United States General Accounting Office

GAO

Report to the Honorable
Kay Bailey Hutchison, U.S. Senate

October 1995

SMITHSONIAN INSTITUTION

Better Care Needed for National Air and Space Museum Aircraft

GAO/GGD-96-9

GAO

United States
General Accounting Office
Washington, D.C. 20548

General Government Division

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October 19, 1995

The Honorable Kay Bailey Hutchison
United States Senate

Dear Senator Hutchison:

This report is in response to your request that we review matters relating to aircraft restoration at the Smithsonian Institution's National Air and Space Museum (NASM). Your request was made on behalf of constituents who were concerned that NASM is not restoring a sufficient number of historic aircraft in its collection.

Copies of this report will be distributed to the Secretary of the Smithsonian, the Acting NASM Director, and cognizant congressional committees. Copies will also be made available to others upon request.

Major contributors to this report are John Baldwin, Sr., Assistant Director, and Robert Homan, Evaluator-in-Charge.

If you have any questions about this report, please call me on (202) 512-8387.

Sincerely yours,

J. William Gadsby
Director, Government Business
Operations Issues

Executive Summary

Purpose

The National Air and Space Museum (NASM), located on the Mall in Washington, D.C., has attracted an average of nine million visitors per year since its opening in 1976. In December 1994, Senator Kay Bailey Hutchison was contacted by an historic aircraft organization, which believed that NASM was not properly managed and in particular was not restoring a sufficient number of aircraft, thereby allowing its collection to deteriorate. GAO was asked to assess the rate of aircraft restoration; examine the adequacy of facilities for preserving aircraft; and if preservation problems exist, identify options to better care for the aircraft collection.

Background

In 1946, Congress passed legislation that the Smithsonian Institution establish a separate air museum, which became the National Air Museum. In 1966, Congress changed the name of the National Air Museum to NASM and granted the Smithsonian the same functions with respect to space objects as it had previously granted the Smithsonian for aviation objects. Congress indicated that NASM should "memorialize the national development of aviation and space flight." The museum was designed to display to the public notable exhibits comprising the nation's air and space collection, including historic and scientific aviation "firsts" such as the original Wright Brothers flyer, Charles Lindbergh's "Spirit of St. Louis," and the first manned spacecraft.

NASM's aircraft collection now consists of 344 aircraft; 210 of which are stored at its Paul E. Garber Preservation, Restoration, and Storage Facility in Suitland, MD; 62 that are on display at the Mall museum; 58 that are on loan to other museums; and another 14 that are stored at three other locations.

Since the mid-1980s, NASM has planned to build a museum extension at Dulles International Airport, VA, to provide additional exhibit space and to replace existing substandard storage and restoration facilities. The planned extension is currently expected to cost about $162 million. The Smithsonian estimates it will have to raise $100 million in private money to supplement funds pledged by Virginia. NASM recently began formulating a financing plan for the extension.

The museum has received considerable media and congressional attention recently, with its proposed exhibit of the "Enola Gay," the plane that dropped the atomic bomb on Hiroshima, Japan. In January 1995, 81 Members of Congress demanded the NASM Director's resignation, protesting NASM's proposed interpretation that would have accompanied

the exhibit. Citing the controversy involving the exhibit, NASM's former Director resigned in May 1995.

Results in Brief

Although the NASM on the Mall is popular with the public and has preserved many of our nation's historic air and space artifacts, management of the aircraft collection at other locations that are not generally seen by the public needs improvement. NASM commits relatively few resources to aircraft restoration, compared to other museum activities and another federally funded air museum. But, even if NASM were to increase its restoration efforts, the museum would not have adequate space to properly display or store the aircraft. Therefore, it is important for NASM to determine how to better preserve its collection in view of the limited financial resources available for aircraft restoration and storage, including determining what size collection can be adequately supported.

Since NASM was established, certain aspects of the museum's mission as a national air and space museum have been vague. For example, the legislation that created NASM does not specify whether the museum should duplicate collections at other federally funded air and space museums or whether a national museum should include foreign aircraft. Once NASM's mission is clarified, NASM would be better able to develop criteria for what constitutes historically and technologically significant aircraft and, in the context of such criteria, consider which aircraft it should have in its collection to fulfill its mission, considering available museum resources and the adequacy of storage facilities.

If it is determined that NASM's current collection is too large in view of the resources and facilities available, options to reduce the collection size so that the collection can be stored or displayed in space with adequate environmental controls include deaccessioning[1] aircraft and obtaining second-party restorations by making temporary loans to other museums. Using more second-party restorations would help preserve NASM's collection, alleviate its storage capacity problems, and help share its collection with the public.

The planned extension at Dulles Airport could help alleviate NASM's storage facility problems, but funding is uncertain and the extension may take several years to complete. One option that may be available to reduce costs in the short term, while NASM seeks funds for the entire extension, would be to limit the new space to the same size as current storage

[1]An object is "deaccessioned" when it is removed from a museum's collection.

facilities. If feasible, this would help NASM expedite plans to replace its deteriorating storage facilities with new storage and restoration space at Dulles with proper environmental controls.

In addition to storing aircraft in substandard space, NASM does not have a management plan for each aircraft that describes (1) whether and how the aircraft will be used in future exhibits, (2) to what extent and when it will be restored, and (3) who is responsible for monitoring its condition.

Collections management staff said that they feel disenfranchised from the Mall museum, citing management's emphasis on research and exhibits.

Principal Findings

Relatively Few Resources Devoted to Aircraft Restoration

In fiscal year 1994, NASM devoted about $2.7 million to collections management, including restoration, or 14 percent of its total expenditures of about $20 million. This excludes time spent by curators on collections management, which Smithsonian officials said was not tracked or reported. NASM currently employs a restoration staff of 12 individuals, which represents 4 percent of its total staff of 288, excluding the security force. The Air Force Museum in Dayton, OH, another federally funded air and space museum, employs 20 restorers out of a total staff of 90, or 22 percent of its total staff.[2]

In the past 5 years, NASM completed seven restoration projects, while continuing the restoration of four other projects, at a cost of about $1.4 million. These 11 projects included 3 U.S. aircraft and 8 foreign aircraft. Assuming that current staff levels remain constant, the restoration staff continue to spend half of their time on other work, and no additional aircraft needing work were added to the collection, GAO estimated that it would take about 100 years to restore aircraft that need work.

NASM's collections management staff at the Garber facility said that since so much attention is placed on exhibits and research, they feel disenfranchised from the museum on Washington's Mall. Their chief concerns were that (1) aircraft restoration is given a relatively low priority; (2) too much of their time is spent on tasks other than restoration;

[2]The ratio of restorers to total staff at NASM and the Air Force Museum may not be directly comparable because of differences in the museums' funding, number of visitors, condition of aircraft, and other factors.

(3) additional restoration work on aircraft is required because the collection has not been properly maintained; (4) NASM's management does not have adequate backgrounds in museums, aircraft, or spacecraft; and (5) little interaction occurs between restoration staff and NASM curators. (See p. 22 for a detailed list of these concerns along with management's responses.) While these concerns were not the focus of GAO's review, some of them could be explained by communications problems and different perspectives from management. GAO also noted that many of the concerns have persisted for years without being resolved. NASM managers, including the former director,[3] said that exhibits do not take away funds from aircraft restoration because exhibits generally are privately funded. Managers also said that they have tried to obtain increased funding for collections management but have not been successful. In commenting on a draft of this report, Smithsonian officials said that feelings of disenfranchisement on the part of the collections management staff resulted from a number of factors, most notably resource-related matters.

Storage Facilities Do Not Provide Adequate Preservation

Even if NASM were to devote more resources to restoration, the museum does not have adequate storage facilities to protect aircraft and related artifacts from deterioration. A NASM conservation assessment undertaken from 1991 to 1994 examined the condition of 13 storage buildings at the Garber facility and the condition of the artifacts. The assessment indicated that the buildings had wide temperature fluctuations, leaky roofs, structural problems, and dirt and dust accumulation. The aircraft and other artifacts were deteriorating as a result.

The Smithsonian spent $9.1 million in the past 10 years to improve the Garber facility, and Smithsonian officials said that the facility needs at least an additional $7.4 million in repairs over the next 5 years.[4] However, Smithsonian officials responsible for maintaining and repairing all museum facilities said that it is unlikely that NASM will receive the needed repair funds because it must compete with other Smithsonian facilities for scarce repair funds. NASM also has a $33.8 million backlog of deferred maintenance and repair at the museum on the Mall.

GAO identified two options to partially address this concern. NASM could decrease the size of its collection by deaccessioning items with less historical and technological significance and could undertake

[3]NASM's former director resigned on May 2, 1995.

[4]The Smithsonian estimates that 35 percent of these improvements were made for NASM's share of the Garber facility, which is also used by other Smithsonian museums.

second-party restoration loans. Second-party restoration loans involve loaning NASM aircraft to other museums for display over a temporary period, such as 10 years, in exchange for having them restored to NASM standards. Although NASM deaccessioned 11 aircraft in the past 5 years, it has not made the difficult decisions on what aircraft could be removed from the collection or developed a strategy to find additional museums that might be interested in restoration loans.

NASM's Future Plans Are Uncertain

NASM has relied on a planned 670,000 square-foot extension facility at Dulles Airport to replace the Garber facility and allow for the acquisition of aircraft that cannot be transferred to the Mall museum as the solution to its storage problems. However, it is unclear when or whether the extension will be built, given the uncertainty surrounding the museum's ability to raise at least $100 million in private funds needed for its construction.

Recommendations

GAO is recommending that the new NASM Director and Secretary of the Smithsonian Institution consult with Congress to better define the mission of NASM. Once that has been done, the new NASM Director and the Secretary should determine the relative priority of the aircraft in the NASM collection and the number and types of aircraft that can be adequately supported. If the size of the collection needs to be reduced, NASM should consider accomplishing that through more emphasis on deaccessioning and loaning out aircraft. For those aircraft that remain in the collection, GAO is recommending that NASM develop a management plan for each aircraft, which includes (1) whether and how the aircraft will be used in future exhibits, (2) to what extent it will be restored and when, and (3) who will be responsible for monitoring its condition. GAO is also recommending that NASM develop a plan to increase the interaction of the collections management staff and the curators. In addition, GAO is recommending that NASM further explore private funding alternatives and the feasibility of options to better care for the current collection, such as constructing an initial phase of the Dulles Airport extension facility.

Agency Comments

GAO requested comments on a draft of this report from the Secretary of the Smithsonian or his designee. The Under Secretary provided written comments, which are discussed in chapter 5.

The Smithsonian recognized a number of issues raised in this report and said it is working to address them. The Smithsonian said that the greatest challenges are the lack of adequate storage space and inadequate resources to do all of the things that must be done. The Smithsonian disagreed with some of GAO's findings and indirectly disagreed with some of GAO's proposed solutions to the collections care problems. As discussed in chapter 5, GAO evaluated the Smithsonian's comments and clarified its findings where appropriate but still believes its recommendations would help solve NASM's resource problems and help ensure that the NASM aircraft collection is better cared for.

Contents

Abbreviations

AMARC	Aircraft Maintenance and Regeneration Center
CEPS	Center for Earth and Planetary Studies
DOD	Department of Defense
NAPA	National Academy of Public Administration
NASM	National Air and Space Museum
NMAH	National Museum of American History
OMB	Office of Management and Budget

Introduction

Background

Since its opening in 1976, the Smithsonian Institution's National Air and Space Museum (NASM), located on the Mall in Washington, D.C., has attracted an average of nine million visitors per year. It received the most visitors in 1984, with 14.4 million. The museum had 8.2 million visitors in 1993 and 8.5 million visitors in 1994.

Since 1976, 106 aircraft have been on display at the Mall museum. Of NASM's 344 aircraft, 62 are currently on display at the Mall museum and seen by millions of visitors to the museum. Of the remaining 282 aircraft, 210 are stored at the Paul E. Garber Preservation, Restoration, and Storage Facility, Suitland, MD;[1] 58 are on loan to and exhibited by other museums;[2] 12 are stored at Dulles International Airport, VA; 1 is stored at the Department of Defense's (DOD) Aircraft Maintenance and Regeneration Center (AMARC), Tucson, AZ;[3] and 1 is at Andrews Air Force Base, MD. NASM estimates that 245 of the 344 aircraft are exhibitable, 55 need minor work to become exhibitable, and 44 need major restoration work. Since the early 1980s, NASM has planned to build an extension facility at Dulles International Airport to replace the Garber facility and to display large aircraft that cannot be shown at the Mall museum.

The Smithsonian's earliest acquisition of aviation artifacts was made in 1876, when it received kites from the Imperial Chinese government to celebrate the American Centennial celebration. In 1905, the Smithsonian acquired its first flying machine, Langley Aerodrome No. 5, a model aircraft that made the first successful flight of any unmanned, engine-driven aircraft. Several other aircraft were added to the Smithsonian's collection before World War I, including the 1909 Wright Military Flyer, the world's first military airplane.

In the decade after World War I, the Smithsonian acquired several World War I aircraft. Paul E. Garber, a Smithsonian employee with an interest in airplanes who joined the Smithsonian in 1920, arranged for the Smithsonian to acquire the "Spirit of St. Louis" in 1928, a year after Charles Lindbergh's historic solo flight across the Atlantic Ocean. During the 1930s, the Smithsonian added many historic aircraft to its collection, which was housed in a small metal building behind the Smithsonian's Arts and Industries Building in Washington, D.C.

[1]NASM also has on display 68 aircraft at the Garber Facility, which received about 18,000 visitors last year.

[2]Three additional aircraft are pending shipment from Garber for loan to other museums.

[3]NASM also has a Boeing 707 fuselage and a Convair C-131E at AMARC, which have not been entered as part of the collection but were acquired for parts.

In 1946, Congress passed legislation that the Smithsonian establish a separate air museum, which became the National Air Museum.

Mr. Garber also obtained many of the Smithsonian's World War II aircraft from a collection assembled by Army Air Force General Hap Arnold, who believed that it was in the national interest to obtain one example of each type of World War II aircraft, including captured enemy aircraft. After World War II, most of these aircraft were stored in an automobile factory building in Park Ridge, IL, until the government sought to reactivate the factory for the Korean War in 1950. That collection subsequently was divided between the Smithsonian and the Air Force. The Smithsonian's then newly organized National Air Museum acquired its share of the collection, which was moved to a 21-acre tract of federally owned land, located by Mr. Garber, in Suitland, MD, about 7 miles from Washington, D.C. The aircraft were mainly stored outside at Suitland from the early 1950s until they were moved into temporary storage buildings that were constructed primarily in the 1950s, 1960s, and early 1970s.

In 1966, Congress changed the name of the National Air Museum to the National Air and Space Museum and granted the Smithsonian the same functions with respect to space objects as it had previously granted the Smithsonian for aviation objects. Congress indicated that NASM should

> "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."[4]

According to the legislative history, the museum was designed to display to the public notable exhibits comprising the nation's air and space collection, including historic and scientific "firsts" such as the original Wright Brothers flyer, the first to fly at Kitty Hawk in 1903; Charles Lindbergh's "Spirit of St. Louis," the first solo across the Atlantic Ocean in 1927; the first Earth satellites; and Alan Shepard's Freedom 7 and John Glenn's Friendship 7, the first manned spacecraft in the Mercury program. Testifying before Congress in 1964, the Director of the National Air Museum said that the museum ". . . cannot accept one of each airplane and

[4]P.L. 89-509.

launch vehicle. We accept only those of great historical significance."[5] The congressional report accompanying the authorizing legislation emphasized that NASM would make possible for the first time a comprehensive presentation to the public of the notable exhibits comprising the nation's air and space collections.

NASM's collection tracks the country's early developments of flight to the most recent space ventures. Although NASM's collection contains some military aircraft, the museum's focus is not military aviation. By contrast, other federally funded aviation museums, such as the Air Force Museum in Dayton, OH, and the Naval Aviation Museum in Pensacola, FL, primarily display military aircraft. Further, NASM does not display replicas but restores aircraft to original, although not flyable, condition. NASM's restorations involve using original parts or locating similar parts, or constructing the parts if they cannot be found.

Some officials in other air and space museums told us that NASM has very high restoration standards—standards that they said their museums generally could not afford to meet. The Director of the Air Force Museum, for example, said that NASM "wrote the book on aircraft restoration," and that NASM's restoration process is "excruciatingly thorough and detailed." The Air Force Museum Director also said that the museum cannot afford to follow NASM's restoration standards and must make compromises in seeking originality. The Director of the Champlin Fighter Museum in Mesa, AZ, told us that NASM's restoration process is more tedious than Champlin's. An official from the Pima Air and Space Museum in Tucson, AZ, told us that his museum tries to put acquired aircraft on display as soon as possible, limiting restoration work to cosmetic changes. The former director said that NASM's high standards are intentional and are designed to allow researchers in the future to study the materials and technology originally used to construct aircraft.

Funding

NASM operates on both federal funds, used primarily for employee salaries, and private donations, which largely fund exhibits.[6] In fiscal year 1994, NASM received about $15.4 million in federal appropriations, grants, and contracts for salaries, travel, research, and supplies. It also received

[5]Hearings on S.2602 to amend P.L. 722 of the 79th Congress and P.L. 85-935, relating to the National Air Museum of the Smithsonian Institution, before the Subcommittee on the Smithsonian Institution of the Senate Committee on Rules and Administration, 88th Congress, 2nd Session, 22 (1964).

[6]According to NASM, over the past 5 years, $802,173 in federal funds were spent on the museum's exhibits, and the remainder, $3,352,500, was provided by other sources, such as corporate donations and Smithsonian trust funds.

$10.6 million in nongovernmental funds, such as private donations and theater and gift shop revenues. Table 1.1 details the sources of NASM funding for fiscal year 1994.

Table 1.1: Sources of NASM Funding for Fiscal Year 1994

Source of funds	Amount received	Amount spent (as of September 30, 1994)
Federal appropriation[a]	$12,210,000	$12,210,000
Government grants[b]	2,950,540	573,784
Grants-government contracts[c]	287,093	106,475
Nongovernment grants	252,430	49,278
Restricted endowments[d]	296,582	113,232
Unrestricted endowments	342,219	185,778
Gifts	2,014,376	315,582
Special purpose[e]	1,598,835	430,328
Bureau discretionary[f]	1,838,910	1,798,495
Bureau auxiliary[g]	3,548,465	3,548,465
Reimbursements[h]	451,795	451,795
Total	**$25,791,245**	**$19,783,212**

Note: Excluded above are expenditures for NASM's facilities repairs and its security force, which are paid for separately by the Smithsonian. In fiscal year 1994, the Smithsonian spent $613,453 on NASM facilities repairs and $2.9 million on NASM's security force, which consists of about 76 personnel.

[a]Includes salaries and benefits, travel, and supplies.

[b]Government grants include funds made available from governmental sources at the federal, state, or local level to support specific types of research, education, or other projects.

[c]The government contracts listed in this category are agreements with the National Aeronautics and Space Administration and the National Research Laboratory to provide funding for specific research projects.

[d]Endowments are funded from the interest on the invested principal. The uses for restricted endowments are set by the terms of the original endowment.

[e]Special purpose funds are those funded by the Smithsonian for special exhibits and scholarly studies.

[f]The sources of discretionary funds include revenue sharing from auxiliary activities, such as the NASM theater, shops, royalties, and honoraria.

[g]Bureau auxiliary funds are revenue producing activities such as the museum theater that are initiated as a means of providing additional resources to accomplish their missions. At the end of the fiscal year, two-thirds of these funds are transferred to the NASM discretionary fund and one-third to the Smithsonian general fund.

[h]Reimbursements are made by other organizations for federal personnel costs and other expenses, such as travel costs, that are incurred by the Smithsonian as a result of providing services.

Source: NASM.

Of the $26 million of funds received in fiscal year 1994, NASM spent about $20 million, as of September 30, 1994. About $6 million of the funds received included revenue from endowments, grants, and gifts that will not be paid out until later years. Table 1.2 shows fiscal year 1994 NASM expenditures in the categories that the museum maintains for its budget data.

Table 1.2: Fiscal Year 1994 NASM Expenditures

Category of expenditure	Amount
Office of the Director[a]	$2,129,000
Art	112,000
Space history	1,020,000
Archives[b]	691,000
Public affairs	299,000
Computer services	567,000
Development/special	438,000
Facilities management[b]	249,000
Aeronautics	1,409,000
Collections management[b]	1,785,000
Exhibits	1,461,000
Audiovisual	586,000
Exhibits production	793,000
Center for Earth and Planetary Studies	1,033,000
Planetarium	900,000
Langley Theater	2,889,000
Education	535,000
Lab for astrophysics	600,000
Building management[c]	2,283,000
Total	**$19,779,000[d]**

[a]Includes salaries of the director, an astrophysicist, and 14 other positions.

[b]Funding for the Collections Management Department includes the categories of archives, facilities management, and collections management. The facilities management category pertains to expenses incurred at the Suitland, MD, and Dulles Airport, VA, facilities for routine maintenance, such as cleaning and snow removal.

[c]The building management category pertains to the Mall museum building only and includes services such as cleaning and routine, minor maintenance.

[d]Does not agree with figure for total spent provided in table 1.1 because of rounding.

Source: NASM.

Objectives, Scope, and Methodology

In December 1994, Senator Kay Bailey Hutchison was contacted by an historic aircraft organization, which said that NASM was not properly managed and in particular was not restoring a sufficient number of aircraft, thereby allowing its collection to deteriorate. We were asked to assess the rate of aircraft restoration; examine the adequacy of facilities for preserving aircraft; and if preservation problems exist, identify options to better care for the aircraft collection.

To obtain information about the formation of the Smithsonian's aircraft collection, we reviewed the legislative history of NASM and historical materials written about the museum and its collection. We also obtained and analyzed NASM data regarding the current number and aircraft in its collection, their condition and location, and the costs of aircraft restoration and storage. We inspected NASM's Paul E. Garber Preservation, Restoration, and Storage Facility in Suitland, MD, NASM aircraft stored at Dulles International Airport, VA, and DOD's AMARC in Tucson, AZ. To obtain information about NASM's plans to collect additional aircraft, we reviewed the museum's collections rationales for aircraft and space objects.

At NASM, we interviewed staff involved in aircraft restoration and preservation, including the Assistant Director for Collections Management, the conservator, 10 restorers, 3 volunteers, and 4 other collections management staff; 5 curators; the former senior curator; the Senior Advisor to the Director; and the former director. We selected NASM employees based on their involvement with managing the collection for our interviews. Some of the individuals we interviewed contacted us on their own initiative to provide information.

To compare NASM's restoration and preservation practices with other federally funded museums, we visited and interviewed officials from the Air Force Museum in Dayton, OH, and the Smithsonian Institution's National Museum of American History in Washington, D.C., and obtained data from these museums about their restoration staffing levels. We also visited and interviewed officials from the Champlin Fighter Museum in Mesa, AZ, about its restoration of an airplane for NASM under contract.

To compare restoration and preservation practices at a nonprofit museum that receives no government funds, we visited and interviewed an official from the Pima Air and Space Museum in Tucson, AZ. We also interviewed other individuals knowledgeable about NASM's restoration and preservation policies and practices, including the Director of the San Diego Aerospace Museum in San Diego, CA, and the Air Force Historian. We also reviewed

reports from 1988 to 1994 of the Research and Collections Management Advisory Committee, an advisory group consisting of academic and museum professionals that was formed by the most recent NASM Director to provide senior management with outside reviews of museum programs.[7] In addition, we interviewed the Advisory Committee Chairman and one of the committee members.

We obtained and reviewed materials relating to NASM's planned extension at Dulles Airport, including space requirements, financing, and future aircraft acquisitions plans. We also reviewed the legislative history regarding the extension and interviewed NASM officials involved in planning the project.

To obtain information on repairs needed, recently made, and scheduled for NASM facilities, we interviewed staff and analyzed data from the Smithsonian's Office of Design and Construction.

As agreed with Senator Hutchison's office, we focused on NASM's collection of 344 aircraft and did not focus on the 8,000 spaceflight items and 23,800 other artifacts in the NASM collection.

We did our work from January through June 1995 in accordance with generally accepted government auditing standards. Our work was done in the Washington, D.C., area; Dayton, OH; Mesa, AZ; and Tucson, AZ. We requested comments on a draft of this report from the Secretary of the Smithsonian or his designee. The Smithsonian's written comments are included in appendix III and discussed and evaluated in chapter 5.

[7]From 1988 to 1991, the committee was called the Collections Management Advisory Committee, after which the committee was renamed the Research and Collections Management Advisory Committee.

NASM Pays Relatively Little Attention to Aircraft Restoration

In fiscal year 1994, NASM devoted about 14 percent of its total expenditures on collections management, including aircraft restoration. Management has no firm plans for restoring each aircraft in the collection and has no recognized standards against which to monitor the productivity of the restoration staff. NASM's collections management staff, who work at the Garber facility in Suitland, MD, said that so much attention is placed on exhibits and research, they generally feel disenfranchised from the Washington, D.C., Mall museum staff. NASM management responded that because exhibits are generally privately funded, they do not take away funds from aircraft restoration. Further, management officials said that they have consistently requested increased funding for collections management, even though those efforts have not been successful.

Restoration Efforts

NASM currently employs 12 individuals who work on aircraft restoration out of a total staff of 288, or 4 percent of its workforce.[1] The Air Force Museum, another federally funded air museum, employs 20 restorers out of 90 total staff, or 22 percent. The ratio of restorers to total staff at NASM and the Air Force Museum may not be directly comparable, however, because of differences in the museums' funding, condition of aircraft, number of visitors, and other factors.

In fiscal year 1994, NASM devoted about $2.7 million to collections management, or 14 percent of its total expenditures. NASM's collections management department staff work mainly at the Paul E. Garber Preservation, Restoration, and Storage Facility in Suitland, MD. Collections management personnel who work at the Garber facility include the restoration staff; personnel who handle the shipping, receiving, and storage of artifacts; the conservator's staff; and the archival staff. The Garber facility contains the restoration shop, stored aircraft and spacecraft and related parts and artifacts, and film storage. Public access is limited to 3 of the 13 storage buildings at the Garber facility, plus the restoration shop. The archival staff work both at the Garber facility and at the Mall museum, where the photo collections are stored. The collections management department also includes the registrar, who maintains the official object records at the Mall museum. Collections management personnel also maintain the 12 aircraft and 2 hangars that NASM has at Dulles Airport.

[1]NASM differentiates between restoration and preservation of its collection. Restoration is defined as bringing an artifact back to its original state, while preservation is defined as maintaining the aircraft to prevent future deterioration. The total staff of 288 does not include the 76 employees involved in providing security of NASM, who are paid for by the Smithsonian. Also, NASM said that in 1994, volunteer restorers contributed an equivalent of 2.3 staff years of effort at NASM.

NASM's restoration staff told us they spend about half of their time working on tasks other than restoration, such as delivering and hanging aircraft, training and supervising interns and volunteers, performing maintenance on shop equipment, research, and administrative work.

During the past 5 years, NASM completed seven restoration projects, while continuing the restoration of four other projects. These 11 projects involved 3 U.S. aircraft and 8 foreign aircraft. NASM spent about $1.4 million to restore 9 of the 11 aircraft; it did not maintain cost records for the other 2. The largest project undertaken was the restoration of the "Enola Gay," which took over 10 years to complete at a cost of about $809,000. During the past 5 years, NASM spent a total of $11.3 million for collections management. Table 2.2 shows a list of restoration projects that NASM worked on from 1990 to 1995.

Table 2.2: NASM Aircraft Restoration Projects From 1990 to 1995

Type of aircraft	Project time	Work hours[a]	Cost
Hawker-Hurricane (World War II British fighter)	Started June 1988, not yet completed	17,943	$231,571
B-29 "Enola Gay" (World War II U.S. bomber)	December 1984-May 1995	57,646	808,948
Voisin (World War I French bomber)	April 1989-June 1991	7,273	104,709
Aichi Serian (World War II Japanese attack plane)	Started June 1989, not yet completed	12,276	178,156
Pflaz D XII (World War I German fighter)	March 1991-May 1991	589	10,949
FE-8 (World War I British reconnaissance plane)	May 1991-August 1991	767	14,796
Fokker D.VII (World War I German fighter)	1991 (repainting)	no records available[b]	
Sopwith 7F.1 Snipe (World War I British fighter)	1992 (recovering)	no records available[b]	
Stinson SR-10 Reliant (1930 U.S. mail plane)	September 1992-April 1993	3,628	38,014
Langley Aerodrome Model 5 (model aircraft)	Started January 1994, not yet completed	470	6,808
Ohka 22 Baka (World War II Japanese bomber)	Started October 1993, not yet completed	4,218	3,966
Total		**104,810**	**$1,397,917**

Note: The restoration costs shown reflect only the staff salaries and do not include the costs of equipment, materials, and overhead.

[a]Does not reflect some projects for which work hours and costs were not recorded, such as on-site preservation of the "Spirit of St. Louis" and repainting and preservation of the P-47.

[b]These projects were staffed exclusively by volunteers with only general oversight by the paid staff; workhours were not recorded.

Source: NASM.

NASM's former Senior Curator, who still works at the museum as a volunteer, told us that the restoration staff's productivity has decreased in recent years. He attributed that productivity decline to (1) the restoration staff being diverted from restoration to other tasks, (2) little or no interest shown by the museum management in restoration, and (3) a decrease in the curators' involvement in restoration.

Although NASM prepares a yearly restoration schedule, it does not have a long-range plan for which aircraft it plans to restore beyond the coming year or specifically what work is needed for each airplane in the

collection. Further, NASM does not determine the relative importance of each aircraft or whether and how each aircraft will be used in future exhibits. In commenting on a draft of this report, Smithsonian officials said it was more important to explain why an aircraft was collected and what role it plays in the collection than to plan its use in future exhibits.

NASM does not use any work measurement standards or other estimates of the time it should take to prepare work or aircraft restorations. The Assistant Director for Collections Management told us that she does not have a technical background in aircraft restoration and does not know how long the restoration work should take. She said that she relies on the restoration shop foreman to evaluate the restoration staff's performance and provide technical guidance to them.

At our request, NASM estimated the amount of time it would take to restore all aircraft currently in its collection that needed work. NASM said that of the 344 aircraft in its collection, 245 were exhibitable, 55 needed minor work to become exhibitable, and 44 needed major restoration work. Assuming that a 12-person restoration staff worked full-time on restoring aircraft, NASM estimated in May 1995 that it would take about 52 years to restore the 99 aircraft. However, since the restoration staff told us they spend only half of their time on restoring aircraft, we estimated that it would take about 100 years to restore the 99 airplanes, assuming that no additional aircraft needing work were added to the collection, the current staffing trends continue, and the restoration staff continue to spend half of their time on other work.

When we asked about the rate of restoration at NASM, the former NASM Director said that he saw no need to accelerate the restoration backlog or to plan NASM's restoration work for the next 50 years because too many changes in restoration techniques would occur over that period. He said that because of the cost of restoring the "Enola Gay," NASM has adopted a new policy whereby any large planes will be accepted only if they do not need restoration work. He added that the museum's mission is broader than restoration and includes research and education, which also have to be supported.

The former director also said that it is harder to obtain additional resources for collections management from outside sources than it is for exhibits. He said that NASM had received some private donations in recent years, including a $250,000 corporate gift that was made after loaning spacecraft and aircraft to Japan, new paint-mixing equipment worth

$50,000 from a U.S. corporation, an airplane hangar at Dulles Airport worth $100,000 from a group of local construction companies, $27,000 for the "Enola Gay" restoration from veterans, and restoration of two engines of the "Enola Gay" by the San Diego Aerospace Museum.

Collections Management Staff Generally Feel Disenfranchised

We asked members of the collections management staff, including the Assistant Director for Collections Management, the conservator, 10 restorers, 4 employees involved in maintaining the collection, and 3 volunteers, about the rate of aircraft restoration. The staff generally were not satisfied with the current restoration efforts at the museum and indicated that they felt disenfranchised from the curators and management at the Mall museum.

The collections management staff said that (1) collections management, including aircraft restoration, is given a low priority compared to other museum activities, such as exhibits, research, publishing, the Laboratory for Astrophysics, and the Center for Earth and Planetary Studies (CEPS);[2] (2) too much of their time is spent on tasks other than restoration; (3) additional restoration work is required on aircraft because the collection has not been properly maintained; (4) NASM's management staff and some curators do not provide effective leadership because they do not have adequate backgrounds in museums, aircraft, or spacecraft; (5) little interaction occurs between the restoration staff and the curators; (6) management wasted funds when it recently held a 3-day retreat outside of Washington, D.C.; and (7) some recent exhibits, such as one on Barbie dolls, contain few or no aircraft.

We asked NASM management to comment on these concerns. Management's primary responses were that (1) exhibits are generally privately funded and do not take away funds from restoration; (2) the collections management department is tasked with many responsibilities in addition to aircraft restoration; (3) NASM's requests for increased funding for collections management have been rejected by the Smithsonian or the Office of Management and Budget (OMB); (4) NASM's management staff have backgrounds in museums, aircraft, and management; (5) the Smithsonian requires curators to spend time on research and publishing; (6) the retreat

[2]CEPS and the Laboratory for Astrophysics are scientific research units of NASM. According to NASM, research at CEPS is focused on "geological and other processes acting to modify the earth's surface and those of the other terrestrial planets." The Laboratory for Astrophysics is charged with conducting basic research in astronomy and astrophysics. Budget data provided by NASM indicated that federal funds, including grants and contracts with other agencies, accounted for $920,000 of the $1,033,000 cost of operating CEPS and $566,000 of the $600,000 to run the astrophysics lab in fiscal year 1994.

was useful to prepare the museum's mission statement; and (7) that one manager had opposed creating new exhibits with few or no artifacts.

A comparison of the collections management staff's views and management's responses to them is provided in table 2.3.

Table 2.3: Collections Management Staff Concerns and Management Responses

Staff concerns	Management responses
Collections management, including aircraft restoration, is given a low priority compared to other museum programs, such as exhibits, research, publishing, the Laboratory for Astrophysics, and CEPS.	Exhibits are generally privately funded and do not take away funds from restoration. Research and publishing are required for curatorial positions. The Laboratory for Astrophysics and CEPS are directly related to the museum's mission, and the research generated by them is incorporated in the galleries and public programs. The Smithsonian only pays for three of the astrophysics lab staff salaries, while all of the lab's other expenses, including three other staff, are funded through grants from other agencies that would not be used for aircraft restoration. Museums are not only about technology. They should also tell stories, not just display inert objects.
The restoration staff's time is spent on too many tasks other than restoration.	NASM tasks its small Collections Management Department with many responsibilities. The staff's efforts to care for and preserve the collection are diluted to meet an ambitious exhibitions program, safety and health regulations, and by sharing the collection with others around the world.
Additional restoration work is required because the collection has not been properly preserved.	NASM has consistently requested additional funding for collections management, but the requests have been turned down by the Smithsonian or OMB. NASM must compete with other Smithsonian museums for repair funds, and other museums have higher priorities than repairing the Garber facility. The planned Dulles extension should provide NASM with a new restoration shop and storage facilities.

(continued)

Staff concerns	Management responses
NASM's management staff does not have adequate backgrounds in museums, aircraft, and spacecraft.	Some of NASM's managers do have backgrounds in museums, aircraft, and spacecraft, and some managers have other valuable skills and backgrounds, such as management.
Little interaction occurs between the restoration staff and the curators. The curators rarely visit the Garber facility.	The Smithsonian requires curators to spend time on research and publishing. The curators do not need to visit the Garber facility unless they are working on a project involving the artifacts.
Management wasted funds when it recently held a 3-day staff retreat outside of Washington, D.C.	The retreat was an opportunity to prepare the museum's mission statement and was useful.
Some exhibits contain few or no aircraft, such as an exhibit of Barbie dolls.	The purpose of the Barbie doll exhibit is to "engage the interest of very young female children with a display of dolls representing some of the changing roles of women in aerospace." The Mattel Corporation is paying for the $5,678 exhibit cost. One manager said that she had opposed creating new exhibits with few or no artifacts.

Source: NASM collections management staff and management officials.

The concerns raised in table 2.3 and NASM's responses show a high level of disagreement and morale problems among the staff who are responsible for preserving and restoring NASM's artifacts. While these concerns were not the focus of our review, our overall work in the management area indicates that some of the conflict that exists could be explained by communications problems and the different perspectives of collections management staff and NASM management.

NASM's focus on research and exhibits, compared to collections management, also has been cited by the Research and Collections Management Advisory Committee, an advisory group formed by the former NASM Director and consisting of academic and museum professionals. The committee's 1994 report indicated that curators perceive that research and exhibition are the only work that counts for advancement, and as a result, many do not spend time with the collection, visit the Garber facility, or address collections issues on an ongoing basis.

In its 1990 report, the Advisory Committee raised the same concerns expressed to us 5 years later by the collections management staff. The 1990 report said that

"the leadership of the Museum must continue to focus its attention on collections management issues. The perception amongst the staff is that the Director is most interested in and concerned with research, publication, exhibition, and scholarship generally, and while the Committee knows of the leadership's dedication to the collection and its care, it believes that this commitment needs continually to be communicated outward to the rest of the staff: to the curators, who need to be reminded of the realities of limits and resources; and to the collections management staff, which often must struggle internally inside the Museum to get the attention and cooperation of other staff."

Morale problems among the collections management staff are not new. According to a 1982 book by a former NASM Director, in the early years of the Garber facility, "a split developed, whereby the people at Silver Hill regarded themselves and were regarded as blue-collar renegades, necessary, but somehow not part of the Smithsonian."[3] The author added that no one really knew or cared how hard and how well the Silver Hill crew was working. In 1994, the Advisory Committee noted that friction between the curators and collections management staff remained, in spite of improved dialogue and increased contact.

In commenting on a draft of this report, Smithsonian officials said that feelings of disenfranchisement on the part of the collections management staff resulted from a number of factors, most notably resource-related matters.

A NASM Collections Management Advisory Committee member also expressed the view that NASM management and exhibits appeared to be geared more toward pleasing academic peers than the public, and that exhibits have too much interpretation of the role that aircraft and spacecraft played in history and society. He cited, for example, the criticism that occurred with respect to the interpretation that was contained in a proposed script for the exhibit of the "Enola Gay," the aircraft that dropped the atomic bomb over Hiroshima, Japan. In January 1995, 81 Members of Congress wrote to the Secretary of the Smithsonian, complaining that the former director's actions in drafting the exhibit script "were a slap in the face to all the parties who contributed their time and expertise in creating an exhibit that best reflects the

[3]In the book, The Aircraft Treasures of Silver Hill, by Walter Boyne (New York: Rawson Associates), 1982, the Garber facility is also referred to as Silver Hill.

contributions that all Americans made to the culmination of World War II" and demanding the NASM Director's resignation. On May 2, 1995, the NASM Director resigned, citing the controversy involving the exhibit, which received considerable media attention. NASM is now displaying only part of the plane, without extensive commentary.

Storage Facilities Do Not Provide Adequate Preservation

Even if NASM were to restore more aircraft, the museum does not have adequate storage facilities to protect them from deterioration. Current conditions are much improved since the time when much of the collection was stored outdoors, and some repairs have been made in recent years to the Garber facility. However, the buildings in which the aircraft are stored do not have humidity controls or air-conditioning, and only a few are heated. As a result, the collection in storage is continuing to deteriorate, including previously restored aircraft. NASM has consistently requested increased funding for collections management and for storage facilities repairs in recent years, but NASM must compete with other Smithsonian museums for limited resources and has been unable to obtain needed funding. In the absence of additional funding, NASM has not developed a strategy to pursue alternatives to lessen the storage burden, such as loaning aircraft to other museums for 5 to 10 years for display in exchange for their restoring the aircraft for NASM or deaccessioning items with less historical or technological significance.

Inadequate Storage Facilities Are Causing the Collection to Deteriorate

The Smithsonian's collections management policy, issued in May 1992, requires museums to ensure that collections are maintained in conditions intended to preserve and extend physical integrity. Under the policy, prudent collections management requires the identification and elimination or reduction of damage to the collection, such as deterioration. The National Park Service, which has prepared guidance on museum collection policies, indicates that collections should be maintained in storage facilities with appropriate levels of relative humidity and temperature.[1]

Much of NASM's aircraft collection was stored outside in Suitland, MD, from the early 1950s until they were moved into temporary storage buildings that were constructed primarily in the 1950s, 1960s, and early 1970s. Although moving the aircraft indoors was an improvement over storing them outdoors, the Garber storage facilities are still not environmentally controlled. The wood, fabric, and even metals used in aircraft are susceptible to deterioration and corrosion when exposed to great differences in temperature and humidity, even though aircraft may be protected from rain and snow. Storing the aircraft outdoors and later in facilities that were not environmentally controlled caused aircraft in the collection to deteriorate, which meant that additional restoration work had to be done.

[1]National Park Service, Museum Handbook, Part I, Museum Collections, 1990.

NASM currently has 236,300 square feet of storage space at the Garber facility, including the restoration shop, and 50,200 square feet of space at Dulles Airport, or a total of 286,500 square feet. Of the 286,500 square feet of space for storage and the restoration shop, 101,500 square feet are heated. The storage space is overcrowded and lacks humidity controls. Overcrowding has resulted in 5 of NASM's 344 aircraft being stored outdoors: 2 are at Dulles International Airport; 1 is at AMARC in Tucson, AZ;[2] 1 is at Andrews Air Force Base, MD; and 1 is on loan at the Pima Air and Space Museum in Tucson.

From 1991 to 1994, NASM undertook a conservation assessment, examining the condition of the museum's 13 storage buildings at the Garber facility and the condition of the artifacts contained in them. According to the assessment, the buildings and artifacts are suffering from wide temperature fluctuations, leaky roofs, structural problems, and dirt and dust accumulation. Moreover, the reports indicated that the building conditions are promoting the deterioration of the collection, including restored aircraft. For example, the assessment on a building that contains restored aircraft indicated that "the restoration process alone cannot be considered a solution because many restored objects in Building 20 are deteriorating . . . . Almost all recently restored aircraft in Building 20 have evidence of corrosion." Excerpts from the reports are contained in appendix I.

The conservation assessment also commented on overall preservation practices at the Garber facility. According to a June 1993 report, "[t]he condition of many objects stored at the Garber Facility illustrates what can happen when museum administrators permit a collection to grow and develop without providing direction and funding for its preservation . . . . [P]reservation is a primary museum responsibility, moreso than education, research, or exhibition, given that those functions are, or should be, collection-dependent. Therefore, preservation is not an option or a low priority, nor is it a one-time budget expense. It is a continuous process that requires adequate levels of staffing and funding."

In the past 10 years, the Smithsonian spent $9.1 million to improve the Garber facility, including roof repairs, asbestos removal, and storm-water

[2]To minimize deterioration, DOD stores aircraft in Tucson, AZ, because of its low humidity and rainfall. Aircraft windows and openings are covered to prevent ultraviolet ray damage to interiors of aircraft stored there.

structures, or an average of $910,000 per year.[3] Also, a new artifacts storage building to be shared with the Smithsonian's National Museum of American History (NMAH) and a new chemical building for NASM are being constructed at a cost of about $1.4 million. While these repairs have helped improve conditions at the Garber facility, much more repair work is needed.

We interviewed officials from the Smithsonian's Office of Design and Construction, which is responsible for maintaining and repairing Smithsonian facilities and asked about the feasibility of obtaining additional repair funds for the Garber facility. The Design and Construction officials indicated that during the last 5 years, the Smithsonian spent over 8 percent of its total repair funds on NASM facilities (including the Garber facility and the Mall museum), which represent 7 percent of the square footage of all Smithsonian facilities, and spent 5 percent of its total repair funds on the Garber facility alone, which represent 3 percent of the square footage of all Smithsonian facilities. The officials also said that over the next 5 years, the Mall museum needs at least $33.8 million in repairs and that the Garber facility needs at least $7.4 million in repairs. However, the officials said that it is unlikely that NASM will receive the needed repair funds because NASM must compete with other Smithsonian museums for scarce repair funds.

The Design and Construction officials said that the Smithsonian has a backlog of $250 million in deferred maintenance for all of its museums, can only afford to make about $25 million in repairs each year, and accrues another $32 million to $35 million in additional repair work each year. Because new requirements exceed available funding each year, the backlog of deferred work will continue to grow. The Office of Design and Construction officials also said that recent improvements that have been made to the Garber facility are not expected to last long. They added that some of the Garber buildings have structural problems and may not be repairable.

NASM must compete with other Smithsonian museums for its overall funding, including collections management, as well as repair funds. In 4 of the past 5 years, NASM's requests for increased funding for collections management have been turned down either by the Smithsonian or OMB.[4] In

[3]The Smithsonian estimates that 35 percent of these improvements were made for NASM's share of the Garber facility, which is also used by other Smithsonian museums.

[4]For fiscal year 1995, the Smithsonian instructed NASM not to request additional funding due to budget constraints.

fiscal year 1994, for example, NASM requested an additional $395, 000 and 3 additional positions for collections management. The Smithsonian reduced that request to $150,000 and 1 additional position, which OMB rejected. For fiscal year 1996, NASM requested an additional $576,000 and 9 additional positions for collections management. The Smithsonian reduced the fiscal year 1996 request to $411,000 and 1 additional position, which OMB rejected.

In making its 1996 request for additional collections management funding, the Smithsonian indicated that

"NASM has the unique mission to preserve the technology represented by the history of aviation and spaceflight, by preserving the vehicles in which early pioneers broke speed records, explored new worlds, fought aerial battles, and sought data about our universe. Judging by the millions of visitors who visit the Museum and by the many letters from the public urging us to step up our efforts to preserve this evidence of flight, there is a broad base of public support for artifact restoration. Sadly, without additional resources, some of our treasures may be lost."

Museum officials said that they must rely on federal funds for maintaining their facilities because of the difficulty of raising private funds for storage facilities with no public access. Another official said that donors want their contributions to be visible, for example, with exhibits, where the contributors' names can be prominently displayed.

While we do not take any position on how NASM should allocate its resources, the Assistant Director for Collections Management suggested reassigning some curatorial staff to collections management temporarily to address critical collections care problems. She also said that the Smithsonian should increase its focus on the care of the collection and place less emphasis on research until major collections problems are under control. NASM's curators are required to conduct scholarly research in their fields of interest, as well as assume other responsibilities involving exhibits, managing the collection, and public service.

We visited AMARC in Tucson, AZ, where NASM currently stores one aircraft.[5] An AMARC official said that NASM does not pay to maintain its aircraft, as the other AMARC customers do. The official said that maintenance normally involves putting a new protective coating on the aircraft and new oil in the engines every 6 months, which involves about 4 hours of work and

[5]When we visited AMARC in March 1995, NASM had six aircraft stored there. NASM also has a Boeing 707 fuselage and a Convair C-131E at AMARC, which have not been entered as part of the collection, but were acquired for parts.

generally costs a few hundred dollars per plane. The official also said that no one from NASM had visited AMARC to inspect its aircraft for 2 or 3 years. The official added that, even though NASM does not pay to have its aircraft maintained, AMARC took care of two of NASM's aircraft at no cost to NASM because they were on display.

NASM has attempted to preserve some of its aircraft that are stored outside at Dulles Airport and Andrews Air Force Base. Two of NASM's aircraft that are stored outside at Dulles Airport —a Lockheed 1049 Constellation and a Lockheed C-130A Hercules—and another that is stored outside at Andrews Air Force Base—a Grumman A-6E Intruder—are connected to dehumidifiers. The airplane at Andrews Air Force Base is housed in a container.

The Collections Management Advisory Committee reported in 1991 that, while the facilities improvements that have been made at the Garber facility were substantial, they were short-term fixes. Stating that a new extension must be built to provide adequate indoor storage space, the committee said in its 1991 report that the longer the delay, the higher the cost in deteriorating artifacts and interim expenses. The committee added that some of the deterioration is irreversible.

According to Smithsonian policy, museums normally establish minimum standards of physical care and regular schedules for the maintenance of collections. NASM Collections Management staff said that they do not conduct formal, periodic inspections of aircraft in storage. Smithsonian officials said that curators are aware of the condition of aircraft when they are acquired and are responsible for reviewing the condition of those in storage. Smithsonian officials said that some curators spend an average of 30 percent of their time on collections management and that one curator spent 3 years working on an engine maintenance program. However, some curators told us that they generally do not inspect the collection unless they have a reason to do so, such as preparing an exhibit involving the artifacts. NASM has adopted a new policy that 0.5 percent of the collection be randomly inspected by 1996 and then the same amount be inspected on a biannual basis. The proposed policy was submitted to the Smithsonian for approval in July 1994, but was not approved until May 1995. NASM's Assistant Director for Collections Management said the Smithsonian does not give collections management a high priority.

We asked NASM officials about who is responsible for seeing that the collection is properly cared for—the curators or the collections

management staff. The Chairman of the Aeronautics Department said that the curators and collections management personnel have joint responsibility. However, the former senior curator said that it is unclear who is responsible for the collection. The collections management staff said that the Collections Management Department is responsible for the physical care of the collection. The former NASM Director said that the curators are supposed to know the condition of the artifacts in their collections and, if they notice a problem, are to bring it to the attention of the collections management staff, who then prepare a correction plan with the assistance of the curators.

We interviewed officials from the Smithsonian's NMAH, who told us that NMAH faces the same, if not worse, storage problems as NASM. NMAH officials said that in the early 1980s, the museum was forced to decide that it could no longer collect large objects because of the lack of storage space. The officials said that of the seven storage buildings NMAH has at the Garber facility, all have leaky roofs, three have asbestos, and one is quarantined because of asbestos contamination.

In a 1991 article for a Smithsonian publication, NASM's conservator said that collections storage is often the most neglected function within a museum. He said that exhibition is generally considered a higher priority and receives a greater share of the funding, and that storage is considered by many to be a static function requiring only space. The conservator also noted that one of the major threats to important collections is poor storage and that as a result of poor storage (1) objects could be misplaced, (2) important information could be lost, (3) irreversible damage could develop and progress go undetected, and (4) theft and damage could go unnoticed for years.[6] NASM's conservator told us that NASM's aircraft need more preservation and less restoration. He said that restoring aircraft is not needed to preserve them.

The former NASM Director said that he would like to move the entire collection at the Garber facility to the museum's planned new extension facility, which is discussed in detail in chapter 4. However, the Research and Collections Management Advisory Committee has recommended that improvements be made to the Garber facility, despite the extension plans. In its 1990 report, for example, the committee noted needed improvements

[6]A March 10, 1995, Washington Times article indicated that a NASM curator was suspended in connection with allegations of stealing and reselling of aviation artifacts. An official from the Smithsonian's Office of Inspector General told us that policy prohibited him from confirming or denying the existence of an ongoing investigation. On July 1, 1995, The Washington Post reported that the curator had pleaded guilty to stealing museum artifacts.

in the chemical treatment facility and welding shop, and overcrowding at the Garber facility. In the minutes of its 1989 meeting, the committee indicated that NASM should not rely on the prospect of the future extension, which may be years away, to substitute for today's crucial conservation and storage needs.

Consideration of Other Alternatives Could Lessen NASM's Restoration and Preservation Burden

Because NASM lacks a clear focus regarding its mission, its collection includes some aircraft whose historical significance has been questioned, some duplicate aircraft, and a number of foreign aircraft. It is not clear whether this fulfills Congress' original intent to establish a national museum that showcases this country's most important aviation achievements. Reducing the size of the collection and undertaking second-party aircraft restorations with temporary display loans are viable alternatives to lessen NASM's burden of caring for a large aircraft collection. However, NASM has not developed a strategy to deaccession aircraft. It also has not accelerated pursuing second-party restorations with temporary loans, despite repeated recommendations to do so by its advisory committee.

Deaccessions

Congress intended that NASM collect, preserve, and display aeronautical and space flight equipment of historical interest and significance. While we have no basis for determining which aircraft should be included in NASM's collection, some other individuals familiar with NASM's aircraft collection that we contacted questioned whether NASM should have collected certain aircraft. The Director of the Air Force Museum, for example, questioned the wisdom of NASM having acquired a large collection of World War II Japanese aircraft.[7] NASM's Senior Advisor to the Director questioned whether the museum should have acquired a Boeing 727—a commercial aircraft still widely used. Further, a NASM curator, who is a former Air Force pilot, questioned whether the museum needs two McDonnell F-4s. Moreover, the Air Force Historian, who is a former NASM curator, said that NASM's collection is disorganized and is too large to care for.

NASM's Research and Collections Management Advisory Committee has repeatedly recommended that the museum accelerate deaccessioning of aircraft. For example, in 1991, the committee reported that NASM

[7]In commenting on a draft of this report, Smithsonian officials said that most of the foreign aircraft in the collection were provided by the U.S. military services.

"must get serious about deaccessioning, and expand where feasible its loan program. We recognize the reluctance on the part of the staff to part with important artifacts and the fear that other institutions, as well as the process of physical transfer, might produce some damage. But the collection is simply too large—for what this Museum needs in terms of a national collection, in terms of balance, and most compelling, in terms of the Museum's ability to prevent artifacts from deteriorating. And the Museum cannot accomplish its mission of preservation and the diffusion of knowledge if so much of its collection is hidden from public view in storage facilities that do not meet minimum museum standards."

In its most recent report, the committee again recommended that NASM accelerate deaccessioning and loans of aircraft and even suggested that the museum consider seeking authority from Congress to sell part of its collection.

We asked the former NASM Director what the museum has done to respond to the committee's recommendation regarding reducing the size of the collection. He said that it is not easy to find other museums to take NASM aircraft. Also, NASM's Senior Advisor to the Director said that there is a reluctance to deaccession aircraft, because some NASM staff believe everything in the collection is valuable. From 1991 to 1995, NASM deaccessioned 11 aircraft. Another six aircraft have been identified for deaccession, but NASM cannot find responsible museums willing to accept them, according to NASM officials.

The Assistant Director for Collections Management said that, while NASM may not have too many aircraft to reflect the history of aviation, the museum does have more planes than it can care for. She also said that there should be more coordination between NASM and other national museums that operate on federal funds, such as the Air Force and Navy museums, to avoid duplication. The Air Force Historian agreed that NASM should not duplicate the collections of the Air Force and the Navy.

The Chairman of the Research and Collections Management Advisory Committee told us that there has been disagreement among museum staff about whether NASM should deaccession aircraft. The Advisory Committee Chairman also said that, since the former NASM Director was not a historian, he had to rely on the advice of expert curators regarding deaccessions, but that the experts could not agree on what aircraft, if any, to dispose of. The chairman said that NASM has the greatest aircraft collection in the world, but that it needs to be pruned. Moreover, the chairman said that because the museum had such a large and varied

constituency, including the public, military, airplane buffs, and film makers, deaccessioning aircraft would be difficult.

Second-Party Restorations/Loans

Another alternative that could lessen NASM's burden of caring for its aircraft collection would be loaning its aircraft to other organizations for display over a temporary period, such as 10 years, in exchange for having them restored. NASM officials told us that they are using second-party restorations and in fact developed the legal and contracting procedures to undertake such work, and would welcome similar proposals from other institutions. While NASM is using this option, it has no detailed strategy to determine whether there are additional opportunities to use it.

NASM reported that it loaned 18 aircraft to other museums for restoration and storage during 1993 and 1994. Of these 18 aircraft, NASM initiated the loan of 8 aircraft—6 for restoration and 2 for storage. The other party initiated the loans for the other 10 aircraft. For example, the Champlin Fighter Museum in Mesa, AZ, contacted NASM about restoring a Kawanishi N1K2-J, nicknamed the "George," for NASM in exchange for being able to display it for 10 years. Table 3.1 shows the six aircraft restoration loans that were initiated by NASM in the last 2 years.

Table 3.1: New Restoration Loans Initiated During 1993 and 1994

Type of aircraft	Museum/Organization
Boeing 307	Boeing Company
MiG 21	U.S. Air Force
Horton II	Museum fur Verkehr und Technik, Berlin, Germany
Horton IIIf	Museum fur Verkehr und Technik, Berlin, Germany
Horton IIIh	Museum fur Verkehr und Technik, Berlin, Germany
Horton VI	Museum fur Verkehr und Technik, Berlin, Germany

Source: NASM.

The Assistant Director for Collections Management told us that NASM does not have an active program to identify outside restorers. The former NASM Director agreed and said that NASM must be careful about who it allows to restore its aircraft, since many museums do not meet NASM's restoration standards. To help overcome this concern, NASM provides standards that second-party restorers must follow. These standards, along with careful

screening of the capabilities of second parties, coupled with periodic monitoring of work in progress during restoration, can help ensure that adequate standards are followed. In addition, NASM officials said that the loan program requires considerable staff time for crating, shipping, and other related tasks that reduces staff time available for in-house restoration efforts.

The Collections Management Advisory Committee has also recommended that the museum expand its loan for restoration program. In its 1990 report, the committee reported that there was some resistance by NASM staff about the program because of concern that the quality control of restoration would be lost. However, the committee noted that, given the positive experience involving the San Diego Aerospace Museum's restoration of one of the four "Enola Gay" engines, the program should be expanded.[8] We also noted that NASM was satisfied with the Champlin Museum's restoration of the Japanese World War II fighter, the "George."

The Director of the San Diego Aerospace Museum told us that his museum would be interested in restoring entire aircraft for NASM in the future. We did not survey other museums about their possible interest in restoring aircraft for NASM, but it is possible that there may be others who might be capable and interested.

Another approach undertaken by the Air Force Museum in Dayton, OH, and the Naval Aviation Museum in Pensacola, FL, involves providing other museums with two aircraft for restoration, allowing them to keep one and restore and return the second. Likewise, NASM has provided three aircraft to a German museum, which, after restoring the aircraft, plans to give one to the Air Force Museum, return one to NASM, and keep the third one.

[8]Following the 1990 Advisory Committee report, the San Diego Aerospace Museum restored a second engine from the "Enola Gay."

Future Plans for the Dulles Extension and Additional Aircraft Are Uncertain

NASM officials cited plans to build an extension at Dulles Airport, VA. as the solution to the museum's storage and restoration problems. However, it is uncertain when or whether the extension will be built, given the museum's need to raise at least $100 million in private funds for its construction. Also, NASM would like to acquire 80 aircraft over the next 30 years, which would exacerbate its current storage problems.

NASM Extension Plans

In the early 1980s, the Smithsonian began looking for a site on which to build an extension for NASM to store its aircraft collection currently housed at the Garber facility and large aircraft to be acquired in the future. By the mid-1980s, the extension was planned also to house the restoration facilities at Garber and to display aircraft on a limited basis. By 1989, NASM wanted the extension to include a theater, a restaurant, and a museum shop, as well as expansion space for other Smithsonian bureaus.

A key consideration in selecting a site was access to an active runway to accept large aircraft that could not be transported to the museum on the Mall. As early as 1983, after considering several sites, the Smithsonian chose Dulles Airport as its preferred site. In 1988, the site selection process was reopened after the Governor of Maryland expressed an interest in locating the facility at the Baltimore-Washington International Airport. Then, in 1990, the City of Denver submitted an unsolicited proposal to locate the extension at Stapleton International Airport.

In February 1991, we testified that the Smithsonian's site selection process had not adequately considered and justified its selection of Dulles Airport as the extension site.[1] The Smithsonian subsequently provided information and analysis needed to support its selection of Dulles Airport as the extension site and its decision to reduce the estimated cost of the extension from $325 million to $162 million. In March 1991, we informed the Chairman of the House Appropriations Subcommittee on Interior and Related Agencies that, in light of the Smithsonian's additional analysis, its decision to locate the extension at Dulles Airport could be objectively defended by the Smithsonian.

NASM is currently planning to build a 670,000 square-foot extension facility at Dulles Airport at a cost of $162 million. NASM plans to finance the extension through private fundraising and funds pledged by Virginia. According to NASM officials, Virginia has agreed to provide the Smithsonian with a $3 million interest-free loan and has pledged to finance site-work

[1]National Air and Space Museum Extension Site Selection Process, GAO/T-GGD-91-5 (Feb. 5, 1991).

improvement for highway access, airplane taxiways, and parking, plus $6 million in construction costs. In addition, the Governor of Virginia has indicated that the state is committed to issuing up to $100 million in bonds to assist in capital construction. Under the proposal, the Smithsonian will make lease payments to Virginia equal to the debt service, and once the debt is retired, title to the facility will pass to the Smithsonian. The Smithsonian will be responsible for all of the extension's operating costs.

In August 1993, legislation was approved authorizing the extension and the appropriation of $8 million in federal funds for its planning and design. However, in July 1995, the President signed a bill to rescind $4,175,000 in planning funds that had been appropriated for the extension. In September 1995, a congressional conference committee adopted a report regarding a fiscal year 1996 appropriations bill authorizing the appropriation of $1 million for planning and design of the Dulles extension. As of September 26, 1995, Congress had not yet approved the conference report. NASM officials estimated that the extension could open sometime during 2000 to 2005, but added that rescinding the planning funds could postpone the extension opening.

The former NASM Director told us that to raise $100 million in private funds, NASM may need to enter into joint ventures with companies, allowing them, for example, to hold permanent aerospace trade fairs at the extension. The former director also said that the extension may incorporate entertainment rides and simulators, and that corporations may be permitted to use their logos in exchange for financial support. NASM has begun formulating a financing plan for the extension.

Some NASM officials said that it would have been difficult for the museum to raise the extension funds under the former director because of the controversy involving the exhibit of the "Enola Gay," discussed in chapter 2. It still remains uncertain, however, if the Smithsonian will be able to obtain the support needed to construct the extension.

In its 1994 report, the Research and Collections Management Advisory Committee noted that NASM management lacked a consensus on the expected benefits of the extension, which were never extensively discussed or debated within the Smithsonian. The committee recommended that the museum formulate a mission statement for the extension. The former NASM Director told us that he was developing a mission statement and that he would like the extension to allow the museum to tell stories involving the (1) history of the Cold War, (2) effects

of the World War II bombing campaign, (3) impact of the revolution in air travel for Americans, and (4) benefits to society provided by downward-looking satellites.

In March 1995, the Secretary of the Smithsonian contracted with the National Academy of Public Administration (NAPA) to review the management of NASM. NAPA is to complete its study in the Fall of 1995, and is to pay particular attention to an examination of NASM's mission. As part of the study, NAPA said it would review whether NASM is adequately considering the mission of the extension. In August 1995, Smithsonian officials said that the Board of Regents would shortly review the scope of NASM's mission.

Plans for the extension include 670,000 square feet of space, compared to 286,500 square feet of space at NASM's current storage and restoration facilities. We asked museum officials about the feasibility of immediate construction of a restoration shop and storage facility at Dulles Airport, as part of the first phase of the extension, to replace the current 286,500 square-feet of storage space. The Assistant Director for Collections Management said that it would be best to start the extension project by building a restoration shop with public access, then build display and storage space, followed by construction of storage-only space. She also said that the extension must have amenities to attract donations and that Virginia has indicated that it may not be interested in providing funds if the facilities were not accessible to the public.

The former senior curator said that the NASM Director should be given a mandate to build the extension, such as was given to the former NASM Director in opening the museum in 1976. He noted that in that situation, former astronaut Michael Collins was selected as the NASM Director because he had the needed experience and visibility in working with Congress.

Future Acquisitions Could Exacerbate Storage Problems

NASM would like to collect 80 aircraft of all types over the next 30 years, even though it cannot properly care for the collection it has now. Included among these 80 aircraft are such large aircraft as the Boeing 747 and Boeing B-52.[2] The 80 aircraft, which were contained in a collections rationale prepared by NASM in 1989, are listed in appendix II.

[2]NASM also has acquired a Concorde, which will be delivered to the museum when the aircraft is removed from service.

The 1989 collections rationale noted that past attempts by the museum to prioritize the collection effort were unsuccessful. The rationale acknowledged that after over 80 years of collecting aeronautical artifacts, NASM at that time barely had adequate exhibition and storage space for the aircraft in its collection or for large aircraft yet to be acquired.

The 80 aircraft that NASM would like to acquire include 23 general aviation aircraft; 11 commercial aircraft; 12 military aircraft; 11 light, ultralight, or homebuilt aircraft; 15 gliders; and 8 vertical flight aircraft. The collections rationale contains justifications for each proposed acquisition. For example, the acquisition of the Boeing 747 was justified because it epitomized the new era of wide-bodied airliners. The rationale also listed some practical criteria to be considered before acquiring additional aircraft: (1) the aircraft must be obtained, preserved, restored, and exhibited at a reasonable cost; (2) it can be transported to the museum at a reasonable cost; (3) it has research, scholarship, and/or educational value; and (4) it meets the physical requirements for exhibition.

In its 1990 report, the Advisory Committee noted that the museum's aircraft collections rationale, which has not been updated since it was last revised in 1989, had no clear goal or guidance. The committee said that to be useful, the rationale should include (1) a statement of the scope of the collection, (2) an explanation of how the scope of collecting relates to the charter of the museum, and (3) an explanation of how professional standards are maintained throughout the collections process. Further, the committee indicated that the rationale lacked safeguards to ensure that additions to the collection are not made if they further jeopardize the museum's ability to cope with the existing collection and if the new additions cannot be cared for adequately. Such a practical consideration as this would seem critical to NASM in view of its traditional inability to obtain funding to adequately care for its collection.

NASM's 1991 Space History Department's rationale also included practical criteria for assessing priorities in collecting future space artifacts. It represented these criteria in the following questions to be applied, in addition to technical criteria, when deciding whether to acquire space artifacts.

- Is the same object preserved elsewhere in a safe or permanent museum, or does it rightly belong in another, more appropriate museum?
- Can the object be preserved by the means at hand, or is its preservation beyond the capability of NASM?

- Is the object too large to be collected and preserved, or might parts of the object adequately represent its history?

By incorporating these criteria in the written aircraft collections rationale, NASM could lessen the impact of exacerbating the museum's ability to care for the existing collection and seeing that new additions are adequately cared for.

In commenting on a draft of this report, NASM officials said that although the collections rationale suggests that 80 aircraft might be added to the NASM collection by 2020, it should be understood that the presence of an aircraft in the rationale does not constitute permission to collect it. Officials said that a curator desiring to collect an aircraft must follow a set of carefully crafted procedures that have been established over the past 6 years. Under the procedures (1) the object must appear in the rationale or replace a similar object listed in the rationale and (2) the acquisition must be proposed and defended before the Aeronautics Department Collections Committee, which consists of all of the curators, and the NASM Collections Committee, which consists of both curatorial and collections management staff.

NASM officials also said that over the past 5 years, no aircraft has been acquired without provision being made for its appropriate storage and care. NASM officials said that from 1989 to 1995, it acquired only 12 aircraft, compared to the acquisition of 56 aircraft from 1982 to 1988.

Conclusions and Recommendations

Conclusions

Although NASM is popular with the public and has preserved many of our nation's historic air and space artifacts, the management of the aircraft collection that is not generally seen by the public needs improvement. NASM commits relatively few resources to aircraft restoration, compared to other museum activities and another federally funded air museum. But, even if NASM were to increase its restoration efforts, the museum would have no place to properly display or store the aircraft. Therefore, it is important for NASM to determine how to better preserve its collection in view of the limited financial resources available for aircraft restoration and storage, including determining what size collection can be adequately supported.

Since NASM was established, certain aspects of the museum's mission as a national air and space museum have been vague. For example, the legislation does not specify whether the museum should duplicate collections at other federally funded air and space museums or whether a national museum should include foreign aircraft. Once NASM's mission is clarified, NASM would be better able to develop criteria for what constitutes historically and technologically significant aircraft and, in the context of such criteria, which aircraft it should have in its collection to fulfill its mission, considering available resources and the adequacy of storage facilities.

If it is determined that NASM's current collection is too large in view of resources and facilities available, options to reduce the collection size so that the remaining aircraft can be stored or displayed in space with adequate environmental controls include deaccessioning aircraft and obtaining second-party restorations with temporary loans to other museums. Using additional second-party restorations would help preserve NASM's collection, alleviate its storage capacity problems, and share its collection with the public.

The planned extension at Dulles Airport should help alleviate NASM's storage facility problems, but funding is uncertain and the extension may take several years to complete. One option that may be available to reduce costs would be to limit the new space to the same size of current storage facilities. If feasible, this option should help NASM expedite plans to replace its deteriorating storage facilities with new storage and restoration space at Dulles Airport with proper environmental controls. Including lower cost, limited public access and a few amenities would make the new space more useful.

In addition to storing aircraft in substandard space, NASM does not have a management plan for each aircraft that describes (1) whether and how the aircraft will be used in future exhibits, (2) to what extent and when it will be restored, and (3) who is responsible for monitoring its condition.

The lack of resources devoted to collections management has resulted in the restoration staff feeling disenfranchised from the Mall museum staff.

Recommendations

We recommend that the Secretary of the Smithsonian, together with the Acting NASM Director

- consult with the appropriate Committees of Congress to better define the mission of a national air and space museum, and within that definition, criteria for identifying historically and technologically significant aircraft. As part of this effort, the Secretary and NASM Director should specifically consider the extent to which the museum should (1) include foreign aircraft in its collection and (2) duplicate aircraft contained in the collections of other federally funded museums;
- determine the relative priority of the aircraft contained in the NASM collection in the context of the definition of historically and technologically significant aircraft referred to in the above recommendation;
- determine the number and types of aircraft that should be retained, given the newly established criteria and actual and expected levels of funding and storage capacity; and
- deaccession those aircraft in the NASM collection that either do not meet the historically and technologically significant criteria or cannot be adequately stored and maintained with available resources. In pursuing the latter, additional consideration should also be given to second-party restorations and temporary loans of aircraft.

We further recommend that the new Director of NASM

- develop a management plan for those aircraft that are to remain in the NASM collection that includes (1) whether and how exhibits will be developed for purposes of displaying the collection, (2) the extent to which each aircraft will be restored and when such restoration will be done, and (3) which organization will be responsible for monitoring each aircraft;
- develop a plan to increase the interaction of the curators and collections management staff; and

- further explore private funding alternatives and the feasibility of options to better care for aircraft, such as constructing a smaller, environmentally controlled facility to house those aircraft that will remain in the collection and are currently in inadequate storage facilities, as an initial phase of the Dulles Airport extension.

Agency Comments and Our Evaluation

We requested comments on a draft of this report from the Secretary of the Smithsonian or his designee. The Under Secretary provided comments dated August 17, 1995, which are in appendix III. The Smithsonian provided additional comments in an attachment to their August 17, 1995, letter.

These comments have been discussed with Smithsonian officials and changes have been incorporated into this report where appropriate.

The Under Secretary said that the Smithsonian recognizes a number of critical issues raised in our report and is working to address them. She said the greatest challenges are the lack of adequate storage space and inadequate resources to do all of the things that must be done. The Under Secretary disagreed with some of our findings and indirectly indicated disagreement with some of our proposed solutions to the collections care problems that we identified.

Regarding our first recommendation, the Under Secretary indicated that (1) the Board of Regents will shortly review the scope of NASM's mission; (2) NASM has rationales that define criteria to assess an object's value to the collection; (3) when NASM was created, it was recognized that there might be some duplication between NASM and other museums; and (4) the overwhelming emphasis of the NASM collection is American. Our work indicated that the scope of NASM's mission was unclear. The Air Force Historian, for example, questioned the wisdom of NASM having acquired a large collection of World War II Japanese aircraft. We still believe that the Smithsonian should consult with Congress to better define NASM's mission and the criteria for identifying historically and technologically significant aircraft. We believe this consultation is necessary primarily because of the inadequate resources NASM has to take care of its current collection and the need to address that problem in a systematic fashion.

Our recommendations to determine the relative priority of all aircraft in the collection in the context of the criteria for historical and technological significance and determining the number of aircraft that should be

retained are parts of our proposed systematic solution to NASM's storage problems. However, the Smithsonian did not address these recommendations in its comments. Also, while the Smithsonian's Board of Regents may help define NASM's mission, the board is not in a position to decide whether federally funded museums should duplicate military aircraft in their collections. Further, the budget climate has changed since NASM was created, and Congress now may want to look for opportunities to reduce or eliminate duplication. Although NASM officials indicated that the practical criteria for assessing priorities in collecting future space artifacts applies to aircraft acquisitions, the written rationale does not indicate that the criteria also apply to aircraft. Moreover, since most of NASM's operating costs probably will be paid by federal funds, including the Dulles extension, we believe that Congress should be further involved in determining the role of the nation's air and space museum.

With respect to our recommendation to deaccession aircraft that cannot be adequately stored and maintained, the Under Secretary said the Smithsonian tries hard to deaccession aircraft and would welcome additional loans to other museums but cannot always find takers. As mentioned in this report, however, NASM has not developed a strategy to find other museums that might be interested in restoration loans. We believe that such a strategy would better inform other museums about restoration opportunities and could result in more restoration loans of NASM aircraft.

Regarding our recommendation to develop a management plan for each aircraft in the collection, the Under Secretary indicated that curatorial responsibility has been assigned for each aircraft and that curators prioritize treatments as required to preserve aircraft. However, as discussed in this report, NASM does not prepare long-range plans for exhibits and restorations. We are not suggesting that an exhibit plan be developed for each aircraft in the collection. However, we are suggesting that NASM make determinations about the likelihood of whether aircraft will be exhibited at some point and the extent of restoration that would be needed to put the aircraft that are likely to be exhibited into exhibitable condition. Further, the lack of resources for collections management demonstrates an even greater need for a management plan.

In response to our recommendation that NASM increase the interaction between the curators and collections management staff, the Under Secretary said that they already collaborate and that such collaboration has developed into a full and genuine partnership. Our interviews with

several collections management staff (discussed in ch. 2) disclosed viewpoints that were substantially different from this. We believe that the substantial differences in opinion between the collections management staff and NASM management on this subject indicates that more attention should be devoted to determining what the condition is and how it should be resolved.

Finally, the Under Secretary indicated that she disagreed with our last recommendation, which dealt with exploring the feasibility of constructing a smaller, initial storage facility at the Dulles extension to replace inadequate storage space. She said that display and educational space would be constructed by 2003 and that storage space would be built after this, as funds become available. We continue to believe that the need for storage space is more critical than the need for additional display and educational space, but we recognize the need to accommodate the differing views and desires of the various parties that may contribute to funding the extension.

Garber Facility Assessment

From 1991 to 1994, NASM undertook a conservation assessment, examining the condition of the museum's 13 storage buildings at Garber and the condition of the artifacts contained in them. Below are excerpts from the assessments.

Table I.1: Conservation Assessment of Buildings at the Garber Facility

Building no.	Year built	Heat, a/c, or humidity control	Contents/Condition
2	1952-1954	None	"Some of the objects stored in Building 2, such as the Gotha Go 229, a World War II German twin-jet-engine flying wing, and two Horten III flying wing prototypes, are quite significant.[a] These artifacts have suffered for years from outdoor storage and mishandling. Environmental conditions in Building 2 are very poor, and certain objects continue to deteriorate."
3	1952-1954	None	"Most of the objects in Building 3 fall into the two broad categories of aircraft engines and armament . . . . Most are of great significance, representing prototype engines, surviving examples of production engines, and captured engines from World War II. The engines are generally in poor condition due to years of outdoor storage.[b] Storage conditions within Building 3 are poor."
4	1952-1954	None	"Most of the artifacts stored in Building 4 are either aircraft or spacecraft hardware . . . . Building 4 contains many gaps and voids that permit dust and dirt to enter the building . . . . Dirt and dust contribute to the degradation of surface finishes and promote corrosion."
5	1952-1954	None	"There are many significant objects stored in Building 5 . . . . We found corrosion, mold, and insect activity . . . . Heavy dirt and dust accumulation has occurred on most interior structural members since the building was constructed."
6	1952-1954	None	"Building 6 contains aircraft engines, wing sections, missiles, and aircraft . . . . Major problems include corrosion, dirty surfaces, and peeling paint . . . . This building was damaged by a tornado on November 23, 1992."[b]
7	1953	None	"Building 7 contains aircraft, weapons, propellers, and avionics . . . . In the summertime, temperatures routinely reach and exceed 38 degrees C; relative humidity is also extremely high . . . . No class of material can be preserved effectively under these conditions. This environment promotes corrosion of metals, destruction of organic materials, and oxidation of synthetics such as rubber, cellulose nitrate, and polyvinyl chloride."
9	1952-1954	None	"Building 9 is used for storage and is not open to the public. It contains a great variety of aircraft and spacecraft hardware, including parts, tools, accessories, etc. . . . . The absence of environmental controls promotes deterioration of objects inside the building . . . . The interior space is dusty and dirty due to gaps along the walls and doorways."

(continued)

Building no.	Year built	Heat, a/c, or humidity control	Contents/Condition
11	1952-1954	None	"Building 11 is a storage building that is closed to the public and contains mostly aircraft engines. . . . The building is in generally poor condition. The concrete slab has several major cracks and is crumbling along the edges; portions of the steel structure are rusting. Gaps along the perimeter allow insects and rodents to enter the building. . . . Ongoing deterioration includes corrosion, paint loss, dimensional changes such as cracking and joint separation in wooden artifacts, and possible insect damage."[b]
20	Late 1960s	Heat only	"Building 20 is an exhibit building which contains aircraft, restored and unrestored, and other artifacts. . . . [C]onditions under which these objects are exhibited do not facilitate their preservation, and in fact contribute to their degradation—even in the case of restored aircraft, which are no less susceptible to harsh environments than are other artifacts. . . . The roof has minor leaks, and condensation drips inside during the winter. . . . A number of artifacts located near the windows have been damaged by light. . . . The restoration process alone cannot be considered a solution because many restored objects in Building 20 are deteriorating . . . . Almost all recently restored aircraft in Building 20 have evidence of corrosion . . . .[The Focke-Wulf FW 190 F-8] demonstrates the restoration myth that once restored, an aircraft is good for another 150 years. When restored, the machine was stripped of all original paint and then repainted. Now, rust is beginning to appear on steel elements."
21	Mid-to-late-1960s	Heat only	"Building 21 is used for storage, shipping and receiving. . . . Almost every artifact (new accession, outgoing loan, or incoming loan) is processed through Building 21. . . . Conditions in Building 21 fall short of recognized museum standards for collections storage and shipping and receiving."
22	Not provided	Heat only	"Building 22 is a display/storage building that has been closed to the public and is now used solely for collections storage. . . . The Caroline, President John F. Kennedy's campaign plane, was among the first of the aircraft to be moved into the building. . . . This object demonstrates how quickly an aircraft can deteriorate when not cared for properly. . . . Despite a requirement for indoor storage, the fuselage and wing sections were stored outdoors for many years. In 1989, a family of feral cats took up residence in the fuselage, and, in addition to numerous cat droppings, shredded the upholstery and the rugs. . . . Relative humidity and temperature were responsible for mold, growth, corrosion, and peeling paint."

(continued)

Building no.	Year built	Heat, a/c, or humidity control	Contents/Condition
23	Early 1970s	Heat only	"Building 23 is a display/storage building. . . . Significant aircraft in Building 23 include a Douglas VB-26B Invader, the nose section of a Mitsubishi Betty Bomber, a Grumman Avenger, a Bachem Ba349 Natter, a Sikorsky S-43 (JRS-1) flying boat, and a cut-away Felixstone F-5L fuselage. . . . The roof leaks, and condensation forms on exposed steel rafters. Rust is visible on structural elements . . . . Of the nine storage building assessed to date at the Garber Facility, Building 23 has fewer problems than the rest. Unfortunately, its environment is still not conducive to long-term artifact preservation."
24	1975	Heat only	"Building 24 is an exhibit and storage building that contains a wide variety of artifacts and environments. Among its exhibits are restored and unrestored aircraft, paper kites, space artifacts, and a number of other relatively small artifacts. . . . The roof leaks, and condensation forms on metal building components. . . . There is no humidity control in the exhibit area; frequent fluctuations between extreme high and low relative humidity values occur daily."

[a]The Horten aircraft have been sent to a museum in Berlin, Germany, for restoration.

[b]NASM currently has a program underway to preserve the engines.

Source: NASM Conservation Reports 1991-1994.

Probable NASM Aircraft Acquisitions

In 1989, NASM prepared a collections rationale, which contains plans to collect 80 additional aircraft of all types over the next 30 years. The aircraft NASM plans to acquire are listed below.

Commercial Aircraft (acquire 11)

Polikarpov Po-2
Douglas DC-4
Bush aircraft: De Havilland DHC-2 Beaver or DHC-3 Otter
Vickers Viscount
Embraer Bandeirante
De Havilland DHC-6 Twin Otter
Boeing 707
Boeing 727
Sud/Sud-Est/Aerospatiale SE 210 Caravelle
Tupolev Tu-104
Boeing 747

Military Aircraft (acquire 12)

Any World War I British aircraft (e.g., Sopwith 1 1/2 Strutter)
Any World War I Italian aircraft (e.g., Ansaldo S.V.A. 9)
Any Interwar (1919-1939) British aircraft, e.g., De Havilland D.H. 82 Tiger Moth
Morane Saulnier 127
Consolidated B-24 Liberator
Douglas A-20 Havoc
Avro Lancaster
Gloster Meteor
Any German bomber (e.g., Junkers Ju 87)
Soviet aircraft: Ilyushin Il-2 Shturmovik
Boeing B-52 Stratofortress
Convair F-102 Delta Dagger
Lockheed SR-71 Blackbird[1]
Dassault Mirage III
Mikoyan-Burevich MiG-21 Fishbed
Grumman F-14 Tomcat

Private Aircraft acquire 11)

Alexander Eaglerock A-2, American Eagle A-1 or Brunner-Winkle Bird
Travel Air 4000, Laird Speedwing, Commercial or Stearman C3B
Fleet 2 or Great Lakes 2-T-1A

[1]NASM acquired this aircraft after this list was prepared in 1989.

	Buhl Bull Pup LA-1 or Cessna C-34 or Ryan Model SC-150/ST Aeronca Champion 7AC, Cessna 120 or 140, Luscombe Silvaire Model 8, Globe Swift, Stinson Voyager, or Taylorcraft BC-12D (acquire 3) Cessna 172 Piper Arrow or Commanche or Mooney M-20/M-22/PFM
Business Aircraft (acquire 6)	Piper Malibu Beech Baron 55 Piper Aztec Beech King Air Rockwell Commander Cessna Citation I
Utility Aircraft (acquire 6)	Stinson SB-1 Bellanca Aircruiser Piper Pawnee or Schweitzer Grumman AG Cat Ayres Turbo Thrush S2R-T65/400 Champion Citabria or Decathalon Christen Eagle Mudry CAP 10B
Gliders (acquire 15)	Akaflieg Stuttgart FS-24 Phonix ASW 12 ASW 22B Bekas N Caproni A-21S D.F.S. Olympia D.F.S. Wiehe Eipper-Formance Quicksilver Glaser-Dirks DG-400 Glasflugel H-301 Libelle Hall Cherokee II Hoffman H-36 Dimona MK II Letnany L-13 Blatnik Nimbus 3/24.5 Slingsby T.21B Woodstock One

Light/Ultralight/Homebuilt Aircraft (acquire 11)	Aerocar Micro-Imp Aerolites Ag-Bearcat Circa Reproductions Sopwith Triplane Freedom Master Air Shark I Glasair III Hamilton HX-321 Holcomb Perigee Lancair 200/235 Ligeti Stratos Monnett Moni Paraplane Pietenpol Air Camper Polen Special Questair Venture SA-60 Silhouette I Sadler A22 Seawind International Seawind 2000 SNS-9 EXP II Hiperlite Starlite SL-1 Van's RV-3 Volmer Sportsman Wheeler Express
Vertical Flight Aircraft (acquire 8)	Bell AH-1G Cobra Bell-Boeing V-22 Osprey Boeing-Vertol CH-47 Chinook Gyrodyne XRON McDonnell Douglas AH-64A Apache McDonnell Douglas Notar Mil Mi-12 Mil Mi-24 Hind Sikorsky H-3 Sikorsky HH-52 Farrington Air and Space-18A Williams Research X-Jet

Source: NASM 1989 Collections Rationale.

Comments From the Smithsonian Institution

Note: GAO comments supplementing those in the report text appear at the end of this appendix.

SMITHSONIAN INSTITUTION
Washington, D.C. 20560
U.S.A.

August 17, 1995

J. William Gadsby
Director, Government Business
Operations Issues
General Accounting Office
Washington, DC 20548

Dear Mr. Gadsby:

Thank you for this opportunity to comment on the draft GAO report "Smithsonian Institution: Better Care Needed for National Air and Space Museum Aircraft." The report highlights a number of critical issues related to the care of the Museum's collections which we also recognize and are working to address.

The Smithsonian Institution was established with a mandate to "increase and diffuse knowledge." The National Air and Space Museum (NASM) shares this responsibility in addition to its specific Congressional mandate. To carry out its responsibilities, the Museum must support not only collections care but also research, exhibitions and public service functions. In evaluating the Museum's performance, it is important to consider NASM's overall mission rather than a single responsibility, like aircraft restoration. As the governing body for all Smithsonian museums, the Board of Regents will shortly review the scope of the Museum's mission.

See p. 41.

Just as NASM must engage in a broad spectrum of activities in order to fulfill its purpose, collections care also entails a range of activities that complement and reinforce one another. NASM has over 32,000 objects under its stewardship. They range from archival documents to paintings and sculpture to engines and rocket motors to aircraft and spacecraft. To determine the extent to which the Museum is providing adequate attention to aircraft restoration, one must evaluate this activity in relationship to the resources devoted to care of the collection as a whole.

See comment 1.

See comment 2.

The Museum is charged with preserving the national collection of air and space objects and equipment. As such, NASM emphasizes conservation and preservation treatments that are intended to arrest deterioration and prolong the life of the object. Restoration, which is designed to return an object to an earlier appearance or condition, is only one aspect of preservation. In order to evaluate whether or not NASM is adequately meeting this charge, one must evaluate the full range of preservation activities (from inspection of artifacts, cleaning and rehousing, preventive conservation to full-scale restorations) undertaken to care for the collection.

See p. 43-44.

The Museum's curatorial departments have developed collections rationales which define the criteria used to assess an object's value to the collection. While curatorial departments have primary responsibility for determining what should be added to the collection, collections care is a responsibility that is shared by curatorial and collections management staff at NASM. Specific recommendations and decisions on accessions, deaccessions, loans, maintenance schedules and treatment plans are made through a collaborative effort between curatorial and collections management staff. The collaboration between these units has evolved over the years into a full and genuine partnership that should ensure the best possible care of the collection. To be accurate, any calculation of Museum resources devoted to collections management must include the collections related activities undertaken by curatorial staff.

See p. 42.

As reflected in its legislative history, NASM was intended to collect air and space artifacts which would represent the "world's greatest collection of the history of manmade flight." It was recognized that there might be duplication between NASM and other museums since, as the national museum, NASM was to collect those objects that had value in the broad history of aviation. It was also recognized that the collection would grow given its role in documenting the history of aeronautics and space flight. NASM does not, however, add objects to its collection haphazardly but takes seriously its responsibility to accession only those objects of historical significance. The collections rationales referred to earlier clearly define not only the criteria used to assess the historical significance of an object but also the practical considerations that must be addressed before an object is accessioned.

By far, the greatest challenges to NASM's ability to care for its collection is the lack of adequate storage space and inadequate resources to do all that must be done. Most of the Institution's aging museum buildings require major renovations to correct structural problems, give better access to the physically disabled, accommodate inadequately housed collections and provide a stable environment for artifacts. Reductions in Federal appropriations limit the Institution's ability to address these needs as rapidly as desired. The Institution is actively working to increase private support; however this will take time. Without additional resources, the needs of NASM will continue to be evaluated in conjunction with other, equally pressing needs.

See pp. 42-44.

Planning and design of the NASM extension at Dulles Airport is continuing, and both House and Senate Appropriations bills authorized the appropriation of $1 million in FY 1996 for this purpose. Construction of the extension will provide museum-quality storage for the Museum's collection. The Commonwealth of Virginia has steadfastly supported this project and has committed to provide about one-third of the total project cost through in-kind and cash contributions. A preliminary financial analysis suggests that potential revenues generated at the site could be sufficient to support a bond issue of up to $60 million. The Institution has also devised a phased approach to construction of the facility which anticipates opening of the public areas, including display areas and education spaces, in the year 2003. Additional storage spaces would be constructed as funds became available. In the interim, improvements to the Garber facility will continue to be made.

See p. 35.

See p. 43.

Again, thank you for this opportunity to comment on the draft report. The NASM has worked to address collections related problems since its founding. Positive trends are apparent in our collections statistics. Attached are more detailed comments that address some of those concerns.

Sincerely,

Constance B. Newman
Under Secretary

See comment 3.

Attachment

- 3 -

The following are GAO's comments on the Smithsonian Institution's letter, dated August 17, 1995.

GAO Comments

1. The scope of our work, as discussed on pp.15-16, was limited to aircraft restoration.

2. The fact that NASM's storage facilities are inadequate to preserve the collection is discussed throughout chapter 3.

3. We did not reproduce the attachment.

Ordering Information

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