FEASIBILITY STUDY OF AN AEROSPACE MUSEUM IN THE WESTERN UNITED STATES

(In Four Volumes)

Volume Two

Documentation

Contract NASW-2215
Final Report
31 July 1972

Smithsonian Institution
National Air and Space Museum
Washington, D.C. 20560

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CONTENTS

Volume One

(Conclusions, Recommendations, and Summary of Study)

Volume Two

(Documentation)

Volume Three

(Further Documentation)

(Part One - Sections I Through IX)

Volume Three

(Further Documentation)

(Part Two - Sections X Through XVII)

Volume Four

(United States Museums and Planetaria with Aerospace Exhibits)

I. Introductory Note

This volume of the Report on Feasibility of Establishing an Aerospace Museum in the Western United States (NASA Contract NASW-2215) contains the supporting papers of this investigation.

Regional Locational Analysis for Aerospace Museums in the Western United States studies the potential locations within the Western United States where aerospace museums might logically best be located. For purposes of these analyses, the region of the "Western United States" was defined to include the thirteen states of Alaska, Arizona, California, Colorado, Hawaii, Idaho, Montana, Nevada, New Mexico, Oregon, Utah, Washington and Wyoming. This definition was concurred with by the technical director of this NASA contract.

The report was produced under contract by Economics Research Associates under direction of the project staff. It is their conclusion that Los Angeles, San Francisco, San Diego, Seattle and Phoenix/Tucson are the most logical locations for aerospace museum development.

Aerospace Museums in the Western United States lists the 26 museums and other organizations with significant public displays of aeronautics, astronautics or astronomy in the Western United States. The author is Program Coordinator for this Feasibility Study.

Museums—Roles, Activities and Functions is an essay treating the obligations of such museums to the user-visitor. The author is the previous Director of the National Air and Space Museum from 1964-1969.

Sources of Museum Funding discusses the ways in which museums obtain funds for construction and improvements, operations and acquisitions. The author is the former Director-General of Museums, Smithsonian Institution.

In Aerospace Artifacts, consideration is given to general curatorial responsibilities in preservation and exhibition of historically significant specimens and of potential sources of artifacts and sources of exhibit materials and related information. The author is Assistant Director, National Air and Space Museum.

II. Supporting Papers

Economics Research Associates

Los Angeles, California
Washington, D.C.

Letter Report

REGIONAL LOCATIONAL ANALYSIS FOR AEROSPACE MUSEUMS IN WESTERN UNITED STATES

Prepared for
SMITHSONIAN INSTITUTION

July 14, 1972

Economics Research Associates
Los Angeles • McLean • Miami Springs • Brussels

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July 14, 1972

Mr. George S. James
Program Coordinator
Astronautics Department
National Air and Space Museum
Smithsonian Institution
Washington, D.C. 20560

Dear Mr. James:

Economics Research Associates has prepared this letter report, at your request, to examine the comparative market potential of major regions within the 13 western states as locations for aerospace museums.

Prior to any analysis or ranking of potential regions of the western states, the purpose of these attractions was defined. After discussions with the Smithsonian's project staff and a review of the Congressional hearing,[1/] it is apparent that the thrust of such aerospace museums would probably be to portray the historic significance of flight in the development of the United States and the status of the aerospace industry today. The benefits to our society from the derivatives of aerospace technology would also be displayed.

COMPOSITION OF MUSEUM ATTENDANCE

One of the most important segments of potential support for the proposed aerospace museum is school groups. Since museum activities appear to be becoming increasingly educational in nature, and are used by teachers in a broad range of subjects as extensions of their own educational facilities and materials, it

1/ U.S. House of Representatives, Hearings Before the Ad Hoc Subcommittee on H.R. 10771 of the Committee on Science and Astronautics, July 16, 1970.

follows that a large portion of the visitors at the proposed facilities will be school groups. A questionnaire sample of existing museums, conducted by the Smithsonian project staff, revealed that students as a group were second in attendance only to the general public for major support. The local resident population is another prime visitor group. Through school children and annual museum memberships, the museum gains exposure and draws a steady flow of resident visitors.

For the most part, museums in the western states are nonprofit entities lacking sufficient funds to properly promote their activity. They must rely on a good location for exposure to tourists, which can comprise an important category of museum attendance.

LOCATIONAL CRITERIA

ERA considered three major criteria by which to judge regions as locations of the aerospace museum: population, aerospace employment, and tourism.

Assuming that the greater the number of inhabitants, the more schools and students there are, population becomes the primary quantitative measure of the regions. The fact that the proposed facility is an aerospace museum makes aerospace employment a significant quantitative gauge, not in terms of attendance, but in terms of locating in an area where aerospace is economically important and where there is the possibility of initial and continuing funding by major aerospace companies. Given that the museum will be exposed to the tourist market, based on a favorable location, tourism is another means of measuring regions as potential locations for the proposed museum.

ERA analyzed all of the 13 western states, dividing them into major regions to rank them with respect to their suitability as possible locations for the aerospace museum. Table 1 lists the states and regions showing their contents by Standard Metropolitan Statistical Areas, counties, or districts.

Table 1

MAJOR REGIONS OF
THE WESTERN UNITED STATES

Region	
Alaska	
Anchorage	Anchorage Census Division
Juneau	Juneau Census Division
Arizona	
Phoenix	SMSA* of Phoenix
Tucson	SMSA of Tucson
California	
Los Angeles	SMSA of Los Angeles-Long Beach
San Diego	SMSA of San Diego
San Francisco	SMSAs of San Francisco-Oakland and San Jose
Sacramento	SMSA of Sacramento
Colorado	
Colorado Springs	SMSA of Colorado Springs
Denver	SMSA of Denver
Hawaii	
Honolulu	SMSA of Honolulu
Idaho	
Boise	SMSA of Boise City
Montana	
Billings	SMSA of Billings
Great Falls	SMSA of Great Falls
Nevada	
Las Vegas	SMSA of Las Vegas
Reno	SMSA of Reno
New Mexico	
Albuquerque	SMSA of Albuquerque
Santa Fe	County of Santa Fe
Oregon	
Portland	SMSA of Portland 1/
Utah	
Salt Lake City	SMSA of Salt Lake City
Washington	
Seattle	SMSA of Seattle-Everett
Spokane	SMSA of Spokane
Wyoming	
Cheyenne	Laramie County

* Standard Metropolitan Statistical Area.
1/ Includes part of Washington.

Source: Economics Research Associates.

REGIONAL ANALYSIS

Table 2 gives past and projected population data for many regions in the western United States. The Los Angeles region is by far the most populous region in the West, with 7.04 million people in 1970, more than twice the inhabitants of the San Francisco region in that same year. San Francisco with 3.11 million people also had more than twice the population of the third largest area, Seattle. Seattle and San Diego are about equal in size, with 1.42 million and 1.36 million residents, respectively.

An analysis of aerospace employment for 1970, shown in Table 3, reveals a similar ranking; Los Angeles is by far the biggest employer with 357,000 aerospace employees, followed by San Francisco with 92,100. The Seattle region had the third highest aerospace employment at 61,200, and Phoenix and San Diego ranked fourth and fifth, with 38,600 and 38,000, respectively.

In Table 4 ERA measures the importance of the aerospace industry to each region by computing the percentage of the area's total work force engaged in that industry. A level of 10 percent of total employment should be considered significant; therefore, the aerospace industry is about equally important to Los Angeles, Seattle, Phoenix, and San Diego. By this analysis, the industry carries only half as much weight in the San Francisco region as it does in the preceding areas. Even though the percent of aerospace employment is lower for San Francisco than for Seattle, Phoenix, or San Diego, the factors of population as well as substantial aerospace employment recommend that qualitatively San Francisco be ranked second, after Los Angeles.

Los Angeles with its significantly larger population, and greater number of students and aerospace workers, provides considerably more potential market support for an aerospace museum than any other region. Further, as a second-choice location, San Francisco, for the same reasons, far exceeds any other region.

Table 2

POPULATION OF MAJOR REGIONS
IN WESTERN UNITED STATES
(Thousands)

Region	1965	1970	1975	1980	Percentage Index for 1970
Alaska					
Anchorage	n.a.	126	133	145	2
Juneau	n.a.	13	14	16	0
Arizona					
Phoenix	838	968	1,158	1,371	14
Tucson	315	352	399	456	5
California					
Los Angeles	6,815	7,037	8,142	9,020	100
San Diego	1,188	1,358	1,448	1,621	19
San Francisco	2,967	3,110	3,466	3,781	44
Sacramento	758	801	986	1,152	11
Colorado					
Colorado Springs	183	236	301	384	3
Denver	529	1,228	1,347	1,510	17
Hawaii					
Honolulu	590	629	684	744	9
Idaho					
Boise	99	112	116	129	2
Montana					
Billings	83	87	92	97	1
Great Falls	77	82	86	90	1
Nevada					
Las Vegas	224	273	301	342	4
Reno	107	121	153	181	2
New Mexico					
Albuquerque	287	316	369	429	4
El Paso	337	359	379	400	5
Santa Fe	49	54	59	64	1
Oregon					
Portland	912	1,009	1,114	1,230	14
Utah					
Salt Lake City	525	558	618	683	8
Washington					
Seattle	1,221	1,422	1,464	1,635	20
Spokane	263	288	290	310	4
Wyoming					
Cheyenne	58	56	57	57	1

n.a. means not available.

Source: U.S. Department of Commerce and Economics Research Associates.

Table 3

AEROSPACE EMPLOYMENT
IN WESTERN UNITED STATES
1970

Region	Aerospace Employees	Percentage Index
Alaska		
Anchorage	x	0
Juneau	x	0
Arizona		
Phoenix	38,600	11
Tucson	4,100	1
California		
Los Angeles	357,500	100
San Diego	38,000	11
San Francisco-Oakland-San Jose	92,100	26
Sacramento	4,800	1
Colorado		
Colorado Springs	x	0
Denver	8,000	2
Hawaii		
Honolulu	x	0
Idaho		
Boise	x	0
Montana		
Butte	x	0
Helena	x	0
Nevada		
Las Vegas	x	0
Reno	x	0
New Mexico		
Albuquerque	1,200	0
El Paso	x	0
Santa Fe	x	0
Oregon		
Portland	1,400	0
Utah		
Salt Lake City	x	0
Washington		
Seattle	61,200	17
Spokane	x	0
Wyoming		
Cheyenne	x	0

x = Less than 1,000 employees.

Source: State Labor Departments and Economics Research Associates.

Table 4

IMPORTANCE OF AEROSPACE EMPLOYMENT
TO EACH REGION

Region	1970 Total Employment (thousands)	1970 Aerospace Employment (thousands)	Percent in Aerospace
Los Angeles	3,711	357.5	10%
San Francisco	1,652	92.1	6
Seattle	555	61.2	11
Phoenix	324	38.6	12
San Diego	389	38.0	10
Denver	467	8.0	2
Sacramento	262	4.8	2
Tucson	102	4.1	4
Portland	387	1.4	0
Albuquerque	107	1.2	1

Source: State Labor Departments and Economics Research Associates.

Although the effect of tourism depends greatly on exposure to the tourist market, ERA assumes that any projected museum exposure to respective markets can be attained in each region. Table 5 shows the estimated number of tourists, both intrastate and out-of-state, who visited the various regions in 1970. A ranking of the regions by total tourism results in a similar ranking. Los Angeles ranks first with 45 million visits, San Francisco is second with 30 million, San Diego is third with 14 million, and Seattle is fourth with 7 million.

Based upon the high rankings achieved by the Los Angeles, San Francisco, and San Diego regions in the foregoing analysis, it is ERA's opinion that California would be the best possible state in which to locate a single aerospace museum if such action is ultimately recommended.

NATIONAL ANALYSIS

To illustrate the strength of California as a potential market for increased aerospace museum activities, ERA prepared Table 6 ranking the 50 states and the District of Columbia by population. California surpassed New York by almost three million persons, with a total population of 18.5 million. Following New York's 15.7 million, a considerable drop of more than six million persons marks the third-ranked Pennsylvania's total of 9.4 million. The closest contender to California in the West is Washington, whose 2.2 million population can only draw 18th ranking nationally.

Extending this analysis to encompass the importance of the aerospace industry, each state was ranked by total aerospace employment and its percentage of total employment was also indicated. The aerospace employment in Table 7 was calculated using Standard Industrial Classification codes for not only aircraft and parts but support industries as well. The states were ranked by aerospace employment only, but for a more comprehensive analysis, the percentage of aerospace employment to a state's total work force must also be considered a factor.

Table 5

TOURISM TO FOUR MAJOR REGIONS
IN WESTERN UNITED STATES
1970
(Thousands)

Region	Origin of Tourists (Number of Visits)		Total Number of Visits
	Intrastate[1]	Out-of-State	
Los Angeles	37,500	7,500[2]	45,000
San Francisco	24,300	5,700	30,000
San Diego	11,000	3,000	14,000
Phoenix	3,000[3]	6,000[3]	9,000
Seattle	4,000[3]	3,000[3]	7,000

1/ Represents multiple trips during the year by state residents.
2/ Of the 7,500,000 tourists to Los Angeles, 300,000 were non-immigrant visitors from foreign countries.
3/ Estimated ratio; information not available.

Source: U. S. Immigration Service and Economics Research Associates.

Table 6

RANKING OF STATES BY POPULATION
1970

Rank	State	Population
1	California	18,500,006
2	New York	15,726,064
3	Pennsylvania	9,365,552
4	Illinois	8,903,065
5	Ohio	8,272,512
6	Texas	8,234,458
7	Michigan	6,806,151
8	New Jersey	6,293,515
9	Massachusetts	4,817,915
10	Florida	4,656,993
11	Maryland	3,307,337
12	Indiana	3,213,598
13	Missouri	2,997,071
14	Virginia	2,846,034
15	Wisconsin	2,542,975
16	Connecticut	2,504,802
17	Georgia	2,280,230
18	Washington	2,248,837
19	Minnesota	2,165,029
20	Louisiana	1,996,197
21	Tennessee	1,917,695
22	North Carolina	1,896,423
23	Alabama	1,801,095
24	Colorado	1,581,739
25	Arizona	1,319,189

Table 6
(Continued)

Rank	State	Population
26	Kentucky	1,288,024
27	Oklahoma	1,281,485
28	Oregon	1,280,691
29	South Carolina	1,017,254
30	Iowa	1,005,569
31	Kansas	949,181
32	Utah	821,689
33	Rhode Island	801,745
34	District of Columbia	756,510
35	Nebraska	634,260
36	Hawaii	629,176
37	Arkansas	595,030
38	West Virginia	545,243
39	Vermont	444,330
40	Nevada	394,356
41	Mississippi	393,488
42	Delaware	385,856
43	Wyoming	332,416
44	New Mexico	315,774
45	Alaska	300,382
46	Maine	214,099
47	New Hampshire	201,693
48	Montana	169,171
49	Idaho	112,230
50	South Dakota	95,209
51	North Dakota	73,653

Source: U.S. Department of Commerce, Bureau of the Census, General Characteristics of the Population, 1970, U.S. Summary; and Economics Research Associates.

Table 7

IMPORTANCE OF AEROSPACE EMPLOYMENT TO EACH STATE

State	1970 Aerospace Employment (thousands)	1970 Total Employment (thousands)	Percentage of Employment
California	508.3	5,517.0	9.2%
New York	283.7	6,109.3	4.6
Illinois	231.0	3,634.9	6.4
Ohio	209.6	3,260.1	6.4
Pennsylvania	176.6	3,672.3	4.8
Indiana	159.0	1,535.7	10.4
Texas	154.7	2,984.5	5.2
Connecticut	148.0	1,047.1	14.1
New Jersey	138.9	2,165.2	6.4
Massachusetts	136.3	1,939.8	7.0
Washington	74.7	825.8	9.0
Michigan	63.4	2,496.6	2.5
Florida	57.6	1,790.1	3.2
Missouri	57.0	1,393.8	4.1
Minnesota	48.5	1,054.8	4.6
Arizona	45.0	436.8	10.3
Tennessee	39.5	1,080.9	3.7
Maryland	37.7	979.4	3.8
North Carolina	36.2	1,486.0	2.4
Kentucky	36.1	695.3	5.2
Kansas	30.2	511.7	5.9
Wisconsin	27.8	1,239.2	2.2
Virginia	25.8	1,114.7	2.3
Colorado	23.5	569.1	4.1
Oklahoma	23.5	581.4	4.0

Table 7
(Continued)

State	1970 Aerospace Employment (thousands)	1970 Total Employment (thousands)	Percentage of Employment
Iowa	22.3	674.9	3.3%
Alabama	21.6	787.6	2.7
South Carolina	17.6	673.7	2.6
New Hampshire	17.2	212.8	8.1
Arkansas	17.1	410.8	4.2
Mississippi	12.0	428.8	2.8
Georgia	11.2	1,256.3	0.9
Nebraska	11.0	366.1	3.0
Oregon	10.4	535.1	1.9
Utah	9.7	237.9	4.1
Rhode Island	9.1	293.8	3.1
Vermont	8.2	120.5	6.8
West Virginia	6.6	394.2	1.7
Louisiana	6.1	809.7	0.8
Maine	5.2	254.7	2.0
New Mexico	3.5	193.7	1.8
Delaware	1.1	175.5	0.6
Alaska	x	N.A.	N.A.
Hawaii	x	N.A.	N.A.
Idaho	x	N.A.	N.A.
Montana	x	N.A.	N.A.
Nevada	x	N.A.	N.A.
North Dakota	x	N.A.	N.A.
South Dakota	x	N.A.	N.A.
Wyoming	x	N.A.	N.A.

N.A. means not applicable.
x means less than a thousand.

Source: 1970 County Business Patterns by individual states, and Economics Research Associates.

In view of California's population base, total employment statistics, an aerospace employment nearly twice that of its nearest contender, and with aerospace being more than 9 percent of total employment in the state, it is apparent that California becomes the most logical location for increased aerospace activities in the western United States.

SELECTION OF MUSEUMS FOR ANALYSIS

Based on the foregoing analysis, the Smithsonian project staff selected six California museums, listed in Table 8, by area. Most of these museums which are considered complementary to the proposed aerospace museums are established and have significant attendance. However, with the exception of one or two, they have not been evaluated in any way as to their availability in whole or part for the housing of the proposed museum. These museums were analyzed as to their current and projected attendance as a basis for evaluating potential exposure should a new aerospace museum be established at the various locations.

ERA surveyed student enrollment in Los Angeles, San Francisco, and San Diego, the three areas where the selected museums are located, and correlated the data to population and previous ranking of the areas. Projections were then made of future attendance patterns at each of the selected museums.

ANALYSIS OF STUDENT ENROLLMENT

As indicated previously, aside from the general public, students represent the largest single contributor to museum attendance. Consequently, enrollment in schools, colleges, and universities merits analysis in each area of consideration.

Elementary and High Schools

A survey of elementary and high schools in Los Angeles, San Francisco, and San Diego illustrates some interesting phenomena. As shown in Table 9,

Table 8

SELECTED CALIFORNIA MUSEUMS
CONSIDERED COMPLEMENTARY TO
PROPOSED AEROSPACE MUSEUM

LOS ANGELES

- California Museum of Science and Industry
- Natural History Museum of Los Angeles County

SAN FRANCISCO

- The Exploratorium
- California Academy of Sciences

SAN DIEGO

- San Diego Aerospace Museum
- San Diego Hall of Science

Source: Economics Research Associates.

Table 9

FULL-TIME ENROLLMENT IN
ELEMENTARY AND HIGH SCHOOLS
1960-1971

	Kindergarten to Sixth Grades		Seventh to Twelfth Grades		Kindergarten to Twelfth Grades		Percentage of Total Population
	Total	Percentage Change	Total	Percentage Change	Total	Percentage Change	
Los Angeles							
1960	799,849	--	508,502	--	1,308,351	--	21.7%
1965	901,984	+ 12.8	643,581	+ 26.6	1,545,565	+ 18.1	1/
1970	897,923	- 0.5	710,371	+ 10.4	1,608,294	+ 4.1	22.9%
1971	866,057	- 3.5	709,562	- 0.1	1,575,619	- 2.0	1/
San Francisco							
1960	462,635	--	294,615	--	757,250	--	22.4%
1965	546,933	+ 18.2	396,551	+ 34.6	943,484	+ 24.6	1/
1970	563,483	+ 3.0	449,976	+ 13.5	1,015,977	+ 7.7	23.6%
1971	552,749	- 1.9	455,759	+ 1.3	1,008,508	- 0.7	1/
San Diego							
1960	140,653	--	86,674	--	227,327	--	22.0%
1965	158,638	+ 12.8	110,723	+ 27.7	269,361	+ 18.5	1/
1970	179,432	+ 13.1	139,825	+ 26.3	319,257	+ 18.5	23.5%
1971	179,980	+ 0.3	145,120	+ 3.8	325,100	+ 1.8	1/

1/ Population for 1965 and 1971 is not accurately known and, therefore, ratio not used.

Source: State Department of Education, Bureau of Administrative Research and District Organization, and Economics Research Associates.

there has been an overall increase in student enrollments in elementary and high schools in the decade from 1960 to 1970. However, since 1965, despite an increasing population, each area has experienced either a decrease or slow down in student enrollments in grades kindergarten through sixth grade, reflecting the nationwide declining birth rate. But regardless of the changing social attitudes, the percent of students to total population for each area never varied more than 0.7 percent in either 1960 or 1970. In 1970 kindergarten through twelfth grade students represented 22.9 percent of Los Angeles' population, 23.6 percent of San Francisco's population, and 23.5 percent of San Diego's population. If the trend in births continues in its present direction these percentages are expected to decrease slightly, but the variance is expected to remain relatively constant. Therefore, a ranking of the three areas by enrollment in lower education facilities, based on this analysis, would give the same result as did the population analysis: (1) Los Angeles, (2) San Francisco, and (3) San Diego.

Colleges and Universities

A direct relationship cannot be drawn between higher education enrollment figures and population totals due to the many out-of-state and out-of-area students attending the various colleges and universities. However, total enrollment in institutions of higher education can be used as a measuring device germane to a potential market for an aerospace museum. As shown in Table 10 Los Angeles again ranks first with 247,666 full-time students enrolled in colleges and universities in 1970; San Francisco is second with 153,593 students, and San Diego with 41,258 students ranks third.

ATTENDANCE PROJECTIONS OF SELECTED MUSEUMS

Based on attendance projections by individual museums, population penetrations experienced by museums in the past, ERA was able to analyze these museums and estimate projected attendance to the year 1980. The following subsections deal with these attendance projections by area and are

Table 10

FULL-TIME ENROLLMENT IN
CALIFORNIA INSTITUTIONS OF HIGHER EDUCATION
1967-1970

	Community Colleges	State Colleges	State Universities	Private Colleges	Total
Los Angeles					
1967	95,779	42,613	31,215	34,633	204,240
1968	100,949	49,818	30,009	36,808	217,584
1969	110,057	54,131	32,946	37,124	234,258
1970	118,421	58,745	32,947	37,551	247,664
San Francisco					
1967	33,915	32,097	31,908	27,993	125,913
1968	43,150	35,412	31,273	28,798	138,633
1969	48,471	36,523	32,279	29,654	146,927
1970	54,513	38,577	30,353	30,150	153,593
San Diego					
1967	11,967	13,823	3,048	3,022	31,860
1968	12,928	16,036	3,654	3,126	55,744
1969	15,764	16,178	4,594	1,582	38,118
1970	16,258	17,866	5,526	1,608	41,258

Source: State Department of Education, State Department of Finance, and Economics Research Associates.

exclusive of any effect by the presence of new aerospace exhibits, since the intended scope of the proposed museum is unknown at this time.

Los Angeles

The California Museum of Science and Industry (CMSI) and the Natural History Museum of Los Angeles County (NHM) are both located in Exposition Park across from the Coliseum. CMSI has by far the greatest attendance of the museums surveyed; as Table 11 shows, more than three million persons visited the museum in fiscal year 1972. Using relatively conservative methods of projection, ERA forecasts an annual attendance of 3,750,000 visitors to CMSI by 1975, increasing to over 4.25 million by 1980. The NHM, located within walking distance of the CMSI, is a considerably smaller facility, but nevertheless commanded 1.5 million visitors during the fiscal year just ended. Attendance is expected to reach 1,650,000 by 1975, and 1,850,000 by 1980.

San Francisco

The San Francisco Academy of Sciences (SFAS), which is located in the eastern section of Golden Gate Park, welcomed 1.3 million visitors in 1972 and, predicated on continued penetration of the San Francisco population, is expected to attract 1.4 million in 1975 and 1,550,000 by 1980. Another museum, the Exploratorium, situated in the Presidio near the entrance to the Golden Gate Bridge, has been operating for only three years. Attendance has increased 25 to 33 percent each year, attaining 300,000 visitors in the fiscal year just ended. However, such a rapid growth rate cannot be expected to continue as the attendance base becomes larger. Therefore, based primarily on market penetration data, ERA projects attendance of 350,000 visitors in 1975, climbing to 400,000 by 1980.

Together, these San Francisco museums accounted for 1.6 million visitors this fiscal year, with expected visitation to be 1.75 million in 1975 and 1.95 million by 1980.

Table 11

PROJECTED ATTENDANCE AT SELECTED MUSEUMS
IN CALIFORNIA
1972-1980
(Thousands)

	1972[1]	1975	1980
Los Angeles			
California Museum of Science and Industry	3,300	3,750	4,350
Natural History Museum of Los Angeles County	1,500	1,650	1,850
Subtotal	4,800	5,400	6,200
Less Double Counting[2]	800	900	1,000
Total	4,000	4,500	5,200
San Francisco			
San Francisco Academy of Sciences[3]	1,300	1,400	1,550
The Exploratorium	300	350	400
Total	1,600	1,750	1,950
San Diego			
San Diego Aerospace Museum	610	655	730
San Diego Hall of Science	0	200	200
Total	610	855	930

1/ Fiscal year 1972.
2/ CMSI and NHM are only one block from each other therefore double counting was estimated.
3/ Lacking sufficient data, projection was estimated using continued penetration of the population base.

Source: Economics Research Associates.

San Diego

The San Diego Aerospace Museum (SDAM), which opened its doors in February 1963 at Balboa Park, admitted 610,000 visitors this year. Growth has been steady but slow, and ERA estimates that 1975 attendance will reach 655,000 persons. By 1980 it is expected that SDAM will attain an attendance level of 730,000 persons.

The San Diego Hall of Science (SDHS) building in Balboa Park is currently under construction with plans to premiere its Rueben H. Fleet space theater in early 1973. Maximum attendance based on capacity at the SDHS was calculated in a previous ERA feasibility study for that museum at approximately 300,000 persons annually. Thus, this figure was used for both the 1975 and 1980 projections of attendance at this facility. Visitors to the two San Diego museums are projected to reach 855,000 by 1975 and 930,000 by 1980.

CONCLUSION

Economics Research Associates concludes that Los Angeles offers the superior location for a museum of aerospace content. In every analysis, Los Angeles was rated as having the greatest potential for such a museum, with San Francisco ranking second. In further order of rank, San Diego, Seattle and Phoenix/Tucson are the most logical locations of aerospace museum development.

If you have any questions regarding this analysis, or if ERA can be of further assistance, please do not hesitate to call.

Respectfully submitted,

Stephen J. Polito
Research Associate

Ned D. Osborn
Vice President

B. Aerospace Museums in the Western United States

A total of 26 museums and other organizations with significant public displays of aeronautics, astronautics or astronomy were identified in the Western United States as a result of the questionnaire survey and interviews with state and community officials.

In California, Washington, and Arizona, the three states of primary interest, as indicated by a survey conducted for the Smithsonian project staff by Economic Research Associates (Section II, A), directors of museums and other organizations with aerospace displays were interviewed to determine their interest in advancing public awareness of aerospace accomplishments.

All of the sixteen existing museums and aerospace organizations in California, three museums with aerospace interests in the State of Washington, and three of the four organizations with aerospace related displays in Arizona, have expressed strong interest in expanding their exhibits and activities in the field of aerospace.

The following sixteen existing organizations and the four organizations in formation were identified in California:

1. American Air Museum Society (In formation)
   2114 MacDonald Avenue
   Richmond, California 94801

2. Ames Research Center
   Moffett Field, California 94035

3. Antelope Valley Aerospace Museum, Inc. (In formation)
   38904 Eleventh Street West
   Palmdale, California

4. California Academy of Sciences
   Golden Gate Park
   San Francisco, California 94118

5. California Air Museum & Education Center (In formation)
   1721 Eastern Avenue
   Sacramento, California 90037

6. Griffith Observatory
   North Vermont Street
   Hollywood, California 90027

7. California Museum of Science & Industries
   700 State Drive
   Los Angeles, California 90037

8. International Flight and Space Museum
   Orange County Airport
   Santa Ana, California

9. Jet Propulsion Laboratory
   4800 Oak Grove Drive
   Pasadena, California 91103

10. Los Angeles County Museum of Natural History
900 Exposition Boulevard
Los Angeles, California 90007

11. U. S. Navy Pacific Missile Range
Missile Park Display
Point Mugu, California

12. Palace of Arts and Science (The Exploratorium)
3601 Lyon Street
San Francisco, California 94123

13. Pasadena Hall of Science (In formation)
Room 109, Throop Hall
California Institute of Technology
1200 East California Boulevard
Pasadena, California 91109

14. Planes of Fame
6920 Orangethorpe Avenue
Buena Park, California 90620

15. San Diego Aerospace Museum
Laurel Street, Balboa Park
San Diego, California 92101

16. San Diego Hall of Science
Balboa Park
San Diego, California 92101

17. San Mateo County Historical Association
1700 West Hillsdale Boulevard
San Mateo, California 94402

18. Space Science Center
12345 El Monte Road
Los Altos Hills, California 94022

19. Travel Town Transportation Museum
Griffith Park
Los Angeles, California 90027

20. U. S. Naval Weapons Center
China Lake, California 93527

Three organizations in the state of Washington indicated their interest in public aerospace displays and education programs:

1. Museum of Flight of the
Pacific Northwest Aviation Historical Foundation
Seattle Center
Seattle, Washington

2. Museum of History and Industry
2161 East Hamlin
Seattle, Washington 98102

3. Pacific Science Center
200 Second Avenue North
Seattle, Washington 98109

Four existing organizations and one air museum in formation were identified in the state of Arizona.

1. Arizona Historical Society
949 East Second Street
Tucson, Arizona 85719

2. Global Aeronautical Museum (In formation)
12448 North 29th Avenue
Phoenix, Arizona 85029

3. Museum of Astrogeology
   Great Meteor Crater
   P. O. Box AC
   Winslow, Arizona 86047

4. Phoenix Art Museum
   1625 North Central Avenue
   Phoenix, Arizona 85004

5. Pima County Air Museum
   Pima County Administration Building
   131 West Congress
   Tucson, Arizona 85705

The states of Colorado, Oregon, New Mexico, and Utah each have an active organization interested in furthering interest in aerospace science and technology:

1. Forney Historical Transportation Museum
   1416 Platte Street
   Denver, Colorado 80202

2. Oregon Museum of Science and Industry
   4015 S. W. Canyon Road
   Portland, Oregon 97221

3. Roswell Museum and Art Center
   100 W. Eleventh Street
   Roswell, New Mexico 88201

4. Hansen Planetarium
   15 South State Street
   Salt Lake City, Utah 84111

Information on these museums, on additional Western museums, and on museums with aerospace interests in other regions of the United States is presented in Volume Four.

George S. James

C. Aerospace Museums - Roles, Activities and Functions

What is a museum? Originally—and literally—it meant "A Temple of the Muses," hence, a place for study. Modern dictionaries generally describe it as "a building or a place where works of art, scientific specimens, and other objects of permanent value are kept, preserved and displayed." But for purposes of this discussion, a museum is much more than a building—more than a shell within which artifacts are exhibited. Any museum worthy of serious consideration in any field (art, history, or science and technology) is fundamentally an educational institution.

Because we are dealing with the fast-moving and rapidly changing technologies associated with air and space museums, educational programs can never be static. For visitors from all walks of life, they must present in clear and understandable fashion a balanced story of where we have been, where we are, and particularly, where we are going. Every visitor, young or old, should leave the museum more knowledgeable than when he entered. Young people should be stimulated and given opportunity to learn more about the subject matter viewed. Every visitor should be consciously or unconsciously conditioned to better

relate his own life and work to the rapidly moving age in which he lives.

The vast majority of museum visitors, the tourists who arrive by the bus-load, come largely out of curiosity or to be entertained. The approximate number of people who may reasonably be expected to visit a particular museum annually may be estimated on the basis of its location, the density of the surrounding population, and the experience of comparable attractions in the neighborhood. More difficult, however, is to "guestimate" the character of the visitor load in terms of education levels, age groups, personal interests, and motivation. More nebulous still is evaluation of potential benefits to be derived from a museum visit by the several categories of visitors.

Several years ago a request was made to the Smithsonian Institution for an analysis of its visitors—with special reference as to age groups, motivation factors and reaction to what was seen. These data were of interest to a special study group concerned with evolving plans and programs for the projected National Air and Space Museum. The group was advised,

TABLE I

Analysis of Potential NASM Audience*

Category	Motivation--Needs	Potential Benefit Derived
Children (3-12 years)	Fun, play, imaginative interest	Education in basic principles
High and Prep School (12-17 years)	Some fun and play, more imaginative interest	Education and inspiration
College Undergraduates (17-22 years)	Imaginative interest, detailed examination	Advanced education plus inspiration
College Graduate to PHD (22-28 years)	Detailed advanced study, professional application	Advanced training, inventive stimulus
Casual adults (all ages)	Cultural appeal, romantic appeal of flight, nostalgia	Understanding and support of aerospace ventures, entertainment, cultural development
Technically qualified adults (all ages), non-aerospace scientists, engineers	Technical curiosity, application possibilities	Education, inventions, extension of professional knowledge
Expert adults (all ages), aerospace scientists, engineers, teachers, lecturers, etc.	Seeking source material for research, teaching, lectures, etc.	Design ideas, inventions, research projects, teaching improvements, broadening of understanding
Civil and military pilots, mechanics operating personnel, etc.	Technical and historical interest	Education, entertainment, pride in craft and skills
Historians	Seeking historical research material also for lectures, books, articles, etc.	Educational and historical dissemination
Artists	Source material, sculpture, painting, medals, music, etc.	Stimulation, inspiration, understanding of subjects
Government and Congressional Personnel	Information on proposed legislation, S. I. Budgets, etc.	Intelligent and informed action
Business Men	Technical and financial data, aerospace business trends and opportunities	Business understanding

*From "Proposed Objectives and Plans for the National Air and Space Museum," a report to the Secretary of the Smithsonian, January 1965

however, that except for total numbers entering each of the several buildings, no other statistics were then available. In the absence of any quantitative data, a purely qualitative tabulation of visitor distribution was synthesized (Table I). At best, this provided only some general guidelines for planning purposes. It seems highly probably, however, that by far the greatest numbers (possibly 95%) come into such museums out of general interest in aviation and the national space program motivated further by nostalgia, curiosity, or because they are visiting Washington and have heard that a visit to the Smithsonian Institution is a must. Only a handful come for serious technical or historical research.

Regardless of numbers, source and motivation, museum visitors are transients and their average exposure time is short. The museum, therefore, must take advantage of all legitimate techniques of attention-getting, and dramatic display to insure that some worthwhile information will rub off and (hopefully) be retained by even the most casual customer of whatever age.

Today, any museum dealing seriously with aerospace matters must go far beyond a mere showcase of Famous Firsts in air and space. Of much greater importance, and of increasing concern, is the impact of expanding man-flight capabilities on our social, economic and political life. Such things require inputs of a different order. Planners must seek advice and counsel not only from scientists, engineers and historians, but also from social scientists, and psychologists. Professional "communicators" must be brought into the act. The most advanced techniques must be applied for the communication of ideas. The best available design and display talent available must be sought to produce meaningful and exciting exhibits.

Techniques of museum display are now changing more rapidly than the technologies they represent. The static artifact in a glass case—from a stuffed Dodo to stuffed spacesuit—may be of vital interest to an ornithologist or a space engineer, but does not hold public attention for long. Even authentic moon rocks rapidly lose their glamour to the average visitor. The growing generation of museum visitors,

brought up on TV, movies, talkies, smellies, et al (not to mention bigger and more fantastic Disneylands), look not only for more "relevance" in what they see on display, but more actual personal "involvement." This (says Alvin Toffler) may lead to the creation of simulated environments by professional "experience makers" which will offer the customer a taste of adventure, danger, sexual titillation or other pleasure without risk of life or reputation. He suggests that "computer experts, roboteers, designers, historians and museum specialists will join to create artificial enclaves... intended to provide a first-hand taste of original reality," or of life in the past, or even in the future (e. g. "Is the smiling, assured, humanoid behind the airline reservation counter a pretty girl or a carefully wired robot?")

The application of such far-out ideas for museums may not be as remote as might be supposed. Tentative beginnings are already in evidence even in such staid institutions as the Smithsonian. Kubokawa's imaginative concepts (Volume Three, Sections XI and XII) point a long way down the road. Such programs offer particularly exciting possibilities for facilities still in the planning stage. Unhampered by traditional concepts,

long-standing prejudices and/or outmoded facilities plans and programs can be focused primarily on the "need-to-know" of up-coming generations; to help prepare them for the new social environments and new political patterns with which they must learn to cope.

It has become increasingly clear that all museums dealing with science and technology must face up to new responsibilities. They must deal not only with the historical past, but, more importantly, they must serve to prepare their constituents for a hysterical future. Programs and presentations must respond to the continuously rapid changes in the disciplines they represent so that visitors are shown not only "where we have been" and "why we are here," but must be prepared for 'what happens next." Museums must provide insulation against what Alvin Toffler calls "Future Shock." His argument is that "there are discoverable limits to the amount of change that the human organism can absorb, and that by endlessly accelerating change... we may submit masses of men to demands they simply cannot tolerate.

We run the high risk of throwing them into that peculiar state that I have called future shock.... Future shock is the human response to over stimulation."

In recent years our science fiction writers have served as a "cushion" to a certain extent. Their audience, however, is more limited than the museum potential. Furthermore, a "credibility gap" exists in most minds as to what is fact and what is fancy in their prognostications. Sound scientific and well-documented displays by responsible museums can help bridge the gap and can prepare large segments of our population against the shock of future surprise.

Beyond exposing the public en masse to exciting and meaningful displays, the modern museum engages in many other education activities of comparable importance.

Although the number of scholarly and/or research-oriented visitors comprises only a small fraction of the total, a responsibility and obligation exists to provide and to maintain adequate facilities for reference and study behind the facade of public exhibits. Aerospace education in

breadth must be backed up by education in depth for an important segment of the visiting public. As indicated above, this group is relatively small, but in terms of feedback to social development, the nation's economy, and perhaps, to the national defense the potentials are great.

Any serious air and space museum must incorporate an adequate, well-stocked and well-catalogued research library. Certainly such a collection must include information and reference material related to the exhibits on display in the public halls. It should be possible for any visitor whose interest (or imagination) has been aroused by what he has seen to acquire further related documentary material in the museum library. This should be a minimal requirement. Beyond this—and to the extent that space, personnel and funding are available—the library should be able to serve the needs of students and researchers in any field related to the aerospace sciences. This, of course, is a very large order—and one probably beyond the capabilities of most libraries excepting the Library of Congress and the Smithsonian. There are, however, a number

of voluminous indices of periodical and other documentary material, published by technical societies, NASA and other government agencies, which should be kept up-dated and readily available for use by the serious researcher.

Every museum accumulates many more artifacts in its collection than it can possibly display. Such material not only provides a reservoir of material against which to draw for temporary exhibit purposes—but more importantly, constitutes what is generally called a "study group" of specimens to be available to qualified persons who wish to do research on actual hardware. Technical historians, patent researchers, scientific writers, etc. frequently need access to such original sources. This implies the availability of adequate storage areas (usually apart from the main museum) where specimens can be received, inspected, preserved, catalogued and protected under the supervision of competent shop, warehousing and service personnel. For obvious reasons, the accession and disposition records of all specimens in the collection must be complete and kept up to date.

Museum budgets are usually organized in three categories: (1) Operations, which includes salaries and expenses for museum programs, administration, and the maintenance and operation of buildings; (2) Acquisitions, which is a large consideration in art museums; and (3) Capital improvements and new construction.

Operational expenses also include the costs of programs of research, education, exhibition, publication, conservation of collections, collection management, library, public information, identification, security, insurance, and the maintenance, repair and operation of buildings. Unfortunately, all revenue producing devices together frequently fail to equal expenses and administrators sometimes are forced to scrimp on the preservation of their collections and the research opportunities the collections should provide.

The current condition and needs of our museums are detailed in America's Museums: The Belmont Report (1968), obtainable from the American Association of Museums, Washington, D. C.

Other normal museum educational features will include lecturing and seminars by staff members, either periodically or on an occasional basis. These may be conducted "in house," or in outside locations in cooperation with local schools, colleges, or civic organizations. Some museums provide study-kits and lecture demonstrations for school groups at all levels. Pre-planned visits by school groups under museum supervision to near-by aerospace installations are extremely useful, both from an educational and public relations point of view.

A few aerospace museums support and conduct a limited amount of physical research in their own laboratories with staff. This is not, however, considered to be a usual museum function. The problems encountered in the performance of most full scale aerospace research are beyond the capabilities of most museums. Some electronic and physiochemical work has been undertaken, notably in the Franklin Institute in Philadelphia.

Finally—as may be inferred from the above brief discussions—the essential elements of any museum are (1) collections,

(2) housing and exhibits, and (3) staff. Collections may be limited, housing and exhibit areas inadequate, but success or mediocrity as a museum depends upon the imagination, initiative and competence of the people who run it. Hans Huth ("Museums and Galleries" Encyclopaedia Britannica 1968 Ed.) points out that although major museums carry up to 300 on their rosters, the minimal requirement for the smallest operation is three: a Director to handle the business aspects, a Registrar to catalogue and classify the collections, and a Curator. Since education is the foremost purpose of the museum he considers that the sine qua non of even the smallest operation "individual and independent thinking by a Curator trained in museum practice and scholarly work."

S. Paul Johnston

D. Sources of Museum Funding

Museums in the United States are victims of their own popularity and successes. Mounting attendance and increasing demands for the enriching experiences which museums offer in education and recreation have caused maintenance and operating costs to grow more rapidly than their financial support.

Very few, if any, of the U. S. museums with annual operating budgets of $25,000 and up are self-supporting. With the exception of very small operations, with volunteer and part-time staff, limited public services and opening only a few hours a day, museums fail to finance their operating budgets from their operating receipts. Such receipts originate from a broad range of charges including parking fees, admissions, museum shop sale, charges for school services, the sale or rental of exhibit space for advertising and/or good will values, and income from royalties paid by publishers and manufacturers for the use of a museum's name or the expertise of its staff in producing publications or for designing educational toys and learning aids for sale.

Earned operating income also might come from grants and contract fees and overhead paid by foundations or granting agencies for experiments in new methods of teaching, new community services and new methods of communicating with and informing the public. Sometimes such experiments also pay for the exhibits on which they are based, thus permitting museums to shift operating funds from exhibits to other needed items. In spite of such ingenious and time-consuming efforts to make ends meet most museums must depend on contributions, material gifts and volunteer workers to avoid deficits.

To avoid deficits museums are continually seeking income-producing endowments, and contributions from wealthy patrons and civic leaders. Other sources of income range from high cost educational tours to "white elephant" and "cookie sales," fees and services obtained from membership in associations of "Friends of the museums," contributions from tourist centered businesses, and local corporate support.

Privately Supported Museums: Slightly more than one-half of the museums in the United States are supported wholly or substantially by private funds. A large number of these are historical museums supported and operated by local, county, or state historical societies, or societies for historical preservation. Many of the largest museums of art, large museums of natural history, and important complexes such as Colonial Williamsburg, Sturbridge Village, and Deerfield, and successful science and technology museums such as those at Chicago, Portland, Seattle, and Boston, are included in the privately supported category.

A few such museums are well enough endowed to be completely self-sufficient and self-supporting. Others are meeting expenses by agressive promotion of membership, increased admission charges, sales shops, benefits, fund raising campaigns, and donations. Some (such as Colonial Williamsburg) depend heavily upon the income from visitor services including restaurants, motels, convention centers, and facilities provided for school and touring groups.

Only a handful of the large privately supported museums make ends meet. Of these many are now contemplating the

early need for public funding or even transfer to public administration. Little is known generally concerning the situation of the privately supported museums. Apparently many of them survive only on the basis of volunteer help, support from related societies, short hours of opening, and limited services to the public.

Most of the larger privately supported museums receive substantial aid from the cities in which they are located. They are experiencing the same difficulties as the municipal museums in justifying the "relevance" of their programs, and the cost effectiveness of their educational and social services. Many are finding that the contributions from the cities are not keeping up with rising costs. This results in reduced visiting hours, higher rates, and increased charges for educational and other services.

Museums versus Attractions: The "attractions" industry has a few well advertised successes of which Disney Land and Disney World are the most striking examples. Many promoters of new museums have deduced that because of the

large numbers of visitors observed at museums, museums should be self-supporting and even profit-making. There appear to be factors in museum costs and income, however, which work against self support. For example, admission charges to even a large museum reach a ceiling around $4.00 per person beyond which increases are self defeating. Increases in numbers of visitors even with skilled promotion, population growth, and higher personal incomes seem to be limited to only 4 or 5 percent a year. This seems to apply to both museums and "attractions."

Given an admissions ceiling and slow increase in attendance, museums suffer more than attractions from the continuing inflation in the costs of operation. The reason lies in the responsibilities of museums for preservation of original objects, and historical buildings, and in the authenticity of restorations and demonstrations. Though both attractions and museums are faced with inflated costs of labor, the museum must pay a premium for the highly skilled craftsmen to work on restorations, repairs, and in some museums for craft demonstrations. The museum must also pay more for

intellectually trained docents (i. e., guides) and for attendants trained not only to meet and serve the public but also to protect irreplaceable objects and facilities. The costs for such people are rising more rapidly than the general average. Many institutions now face rising deficits as the slow rise in income from admissions is outdistanced by the rapidly spiraling rise in costs.

Municipal Museums: Municipal museums comprise about 10 percent of the nation's museums. They include, for example, such highly regarded museums as the Oakland (California) Museum, the Grand Rapids (Michigan) Public Museum, and the Rochester (New York) Museum. Frequently, municipal museums were built by wealthy collectors or public spirited citizens who donated collections and funds to build in their communities. These gifts were made with the understanding that the cities would provide operational funding and assure the continuing existence and growth of the institutions.

The operational funding of municipal museums is sometimes by direct appropriation and sometimes via appropriation to the parks and recreation boards, school districts, or city universities, which administer the museums. Such museums, therefore, are in competition for city funds which are usually in short supply for schools, welfare programs, recreation facilities, and all of the municipal services of security, protection and maintenance. In most cities museums are being required to justify convincingly the need for and effectiveness of the services they provide. Increasingly municipal museums are seeking county and state support on the principle mentioned before that the museums provide services for citizens beyond the city limits. The promotion of a new municipal museum requires exceedingly convincing argument that a museum can meet an obvious social or educational need better than any other institution, or would promote the economic growth of the city by attracting tourists in substantial numbers.

County Museums: Museums supported and administered by counties number about 4 percent of the total—the smallest category of publicly supported museums. They range from the large, excellent, Los Angeles County museum, to the most modest of house museums. Frequently county museums are supported in part by the municipalities in which they are located. They are so diverse in character and funding that it is difficult to generalize about them. Much of what is said about state and municipal museums also applies to county museums.

State and Other Publicly Supported Museums: About 10 percent of the museums of the United States are state supported, e. g. New York, North Carolina, New Jersey, Illinois, California, Florida and Pennsylvania. In some states the state museums are independent establishments not affiliated with other state agencies. State museums are generally administered and funded through universities, state education departments or state art, history, or museum

commissions. In California, for example, museums are administered by the Department of Commerce, the Department of Parks and Recreation and universities and state college districts.

The sophistication of state museums and the competence of their administration and funding varies greatly. In the more sophisticated state governments, the museums have the same advantages and benefits from their relationships with their legislatures and other state agencies that federal museums derive from their relations with other federal agencies. Pennsylvania, for example, has a state general services agency which provides advice and services to the Pennsylvania Historical and Museum Commission in the design, construction, and operation of the numerous museums in that complex.

Funding of the operations of state (and Municipally supported) museums is sometimes limited to the returns from certain designated taxes. Construction of state museum facilities might be funded by the sale of bonds of various technical descriptions and limits of cost.

States provide funds for the partial support of the museums within that state on the theory that museums wherever located within the state serve all citizens of the state in a highly mobile society. These funds usually are appropriated to state arts and museum councils and distributed by grants to support specific projects of museums. Usually grants are not made for new facilities or ongoing programs.

Federal Funds for Non-Federal Museums: The National Museum Act, as amended in 1970, establishes modest funding through the Smithsonian Institution to provide technical aid and assistance to museums throughout the United States and abroad. In addition, funds may be granted for specific proposals that will advance the museum profession either through research, publication, or training. Grants cannot be awarded for construction of facilities, for purchase of major equipment or acquisition, or to meet general operating expenses.

An Advisory Council for the National Museum Act has been created to assist and aid the Secretary of the Smithsonian. The Council met for the first time on November 10, 1971, to recommend guidelines and procedures for granting these funds. Science, history, and art museums, as well as museum-related

organizations, are eligible to apply for grants. For additional information: National Museum Act, Smithsonian and National Museum Programs, Smithsonian Institution, Washington, D. C. 20560.

Funding of Federal Museums: Several agencies such as the Smithsonian Institution and the National Park Service have legislative authority to operate museums. A number of federal agencies including the Department of the Interior, the Federal Bureau of Investigation, and NASA maintain museums or substantial exhibits in their headquarters buildings or field stations usually as elements of their public information services. The funding of the operational expenses of these museums and the restoration and repair of their facilities is obtained by the usual federal government procedures of budget estimates and justifications, appropriation requests contained in the President's budget, hearings before appropriation subcommittees, and appropriation legislation.

The proper route for funding new federal museums and facilities is the two-step process of legislative authorization and appropriations. A bill to authorize a new museum usually

would be introduced at the request of the agency concerned. However, a bill might be originated by members of Congress on behalf of others as was the case of the original NAM legislation which was conceived in the Department of Defense. The usual route is through the agency's legislative committee but new museums have been authorized by bills cleared through other committees such as public works.

The decision to request legislative authority first is usually determined by the size of the program, the prominence it will have in subsequent appropriation requests and the estimates of the chances of winning Congressional approval of the project before or after the fact. (It is an axiom that a new program is heard and turned down at least once before it is accepted at a subsequent hearing.)

Appropriations for feasibility studies(but not for architectural planning) for a new museum facility might be made properly before legislative authority is obtained.

When seeking legislative authority it is important to obtain the broadest possible authority for the program and its funding. For example, the authority to accept donations, establish trust funds, receive and make grants, will affect

future funding. For a federal program, specific legislative authority to accept transfers, contracts, and grants from other federal agencies is very important. At present there is a Congressional attitude that a federal agency should request direct appropriations for all its projects and not expect to obtain funds for them from other federal agencies, such as the National Science Foundation (NSF).

Federal museums enjoy benefits other than direct appropriations which assist in operations and capital improvements. Important among these are the services of the General Services Administration (GSA) which provides advice and assistance including the transfer of land and the rental of buildings for museum programs such as the storage of collections or an exhibits production facility. Estimating, information about available government-owned land and buildings, review of architectural drawings, contracting and the supervision of construction are among the services provided by the GSA—some free and some charged to the agency presumably at cost.

Federal museums also have advantages in acquiring excess government property such as shop and laboratory equipment and artifacts for the collections through government salvage and disposal procedures. The Smithsonian and some of its bureaus have authority to receive classes of materials from other federal agencies. Legislation also directs agencies to dispose of excess historical or scientific objects to the Smithsonian at the Smithsonian's discretion. Contracts and agreements for the disposal of historical objects are appropriately made between agencies and federal museums.

Federal museums also enjoy substantial service support from other federal agencies in the nature of the free storage of collections, use of heavy equipment and working parties to install large machines, aircraft and space artifacts, and for the transportation of personnel and things.

Comments on Funding Methods for Establishing a Major Aerospace Museum: What steps are required to bring into being a major Western aerospace museum? The answer is an individual—a person who is capable of putting together a conceptual scheme for a museum and also capable of convincing enough leaders of opinion in government, industry and a

community, that the institution he has conceived is needed and that they should support it. This person will start with an invaluable advantage namely the initiative and interest of the influential members of Congress who introduced the bill and held hearings on it.

The hard work of starting from the beginning and putting concept and support together, step by step, conceivably could be avoided. For example, the Congress might pass a resolution naming the California Museum of Science and Industry (CMSI) the National Aerospace Museum of the West and designating it an educational institution eligible to receive support from specific granting agencies of government such as the Office of Education, the National Endowment of the Arts and Humanities, the Atomic Energy Commission, the National Science Foundation and the National Aeronautics and Space Administration, in furtherance of their program in experimental education, experimental museum programs, and public information and education in science, space, and atomic energy. An energetic director might use this "authority" to obtain substantial support for developing a museum of national importance.

Two supplementary papers on funding of museums and a bibliography of significant works on museums are included as Volume Three, Sections IV, V and VI.

Frank A. Taylor

E. Aerospace Artifacts

Definition: Aerospace artifacts of museum interest are specimens which document the history of the science and technology of aeronautics and astronautics and of flight in the atmosphere and in space. The significance of and interest in these artifacts stem mainly from their relation to:

1. Historic flights, programs, activities or incidents.
2. Achievement of new plateaus of increased or improved technical capabilities and/or understanding.
3. Association with important or well-known personalities.

Such artifacts are of interest to the public for reasons of curiosity, study, and perhaps inspiration. They are of interest also as a basis for educational exhibits relating to

the development, demonstration and application of aerospace science and technology and as portents of the future. It is important that selected artifacts be preserved for subsequent research because they document the state-of-the-art at a point in technological history. Their use in public exhibits heightens and dramatizes communication and stimulates vicarious experience.

Obvious examples of aerospace artifacts are aircraft, space launch vehicles, manned spacecraft, scientific satellites and space probes, applications satellites (communications, weather, navigation, earth resources), rocket ordnance and guided missiles. Equally important are sub-systems of the above, such as aircraft and rocket engines, power supply, navigation and guidance, communications, life support, flight equipment, spacesuits, training devices and simulators, recovery systems, photographic equipment, etc. These artifacts are a three-dimensional documentation of the rapid progress in flight technology and accomplishment. It is important that artifacts be accompanied by supporting documents such as operating handbooks, summary reports, drawings, log books, photographs, motion picture films, sound tapes and memorabilia, as appropriate.

Curator Responsibility

In museum parlance a curator is one who has custody of collections and responsibility for identification of significance, selection for acquisition and determination of conditions of storage, preservation, restoration, physical security, and exhibition. This stewardship is a public trust and the quality of curation determines the future lifetime and quality of artifacts.

In the field of aerospace technology desirable qualifications of a curator include a thorough knowledge of history of development of flight in general and knowledge in depth of his specialized areas. In this way only can sound judgments be made regarding the significance of individual artifacts and the necessity for acquisition and preservation.

In the philosophy of aerospace curation, once a prime artifact has been located and acquired, preservation is of first importance. Exhibition imposes potential hazards through handling, in preparation for exhibit, and public exposure. The threat of mis-handling, theft, vandalism, and damage by inquisitive fingers must be considered in

procedures for handling, transportation and placement on public exhibit. To ensure that irreplaceable aerospace artifacts will survive to be viewed, to excite and to inspire future generations as well as to preserve a record of the steady march of technological sophistication and elegance in design requires professional judgment and technical experience.

To achieve these ideals is difficult and expensive. It is necessary for control of aerospace collections to rest with technically trained curators who are thoroughly grounded in the history of development of their subject area, knowledgeable of the techniques of preservation, and experienced in the exhibition of aerospace artifacts.

Requests for loans of space artifacts cannot be approved without prior investigation and approval of conditions under which exhibit will be made, including physical protection, the experience of personnel who will have access to and responsibility for handling the artifacts. All curators who engage in loans know of tragic cases where priceless artifacts have been irreparably damaged through ignorance, irresponsible care, or lack of appreciation. Accordingly, loans of aerospace

artifacts require strict specifications to cover all possible local hazards. Suffice it to say that unless provisions for continued proper curatorial care are arranged before an artifact travels it is not likely to survive long without damage. Therefore, curatorial responsibility must not be transferred lightly, nor must there be yielding to pressures to reduce standards of preservation in cases of unique artifacts.

One obvious way of protecting artifacts to be loaned is the creation of traveling exhibits wherein the protective measures have been considered carefully in exhibit design. Further, such traveling exhibits offer the potential of reaching a far larger audience than permanent exhibits in one museum. Estimates of the costs for traveling exhibits of various sizes which might be developed by the National Air and Space Museum for Western aerospace museums and elsewhere are summarized in Volume Three, Section X.

Sources of Aerospace Artifacts

Potential sources of aerospace artifacts lie in both the public and private sectors. The United States Army, Navy and Air Force operationally use aircraft, rockets and guided missiles. The U. S. Marine Corps (of the U. S. Navy) and the U. S. Coast Guard (of the Department of Transportation) likewise

operate aircraft. All such aircraft and missiles become obsolete eventually. The military services each maintain museums, collections and curatorial staff. Also, each service has a department of history which is a useful starting point for information on reference documents. The general policy of the military services is to consider requests for obsolete equipment by established U. S. museums before public sale by General Services Administration.

The military services also provide temporary exhibits of an educational nature aimed at communicating their aerospace activities and responsibilities. Sometimes these exhibits include artifacts. Clearly, commitment of military public information funds to provide such exhibits is affected by the extent of public exposure. Thus such services are most likely to be made available to large museums only. Inquiries concerning loan of public exhibits should be directed to the Public Information Offices of the military services in Washington, D. C. Additionally, all military bases maintain Public Information Offices which may be helpful.

Aerospace industries that manufacture aircraft, rockets, guided missiles and space vehicles are another potential source of artifacts. Although the aerospace product is often federal property, occasionally a firm may have title to rejected material, obsolete mock-ups, or exhibit material such as graphic displays. Most aerospace firms have material prepared for industrial exhibits, stockholders' and professional society meetings. Artifacts are sometimes used in these instances.

The Aerospace Industries Association of America, Inc. (AIA) is the major national trade association of the manufacturers of aircraft, missiles, spacecraft, propulsion, navigation and guidance systems. AIA maintains a public information department and provides economic, technical and other data.

The General Aviation Manufacturers Association (GAMA), Washington, D. C., represents the airframe, engine and avionics manufacturers whose primary business is general aviation (primarily private and executive aircraft).

The National Aeronautics and Space Administration (NASA) has the responsibility for development and operation of the national aeronautical research and space programs. As a result, NASA is the prime producer of such artifacts. Because NASA did not have statute responsibility to preserve and exhibit such artifacts and becuase the National Air and Space Museum is charged with collection, preservation and exhibit of aeronautical and astronautical artifacts, NASA entered into an aerospace artifacts agreement with the Smithsonian Institution in March 1967. By the terms of this agreement NASA will offer aerospace artifacts to this Smithsonian Museum when there is no longer technical utility to NASA or other federal agencies. If title is accepted by the National Air and Space Museum the Museum accepts the responsibility for preservation and, as feasible, public exhibit of such artifacts. Artifacts in excess to Museum needs are considered available for period loans to NASA Centers, other federal agencies, and established museums in the U. S. and abroad. A copy of the Agreement concerning custody and management of aerospace artifacts between NASA and the Smithsonian Institution is included as Section II of Volume Three. A copy of the

National Air and Space Museum Policy on the Loan of Artifacts is attached as Section III, Volume Three. Also included in Section III, Volume Three is a Museum Loan Agreement form.

The National Air and Space Museum also makes occasional loans of aircraft, primarily to those organizations which have facilities and the capability to restore aircraft under strict specifications.

The National Aeroanutics and Space Administration maintains public affairs offices at each of the NASA Centers which provide technical public information on NASA programs and have a limited number of exhibits and lunar rock samples available for short-term loans. Lists of educational publications and motion picture films available for loan may be obtained upon request.

Numerous other federal agencies provide public information on aerospace activities with which they are concerned. In addition, aerospace exhibits may be available upon request. Among these agencies are Department of Commerce's Federal Aviation Authority (airline traffic control), and National Oceanic and Atmospheric Administration (NOAA) (operational

meteorological satellite systems), U. S. Geological Survey (earth resources survey) and the U. S. Army Map Service (lunar mapping).

U. S. airlines represent another potential source of artifacts as their operating aircraft and engines become obsolete. The Air Transport Association, Washington, D. C., is the trade association of air carriers and provides public information on the U. S. airline industry. General aviation (privately-owned aircraft) is represented by the Aircraft Owners and Pilots Association, Washington, D. C.

A useful publication giving names of officials and addresses of aerospace industries and products, commercial airlines and professional aerospace organizations if the World Aviation Directory, Ziff-Davis Publishing Company, Washington, D. C.

An important, though informal, association of aerospace curators is Committee No. 17 of the International Association of Transport Museums. Affiliated with the International Council of Museums (ICOM), Paris, France, the committee

is comprised of aerospace curators and directors of most of the world's museums with significant collections of aerospace artifacts. Chairman of this committee is L. S. Casey, Curator of Aircraft and Assistant Director for Aeronautics, National Air and Space Museum, Smithsonian Institution. This committee meets annually and is a prime source of information on historic aircraft and engines.

There are a number of professional societies and associations in the United States which have interest in the history and preservation of aviation and space artifacts. Many members of these groups are historically oriented and may provide information on sources of artifacts and the history of flight. Some of these organizations are Cross and Cockade, The Early Birds, American Aviation Historical Society, Experimental Aircraft Association, Antique Airplane Association, American Institute of Aeronautics and Astronautics, American Astronautical Society, Wingfoot Lighter-than-Air Society, International Plastic Modelers Society, National Association of Rocketry and National Model Airplane Association.

Finally, the National Aerospace Education Association, Washington, D. C., represents a single point source of contemporary information on aerospace science, technology and programs. Their publications primarily are designed to serve the aerospace educator.

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Note: In addition to the above documents, references included material listed in the Bibliography of Selected Publications on Museum Operation which appears in Volume III, Section VI, of this report.