these components had been in Ludwig's possession since they were built in the late 1950s, with the exception of short intervals when the components were at JPL under his care. Their provenance, in other words, is unquestioned, and he has provided extensive documentation attesting to their historical role in the early Explorer series.

Possibly the most significant corrective to our documentation of IGY-era artifacts in the NASM collection came as a result of Ludwig's assistance. In 1961, the Jet Propulsion Laboratory transferred what it claimed was a fully instrumented flight spare of Explorer 1 to the Smithsonian Institution (A19620034000). Attached to an empty fourth-stage Sergeant rocket, it was initially displayed in the Smithsonian's Arts & Industries building to symbolize the United States' first successful artificial satellite. It became a centerpiece of the NASM Milestones gallery upon opening in 1976, having toured briefly just before the opening (Figure 6). In 2005, acting upon an inquiry from Ludwig (2005a), who was then searching out all surviving cosmic-ray Geiger counter detectors inventoried in Van Allen's Iowa laboratory that supplied the first Explorers, the Collections Management staff of NASM, led by Karl Heinzel, removed the object from display for dismantling (Figure 7), conservation evaluation, and inspection. It was empty (Figure 8).

Naturally, we reported this fact back to Ludwig, after taking detailed photographs of the interior instrument frame, wiring and markings. The micrometeoroid detector was in place, wrapped around the external shell, but not any of the associated electronics. Nothing from the cosmic ray package survived. But there were clear markings that at one time, the instrument frame had held "Payload II" as those words appeared in red (Figure 8). Ludwig's highly detailed documentary record showed, immediately, that this was indeed the flight backup for "Deal 1" that was sent back to Van Allen's Iowa laboratory for inspection and testing, and then was returned to JPL later in 1958. The

FIGURE 5. George Ludwig examining his engineering model for the payload for the first fully instrumented Vanguard flight and became the template for the Explorer 1 payload. (NASM photograph by Dave DeVorkin)

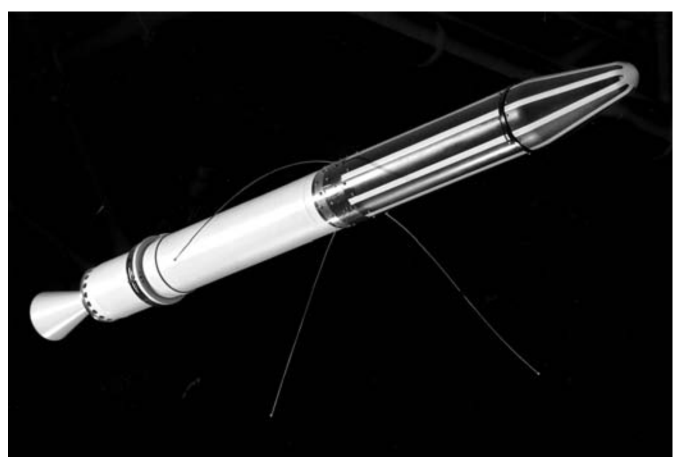

FIGURE 6. Explorer 1 (A19620034000), initially displayed in the Smithsonian's Arts & Industries building, became a centerpiece in NASM's Milestones gallery upon opening in 1976. Opening it for inspection revealed it was a true backup but was devoid of instrumentation. (NASM photograph)

FIGURE 7. Inspection and conservation evaluation of Explorer 1 (A19620034000) by Matthew Nazarro, specialist at the NASM's Paul E. Garber Restoration Facility. (NASM photograph)

cosmic-ray package donated by Ludwig in 2006 was indeed the Vanguard payload that served as template for the flight version of Deal 1. Ludwig is not absolutely positive that his donated package was originally inside the spacecraft we display today in Milestones, but it is identical in nature (Ludwig, 1959, 1960, 2005).

IGY-Related Collections: Pioneer

Van Allen's group was also engaged to instrument a series of Pioneer flights under Air Force auspices that were aimed at the moon. Although not successful in this goal, three of them managed to detect the complete inner and outer structures of the Earth's radiation belts, as well as confirm the profound influence that solar activity has on the Earth's radiation environment. The first Pioneer reached 70,000 miles altitude, less than a third the distance to the Moon, but failed to achieve either orbital or escape velocity and so re-entered the earth's atmosphere and was destroyed. The Pioneer 1 replica in the collection was reconstructed out of original parts that failed to meet flight specifications (A19640665000). Two examples of the smaller Pioneer IV are also in the collection. One is a cutaway model showing the instrumentation and housekeeping elements, and the other is a fully instrumented flight spare (A19751426000; A19620018000).

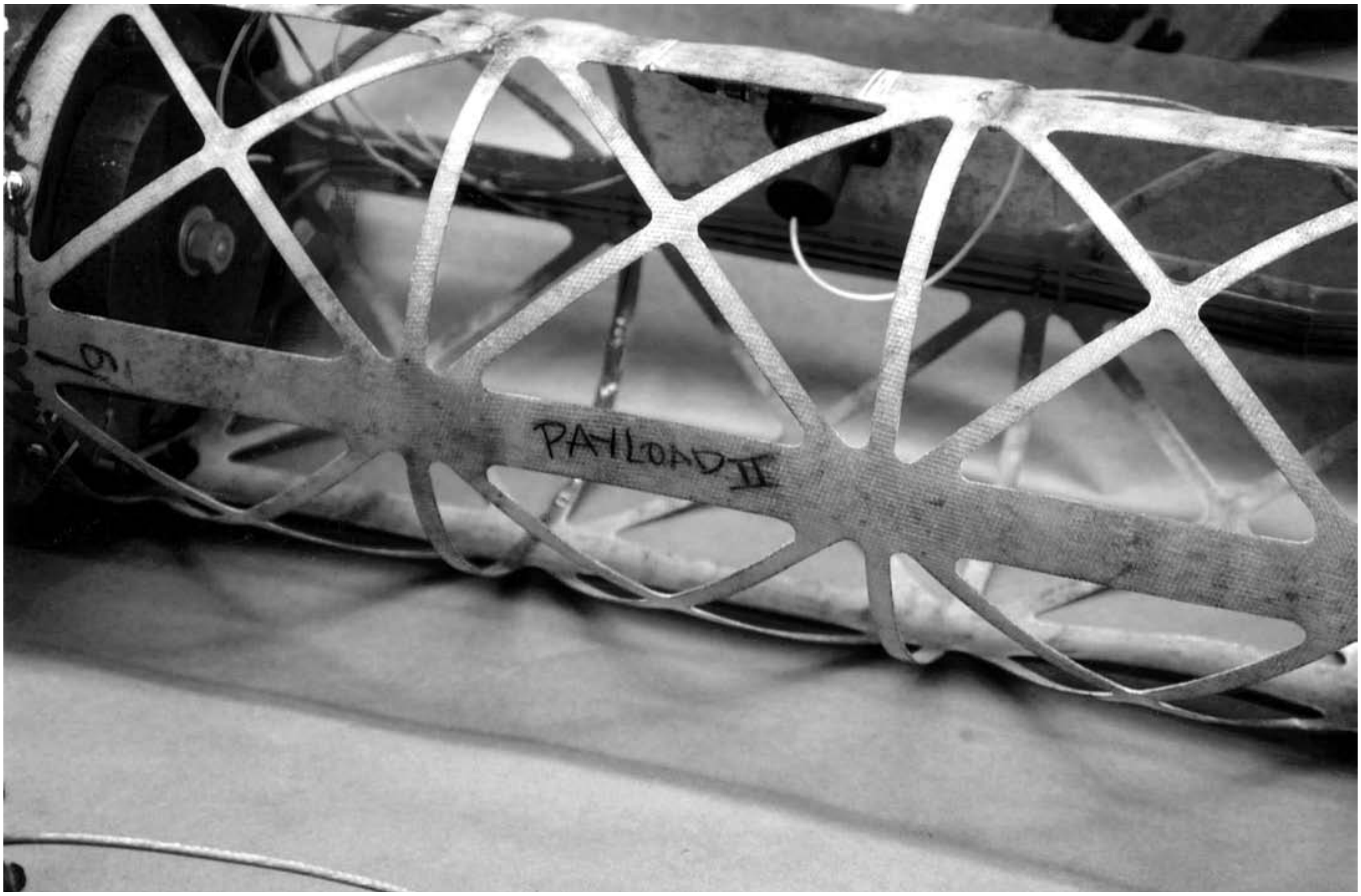

FIGURE 8. Inspection revealed that Explorer 1 (A19620034000) was empty but that at one time, the instrument frame had held "Payload II." (NASM photograph.)

IGY-Related Collections: Launch Vehicles and Support Equipment

The NASM Collection boasts probably the strongest collection of IGY-era launch vehicles in the world. As noted above, a full and virtually complete multi-stage Vanguard TV-2BU is preserved, as well as examples of turbo-pumps and engines. In addition, the precursors to its various stages are in the collection, including a full-scale Viking rocket that was prepared for display in the early 1950s using real components from the Glenn L. Martin Company and Reaction Motors inventories. A Jupiter-C missile, donated by the Army in 1959, dominates NASM's "Missile Pit" (Figure 4, left) and is capped by a complete array of scaled-down Sergeant rockets in a configuration identical to that used for the launch of Explorer 1 (A19590068000).

Numerous Aerobee and Aerobee-Hi components, along with a complete unit, document the most prolific sounding rocket in history. The collection also contains many smaller solid rockets, most with tactical air-to-ground and ground-to-air origins, and even one example of the multistage *Farside,* a gigantic balloon-launched rocket system created for the Air Force Office of Scientific Research for extreme high-altitude non-orbital flights in the fall of 1957 (A19680013000).

Although there are several Loki-based multistage systems in the collection, we lack a fully articulated "Rockoon" system consisting of a Skyhook-balloon, connecting hardware, radio telemetry control, and a small solid-fuelled rocket, such as a Loki or Loki-Dart. These systems, in the hands of James Van Allen's Iowa team, as well as various NRL groups, carried cosmic-ray detector payloads to high altitudes at a wide range of geographic latitudes during the IGY.

IGY-Related Collections: Individuals

There is little question today that the one name that will survive from the IGY in historical accounts written in future centuries will be James Van Allen. From a cursory analysis of newspaper coverage of the IGY era based upon a Proquest survey conducted by Sam Zeitlin, 2007 NASM Summer intern, Van Allen's name stands out above all others as most frequently cited or referred to. A significant region of space surrounding the earth has been named for him, the "Van Allen belts," a term which at this writing garners more than 78,000 "hits" in a simple Google search. So it is reasonable to ask: What have we done to preserve the material legacy of James Van Allen at NASM?

Van Allen was a Regents' Fellow at the Smithsonian in 1981, spending much of the academic year preparing a personal scientific memoir and submitting himself to some 18+ hours of oral history interviews by NASM curators and historians (SAOHP, NASM Archives). He also participated in several symposia and seminars (Hanle and Von del Chamberlain, 1981; Mack and DeVorkin, 1982; Van Allen, 1983). He was then planning for the organization of his papers at Iowa, where they would be housed, and engaged NASM staff in an advisory capacity to appraise the collection. Out of this intimate contact, Van Allen eventually donated a small selection of objects that both informs and symbolizes his career. In the early 1990s, he donated a casing from a World War II–era Mark 58 radio proximity fuze for antiaircraft artillery fire control (Figure 9). The fuze had been partly cut open to display the microelectronic components (A19940233000). He was part of the wartime effort to design, test, and build these fuzes,

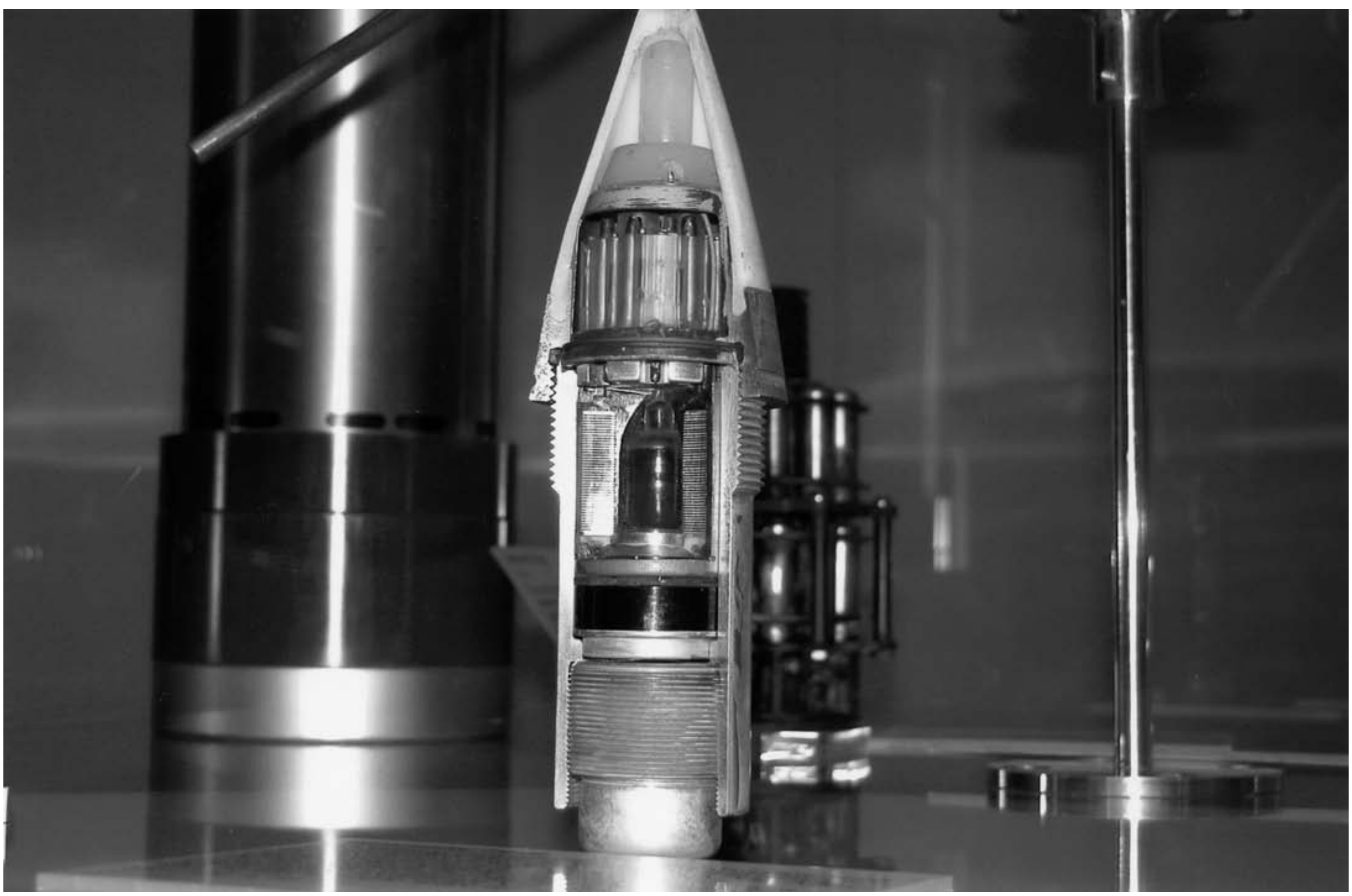

FIGURE 9. World War II–era Mark 58 radio proximity fuze for anti-aircraft artillery fire control designed by the Applied Physics Laboratory group that included Van Allen. (NASM photograph)

and Van Allen played a significant role in bringing them into operation through tours with the fleet in the Pacific. The experience and expertise he gained managing his portion of this program served him well after the war when he devoted much of his energies to building delicate and complex arrays of Geiger counters for rocket flights aboard captured German V-2 missiles, then Aerobees, and especially the innovative balloon-launched Loki-Dart systems (Figure 10) he developed at Iowa that subjected payloads to huge accelerations and confined quarters reminiscent of the fuze-equipped 5-inch shells (Figure 9). He also donated a complete flight backup payload for Explorer IV; the first payload designed with knowledge of the existence of the trapped radiation field, and thereby employed new Anton detectors that had smaller cross sections, as well as two small scintillation detectors. Van Allen also asked his Iowa staff to refurbish a plaque bearing a gold-plated flight-spare tape recorder that commemorated the flight of Explorer III, the first to be able to record and ultimately transmit a continuous record of the radiation fields it was encountering, and the first to show unambiguously the presence of the inner regions of trapped radiation.

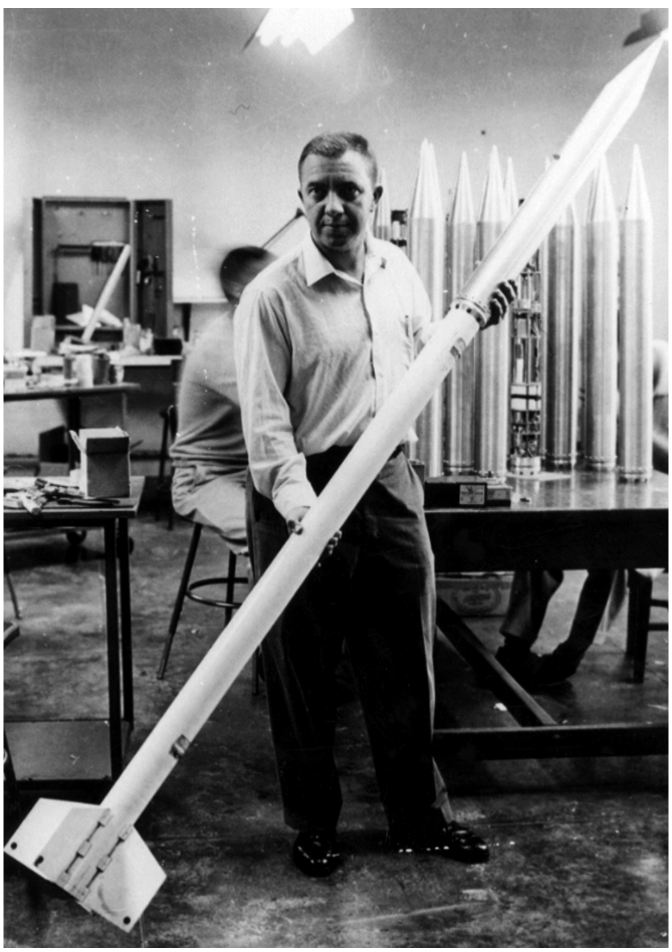

FIGURE 10. James Van Allen holding a balloon-launched Loki-Dart payload developed at Iowa. (James A. Van Allen Papers, The University of Iowa Libraries, Iowa City, Iowa; c. 1950s)

Some 17 objects in the collection preserve the character of the Explorer 1–4 series and Van Allen's contribution. Among them is a flight spare radio transmitter for Explorer 1, donated by Henry L. Richter, former head of the JPL group that built these units. Richter found that JPL had discarded this unit some years later, and saved it from oblivion. But the surviving mercury-cell batteries in the unit had seriously corroded the overall structure, so Richter removed the corrosive elements, fully documented the process he took to neutralize and restore the structure, and donated the object to the museum in 1997 (A19980115000).

Van Allen is not the only pioneer space scientist to be represented in the collection. Objects relating to the efforts of two groups at the Naval Research Laboratory headed by Richard Tousey and Herbert Friedman, over the period starting with V-2 flights and lasting through the 1960s and 1970s, have also been preserved and are on display (DeVorkin, 1992; 1996).

GENERAL OBSERVATIONS

It should be evident from this brief reconnaissance of IGY-era objects in the NASM collection that, even though our holdings may be impressive, they are not the result of a single rational process or any consistent, premeditated program to preserve IGY history. Some of the objects exist because they were part of the developmental process leading to the flight instrument. Others are replicas or facsimiles created to symbolize the historic event (Figure 11). Most were collected with little or no apparent priority given to engineering, scientific or symbolic value, though they had to possess at least one of those qualities. Some objects came to us serendipitously, some due to our intrinsic visibility and centrality to national preservation. Some were collected as the result of judicious inquiry, but not to the extent of specifically collecting the IGY era.

There were, however, some consistently applied schemes. For instance, we planned out a collection documenting 30 years of electronic ultraviolet and X-ray detector development by Herbert Friedman's group at the Naval Research Laboratory (1949–1980s); there was a similar program tracing the evolution of ultraviolet detectors for solar research

FIGURE 11. Inspection of a replica of Vanguard 1 that had been modified to hold a solar powered audio system for demonstrating the "beeping." (NASM photograph)

with rockets over the same period by members of Richard Tousey's NRL group, and the efforts of similar teams were devoted to aeronomy and ionospheric physics in the 1950s at NRL, the Applied Physics Laboratory, at the University of Colorado, at the Air Force Cambridge Research laboratory, and elsewhere (DeVorkin, 1992; 1996; Hirsh, 1983; Schorzman, 1993). Collections arising from these efforts produced a large set of oral and video-histories, as well as a considerable cache of non-record archival material, all a result of our search for representative artifacts documenting the origins of the space sciences in the United States. Many of them bordered on IGY interests and activities, but did not center on them.

Even so, our collection does reflect the enormous excitement and public impact of the first years of the Space Age. We do meet the goal of memorialization, for instance, because at any one time our collections of multiple examples of Explorer 1 and Vanguard 1 spacecraft replicas are on loan to museums across the United States, in Europe, Asia, and Australia. More than a dozen examples of IGY-era artifacts are presently on display at NASM, as well as the new NASM facility at Dulles, the Udvar Hazy Center.

So as we ask questions about the IGY during this season of commemoration, at the beginning of the new International Polar Year 2007–2008, I hope we will continue to ask how well our collections inform the historical actors, events, episodes and eras that made up the IGY. Where did the expertise come from that allowed our nation to respond to *Sputnik* and that framed the character of that response? What sorts of technologies were bought to bear? And what was the nature of the infrastructure created to facilitate space-borne research? If our present commemoration efforts do not adequately answer these sorts of questions, hopefully future historians will succeed in the effort, asking questions stimulated in part by our material legacy.

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