

Three Studies of *Explore the Universe*

**A new exhibition at the National Air and Space Museum
Smithsonian Institution**

April 2002



Smithsonian Institution

Office of Policy and Analysis
Washington DC, 20560-0405

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NASM staff generously assisted the implementation study. John Benton, executive officer, offered suggestions at the beginning of the study. Extensive information about the process of creating the exhibition was provided by Thomas Alison, David DeVorkin, Stephen Estrada, Frank Florentine, David Heck, David Paper, Sandy Rittenhouse-Black, David Romanowski, Alma Jane Shepherd, Steve Sumner, and by Beatrice Mowry, who also prepared a detailed timeline of the project.

In the Office of Policy and Analysis, David A. Karns assumed overall responsibility for the studies. Data from the questionnaire study was prepared for analysis by Kerry DiGiacomo and Ioana Pop. David A. Karns designed the questionnaire study, conducted the analysis and wrote the report. Andrew J. Pekarik designed the other two studies, conducted interviews, and wrote the reports. Interviews of visitors were also conducted by Abigail Sharbaugh and Jeffrey Sutton. Interviews of NASM staff were also conducted by Zahava D. Doering.

We also want to acknowledge the many visitors who took the time to answer our questions and share their experiences and insights.

Carole M. P. Neves, Director
Office of Policy and Analysis

Background

The National Air & Space Museum opened a major, new permanent exhibition entitled *Explore the Universe* in September 2001. This was the first new permanent exhibition installed by NASM since *How Things Fly* in 1996. The exhibition occupies about 4,900 square feet on the ground floor, east wing of the NASM building on the National Mall, in a gallery between *How Things Fly* and the food service area (which was closed for renovation during the period of these studies).

The exhibition displays 73 objects, including historical telescopes and astrolabes from the collection of the National Museum of American History, scientific instruments from the NASM collection (such as the backup mirror to the Hubble Space Telescope), as well as three major loans, a lens made by the Huygens' brothers, the Herschel 20-foot telescope tube and the Newtonian mirror cage from Mount Wilson—parts of the most important telescopes in history.

The gallery also features more than two dozen interactives including replicas of early astrolabes, quadrants and telescopes; mechanical representations of galaxies; an infrared camera and monitor station; and several computer stations and video kiosks for expanded illustration of how the artifacts are used.

The museum has produced three short videos for the gallery: the computer-animated adventures of “Priscilla the Proton,” the artifact-appraising spoof “Museum Roadshow” and “Scott Hamilton Skates the Universe,” in which the Olympic gold medalist and national champion zips through the cosmic rink to “Galaxy Song,” from the Monty Python film “The Meaning of Life.”

The Secretary of the Smithsonian, Lawrence M. Small, asked the Office of Policy & Analysis to undertake a comprehensive study of the exhibition that would include a representative sample of visitor experiences in the exhibition, in-depth ethnographic interviews with visitors, and a study of the process of creating and installing *Explore the Universe*.

These topics were addressed in three separate studies conducted around the same time. This document contains a separate report for each study as well as the relevant appendices. Additional copies can be obtained directly from the website of the Office of Policy and Analysis (<http://www.si.edu/opanda/reports/>).

Visitor Experiences in *Explore the Universe*

Summary

Explore the Universe is the most recently installed permanent exhibition in the National Air and Space Museum (NASM). According to a sample of NASM visitors who saw the exhibition, it is a well-constructed exhibition that satisfies its visitors and disappoints virtually no one. It is seen as informative and well-designed for adult visitors seeking information. Possible shortcomings are that it is viewed as adult-oriented rather than adult- and child-oriented and that it could use more interactive and hands-on activities. Its visitor attraction is above average among NASM exhibitions included on museum exit surveys.

Recommendations

The Office of Policy and Analysis suggests the following recommendations to further strengthen the exhibition, *Explore the Universe*:

- Modify the exhibition title by adding a tagline that gives more of a cue that the content of the exhibition focuses on astronomical exploration.
- Research how the introductory panel at the exhibition entrance, which visitors find useful, could be made even more useful in orienting and attracting visitors, especially visitors entering and leaving McDonald's.
- Consider adding interactive and hands-on activities, after all currently planned activities have been installed and are working.
- Research the attractive power of diorama exhibits.

How was the study done?

For this study, separate samples of visitors exiting NASM and visitors exiting *Explore the Universe* were used.

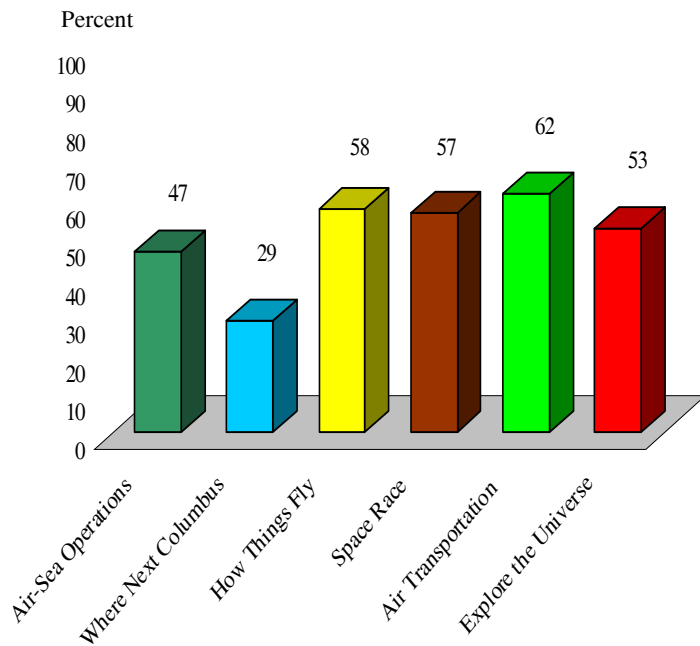
First, a representative, random sample of visitors was intercepted as they left *Explore the Universe*. Each person was asked to complete a two-page, self-administered questionnaire. Three-quarters of the 732 eligible visitors (550) completed the questionnaire. Most refusals were caused by language difficulties, such as the visitor not being adequately fluent in English. Interviews were conducted in November and December 2001.

A second sample of visitors was intercepted as they exited the museum in January 2002. Of the 459 eligible visitors intercepted, 302 completed a one-page questionnaire for a cooperation rate of 66 percent.

How many NASM visitors entered *Explore the Universe* compared to other NASM exhibitions?

Presented with a set of six photographs of NASM exhibitions, more than half of the visitors reported spending time in *Explore the Universe* (53%). Thus, it appears to be one of the more frequently visited NASM exhibitions even though the adjacent restaurant was closed, which may have reduced the traffic walking past it. (See Figure 1) The percent reporting a visit was slightly less than the percent visiting first floor exhibitions such as *Air Transportation* and the immediately neighboring exhibitions (*Space Race* and *How Things Fly*), but greater than the second floor exhibitions (*Air-Sea Operations* and *Where Next, Columbus?*)

Figure 1: Visitors Entering NASM Exhibitions
Source: Appendix A, Table 1



Visitors who did not see *Explore the Universe* gave different reasons for not doing so. Wanting to see specific exhibitions (26%)—perhaps verbal shorthand for limiting the amount of time in NASM—was the most frequently cited reason. Having seen *Explore the Universe* on a previous visit to NASM was the next most frequent reason (20%). (See Appendix A, Table 2.) Failing to see any information about the exhibition was mentioned (16%), and a series of reasons indicating that the exhibition did not sound interesting or like fun were mentioned by fewer than five percent of visitors who did not see the exhibition.

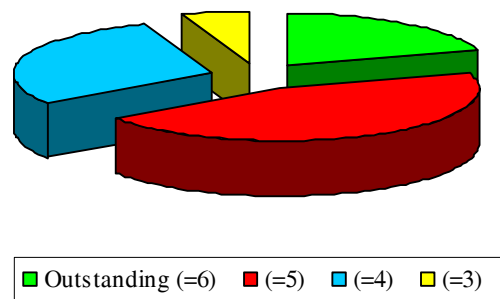
Overall, how well did *Explore the Universe* visitors like the exhibition?

Explore the Universe was successful with its visitors. Among the subsets of visitors who reported seeing other exhibitions, only *Space Race* (43%) and *How Things Fly* (37%) had a larger percent of their visitors picking them as the favorite exhibition than *Explore the Universe* (32%). (See Appendix A, Table 1.)

Explore the Universe visitors generally found their experience in the exhibition satisfying. One-fifth of exiting visitors rated it as outstanding (numerical value of 6 on a scale from one to six). (See Figure 2 and Appendix A, Table 3.) Almost another half (45%) gave it a value of five, which resulted in a mean rating of 4.79. The separate sample of visitors exiting the museum who visited the exhibition rated the exhibition identically (mean 4.77).

Figure 2: Rating of *Explore the Universe* Visit Experience

Source: Appendix A, Table 3



While *Explore the Universe* visitors enjoyed the exhibition, NASM visitors rated their experience in the museum significantly more favorably than *Explore the Universe* visitors rated the exhibition. For example, one-third of visitors exiting NASM, (both visitors who said that they spent time in *Explore the Universe* and all NASM visitors), said that they had had an outstanding experience compared to one-fifth of exhibition visitors. On the average, the museum experience was rated 0.3 points higher than the exhibition experience—a statistically significant difference.

Although the present study cannot test the hypothesis, the study team believes that visitors’ satisfaction with their overall museum experience is a cumulative function of their satisfaction in separate exhibitions. Thus, overall satisfaction is never less than a visitor’s satisfaction with any individual exhibition, and,

normally, must exceed or equal satisfaction with any individual exhibition. We did not ask visitors to rate any other exhibition seen on the day of the visit, other than *Explore the Universe*. There was a smaller difference between the mean ratings of the museum and exhibition experiences for museum visitors who said that *Explore the Universe* was their favorite exhibition as compared with visitors who preferred another exhibition.

In spite of high ratings, nearly half mentioned some aspect of the exhibition that they would like to see changed (47%). (See Appendix A, Table 4a.) By a wide margin, the most frequently suggested change was to increase the number of hands-on or interactive activities (33%), followed by presenting more information in the exhibition (16%), and modifying specific aspects of the physical layout of the exhibition such as lighting, temperature, seating, and so forth (11%). (See Appendix A, Table 4b.)

Did visitors understand the message in *Explore the Universe*?

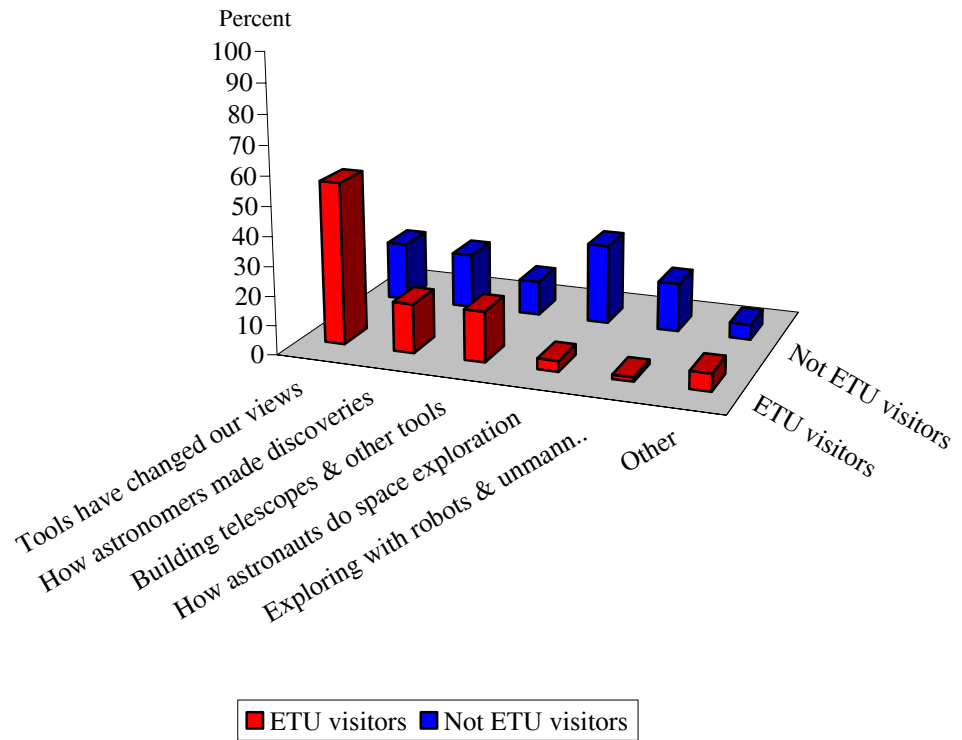
Over half (55%) of the visitors exiting *Explore the Universe* selected “How astronomical tools have changed our view of the universe” as the best description of the exhibition. (See Figure 3). Although alternative descriptions captured other aspects of the exhibition, such as, “How astronomers made discoveries,” the broader description selected by the majority of visitors best captured the overall message of the exhibition.

Visitors who had not visited *Explore the Universe* were less likely to select the best description. Visitors entering NASM appeared to randomly select a description based on the exhibition’s title. The most frequently mentioned description of what visitors might expect to see in the exhibition was “How astronauts do space exploration (27%). (See Figure 3.) Three other descriptions were mentioned almost as frequently: the effect of astronomical tools (20%), astronomers making discoveries (19%), and the role of robots in space exploration (17%).

Visitors exiting the museum who did not see *Explore the Universe*, were unable to tell from the title what to expect. Those exiting the exhibition understood its message. The statistically significant difference between descriptions based on the title, *Explore the Universe*, and those based on the exhibition indicates that the exhibition conveyed its underlying message better than the title did.

Figure 3: Descriptions of “Explore the Universe:” Visitors and Non-visitors

Source: Appendix A, Table 5



How do visitors rate specific aspects of *Explore the Universe*?

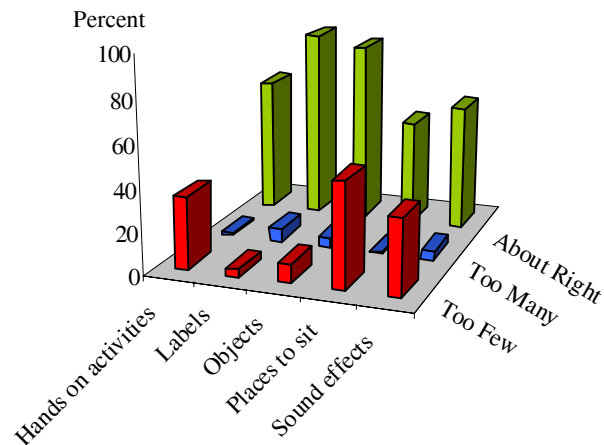
Were there too many or too few of various elements?

Exhibitions vary in the number of elements that are designed into either the physical layout (e.g., seating) or presentation (e.g., labels with information). Significant numbers of visitors expressed their opinions that *Explore the Universe* had too few places to sit (50%), too few sound effects (37%), or too few hands-on-activities (35%). (See Figure 4.)

Conversely, almost all visitors felt that the exhibition had about the right number of labels (90%) and objects (86%). Older visitors (45 and older) were less likely to say that there were too few sound effects and interactive, hands-on-activities. Local visitors from Washington and surrounding suburbs were more likely to feel that the exhibition had too few objects and too many labels than other United States or foreign visitors. Women were significantly more likely to feel that more places to sit are needed than men.

Figure 4: Exhibition Design Aspects: Too Many or Too Few

Source: Appendix A, Table 6



What enhanced and detracted from visitors' experiences?

Presented with a list of ten exhibition attributes, *Explore the Universe* visitors said that each enhanced their visit experience in contrast to detracting from it. (See Appendix A, Table 7.) Telescopes and other objects were identified by more than four out of five visitors as enhancing their experience (85%). Seven attributes received “enhanced” responses from two-thirds to three-quarters of exiting visitors. Videos were close with 62 percent. Fewer than ten percent of visitors indicated that any attribute of the exhibition detracted from the visit experience.

How did visitors relate to the amount and presentation of information?

Explore the Universe visitors appreciated the amount and presentation of information. More than half (54%) indicated that the exhibition information made objects more understandable. (See Appendix A, Table 8.) More than one-third (38%) said that the information at the exhibition entrance was useful, while one-third also said that they read most of the information on labels in the exhibition (34%).

In contrast, relatively few visitors chose to indicate that there was too much information (12%) or too little information (10%). Even smaller percentages said that the label type was hard to read (5%), the text was hard to understand (5%), or that it was hard to find labels associated with exhibition objects (4%). In general, *Explore the Universe* visitors found the amount and level of information that they sought. Given the vague message in the exhibition title, the percentage indicating that the orientation information at the exhibition entrance was helpful is, perhaps, lower than might have been expected. However, it is also possible that fewer than half of entering visitors may actually use entrance information as an orientation

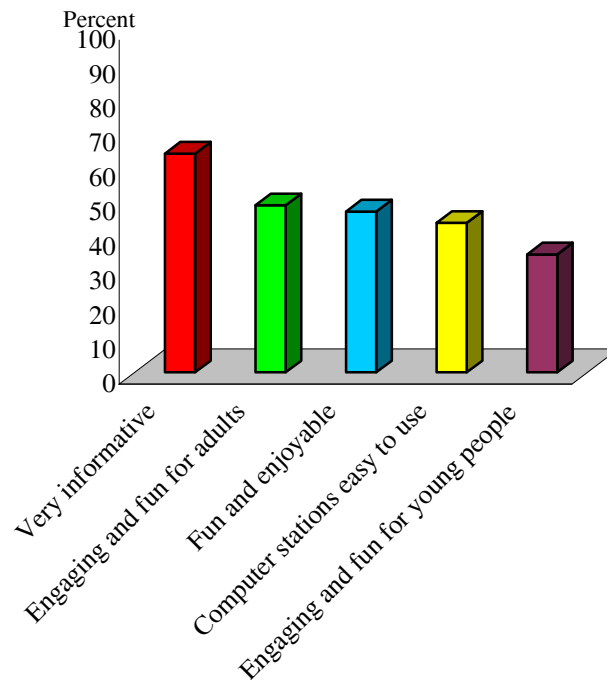
tool. The present survey does not allow us to determine how many visitors tried to orient themselves.

What did visitors experience in “Explore the Universe?”

Visitors to *Explore the Universe* found it to be relatively informative (64%), however, fewer than half rated it as being engaging and fun, especially for children, or as having easy to use computer stations (although not all visitors may have tried to use the computer stations). (See Figure 5.)

Figure 5: Visitor Reactions to the Exhibition Presentation

Source: Appendix A, Table 9



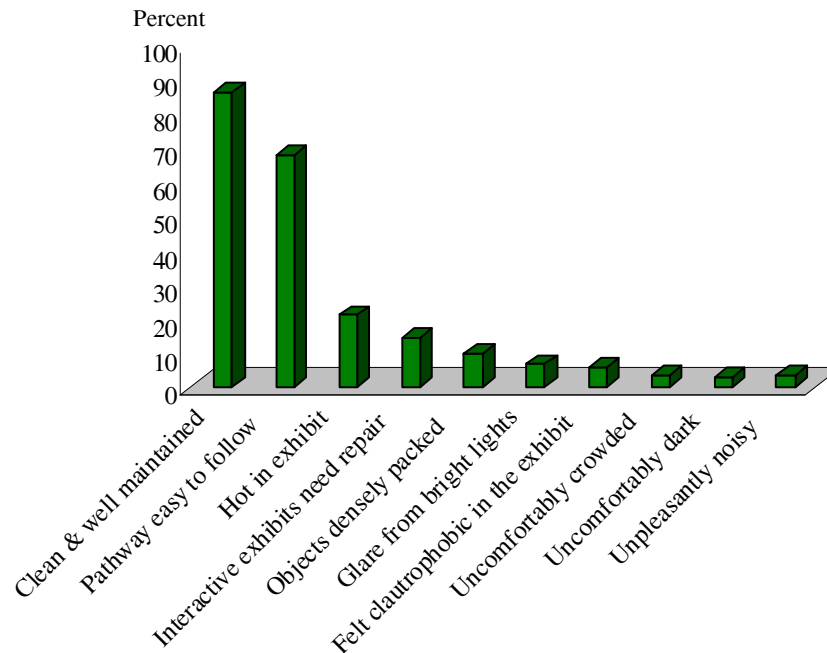
How did visitors assess the exhibition layout?

Explore the Universe visitors reviewed the physical layout and other physical aspects of the exhibition favorably. Almost all indicated that they found the exhibition clean and well-maintained (86%) (See Appendix A, Table 10.)

Similarly, two-thirds indicated that it was easy to follow the pathway through the exhibition (67%). Remembering that NASM visitation was low during the survey period—both due to traditionally lower visits during the winter and the post-9/11 visit drop—one-fifth of visitors indicated that the exhibition was hot (21%), about one-eighth indicated that interactives needed repair (14%), and one-tenth noted that objects were densely packed (10%). Even fewer indicated other negative aspects of the exhibition as shown in Figure 6.

Figure 6: Visitors’ Assessment of Physical Layout of the Exhibition

Source: Appendix A, Table 9



Was there one object or place that was especially interesting?

Slightly more than one-half (54%) of *Explore the Universe* visitors found one special object or place in the exhibition that was especially interesting. (See Appendix A, Table 11A.) The thermal imaging camera that showed an infrared picture of the visitor (18%) and the range of telescopes in the exhibition (17%) were most frequently mentioned. Information about astronomy, especially theoretical information, was the third most frequently mentioned (10% of impressed visitors). (See Appendix A, Table 11B.)

What effect did *Explore the Universe* have on visitors?

How long did visitors stay in the exhibition?

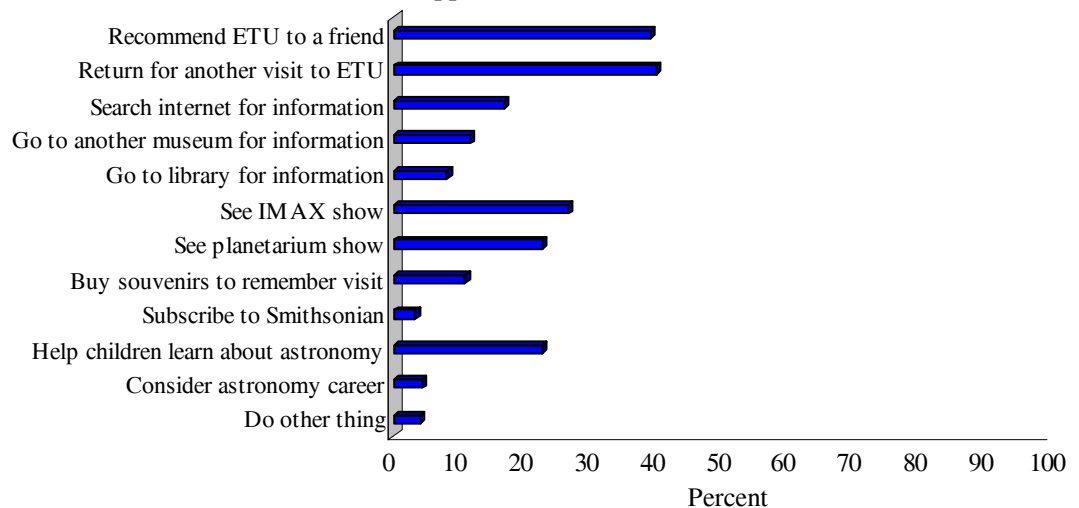
Although *Explore the Universe* has much information and many objects, visitors tended to move expeditiously through the exhibition. Seven out of eight visitors spent 30 minutes or less in the exhibition (83%). (See Appendix A, Table 12.)

What do visitors say that they may do as a result of visiting *Explore the Universe*?

Visitors to *Explore the Universe* leave the exhibition with a high level of expectations about different possible actions that they may take as a result of their experience. (See Figure 7.) This question has not been asked in previous exhibition surveys, and, therefore, we do not know whether the intention level is extremely high, or not, compared to other exhibitions. It is also true that the intention level is usually much higher than actual follow-up behavior.

Figure 7: Visitors' Intended Behavior as a Result of Their Exhibition Visit

Source: Appendix A, Table 13



Over half of exiting visitors said that they either expected to recommend the exhibition to a friend (39%) or return for another visit (40%). Similarly, two-fifths say that they will buy a ticket, souvenir, or subscription. The most commonly mentioned Smithsonian Business Venture (SBV) activities are seeing an IMAX film (27%) or a planetarium show (22%). About one-quarter indicated that they will help a child learn more about astronomy (23%) or indulge in one or more learning activities regarding astronomy (21% combined).

If *Explore the Universe* visitors follow through on their intentions, the experiences provided in the exhibition should significantly impact SBV operations and NASM's contribution to the intellectual development of visitors and their children.

What aspects of the exhibition have the greatest effect on felt satisfaction with an *Explore the Universe* visit?

An important issue in the evaluation of this exhibition is the identification of aspects, features, and characteristics of the exhibition that are most significantly related to variation in satisfaction

We applied a statistical technique, linear regression, to identify aspects that are most significantly correlated with satisfaction. For example, if visitors who said that they found an impressive object in the exhibition had a higher average satisfaction level than those who did not find something impressive, then satisfaction is significantly correlated with an impressive object in the exhibition.

Based on the results of the regression analysis, we identified nine significant factors (questions) correlated with satisfaction. The percentage of visit satisfaction that is causally linked with each of the nine questions is:

- 16% The exhibition was fun and enjoyable.
- 14% One object or place was especially interesting.
- 14% While the visitors found telescopes interesting objects, visitors saying that the telescopes and other objects did not enhance the visit experience (perhaps compared with other attributes of the exhibition). In other words, finding other exhibition attributes, including information, especially engaging.
- 12% The quality of exhibition construction enhanced the visit experience.
- 11% The exhibition was engaging and fun for adults.
- 11% The visitor did not feel that the exhibition presentation could be improved.
- 8% The visitor said that they read most of the information on labels.
- 7% Videos in the exhibition enhanced the visit experience.
- 5% Information at the exhibition entrance was said to be useful.

***Are Explore the Universe* visitors typical NASM visitors?**

Based on studies conducted by the Institutional Studies Office, the only substantial differences between the 1994-1995 Winter demographic data and the current data were: (1) a larger percent of first time NASM visitors in the 2002 exhibition exit sample; (2) slightly more adults with children and fewer adult couples in the 2002 museum exit sample; and (3) slightly younger visitors in the 2002 exhibition exit sample. (See Appendix A, Tables 14-18.)

exhibitID Q16

**Visitor Experiences and Opinions
Explore the Universe Exhibition
National Air and Space Museum**

Thank you for visiting the Smithsonian National Air and Space Museum today. We are interested in learning about your visit to help us improve visitor experiences. Please take a few minutes to answer these questions.

1. How would you rate your visit to *Explore the Universe* today?

Disappointing					Outstanding
1	2	3	4	5	6
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

**2. How would you describe this exhibit to a friend?
(mark only ONE box)**

- How astronauts do space exploration
- How astronomers made discoveries
- How astronomical tools have changed our view of the universe
- How robots and unmanned vehicles are used to explore space
- How telescopes and other astronomy tools are built
- Other _____

3. Could your experience in this exhibit have been improved?

Yes No

4. What change would improve this exhibit?

5. Were there too many or too few of the following in this exhibit?

Too Many	About Right	Too Few	
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Hands-on activities
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Labels
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Objects
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Places to sit
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Sound effects

6. Did the following DETRACT from or ENHANCE your experience in this exhibit?

No Effect	Detract	Enhance	
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Colors & textures of materials used
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Computer stations
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Hands-on activities
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Labels with questions & answers
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Labels with text information
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Lighting on objects/ text
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Museum staff in exhibit
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Quality of exhibit construction
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Telescopes & other objects
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Videos

**7. Regarding information in *Explore the Universe*, which of the following did you find?
(mark as many as apply)**

- Text was hard to understand
- Type was hard to read
- Too little information
- Too much information
- Hard to find label about the object
- Information made objects understandable
- Information at exhibit entrance was useful
- I read most of the information on labels

PLEASE CONTINUE TO THE NEXT PAGE

8. Which of the following experiences did you have? (mark as many as apply)

- Computer stations easy to use
- Engaging and fun for adults
- Engaging for young people and children
- Fun and enjoyable
- Very informative

9. Thinking about the physical layout which of the following apply? (mark as many as apply)

- Clean and well maintained
- Easy to follow the pathway through exhibit
- Felt claustrophobic in the exhibit
- Glare from bright lighting
- Hot in exhibit
- Interactive exhibits need repair
- Objects densely packed into exhibits
- Uncomfortably crowded with visitors
- Uncomfortably dark
- Unpleasantly noisy

10. Was one object or place in *Explore the Universe* especially interesting to you?

- No
- Yes --> What was it? _____

11. Which of the following will you do as a result of your visit to *Explore the Universe*? (mark as many as apply)

- Consider astronomy career
- Recommend *Explore the Universe* to a friend
- Return for another visit to this exhibit
- Go to library for astronomy information
- Go to another museum to learn more
- Help my children learn about astronomy
- Search the Internet for astronomy information
- Buy souvenirs to remember my visit
- See a planetarium show
- See an IMAX show related to astronomy or space
- Subscribe to Smithsonian magazine
- Other (please specify) _____

12. Is this your first visit to this museum?

- Yes, this is my first visit to this museum
- No, I last visited in the last 12 months
- No, I last visited more than a year ago

13. Approximately how long did you spend in this exhibit?

- 30 minutes or less
- 31 to 60 minutes
- More than 1 hour

14. Where do you live?

- Washington, DC
- Maryland suburbs (Montgomery/Pr. George's Co.)
- Virginia suburbs (Arlington/Fairfax/Alexandria)
- Other U.S. state
- Another country

15. With whom are you visiting today?

- Alone
- One other adult
- Several adults
- Adult(s) with child(ren)/teen(s)
- One other or several teens
- Other kind of group (tour/school/church)

16. How old are you? _____ years

17. What is your gender?

- Female
- Male

THANK YOU FOR YOUR ASSISTANCE

9921084047

- Mall Exit
 IndepAve Exit

ID

Q10

Visitor Experiences and Opinions National Air and Space Museum

Thank you for visiting the Smithsonian National Air and Space Museum today. We are interested in learning about your visit to help us improve visitor experiences. Please take a few minutes to answer these questions.

1. How would you rate your visit to this museum today?

Disappointing Outstanding
1 2 3 4 5 6

2. Which exhibits, pictured on the clipboard, did you visit TODAY? (mark as many as apply)

- Air-Sea Operations (2nd floor)
- Where Next, Columbus? (2nd floor)
- How Things Fly (1st floor)
- Space Race (1st floor)
- Air Transportation (1st floor)
- Explore the Universe (1st floor near Lunar Lander/restaurant)

3. Which ONE exhibit did you like best? (mark only ONE)

- Air-Sea Operations
- Where Next, Columbus?
- How Things Fly
- Space Race
- Air Transportation
- Explore the Universe

4. If you did not see *Explore the Universe* today, why not? (mark as many as apply)

- I saw *Explore the Universe* on an earlier visit
- I saw no information on the exhibit
- I wanted to see other, specific exhibits
- It did not look like fun
- My children would not enjoy it
- I wanted to visit another museum
- The title was not interesting
- The subject was not interesting

5. Based on the title *Explore the Universe*, what would you expect this exhibit to be about? (mark only ONE box)

- How astronauts do space exploration
- How astronomers made discoveries
- How astronomical tools have changed our view of the universe
- How robots and unmanned vehicles are used to explore space
- How telescopes and other astronomy tools are built
- Other _____

6. If you saw *Explore the Universe* on your visit today, please rate the exhibition.

Disappointing Outstanding
1 2 3 4 5 6

7. Is this your first visit to this museum?

- Yes, this is my first visit to this museum
- No, I last visited in the last 12 months
- No, I last visited more than a year ago

8. Where do you live?

- Washington, DC
- Maryland suburbs (Montgomery/Pr. George's Co.)
- Virginia suburbs (Arlington/Fairfax/Alexandria)
- Other U.S. state
- Another country

9. With whom are you visiting today?

- Alone
- One other adult
- Several adults
- Adult(s) with child(ren)/teen(s)
- One other or several teens
- Other kind of group (tour/school/church)

10. How old are you? _____ years

11. What is your gender? Female Male

THANK YOU FOR YOUR ASSISTANCE

APPENDIX B: Tables of *Explore the Universe* Survey Data

Table 1
Exhibits seen during visit to NASM

NASM Exhibit	NASM Exiting Visitors* (%)	Best liked exhibit (%)	Best liked exhibit if visited** (%)
Space Race	57	25	43
How Things Fly	58	22	37
Explore the Universe	53	17	32
Air-Sea Operations	47	15	30
Air Transportation	62	14	22
Where Next Columbus	29	6	21
Total		100	

* Note: Responses total to more than 100% because respondents could check as many attributes as needed.

** Note: Percents are calculated using different bases.

Table 2
Reasons for Not Seeing *Explore The Universe*
(Limited to visitors who did not see ETU)

Reason	NASM Exiting Visitors who did not see ETU on this visit (%)
Wanted to see specific exhibits	26
Saw ETU on an earlier visit	20
Saw No information about ETU	16
Wanted to see another museum	16
My children would not enjoy it	4
Subject was not interesting	3
Did not look like fun	3
Title was not interesting	2

* Note: Responses total to more than 100% because respondents could check as many attributes as needed.

Table 3
 Rating of Visit Experience in *Explore The Universe*

Rating	ETU Rating		NASM Rating	
	Sample exiting ETU (%)	ETU visitors in the sample exiting NASM (%)	All visitors in the sample exiting NASM (%)	ETU visitors in the sample exiting NASM (%)
Outstanding (=6)	20	20	33	33
(=5)	45	45	46	46
(=4)	29	29	17	16
(=3)	6	5	4	5
(=2)	0	2	0	0
Disappointing (=1)	0	0	0	0
Total	100	100	100	100
Mean rating	4.79	4.77	5.08	5.07
Median rating	5.00	5.00	5.00	5.00
Standard deviation	0.85	0.87	0.81	0.84

Table 4a
 Could *Explore the Universe* (ETU) Have Been Improved and How

Could be improved	Percent of ETU visitors (%)
No	53
Yes	47
Total	100

Table 4b
 Suggested Improvements and Modifications

Change	Percent of ETU visitors* (%)
Interactive exhibits	33
More information/detail	16
Physical layout	11
Telescopes	8
Repairs	6
Pictures	6
Kid orientation	4
Guides/Visit assistance	5
Larger	4
Staff involvement	2
Objects	1
Theater/planetarium	1
Other	4
Total	100

* Note: Responses are limited to those who suggested changes.

Table 5
 How *Explore the Universe* (ETU) would be described to a friend

Response	ETU visitors (%)	NASM, but not ETU visitors (%)
How astronomical tools have changed our view of the universe	55	20
How astronomers made discoveries	17	19
How telescopes & other astronomy tools are built	17	12
How astronauts do space exploration	4	27
How robots & unmanned vehicles are used to explore space	1	17
Other	6	5
Total	100	100

Table 6
 Were There Too Few or Too Many in the Exhibit?

Category	Too Few (%)	About Right (%)	Too Many (%)	Total (%)
Hands on activities	34	64	1	100
Labels	4	90	6	100
Objects	9	86	5	100
Places to sit	49	50	1	100
Sound effects	36	60	4	100

Table 7
Exhibit attributes that enhanced or detracted from the *Explore the Universe* visit experience

Exhibit attribute	Enhanced (%)	Detracted (%)	No effect (%)	Total (%)
Telescopes and other objects	85	4	12	100
Quality of exhibit construction	76	6	19	100
Hands on activities	73	6	21	100
Colors & textures of materials used	73	5	22	100
Lighting on objects and text	71	9	20	100
Labels with text information	70	8	22	100
Computer stations	66	7	27	100
Labels with questions and answers	66	6	28	100
Videos	62	8	30	100
Museum staff in exhibition	35	6	59	100

Table 8
Information in *Explore the Universe*: Visitor reactions*

Statement	Checked (%)
Information made objects understandable	54
Information at exhibit entrance was useful	38
I read most of the information on labels	34
Too much information	12
Too little information	10
Type was hard to read	5
Text was hard to understand	5
Hard to find label about the object	4

* Note: Responses total to more than 100% because respondents could check as many attributes as needed.

Table 9
Visitor Experiences in ETU*

Experience	Checked (%)
Very informative	64
Engaging and fun for adults	49
Fun and enjoyable	47
Computer stations easy to use	43
Engaging and fun for young people and children	34

* Note: Responses total to more than 100% because respondents could check as many attributes as needed.

Table 10
Assessment of *Explore the Universe* Physical Layout*

Aspect of physical layout	Checked (%)
Clean & well maintained	86
Easy to follow the pathway through exhibit	67
Hot in exhibit	21
Interactive exhibits need repair	14
Objects densely packed into exhibits	10
Glare from bright lights	7
Felt claustrophobic in the exhibit	6
Uncomfortably crowded with visitors	3
Uncomfortably dark	3
Unpleasantly noisy	3

* Note: Responses total to more than 100% because respondents could check as many attributes as needed.

Table 11a
Was one object or place especially interesting?

Response	Percent of ETU visitors (%)
Yes	54
No	46
Total	100

Table 11b
Objects and Places in ETU that were Especially Interesting

Object or place	Percent of ETU visitors (%)
Thermal images	18
Telescopes	17
Information on theoretical topics	12
Hubble	7
Interactive/computer	7
Spectrography	7
Dark matter	5
Historical	4
Photography	4
Laser	3
Astrolabes	3
Herschel	2
Everything	3
Galileo	2
Other	7
Total	100

* Note: Responses are limited to those who said that there was something especially impressive.

Table 12
Length of Time Spent in *Explore the Universe*

Time spent	ETU Visitors (%)
30 minutes or less	82
30 minutes to one hour	11
More than an hour	6
Total	100

Table 13
Anticipated Future Actions as a Result of the ETU Visit*

Response	ETU visitors (%)	Cumulative (%)
Recommend ETU to a friend	39	
Return for another visit to ETU	40	
One or more of above		58
Search internet for information	17	
Go to another museum for information	12	
Go to library for additional information	8	
One or more of above		21
See IMAX show	27	
See planetarium show	22	
Buy souvenirs to remember visit	11	
Subscribe to Smithsonian magazine	3	
One or more of above		40
Help children learn about astronomy	23	
Consider astronomy career	4	
Do other thing	4	

* Note: Responses total to more than 100% because respondents could check as many attributes as needed.

Table 14
First Visit to NASM

Response	ETU Visitors	Visitors	
	(Nov.- Dec. 2001)	exiting NASM (Feb. 2002)	Late Winter 1994 Visits
	(%)	(%)	(%)
First visit to NASM	52	33	35
Visited NASM more than a year ago	32	36	65
Visited NASM in past year	<u>15</u>	<u>31</u>	<u>*</u>
Total	100	100	100

* 1994 Late winter data only recorded first and return visits.

Table 15
Residence

Residence	ETU Visitors	Visitors	
	(Nov.- Dec. 2001)	exiting NASM (Feb. 2002)	Late Winter 1994 Visits
	(%)	(%)	(%)
DC & MD/VA suburbs	27	42	33
Other US state	54	50	50
Foreign	<u>19</u>	<u>8</u>	<u>18</u>
Total	100	100	100

Table 16
Composition of Visitor's Group

Group composition	ETU Visitors	Visitors exiting	
	(Nov.- Dec. 2001)	NASM (Feb. 2002)	Late Winter 1994 Visits
	(%)	(%)	(%)
Alone	23	17	21
Adult couple	39	29	39
Adult group	14	13	11
Adult with child	17	34	19
Teens	3	3	*
Other group	4	4	10
Total	100	100	100

* 1994 Late Winter survey data combined teens and other groups.

Table 17
Age of Visitor

Age range	ETU Visitors	Visitors exiting	
	(Nov.- Dec. 2001)	NASM (Feb. 2002)	Late Winter 1994 Visits
	(%)	(%)	(%)
Under 25	22	17	17
25 to 34	34	27	25
35 to 44	22	33	27
45 to 54	14	13	20
55 & over	8	10	12
Total	100	100	100

Table 18
Gender of Visitor

Gender	ETU Visitors	Visitors	
	(Nov.- Dec. 2001) (%)	exiting NASM (Feb. 2002) (%)	Late Winter 1994 Visits (%)
Female	31	34	36
Male	69	66	64
Total	100	100	100

Interviews with visitors in *Explore the Universe*

In addition to administering questionnaires to visitors, as described in the preceding report, (Visitor Experiences in *Explore the Universe*), staff from the Office of Policy and Analysis conducted interviews with a sample of visitors exiting the exhibition. The interviews focused on four dimensions of the visit experience: the context of the visit, the content of the exhibition, the quality of the presentation, and comparison with other exhibitions in the museum. Three interviewers, working at different times between November, 2001, and March, 2002, spoke with 22 visiting groups (comprised of 52 visitors) about the exhibition, NASM, and the Smithsonian. These findings expand on the results obtained from the questionnaires by providing a deeper understanding of some visitors' experiences in the exhibition.

Findings

Context: The visit as personal exploration

- *The Smithsonian was described as a large, varied place to explore.*
- *Visitors saw a NASM visit as offering something new to see or learn.*
- *What visitors enjoyed was based on their backgrounds and personalities.*

Two of the greatest attractions of the Smithsonian are its size and variety — something that most other museums, especially local ones, cannot provide. Visitors felt that if they “explored,” “browsed,” or “wandered” through the Smithsonian or one of its museums, they would be likely to find some experience that pleases them -- even if they had been here many times before. Repeat visitors to NASM were specifically looking for what has changed since their last visits. They wanted to see what’s new. *Explore the Universe* visitors were drawn by the museum’s reputation, the subject matter, and new scientific information. As is apparent from these interviews, there are strong individual differences in what draws people and what pleases them. (For additional examples see Appendix A.)

I knew the Smithsonian Institution as a whole. I knew that it is a phenomenal museum of information, not just necessarily Air and Space. I’ve discovered that it’s not just the Air and Space, it’s just so much.
— Reservist from Pennsylvania

And the Smithsonian is one of those places where you can have gone to the same museum four, five, ten times and every time you go in, you discover something that never caught your eye before.
— Frequent visitor from Pennsylvania

Content: *Explore the Universe* and learning

- *Visitors valued NASM and *Explore the Universe* as an educational opportunity.*

- *Visitors had various interpretations of the “message” of the exhibition.*
- *Visitors found the content of Explore the Universe to be difficult.*

When visitors described their reasons for visiting the Smithsonian, NASM, or *Explore the Universe*, many of them used words such as “educational,” “informational,” and “learning.” When asked specifically what they had learned in *Explore the Universe*, visitors gave a range of replies, including details of recent events, the development of astronomy, and science facts. Some visitors were uncomfortable discussing what they had learned, and had difficulty articulating anything specific. As one visitor said, “I don’t know if I learned or whether it just emphasized what I was informed of.”

When we asked visitors to go beyond specific things that they might have learned and to describe the message that the exhibition communicates, they had different interpretations. Some did not see that there was any message.

A few visitors spoke directly about the difficulty of the content in the exhibition. Others implied it when they stressed that the exhibition was for adults, not for children, despite its child-friendly interactives. As is typical in studies of this kind, none of the visitors interviewed in the study suggested that the material should have been made more understandable. A few even seemed pleased to have been challenged by it.

I learned something about the Hubble telescope. I didn’t know how they fixed it. I learned how they repaired it. — Man from United Kingdom

I learned that there are several different kinds of galaxies, but I think all of them are the Milky Way. — 9-year-old girl from Virginia

Mother: what will you tell Mrs. Curtis about?

Daughter (Age 5): If it goes really fast it turns red, and if it comes really fast to you towards you it goes blue.

Mother: Right. We’re going to tell our kindergarten teacher about the Doppler effect.

— Family from Minnesota

The most knowledge-focused visitors interviewed in this study were a pair of college students from Wisconsin who were deeply engaged by the quiz computers at the end of the exhibition. They sat at separate computers competing quiz after quiz. The woman did better, scoring 22 out of 48 on three quizzes. It was their favorite part of the exhibition. They claimed that they had learned about half of the answers in the exhibition, although they deliberately avoided the quizzes on the two areas of the exhibition where they had spent the most time — telescopes and spectroscopy. Learning, they said, was what they enjoyed most.

Content: *Explore the Universe* and families

- *The visit to NASM was also a social or family event.*
- *Visitors viewed How Things Fly as an exhibition for children, in contrast to Explore the Universe.*

Visitors in family groups were involved in intricate trade-offs and negotiations about what to see and what to do in the museum and the exhibition. Parents, in particular, were

focused more on the experiences of their children than on their own experiences. Visitors said that *How Things Fly* was more for children than *Explore the Universe* because *How Things Fly* was related to everyday experience, because it had more interactives, and because its content was more accessible. *Explore the Universe* was considered less interactive and more “cerebral.”

Father: I want to go to art exhibits down the street. I wanted to go there first, but I was out-voted.

Interviewer: Who wanted to come here first?

Father: The girls did.

Interviewer (to the mother): What about you?

Mother: It doesn't matter.

— Family from Virginia

Being with my five year old, I don't really have time to really stand and read anything. — Mother, family from Massachusetts

We also enjoy it now while we can. We've got a six-month-old little boy so before we start bringing him here we want to come ourselves. Be able to look and read stuff. — Couple from Virginia

I think [*Explore the Universe*] is pretty on par with the rest of the museum. It's been a few years since I've been here, so I don't remember everything. It's probably more of a grownup thing -- we peeked in *How Things Fly* and it's obviously aimed at kids. This is probably more an adult thing. —
— College students from California

The value of an exhibition to a child can be hard to predict. One man, a frequent visitor, said that he comes to NASM because of a fascination with the subject of space that started when he was in third or fourth grade and read an article by Werner von Braun in *Collier's* magazine about a three-stage rocket to Mars. It caught him and he became a science fiction fan, fascinated by Buck Rogers and Flash Gordon and, now, Star Trek. It influenced his Army service (flying helicopters) and his subsequent job in the air wing of the Customs Service. He feels that *Explore the Universe* isn't going appeal to most kids, but “it's hard to tell. I'm not that bright, but I saw the Werner von Braun plans and it sparked my imagination. You never know what clicks with a kid.”

Content: Objects in *Explore the Universe*

- *Visitors were drawn to the objects.*
- *The telescopes were popular objects, especially Galileo's and Herschel's.*

Some visitors cared more about objects than learning. The objects with the greatest impact among these visitors were the telescopes and astrolabes, especially the Galileo telescope (a reproduction that visitors could use), the large Herschel telescope and the equipment from Mount Wilson. The recent objects mentioned were all associated with the Hubble Space Telescope.

A man from Texas wanted his eight-year-old son to learn something in the exhibition, but he himself cared more about the objects. The boy, who is home-schooled and visits museums frequently, gave the interactives a lot of attention. His father helped him read the texts. When the interviewer walked them both through the exhibition again, however, it became immediately apparent that the boy (and often the father, as well) had very little idea what their favorite interactives were about.

The father recalled visiting NASM at age 9 and seeing “The Spirit of St. Louis.” “I remember the enormity of the things and when you’re small it seems like it’s huge, but you come back and you realize that [in fact] it is as big as you thought it was.” What impressed him most in *Explore the Universe* was the size of the Herschel telescope. It had a visceral impact: “Maybe we’ve become a little desensitized to being amazed at things,” he said.

Content: *Explore the Universe* and the imagination

- *Visitors were inspired by the exhibition to reflect on large issues.*

Because the subject matter of this exhibition includes the origin and nature of the universe, it inspired some visitors to reflect on the meaning of things.

You get a real sense of us being a tiny dot on earth in an enormous universe. That was fascinating. ...It got my imagination going.

— Man from United Kingdom

An active-duty reservist from Pennsylvania interviewed in this study approaches museum exhibitions with a very active imagination. He described how he responded to Michelangelo's *David* when he first saw it:

“It was so big and it was so life-like. I had read that Michelangelo used to like yell at it, ‘Hey talk to me. Don’t just sit there!’ And I’m looking at it and I’m looking at the fine detail of it and I’m thinking. ‘Yeah, he looks like he could walk away at any moment.’ And my imagination starts running wild again and I said, ‘So dude, don’t you get tired of just standing there all these years?’ ... Museums in general just let your mind flow and let your imagination run wild, too.”

Quality: The attraction of *Explore the Universe*

- *Visitors offered definitions of “Smithsonian quality” in connection with the exhibition.*
- *Visitors were drawn to Explore the Universe by the entrance, and expected stars and planets.*
- *Interactives were highly regarded.*

According to these visitors Smithsonian quality, as demonstrated in NASM, stands for fine graphics, technology, educational focus, accuracy of information, scale, variety, and free admission.

The design of the entrance drew visitors. They were attracted to the colors and the images of stars, although the entrance also led a few of them to expect that the planets would be included. A number of these visitors liked the interactives best.

The Smithsonian has always been great. They do everything first class. So it didn't really surprise me because this is what you expect of the Smithsonian. — Brothers from Connecticut and Washington, DC

By quality I mean everything from the clarity of the images to the technology, to the way that *How Things Fly* implements the educational aspects. — Civil engineer

When I come to the Smithsonian, I come expecting to see a display in a particular manner -- more accurate, more representational.
— Young couple from Virginia

I guess I was just kind of walking down and the entrance looked a little appealing... — Civil engineer

Interviewer: What was your favorite part?
Visitor: The heat thing. — Couple from Wisconsin

He liked the light rays, the thing with the piano.
— Family from Maryland

My five-year-old liked the one where you turn the wheel and the universe comes closer and further.
— Mother, family from Massachusetts

Comparison: *Explore the Universe* and the rest of NASM

- *Visitors compared the exhibition favorably to the rest of NASM.*
- *Visitors made some suggestions for improvements to Explore the Universe.*

When comparing it to the rest of the museum, visitors described *Explore the Universe* as “interactive,” in contrast to most of the rest of the museum, which was described as “static.”

Visitors suggested improving the computer interfaces, showing photos of the planets, adding more interactives (including a more immersive type of interactive), and introducing appropriate background music.

I got a kick out of this [*Explore the Universe*]. I really did. It was refreshing. Not just looking at static [objects].

— Frequent visitor from Pennsylvania

I'd say this is a little livelier than some of the other stuff. You look at the other stuff here and it's static displays of things. This here kind of draws you in....The rest of the museum is “you see it — boom -- you've done that.” — Family from Pennsylvania

I like it better because it's a little bit more interactive with the stuff that's in it, while most of the rest of the museum is static display where you're just reading about what it is. — Friends from Florida

What's missing are the close ups of Mars and planets.

— Frequent visitor from Pennsylvania

Some Steve Reich music would sound very good right now.

— Reservist from Pennsylvania

Discussion

The visitors interviewed in this study clearly considered this to be a successful exhibition, even though a number of them admitted that the content was difficult. Their remarks are suggestive enough to allow us to consider why the exhibition was so well received. Five factors stand out:

1. Enticing design of the entrance.
2. Division of the exhibition into two parts: historical and interactive.
3. Interesting telescopes and astrolabes.
4. Quantity and quality of interactives.
5. Sophistication of subject matter.

The entrance

The entrance was important not only because it was attractive, but also because it immediately gave visitors the impression that this exhibition was about the stars and planets. The interviews suggest that visitors were aware of two types of exhibitions in the museum (interactive and static) and two broad subject areas (space and air). *Explore the Universe* was immediately identifiable as a “space” exhibition, as opposed to an “air” exhibition. Because they could see at a glance what this exhibition involved, the visitors who entered were the ones likely to be interested in the topic. One of the simplest ways to ensure that visitors are not disappointed is to make it instantly, visually clear on entrance what the exhibition is about, so that they can accurately decide whether or not to enter.

Titles have a similar impact. The survey study indicated that the title of the exhibition is ambiguous in that it is often taken to mean that the exhibition is about space exploration. This might be causing some who are interested in astronomy more than exploration to skip the exhibition.

Division into two parts

The exhibition is divided into an historical section, in the front, that is dominated by the chronological history of telescopes, and a more open section that is dominated by interactives, graphics, and contemporary equipment. Effectively this distinguishes two different types of experiences. The front section emphasizes historical objects and provides an atmospheric, evocative setting in which to contemplate these objects. The open section emphasizes ideas and knowledge. These two types of experiences often tend to conflict with one another, since a setting that effectively promotes ideas can interfere with the appreciation of rare objects, but the exhibition design here adroitly sidesteps any possible conflict by physically separating the two approaches.

Interesting telescopes

The old telescopes pleased a number of visitors, especially those interested both in historical objects and in space. Exhibitions about space usually contain only contemporary items that generally do not have the aesthetic appeal or intrinsic interest of artifacts from earlier times. For some visitors the old material also served to emphasize how far knowledge has advanced in a relatively short period.

Interactives

Visitors were pleased to find so many interactives in the exhibition. Families, in particular, have come to regard interactives as essential for maintaining the interest of children in museums. At the same time, the adults also seemed to enjoy the content and presentation of these interactives. Even when the users didn't understand the ideas that the interactives were intending to communicate, they felt that the experience of engaging them was worthwhile.

Subject matter

Many of these visitors were struggling to fully understand the content. Ordinarily this might have aroused feelings of frustration or disappointment. Unlike in *How Things Fly*, where complex principles were presented in ways that visitors felt were accessible to children, even adults felt that parts of *Explore the Universe* were beyond them. Rather than blame the museum for this difficulty, they blamed themselves and the subject matter. Instead of giving them the impression that they, too, could be scientists, the exhibition tended to reinforce the idea that scientists were a breed apart, capable of understanding what is beyond ordinary people. The subject matter itself, the origin and nature of the universe, is so far from everyday experience that the inaccessibility of the content did not strike visitors as unreasonable. Some visitors even seemed pleased to encounter an exhibition that challenged them intellectually.

Appendix A: Additional Examples from the Interviews

The Smithsonian was described as a large, varied place to explore.

Here you get a complete coagulation of stuff from all around the world. It's not just local stuff. — Young couple from Virginia

When you hear about the Smithsonian a lot of people think it's one museum. They don't realize it's a whole complex. -- Couple from Virginia

I've always enjoyed the Smithsonian. You know there's a lot here. I've certainly never seen all of it. And it's nice that it's both in-doors and out-doors. There are things to see outdoors, too. On a nice day like this, it's nice to be able to spend some time outside.

— Family from Massachusetts

I would have to go back and take a second look because I didn't give it as much justice this time around. For me it takes one, two or three times for everything to sink in. And the Smithsonian is one of those places where you can have gone to the same museum four, five, ten times and every time you go in, you discover something that never caught your eye before. The Hirshhorn is a classic place. First time you go through, you zip through..."Okay. There's a sculpture. There's a painting. What the hell was this guy thinking of?" And you go down there and it's junk. And then you see other things. I like other things. I like modern art, abstract art. And then the second time I went through, it was "I think I saw this before" and it's different. You come away with something. So there's a lot in here. Maybe a middle school or high school teacher would take about a quarter to half a year to put in front of kids for it to sink in. There's a lot.

— Frequent visitor from Pennsylvania

I knew they had a flight simulator in here, but apparently that's temporarily closed, but so I was looking forward to that. I like more the space part of the National Air and Space Museum. Not that the air part of it's not really cool too, but I just wanted to explore it. This is pretty awesome place... I knew the Smithsonian Institution as a whole. I knew that it is a phenomenal museum of information, not just necessarily Air and Space. I've discovered that it's not just the Air and Space, it's just so much. Of course, you hear about it and the explorations and of course, I saved every National Geographic that I've ever owned for the last ten years, and they're always talking about the Smithsonian in their various publications, so the whole thing is just basically preserving and educating. If you don't have places like this, everything that's learned fades away. So you need places like this to keep it going. — Reservist from Pennsylvania

Aviation is one of my hobbies I guess. — Civil engineer

Visitors saw a NASM visit as offering something new to see or learn.

Man: Both seeing the old stuff, and learning new ideas were interesting, but learning new ideas was more interesting, I thought.

Woman: Yeah. Updates on what people are thinking are really interesting.
— College students from Wisconsin

Visiting this museum is very informative. Also, each time it has new information in it so it doesn't get boring in time. — Brother and sister from DC

I just wanted to see what was new, what the new displays were. — Friends from Florida

What visitors enjoyed was based on their backgrounds and personalities.

What I like best would probably be related to the space rockets and that kind of stuff. I'm a civil engineer, structural engineer by trade and when I think about designing a building or bridge, it kind of pales in comparison to space exploration, the engineering that went into a lot of this stuff. Aviation is one of my hobbies I guess. The object that meant the most to me was the old telescope right at the beginning. It was pretty neat to see how it was manufactured and the basics of what went into it. That's one of the drawbacks of being an engineer. You always think, "how was it put together?"
— Civil engineer

This exhibition wasn't my favorite. My favorite was the transition from the piston engine to the jet. The development of the jet. Being a mechanical person, that's always intrigued me. I've worked on piston engines, but I've never of course been involved with jet engines, yet I recognize the huge step in possibilities they brought, and so, I can see that very clearly here. As a mechanical person what I liked about the presentation was the cut-away, real engines. I wish I could have got that plastic off there, and felt the pieces.
— Retired school principal

I'm from Virginia and I made sure that I wanted to be the first woman on Mars. I'm in third grade. I just got done learning about space and the solar system. At this museum I think I like the stars. I just don't know why. They glow bright and then I like the solar system because ... I don't know. I like Saturn. We were upstairs and my mom said, "Well the solar system stuff is downstairs" and I rushed downstairs.
— 9-year-old girl from Virginia

I always been interested in astronomy and as soon as I walked in here I went up to the front desk. I said, "I'm into astronomy, point me somewhere," and he pulled this out and said, "you need to start here," so this is why I'm here.
— Reservist from Pennsylvania

Visitors valued NASM and *Explore the Universe* as an educational opportunity.

It's such a great resource of information here that it's kind of disappointing if you don't take advantage of it. In *Explore the Universe* I learned some of the interesting aspects of spectrography I was reading about over there, and some of the early telescopes were kind of neat. — Civil engineer

When I go to museums, especially the Smithsonian, I'm looking for an informational experience. In *Explore the Universe* it was the myriad of telescopes. Especially the ones at the beginning. When astronomy was started. You hear more about the newer stuff. Like Hubble and all the others. It's the really old ones that you don't know much about.
— Young couple from Virginia

I liked how through the study of light, the universe is expanding. I thought that was pretty cool. I didn't know how they'd come to that conclusion. That it was actually through the study of light, that that was the way they tracked it. I thought that was pretty neat. — Environmental engineer

For me personally museum going is definitely a learning experience. That's one reason, I brought [my son] along. Part of the benefit of being able to home-school him this year is that we're able to do stuff like this. He was able to go on this trip with me and part of why he's here is to do what we're doing today. While it's an opportunity to see some really neat things, it's an opportunity to learn and I'm sure he'll go back with knowledge that he'll hold on to.
— Father and son from Texas

Man: That's the nice thing about having the interactive stuff. You can take it at your own pace and learn it for yourself and there's no pressure on you, for people like me, who don't really spend too much time with science. I can just pick it up for myself at my own pace. Some time [I use the internet], but it's hard because there's so much information on the internet. It's hard to narrow it down to what you want.

Woman: There's so much unreliable stuff there, too. You know, that you can't take for actual information. But here...

Man: But this is all right here for you. You can see this and this and this.

Woman: There's nothing to weed out here. Everything is good information here.
— College students from Wisconsin

I go to museums because my daughters both learn a lot, and especially in science at school, but at the museums they often have exhibits that reinforce some of the concepts they learn out of books. So I think that's our main motivation, and they enjoy it. My five year old does get tired, but she has a good time. My nine year old really loves it — she would stay all day...I've never brought my kids to the Smithsonian before. I've always enjoyed the Natural History museum the most, just because that's the area I'm most interested in. I'm a biologist, so all this stuff leaves me a little cold, but with the kids here, we really were looking to enhance the things that they're learning in school.

— Family from Massachusetts

As a teacher you always have to have a lesson that makes a student or a child learn more. You're lesson isn't just to give somebody a whole bunch of facts. At least that's the way I felt about my teaching. You have to do something that makes your student want to learn more. And that's what this has done. — Retired school principal

I'll tell my friends, "you should go to this place because I learned a lot at this museum and you can learn a lot too and you'll learn the same things as me." I'd tell them, "there's more to explore in the universe." — 9-year-old girl from Virginia

When I was a child, I used to come here with my family every other week. You know. All that, during the summer and sometimes during the winter. It was just my family always looked at it as another free education, learning tool. We visited this one and the Natural History Museum and Smithsonian. But I didn't learn a lot. Not really, to be honest. Not really. It was more or less to come down and look at the advances in technology and space or air travel. I love to come and see just the different types of planes, missiles and rockets. How everything's changing.

— Mother with family from Virginia

I like this exhibit more because it is less static and because I started learning something. It was a learning experience. The lady down at the end of the hall caught me with the prism and the laser light. Turning the wheel on all of that. I didn't even get a chance to read all the text, because it didn't connect that there were the three types, four types of telescopes. And the exhibits on the different observatories were really done nicely.

— Frequent visitor from Pennsylvania

You learn about all the different breakthroughs in telescopes that they've used and the different shots from space that they have. — College students from California

Interviewer: What kind of experience were you looking for today?

Visitor: Educational. And also I suppose entertainment, but to learn something.

— Man from United Kingdom

What I liked about Explore the Universe is how informative it was. The interactive displays with it. Explanations are very good. Displays -- I like the way the displays were set up. I think people would come here to try to find some answers to questions that they

might have. I came to find out a little more than what I pick up through news or newspapers or books. It's entertaining and you learn a lot while you're having fun.

— Friends from Florida

Interviewer: If you had to say in one word why the Smithsonian is important, what would you say?

Visitor: Education.

Interviewer: What do you mean by that?

Visitor: Just basically exploring well beyond your own world. Whether it's just the physical planet earth or your own personal world, in the grand scheme of things you really are small and there's so much more out there beyond our physical world. It's still yet to be discovered and the more about it you know, the more positive impact it can have on your own world.

— Reservist from Pennsylvania

Visitors had various interpretations of the “message” of the exhibition.

The message I'd probably take from this is the incredible advancement in technology, the kind of power it holds to reveal new items or new findings. — Civil engineer

Science is a good thing. Look, because you'll never know what you'll find.

— Young couple from Virginia

Off the top of my head, I can't think of one. — Reservist from Pennsylvania

It takes a long time for scientists to learn anything... Just walking through from the beginning to the end, you realize it's been a long, long process, and we're still just at the beginning of learning anything. — Family from Massachusetts

They learned so much more since the Hubble went up there, and the details they've gotten out of that. I'm sure that's going to keep the astronomers busy for hundreds of years, analyzing that data. I think that's one of the messages you get out of it, so it shows you you've got a whole new perspective of the universe and the galaxies since the Hubble. How their perception of what the universe is like is changing and how it, generally, like any science, raises more questions than it gives answers.

— Brothers from Connecticut and Washington, DC

I think to me, the message is that there is so much out there and we've found out all those things, but I think it also told me that you've just scratched the surface, you really don't know. You think you know, but you're just getting started, there is so much more.

— Retired school principal

The different equipment that was used to explore it. — Family from Minnesota

I didn't see a main message. I don't know. It was just informative to see different space looks, I guess. — Couple from Wisconsin

It's above my head. It's just trying to figure out what the universe is all about. That's what I got out of it. It's just like, “what is it all about?” Some of the points of it are ideas I really didn't understand before and they are a little clearer now, like the universe

expanding...They are a little clearer to me now. I picked that up probably in the readings and the writings in there. Just reading off the walls. Each display had something to say.

— Family from Pennsylvania

I guess it's how we've tried to do it over the ages...from Galileo up to what we're doing now. And the changes since the late forties, when you had to sit outside all night to look at things. Now the technology makes it a lot easier. I just saw Jodie Foster...that [film] was on a couple of times last week. What grabbed me was that there was one photo of very large arrays [in the ETU exhibit] and I thought..."oh my god, Jody Foster should see this." It was really neat. A philosopher, even a scientist, would look at it from the standpoint of how big it is and how little we know today. We took a stab with the big bang theory but that just opened up more questions. So this is probably something that would go right by a kid. I mean we're talking about endless, infinite endlessness to what we know as creation. [This message] was most clearly expressed with the different observatories. There is a mural back there that has several types of observation techniques...The Hubble telescope, very large array, your traditional observatory. I put together what's going on. — Frequent visitor from Pennsylvania

Probably just to show the process of continuing to learn more and to show all the past achievements, and then to look toward the future and what's going to happen, and what else we can learn. I guess it is trying to get a better understanding of where we stand in the universe. Earth's position and how it all works. — College students from California

As tiny dots we try to understand what's going on in the furthest reaches and how to visualize and to see and understand what's happening and how far out it goes and really to get a feeling of connection with the outer reaches of the universe. I think that was the feeling: connection. — Man from United Kingdom

Woman: That we're not the only ones out here.

Man: That there's got to be something else out there. And to try to get more people interested in what's out there and to take a look at the stars. I picked that up, I'd have to say, in the last display with the 28 panels from the Hubble scope that show a lot of the stars and galaxies in just a small section of the sky. To imagine that it's never-ending is kind of intimidating. — Friends from Florida

Some visitors found the content of Explore the Universe to be difficult.

I'm always interested in exploration and the development of things, but when I got in there, I realized, yep, I can understand this because somebody has told me it is so, but I can't. We're getting into physics, new dimension of time, etc, and it's beyond my comprehension with the background I've had. And suddenly I found myself beyond my depth in there. It was very interesting, but I realized how much specialized knowledge this is. This is where Einstein comes in, and people like that, who can understand these concepts that enable them to put things out for us mere mortals to see. I realized that, boy, we're lucky there is somebody that can figure this all out. When we got around to talking about the dimensions of time, theories where you really, really know your stuff — physicists.... My son teaches physics in the high school, and he has never seen an

exhibition near this caliber, so I would tell him that there is stuff there that you would understand that I didn't but you ought to see it because there is some there that you won't understand, that will make him think. — Retired school principal

I can understand other people -- if they're used to things on TV being thrown at them -- might have difficulty because there are a lot of abstract concepts there, which you try and make tangible. But I can imagine a lot of people might have difficulty with that. I know this is a new exhibition. So I can see this one being controversial. But I support it, because I think it's important because it really goes beyond the planet in very great way. I'd recommend it not for the children but for the parents. I would say males, technologically oriented males, would enjoy it. I don't think the females I know would enjoy it, but that might say something about my relationships. But that's a different....that's natural history. — Man from United Kingdom

The visit to NASM was also a social or family event.

I'm sure there's museums around the world that compare in terms of just here and there, but when you look at what the Smithsonian offers, in terms of an entire package, there's nothing else like it in the world. I mean this is like the cream of the crop. You come here and you get it all. You know, we were talking to my dad, his grandfather, just the other day. He absolutely loves history and I remember coming here with him and we just couldn't get enough of it. You could really spend weeks going through all of these museums and we spent a week here the first time we came. Dad was talking to Cole about it. [Addresses child.] Grandpa told you about coming here and the different things that you'll see and the experiences that you'll have. One thing that will be neat too is that when we bring his brothers and sisters here in the future, as you get older you'll be able to tell them. You'll just show them around. We won't need to do the audio tour. We'll just do you. This experience is different for me, too, because I'm looking more to what he's interested in and although I might be drawn to something right now, I probably won't go up and look at it if he's not interested. I'll go do what he wants to do.

— Father and son from Texas

I try to get here at least once a year. And more often -- any time we've got visitors from out of town we try to bring them. — Brothers from Connecticut and Washington, DC

I would bring my grandson down, next time he's here. I have a grandson who's very interested in science. He's in the second grade. I brought him down here before, a couple years ago, and he just loved this place. He likes the hands-on exhibit, but now he's a little more mature, and I think he would start understanding a lot of what's in there. He's very bright and he's very inquisitive in that regard. He always likes to come here. So I would bring the grandchildren here. — Brothers from Connecticut and Washington, DC

You've got actual air travel at that end and space travel at this end and it fits because everybody just doesn't want to know about just the shuttles or anything like that. They want to know what people have found out about what's in the universe. That's what people want to know -- what they're finding out. — Mother with family from Virginia

My sister is visiting me so I thought it was a nice place to come visit. The space museum is a known place to visit -- entertaining in a way. So my sister showed interest and we did come. — Brother and sister from DC

This is my second time to the Smithsonian. The last time I was a kid when I was here. My wife was reading that this was the most visited museum in the world so we figured let's go see it. So this was the first one on the list. — Family from Pennsylvania

Visitor: Basically I came to show [my girlfriend] around. She's visiting for about a month, so I want to show her all the museums and stuff while she's here.

Interviewer: What kind of experience were you looking for?

Visitor: I guess fun and informative. — College students from California

The kid really liked it. She was three years old the last time we came here. She said, "Mom, I want to go back." — Family from Virginia

Visitors viewed *How Things Fly* as an exhibition for children, in contrast to *Explore the Universe*.

I really liked the interactive stuff. I think it's so much fun. We spent a lot of time in the kid's section over there [i.e., *How Things Fly*]. — College students from Wisconsin

I went into the one obviously aimed at school children, "How Things Fly." There it is, you can do it and understand it. I like playing with those things. There's a computer designing an airplane. You push the buttons. It's great! — Retired school principal

I really liked the exhibition. It was a lot more cerebral than the whiz-bang of looking down at the ballistic missiles, which is not bad but it's a different type of exhibit. It's really for very smart kids or adults; that's whom it's going to appeal to. It wouldn't appeal to the younger kids unless you have a prodigy. But it's hard to tell. It depends. I'm not that bright, but when, [as a child] I saw the Werner von Braun plans, it sparked my imagination, and you never know what clicks with a kid.

— Frequent visitor from Pennsylvania

A kid will go in [Explore the Universe]. They'll push the buttons, turn the wheel, play with things and I don't think that kids today...Now, if kids were prepped in some way like by a teacher who knew about the exhibit before they brought the kids in there. Then you wouldn't get the reaction of...and this goes not just from eight to ten to eleven years old, but you can see it with the teeny boppers back there that some of it is going right over their heads, unless they're reading. See that woman -- she is reading. She's looking for the message. Even some of the adults go by...look at it and say "looks like junk, old telescopes," something like that. I think that [for children] this would be best done with school groups. I don't know if the Smithsonian has any outreach that goes to schools. You get somebody out there that is familiar with the exhibit and tells kids and the teacher what it's all about; it's not just a lot of stuff. There's a lot of whiz bang here, which is okay. But it also has a lot of messages, a lot of nice facts that you would not ordinarily

know, unless you were a voracious reader in this area. That's the great thing about it ...I would say if you spent an hour to two hours here and absorbed it all, you would get what would probably take you two or three books to read. Which is great.

— Frequent visitor from Pennsylvania

This is more cerebral than *How Things Fly*. And more educational. I think this is more for adults than for kids. Here you have to picture yourself as a tiny species in the whole universe. *How Things Fly* is more directly related to everyday experiences. I would say about ten onwards would be appropriate for this exhibition and, for *How Things Fly*, five, probably less than that, maybe three or four, because you can play with the things in there. — Man from United Kingdom

Visitors were drawn to the objects.

I liked the antiques, the astrolabes, and the antique exhibits. Those were interesting to me. Those were things I hadn't seen at other science museums.

— Family from Massachusetts

I think when you just hear the title "Air and Space Museum," we know a lot about air, we know a lot about airplanes, when you hear about space you think about space exploration. It makes you start to wonder and you want to see first hand, or a little more in-depth, what it is. Though pictures are wonderful, and movies are better, to see something is that much better yet, because you can transfer, calculate size better than from a picture. Those space capsules were so small, for three people to get in, to think, how in the world did they get three people in here? And you see where they are, and I still don't know how they were even able to move their arms to manipulate the things when they flew. And that's what seeing it in person does. I was surprised that you have the Russian missiles here. That exceeded my expectations. And that's fantastic. We need more of that. We need to know how things compare. Because people seem to think the Russians were rather primitive and so on, but hey, they had just as good stuff, and beat the West in a lot of ways, and it was good to see them here, and the business of the secrecy and the adversary and so on.

— Retired school principal

Well, I've always had an interest in space travel and the universe and I'm a private pilot myself, so it held some interest for me, and actually I did work on the space program for a time with Lockheed space operations company. I was an environmental engineer on the space shuttle program. I primarily came here to see artifacts on the history of space flight and aviation. I wanted to see some of the real items that had actually gotten into space and had some historical significance. I wanted to see them for myself.

— Environmental engineer

I like the old spacecrafts that they used and how small they were. It's pretty amazing that someone was in space in that little sardine can. — College students from California

We have a science center in Toronto that's pretty good. This is just larger scale. You have more authentic things like used in Hubble, a lunar lander. That kind of stuff. Much more. It's very cool when you see something that was actually used.

— College students from Toronto

There are a lot of interesting things in here. I always wanted to see when I was in science class and now I'm getting to see it. The Hubble space telescope. The Galileo telescope. I got to see it just a second ago. I like this place. It's nice. A lot better than most places. The best part is to be able to look at them in person, rather than looking at them in a book. I stand here and think, "They actually got in and rode to outer-space in them". That's something that I'll never be able to do. It's kind of a step forward. ... This is good. I like this. You can actually walk around and read about it, instead of pressing buttons, take your time. I went to a Roosevelt thing when I was a kid and I just barely remember it. You just walk in a hit a button and they start doing stuff. That wasn't my thing. I prefer actually being over these [things] rather than looking at them in a book or having someone tell me about them. ... I just want to see stuff.

— First-time museum-goer

The telescopes were popular objects, especially Galileo's and Herschel's.

The Hubble telescope. It was interesting seeing that. The scale model.

— Family from Maryland

I was particularly interested by the 20-foot telescope. Since long, long ago, people have tried different ways of having access to information about space. Pretty much the basic science is still the same; we have just become more sophisticated in terms of the tools.

— Brother and sister from DC

I can really appreciate how man has come in a short amount of time, looking at some of the primitive instruments that Galileo used and what we use today. I saw some of the much bigger telescopes that they got in there. It's amazing over a period of a few hundred years what we have learned and how equipment has progressed and advanced. I think that is the message of the exhibition. That's pretty much it in a nutshell. I picked that up when I saw the big telescope in there. Saw the one from Mount Wilson. I guess that's pretty old too, but that's much more advanced than say the tiny one that Galileo used that's up there on the wall. I think that's a pretty stark example of how things progress along. — Environmental engineer

The only real things I looked at were the telescope discoveries from Mount Wilson. That was kind of nice and that's right around from where I'm from in California. I just saw the discoveries they made with the telescopes and how they get clear pictures of different galaxies. — College students from California

Visitors were inspired by the exhibition to reflect on large issues.

It just reinforces that man is an inquisitive and inventive being, and no matter where you are, you are trying to grow. ... Human beings are never going to be static. Never. They are constantly trying to do something greater and better than they're doing now. And it started at the beginning with the early flights of some of those French balloonists, and they just had to get off the ground. Michelangelo thought about it, he never did it, but he had the idea! And man will never stop... Even when you see the space area, you look at those little capsules they used first and how primitive they actually were, and then they get better and better and better, to this one behind us (lunar lander). To me that's the message, that man is a very intelligent and inventive creature, and is never going to stop.
— Retired school principal

I'm always fascinated by the big bang theory and I like that little wall, the kind of time line you have over there. The chronology from the big bang and what happened. All these neat little theories. Everybody talks about the big bang and this big explosion and I'm thinking, "ok, so if we bring that explosion back down what was there before that? Where was that sitting?" To me, I look at it like a firecracker, so here's a firecracker that's about to explode. What's sitting on this stool before it exploded? Where was this firecracker sitting? What was there? It's pretty neat. ... You look around and it's like when you read some information that says Betelgeuse can fit one hundred billion of our suns in it. You try to realize how insignificant we really are in the whole grand scheme of things. We could fit a hundred earths in the sun and a hundred billion suns in Betelgeuse. Wait a minute, man. Where do we fit in comparison to the whole picture? Then of course, I also like to think about it in the other direction. It's like when we think about a speck of dust. There's something smaller than that speck of dust. — Reservist from Pennsylvania

Visitors offered definitions of "Smithsonian quality" in connection with the exhibition.

It sure is nice to have all of the original artifacts and the quality of the exhibits is just outstanding. By quality I mean everything from the clarity of the images to the technology, to the way that How Things Fly implements the educational aspects. It makes me feel good knowing your tax dollars goes to something that I think really makes a difference and is a great public service. — Civil engineer

It's got the Smithsonian's quality. When I come to the Smithsonian, I come expecting to see a display in a particular manner -- more accurate, more representational. The information [is accurate], and the displays are set up realistically and legibly and they're easy enough for everybody and anybody, too. — Young couple from Virginia

I like to visit the Smithsonian because there's more room. There are a lot more exhibits. A lot more interactive things for the kids to be involved with. They enjoy that a lot. It's laid out well. A lot of good explanations of what you're actually seeing. The whole layout is pretty nice. ... [The most important thing about the Smithsonian] is access for the general public. People can come and not have to worry about paying. They're able to see many different areas of interest and they don't have to worry about whether they can afford to take their kids in to see it. To me that's critical. — Family from Virginia

Visitors were drawn to *Explore the Universe* by the entrance, and expected stars and planets.

I guess I was just kind of walking down and the entrance looked a little appealing and I saw the topic in the brochure we have. I guess I thought it had to do with images of space and stuff. I thought it had to deal with images of solar system. — Civil engineer

I don't know. My older daughter has an interest in stars. I wasn't quite sure what to expect from the outside, but it was interesting. I think probably I expected something more like a planetarium. But what we got was fun. [The children] weren't very interested in looking at the telescopes, but they did do some of the hands-on things, with the light. I don't think they understood the physics of it all that well, but they're nine and five, so that's ok. — Family from Massachusetts

Interviewer: Is that the first exhibition you've actually gone into?

Visitor: That's right. Explore the Universe

Interviewer: So what made you head to that one.

Visitor: The stars and the planets.

— Family from Maryland

Interviewer: What made you decide to enter this exhibit?

Visitor: The look of it from out here. It looked neat for our kids to come into it. Our kids like to touch everything.

Interviewer: What about the look captured your interest?

Visitor: The colors on it. Just jumps at you. It's dark and has ultraviolet colors. Looks mysterious.

— Family from Pennsylvania

Interactives were highly regarded.

The best part were the displays, especially the interactive ones.

— Young couple from Virginia

I was here a few years ago just on a business trip for a quick run through and I've noticed that now there is more use of the computers and monitors -- more interactive stuff like that. I remember years ago really the only major interactive thing that they had was some of those things where you could go up and start it and you'd get a recording. But I think stuff like this really intrigues kids especially and adults as well.

— Father and son from Texas

My five-year-old liked the one where you turn the wheel and the universe comes closer and further. My older daughter [age 9] especially liked the light going through the

different elements and trying to figure out, based on the diffracted pattern, what she was looking at. — Mother, family from Massachusetts

Interviewer: Anything in particular you liked?

Visitor: It's a galaxy thing. It glows different kinds of colors when you turn the wheel over there and it goes up and down. Milky Way changes colors.

— 9-year-old girl from Virginia

What I liked best were the models. I like the models and the actual working models, so that you can see the hydrogen spectrum. I like the actual working models, [such as] the little buttons with the hydrogen and the different atoms and the spectrum of elements in there. — Family from Pennsylvania

The glaring thing was and it was kind of funny, the four types of telescopes, which were staring at me right in front of my face and I'm playing with the laser light, the prisms and the mirrors and the lady back there put it between my eyes. And son of a gun. I probably would have figured it out, if I would have walked up there and read everything first and done it. But it was something to take back with me.

— Frequent visitor from Pennsylvania

Believe it or not, some of the little interactive stuff is pretty neat. That one, for example, about the expanding universe — “What's the center of the expanding universe.” I think that's pretty neat. ... The infra-red TV over there is kind of neat, too, when you stand in front of that. ... I like the idea over there. How long does it take to light to travel from the moon to the earth? So I actually went over and I pushed it and I said I want to count it out and I went one one thousand, two one thousand and two seconds. That's pretty neat too, the idea of the speed of light. — Reservist from Pennsylvania

I think a lot of the examples are really good. A lot of the analogies used. Like showing kids light rays with piano keyboards and things like that.

— College students from Toronto

The test your knowledge thing is definitely the best part. It's a lot of fun. ... What's helpful about these quizzes is that the pictures are the same as the pictures in the exhibit, so you can just really put two and two together. Because at some of them I was like “oh, I wish I had read that more.” ... It is nice. The quizzes are short enough. You can make it longer by taking others. But they're short enough that you can kind of just go through. ... That's the nice thing about having the interactive stuff. You can take it at your own pace and learn it for yourself and there's no pressure on you, for people like me, who don't really spend too much time with science. I can just pick it up for myself at my own pace. — College students from Wisconsin

Visitors compared the exhibition favorably to the rest of NASM.

I got a kick out of this [*Explore the Universe*]. I really did. It was refreshing. Not just looking at static [objects]. These are great to look at -- it's hypnotic looking at that thing [Lunar Lander]. But this was sort of...I guess I was in there for an hour. It kept my interest. ... I like the logic of the way it was put together. That's what I liked.

— Frequent visitor from Pennsylvania

Visitor: I'd say this is a little livelier than some of the other stuff. You look at the other stuff here and it's static displays of things. This here kind of draws you in.

Interviewer: How would you say that this exhibition fits with the rest of the museum?

Visitor: I'd ask the question, "does the rest of the museum fit with this?" This kind of draws you in. The rest of the museum is "you see it — boom -- you've done that." This calls you and wants you to check it out. — Family from Pennsylvania

I would say that this [exhibition] takes a bit more imagination because it's dark and your brain has to fill in the missing elements. The rest of the museum you can approach in a variety of ways. You can look at it as an old air force person and reminisce, or you can come to it and just see for real what you've seen on the TV. With this particular exhibition I would say that it's adventurous in the sense that it has tried to make the abstract tangible. And that's not easy to do. ... With this exhibition I had to bring myself more to it. With the other exhibitions in the museum, they throw themselves at you. There's nothing wrong with using my own brain. — Man from United Kingdom

I like it better because it's a little bit more interactive with the stuff that's in it, while most of the rest of the museum is static display where you're just reading about what it is. [*Explore The Universe*] reinforces with an interaction where "you touch the screen and something happens." You can find some stuff out like that, whereas with the rest of them you're standing and looking at it. — Friends from Florida

It's the National Air and Space Museum. Yes, you document what we, as a people, have done to put things in space or explore space so it fits in that you have to show how much is still out there; how very little is the dent we have made in space flight and space exploration. So if you keep an awareness up, an overall awareness, people have more interest in allowing agencies to explore space and appropriate the funding to do that, because we all know it costs a lot of money. But its good to keep your awareness up and this exhibit does that. — Friends from Florida

Visitors made some suggestions for improvements to Explore the Universe.

Man: Some of the computer displays we kind of looked at.

Woman: They were boring.

Man: They didn't really grab us. But if we sat down, I'm sure they would have been interesting, but we just didn't. It just didn't grab you.

Woman: It lacked sound. You touch a screen and that kind of thing, maybe if you had more sound.

— College students from California

Well, most people like to be shown things if there's more...when I say interactivity, I mean in the sense that if someone could stand almost like in an arcade game. It's almost like they stand there and almost picture back there in some sort of rocket ship and they're traveling away from the earth and almost see the earth disappearing with the other planets coming in. I mean this is just an example. In other words, that would be a way of bringing these concepts to people with greater force -- an arcade game type of approach or with people standing and things happening around them. That would really make it easier for them to visualize. The moment one has to bring one's own visual cues, one takes primary cues from here but you have to fill in secondary cues from inside one's own head. And I think that a lot of people, with great respect, might have difficulty with that. — Man from United Kingdom

Woman: I'd make it bigger.

Man: Yeah, make it bigger. So more people could interact with stuff. There aren't very many people now, but I could see where if there were a lot of people, you could get a backlog people waiting to get to something. They might get tired of waiting and then walk off and wouldn't enjoy the exhibit as much as they could. So I'd probably just make it bigger. For example, the one of "find your birthday star," I could see where a lot of people would want to do that, but there's only one station for that and you would end up with a lot of people lined up and they'd get tired and wouldn't want to wait and take off. — Friends from Florida

What's missing are the close ups of Mars and planets. NASA has some stuff. That face thing that's on the surface of Mars and what they thought were canals. I'm pretty sure they picked that up with the Hubble telescope. — Frequent visitor from Pennsylvania

A friend of mine is very much into space ambient music. He's actually a DJ. He does a show every Saturday night from 1:00 to 6:00 a.m. from the University of Pennsylvania and that type of music maybe would add to the atmosphere a little bit. Very spacey, ambient music. I practice yoga meditations and a lot of times I put that on, and set the mood. I was thinking about that as I was walking around. I was thinking of a few artists that do that kind of music. Some Steve Reich music would sound very good right now.

— Reservist from Pennsylvania

Appendix B: Interview Guide

Visitor Interview Study
Interview Guide

Version 1
November 1, 2001

CONTEXT questions such as:

Where are you from? Who are you here with?
Do you visit museums often? Have you been to the Smithsonian before?
What brought you here? What kind of experience were you looking for?
Have you visited any other museums on the Mall today?
Have you visited NASM before? When?
Has NASM met your expectations so far? In what way?
What about NASM today has pleased you the most? The least?
This museum is one of the most-visited in the world. Why do you think that is?

CONTENT questions such as:

What made you decide to enter the exhibit?
What is the message of the exhibition? Does that mean a lot to you?
Where did you pick up the message of the exhibition most clearly?
Did you learn something new in the exhibition? What?
Do you know someone who would really love this exhibition? Why?

QUALITY questions such as:

What did you like best about the exhibition? What did you like least?
Would you recommend this exhibit to a friend or family member? What would you say?
What was your favorite part of the exhibition? [Possibly go back and look at it together.]

COMPARISON questions such as:

Did this exhibition surprise you in any way?
How does this exhibition compare to other exhibitions here? Is it different, similar?
How does this exhibition fit in with the rest of the museum?
Do you like it more or less than the other exhibits you saw here today? Why is that?
What did other exhibits have/do (not have/do) that makes that so?

Estimate Age
Record Gender

Appendix C: Interviewee List

Interviewee List and Characteristics

Gender	Characteristics	Residence
M	Civil engineer (estimated age: 30s)	Missouri
M,F	Young couple (20s)	Virginia
M,M	Father and home-schooled son (8)	Texas
M	Reservist on active duty (30s)	Pennsylvania
M ,F,F,F	Father (30s), mother, and two daughters	Virginia
M,F	College students (20s)	Toronto, Canada
M ,F	First visit to any museum	Georgia
M,F	College students (20s)	Wisconsin
F ,M, F ,F	Father, mother (35) & two daughters (9)	Massachusetts
M,M	Brothers, (70s)	Connecticut
M	Retired school principal, (mid-60s)	Alberta, Canada
F , F , F ,M,M	Grandmother, mother (35), daughter (5) and 2 sons	Minnesota
M,F	Return from previous day's first visit (40s)	Wisconsin
M , F ,M	Parents and 3-year-old son, (30s)	Maryland
F,M, F , F ,F	Parents and three daughters (interviewee age 9)	Virginia
M ,F	Brother (age 48) and sister	Washington area
M	Environmental engineer/First visit (40)	California
M ,F,F,M,M	Parents and three children (38)	Pennsylvania
M	Frequent visitor (65)	Pennsylvania
M, F	College students, (19)	California
M	Age 52	United Kingdom
M,F	Friends, (38 and 36)	Florida

* Principal interviewee(s) in groups identified by noting gender in bold typeface.

Explore the Universe Implementation Study

Introduction

The Secretary of the Smithsonian, Lawrence Small, requested that the Office of Policy and Analysis conduct a comprehensive review of the new exhibition, *Explore the Universe*, which opened at the National Air and Space Museum (NASM) in September, 2002. The review includes two studies of exhibition visitors (a self-administered questionnaire and personal interviews) and this study of the process by which the exhibition was created. The study team was asked to determine why it took ten years for this project to be completed.

This study is based on interviews with eleven NASM staff members, including the three core team members (curator, writer, and designer), the project manager, a fund-raiser, exhibition department managers, and other personnel who were closely involved with the exhibition. It also relies on a timeline of the exhibition development process constructed by the designer from an extensive file of notes and correspondence. A brief summary of that timeline is included as the last page of this report.

What took place?

Explore the Universe took ten years from the time the idea for the exhibition was first raised, in the summer of 1991, until the exhibition opened. The exhibition topic, cosmology, was encouraged by NASM's director at the time, Martin Harwit, an astrophysicist, and he was frequently present in the early meetings. The first stage, idea generation, took one year, and the exhibition idea was approved for development in July 1992. The director gave primary responsibility for the development of the exhibition to researchers in the museum's Laboratory for Astrophysics. At this time the museum estimated that the project would take three years.

The next stage, concept development, was very lengthy and complicated, due to differing points of view among the astrophysicists and their lack of experience in producing exhibitions. It took two and a half years, a relatively long time, for the team to arrive at an exhibition concept. This initial concept involved extensive technology, including numerous state-of-the-art computer workstations, and had an estimated budget of \$7 million. It was soundly rejected by the museum's Exhibition Committee, which was responsible for approving projects, in February 1995, on the grounds that the estimated cost was too high.

In May 1995, Harwit resigned and in November the acting director, Robert Hoffman, approved a revised concept and authorized continued concept development leading to a planning document. The new director, Donald Engen, approved the continuing process in

November 1996. Altogether the revised plan took another two and a half years to produce due to staff changes (e.g., the Laboratory for Astrophysics was abolished), and the need for key staff members, such as the designer, to address other projects. In January 1998, a planning document with a budget of \$2.9 million was finally approved.

Design-development and fund-raising took place simultaneously but intermittently over the next three years as the museum's attention was increasingly focused on the plans for the new Hazy Center at Dulles Airport. Corning came through first with a pledge of \$500,000 in 1999. They wanted to support the exhibition because 2001, the year the exhibition was now scheduled to open, was their 150th anniversary year.

NASA offered only \$250,000 in cash and \$300,000 in in-kind support, a major disappointment for the project. In 2000 TRW pledged \$1 million because 2001 was their 100th anniversary year. Various funding deadlines were missed, but the project was not cancelled, due to the heavy investment in the project to date. Finally, in February 2001, NSF promised \$1.35 million, which completed the necessary funding.

Because the agreements with funders required that the exhibition open in 2001, fabrication and installation had to be completed in seven months, about half the normal time, through an intensive, well-coordinated effort. The exhibition opened on schedule in September 2001.

Although the project took ten years, the significant delays occurred in the first six years of the idea-generation and concept-development stages, which should have taken only one year ideally. Once the planning document was approved in January 1998, the project continued to move slowly because resources could not be exclusively dedicated to it, but the overall four-year time period for design-development, fund-raising, fabrication and installation, was not unduly long.

Why did it take so long?

CONCEPT DEVELOPMENT WAS POORLY MANAGED

The first concept-development process was leisurely, unfocused and dominated by inexperienced staff. The concept-development stage should have taken less than a year, but instead it took two and a half years. The researchers in the Laboratory for Astrophysics had no previous experience with exhibitions and produced a concept that the rest of the museum considered unrealistic and unworkable.

DURING THE REVISED CONCEPT-DEVELOPMENT PROCESS, STAFF AND PRIORITIES CHANGED

Momentum for the project was lost when Martin Harwit, its original internal proponent, resigned, and especially when many of the staff working on the project left the museum. Subsequent directors allowed the project to continue, but did not give it a high priority, and it was allowed to drift with only occasional, sporadic support. As team members worked on other projects, the development of *Explore the Universe* lagged.

THE NEEDS OF THE HAZY CENTER DOMINATED FUND-RAISING AT THE MUSEUM

Once fund-raising began for *Explore the Universe*, it was in direct competition with the needs for the new Hazy Center at Dulles Airport. Even when a specialist in fund-raising was directly assigned to *Explore the Universe*, most of that person's time was spent working on the Hazy Center.

MUSEUM MANAGEMENT DID NOT EMPHASIZE AN EFFICIENT DEVELOPMENT PROCESS

The museum's approach to exhibition development was to allow multiple projects to go forward with intermittent, low levels of support, as possibilities for the future, and then to elevate or eliminate them depending on shifting priorities and fund-raising responses. In other words, the exhibition development process was not managed.

What was the impact of the long development time?

THE PROJECT LOST MOMENTUM

By the time a planning document was approved in January 1998, after six and a half years of discussion and effort, much of the original impetus for the project had been lost. The push for cosmology as the central topic had come from astrophysicists who were no longer working for the museum. The new team felt that their exhibition had little support and they were distracted by other projects. Under these circumstances it was very difficult to maintain the energy and enthusiasm needed to produce an imaginative, innovative exhibition.

TEAM MEMBERS WERE DISCOURAGED BUT BONDED IN ADVERSITY

The labored, intermittent development process was difficult for the final team members, who were periodically demoralized by the rise and fall of interest and support for the project. At the same time, their personal efforts to overcome these difficulties bonded the final core team more closely together than is typical for exhibition development projects. When the project was in the design-development stage, individuals on the core team were actively teaching and learning from one another in a way that benefited them all.

COSTS WERE HIGHER

Because funding was linked to an opening in 2001, the longer that it took to begin fabrication, the less time would be available for that final step. In the end, only seven months were available and resources were stretched considerably in order to meet that deadline. This created an unnecessary atmosphere of urgency and sacrifice, put a burden on staff and museum resources, and increased costs.

What lessons can be learned from this?

EXHIBITION DEVELOPMENT SHOULD BE MANAGED

Rather than allowing multiple projects to drift for years with intermittent support and constantly shifting priorities, the museum should seek to better organize the development of exhibitions against an overall exhibition strategy and plan. In particular, consideration should be given to establishing principles such as the following:

- Evaluate and select exhibition ideas on the basis of strategic priorities.
- Set a time limit for the concept-development stage (ideally 6 months). The product of this stage is a funding proposal.
- Ensure that resources are adequate and focused enough to meet that time limit.
- Involve fund-raisers in the concept-development process so the project has a head start.
- Set a reasonable time limit on fund-raising (2 years) and cancel the exhibition if goals are not met or provide internal resources if the topic is considered critical.
- Complete fund-raising before investing in the design-development stage.
- Allow a year and a half for design development and one year for fabrication and installation.
- Total time would thus range between three and five years.

PLANS SHOULD REFLECT TRUE PRIORITIES

Interviewees, including those most committed to the project, realized that the Hazy Center had higher priority and recognized the legitimacy of that higher priority. They felt that the exhibition plan should have been cancelled when it was clear that it would be in direct competition with the Hazy Center for staff and financial resources. Even though the project was ultimately successful, the resources applied to it could have been applied to the Hazy Center.

PLANNING TEAMS SHOULD BE LED BY PEOPLE WITH EXPERIENCE

The concept development process was so drawn out, convoluted and ineffective because it was led by researchers, none of whom had had significant exhibition experience. An exhibition is an artistic medium, like film or theater, with its own vocabulary, style, and process. Making an exhibition is a specialty that requires skill and experience. Expertise in making exhibitions is an essential qualification for the leader of an exhibition development team; expertise in a technical subject matter, such as cosmology, is not.

Other observations

In establishing its future exhibition plans, the museum would benefit from an early determination of the primary goal of each exhibition -- Is it to teach? To show off a

collection? To highlight a technology? To inspire the imagination? To provide a pleasurable social experience? To provide aesthetic pleasure? To entertain? Rather than trying for the impossible task of achieving all of these aims equally, each exhibition could focus on doing the best possible job of delivering the aim(s) that it selects as primary.

Although the exhibition development process should be managed, it should not be controlled too tightly. A maximally efficient development process might discourage innovation. Some creative projects only have their breakthrough concepts relatively late in development and, as a result, might take longer to produce. Before canceling a project due to a violation of deadlines, the individual(s) responsible for review should be convinced that the delay is not justified by a brilliant new direction.

Timeline Summary by Key Stages

IDEA GENERATION (ONE YEAR)

Idea Generation -- one year (summer 1991-summer 1992)
Exhibition idea approved (July 1992); Opening scheduled for 1995

CONCEPT DEVELOPMENT (FIVE YEARS)

Concept Development -- 2.5 years; Opening shifted to 1997 behind other exhibits.
Concept rejected by Exhibition Committee (February, 1995)
Concept revision -- 2.5 years; Opening date to be affected by window-wall project
Revised Concept approved by Director Engen (November, 1996) for opening in 2000.
Planning document approved (January, 1998); Fund-raising begins

FUND-RAISING AND DESIGN DEVELOPMENT (SIMULTANEOUS BUT INTERMITTENT - THREE YEARS)

Mid-1998, design development begins after six-month delay due to other work
In March 1999, opening reset to 2001 due to funding difficulty and window-wall schedule
First pledge (\$500,000) received in 1999 (Corning) dependent on 2001 opening date
NASA pledges \$250,000 in 1999, with \$300,000 in-kind support
In late 1999, June 2000 is set as deadline for funding
In June 2000 the funding deadline is reset to September 2000
TRW pledges \$1 million in August 2000, also dependent on 2001 opening date
In September 2000 the funding deadline is reset to November 2000
November deadline missed. No new deadline set.
Design development complete in January 2001-- 2.5 years
Funding complete in February 2001 -- 3 years, when NSF promises \$1.35 million

FABRICATION AND INSTALLATION (7 MONTHS)

Concentration of resources and extra efforts complete this stage in less than 7 months.
Exhibition opens September 2001