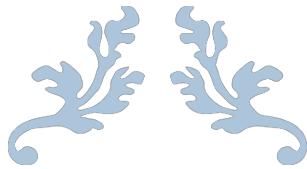


Taking a Tour of Museums



---

## TAKING A TOUR OF MUSEUMS

---

A Usability Report on Museum Websites

Xin Pan

University of Texas, Austin



## Table of Contents

Introduction .....	2
Methodology .....	2
Participants .....	2
Instruments .....	2
Background Questionnaire .....	2
Site-related tasks .....	3
Feedback Questionnaire .....	4
Usability testing execution.....	4
Results.....	4
The Museum of Flight .....	4
Task 1: General impression.....	4
Task 2: Specific Tasks.....	5
Task 3: Open-ended tasks.....	9
National Air and Space Museum .....	11
Task 1: General impression.....	11
Task 2: Specific tasks.....	12
Task 3: Open-ended task .....	15
Discussion .....	18
Overall Impression .....	18
Information Design.....	19
Interaction Design .....	20
Interface Design .....	21
Recommendations.....	22
Conclusion .....	24
URLS for Sites Evaluated .....	25
References .....	25
Appendix A.....	26
Appendix B.....	27

## Introduction

The websites for usability testing were chosen because the two museums are pretty popular nationwide and both have a pretty high review among visitors. They provide an abundant collection of aircraft and spacecraft and cover a wide range of topics on the development in space and air through the history. Their websites also list these collections and fascinating events for the public to visit.

### 1. The Museum of Flight: <http://www.museumofflight.org/>

The Museum of Flight is a non-profit air and space museum located in the south of Seattle, Washington. It is the largest private air and space museum in the world and hosts largest K-12 educational programs. It attracts over 500,000 visitors every year and serves more than 140,000 annual through its programs. As for the collection, it collected more than 150 aircraft, including *City of Everett* (first flight-worthy Boeing 747) and Boeing VC-137B SAM 970 (the first presidential jet).

### 2. National Air and Space Museum (NASM): <https://airandspace.si.edu/>

As one of many museums located in Washington, D.C., the National Air and Space Museum (also called NASM) maintains the largest collection of historic aircraft and spacecraft. The two landmark facilities (the Museum in Washington, DC and the Steven F.Udvar-Hazy Center in Chantilly Virginia) together attract more than 800,000 visitors a year. The museum encompasses around 60,000 objects and 21 exhibition galleries, covering topics from world wars to the history of astronomy.

## Methodology:

### Participants

Three participants were selected to do the usability testing of the two websites. They all have prior experiences in visiting museums and show interests in air and space, but none of them has professional background knowledge in air and space or astronomy. Their background and interests were collected through the questionnaire.

### Instruments

In this study, data were collected through the following methods: 1) the questionnaire given to participants before the testing, 2) site-related tasks, and 3) a feedback questionnaire evaluating the site.

### Background Questionnaire

After participants sign the consent form, they are given a background questionnaire asking about demographics, computer experience, and interest and experience. It first asks for

demographic information, such as gender, age, and occupation. The second part asks about internet usage, including time usage per day and the purpose of using the internet. The last part intends to know more about their interests in air and space and previous experience in visiting museums.

### *Site-related tasks*

Task 1: General impression. The first task intends to get general ideas and impression from users when they browse the website for the first time. These questions are mostly based on Nielsen's methodology (Nielsen et al, 2000), including what the website is about and the target audience. Basically, the user will be given about 3 minutes to explore the website without explanation and then be asked to answer the question.

- What does this website have? Who do you think is the target audience?
- If it is the first visit of this website, what is your general impression on it?
- Do you think this website can provide you with information that you are interested in?

Task 2: Specific tasks. In order to observe how the participants interact with the websites, the researcher requires participants to perform some specific tasks. Tasks are designed based on the common functions of museum websites and important information that target audience may be looking for. The first task focuses on the interaction between users and the search function. The second one intends to look for specific information. The basic requirement for both websites is similar besides minor changes on the content.

Tasks	The Museum of Flight	National Air and Space Museum
Find information of a specific aircraft/spacecraft	Find collection - aircraft - the first aircraft made by Wrights brothers at Kitty Hawk in 1902 - its information and location in museum	Find collection - the model of <i>Mercury-Redstone 3</i> , the first United States human spacecraft sent in 1961 - its information and location in museum
Get information on admission tickets, directions, and open hours	Get information on the admission fee of senior people (>65), directions to go there, and open hours.	Get information on the admission fee, directions to go there, and open hours.
Find the educational materials on air and space	Find grand requirement and rules to apply for educational grant assistance	Find the activity on how to create your own paper airplane online

Task 3: Open-ended tasks. In open-ended tasks, participants are given general and vague questions so they can explore freely with their own interest and judgment. They will visit a wide range of pages on the site and express their opinions on the website.

- Explore exhibitions and events in the museum and find the one that you are most interested in
- Explore the membership of each museum

#### *Feedback Questionnaire*

When all the tasks are completed, participants are required to complete a feedback questionnaire which asks about the overall experience. With a Likert scale of 1 (strongly disagree) to 5 (strongly agree), the participants need to evaluate each site based on three components: Information, Interaction, and Interface.

#### *Usability testing execution*

In this study, the researcher sat beside the participant and took notes of their behaviors and ideas. Their actions to perform the tasks were observed and recorded by the researcher. If participants found problems to do a task, the researcher would give some hints. The usability testing on average took 20 minutes per site per participant.

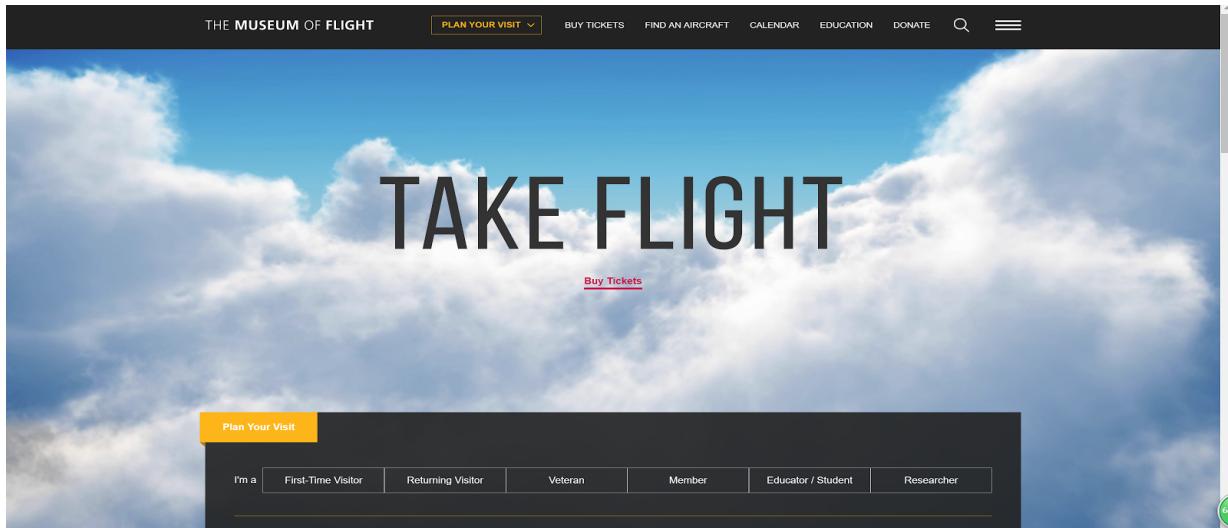
## Results

Findings of the usability testing of participants are discussed below. Results are organized by each museum website and the three tasks.

### The Museum of Flight:

#### *Task 1: General impression.*

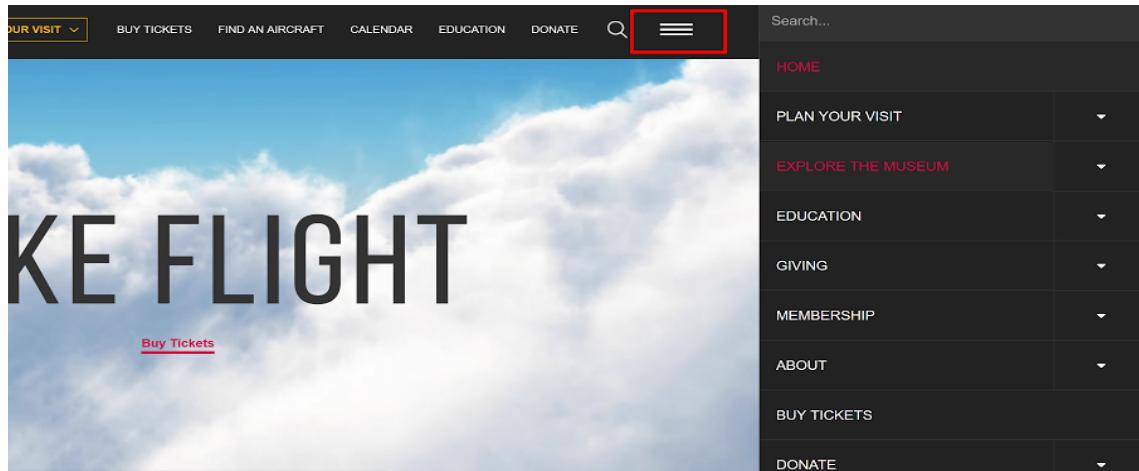
When looking through the website for the first time, participants both went through the navigation bar on the top. They also chose themselves as first-time visitors and then went to the page that introduces a series of exhibitions for them. They used the filter to choose their age groups and time available for the visit. Participant A found visitors can buy their tickets online, but she does not like this feature since she would not buy the ticket without knowing more about it. Participant B said it is so nice to have an introduction of the collection. They have a pretty good impression on the website. As for the target audience, they mentioned adults and Participant B said it would also attract children because the design is pretty "childish". They said they would be able to find useful information on the website.



### *Task 2: Specific Tasks.*

The first task is to find the first aircraft made by Wrights brothers in 1902. Both participants find out the result quickly. Participant A clicked on “find an aircraft” on the navigation bar and then used the filter to enter “manufacturers” and “years” on the drop-down menu. After she applied these filters, the page returns two aircrafts with the year indicated.

Participant B searched the collection in a different way. He clicked the menu icon on the top right of the page and then chose “explore the museum”. Then he was guided to the page that asks him about his interest among the four categories. By selecting “aircraft”, he is guided to another page to enter related information, including era, manufacturers, and type.



**Explore The Museum**

Travel through time and space! The Museum of Flight is full of an incredible collection of aircraft, spacecraft, artifacts, galleries, exhibits, facts and stories that embody the past, present and future of flight.

Aircraft

Spacecraft

Exhibits

Objects & Artifacts

*Sort by Your Interest!*

**Explore The Museum**

- [Help Me Explore](#)
- [Air & Spacecraft](#)
- [Collections & Research](#)
- [Museum Galleries](#)
- [Exhibits](#)
- [Step Inside](#)
- [Aircraft Restoration](#)
- [Chronicles Of The Museum](#)

**Chronicles of the Museum**

- [DIVE IN](#)

**THE MUSEUM OF FLIGHT**

[PLAN YOUR VISIT](#) [BUY TICKETS](#) [FIND AN AIRCRAFT](#) [CALENDAR](#) [EDUCATION](#) [DONATE](#) [SHARE](#)

**Explore The Museum**

Help Me Explore

Show me **Aircraft** from **1900s** by **Any Manufacturer** that is **Any Type**

**Wright 1902 Glider Reproduction**

Why is this called the most significant aircraft ever built and flown? No, it's not the plane that made history at Kitty Hawk, North Carolina in 1903.

**Explore The Museum**

- [Help Me Explore](#)
- [Air & Spacecraft](#)
- [Collections & Research](#)
- [Museum Galleries](#)
- [Exhibits](#)
- [Step Inside](#)
- [Aircraft Restoration](#)
- [Chronicles Of The Museum](#)

After clicking on the aircraft, participants scrolled down the page and read through the information on the left. It introduces the story of the first aircraft made by Wright brothers. They both found the museum location of this aircraft on the right side.

**ABOUT SPECS**

**Controlled Flight**

Why is this called the most significant aircraft ever built and flown? No, it's not the plane that made history at Kitty Hawk, North Carolina in 1903. However, that aircraft owed its success to the nearly 1,000 stability and control flights the Wrights made with this type of glider. The Wrights' experiments with gliders solved the main problem of heavier-than-air manned flight: control.

**Manufacturer:**  
Original design by Orville and Wilbur Wright, reproduction by University of Washington School of Engineering

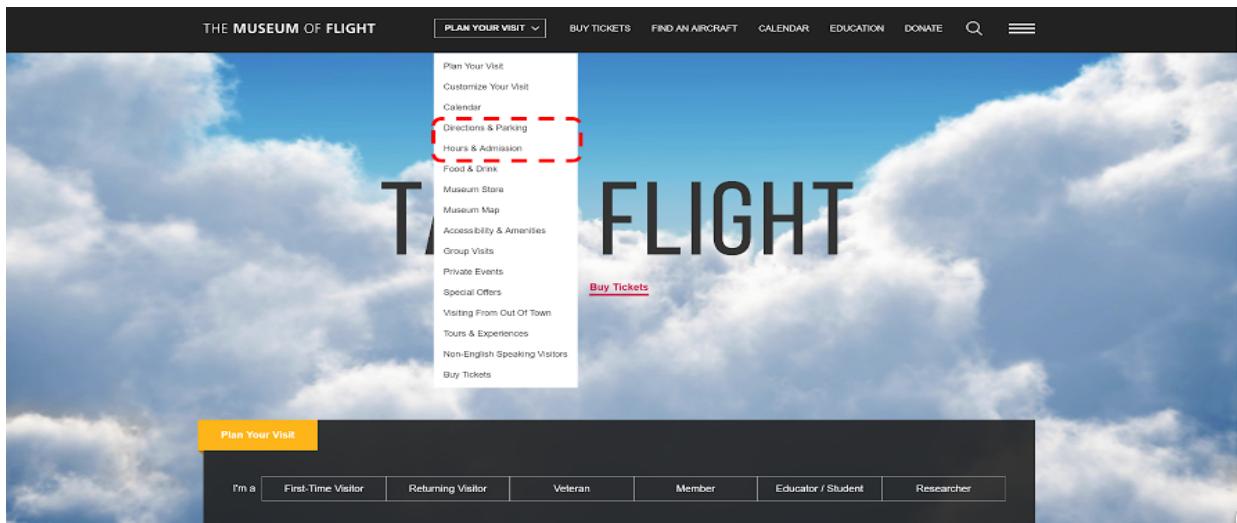
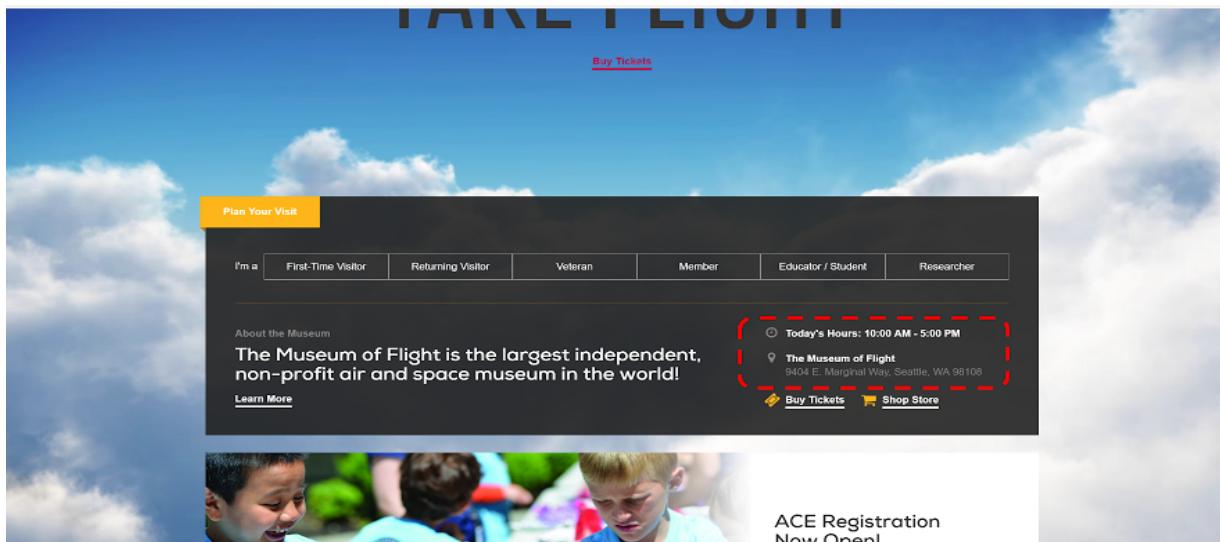
**Model:**  
1902 Glider Replica

**Year:**  
1902 (1960 replica)

**On Loan From:**  
Museum of History and Industry

**Museum Location:**  
Museum Lobby

The second task is to find information on the admission fee of senior people, directions to go there, and open hours. Participant A found the open hours on the homepage and said this is a pretty good design. Participant B found open hours on the right side of "directions" page. They also found both directions and hours & admission are available on the drop-down menu of "plan your visit". One of the participants said it is nice to have all the important information under that tab.



Both participants said the directions are pretty comprehensive for visitors since it provides information to get there through multiple transports, like by car or by bus. They found out the admission price for senior people quickly on the page.

**Directions & Parking**



**Location**  
The Museum of Flight  
9404 East Marginal Way S.  
Seattle, WA 98108

**Directions | Arrival By Car**  
Take Interstate 5 to Exit 158.  
Turn right on East Marginal Way.  
Enter the Museum lot a half mile down the road, on your right.  
All parking is FREE! Convenient parking is located next to the Museum entries on the east and west sides of East Marginal Way. Please see the [Parking Map](#) below for additional information.

**Plan Your Visit**  
[Customize Your Visit](#)  
[Calendar](#)  
**Directions & Parking**  
[Hours & Admission](#)  
[Food & Drink](#)  
[Museum Store](#)  
[Museum Map](#)  
[Accessibility & Amenities](#)  
[Group Visits](#)  
[Private Events](#)  
[Special Offers](#)  
[Visiting From Out Of Town](#)  
[Tours & Experiences](#)  
[Non-English Speaking Visitors](#)  
[Buy Tickets](#)

**East Campus Hours**  
Including the Great Gallery, Personal Courage Wing, and Red Barn  
The first Thursday of each month, the Museum is open from 5:00 PM - 9:00 PM with FREE ADMISSION!

Mon, Apr 10	10:00 AM - 5:00 PM
Tue, Apr 11	10:00 AM - 5:00 PM
Wed, Apr 12	10:00 AM - 5:00 PM
Thu, Apr 13	10:00 AM - 5:00 PM
Fri, Apr 14	10:00 AM - 5:00 PM
<b>Sat, Apr 15</b>	<b>10:00 AM - 5:00 PM</b>

**Plan Your Visit** **Hours & Admission** **SHARE**

**Hours & Admission**



**Plan Your Visit**  
[Customize Your Visit](#)  
[Calendar](#)  
**Directions & Parking**  
**Hours & Admission**  
[Visitor Guidelines](#)

**Food & Drink**  
[Museum Store](#)  
[Museum Map](#)  
[Accessibility & Amenities](#)  
[Group Visits](#)  
[Private Events](#)  
[Special Offers](#)  
[Visiting From Out Of Town](#)  
[Tours & Experiences](#)  
[Non-English Speaking Visitors](#)  
[Buy Tickets](#)

**Museum Hours**  
Open daily from 10:00 AM - 5:00 PM.  
The first Thursday of each month, the Museum is open from 5:00 PM - 9:00 PM with FREE ADMISSION!  
The Museum and Aviation Pavilion are closed Thanksgiving and Christmas Day.  
Regular hours 10:AM - 5 PM Daily, resumed as of Tuesday, September 6.

**Admission Prices**  
All admission prices include tax.

Child (4 and under)	Child	Adult	Senior	FREE
FREE	\$13	\$21	\$18	FREE
Child (5-17)	\$13	\$21	\$18	FREE
Adult (18+)	\$13	\$21	\$18	FREE
Museum Members				

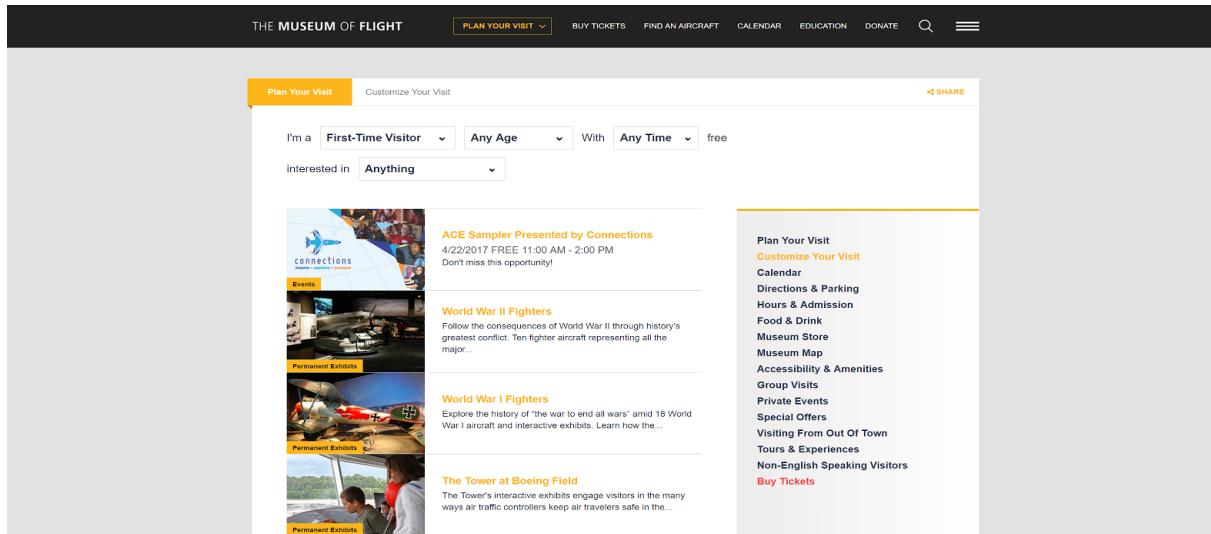
**East Campus Hours**  
Including the Great Gallery, Personal Courage Wing, and Red Barn  
The first Thursday of each month, the Museum is open from 5:00 PM - 9:00 PM with FREE ADMISSION!

Mon, Apr 10	10:00 AM - 5:00 PM
Tue, Apr 11	10:00 AM - 5:00 PM

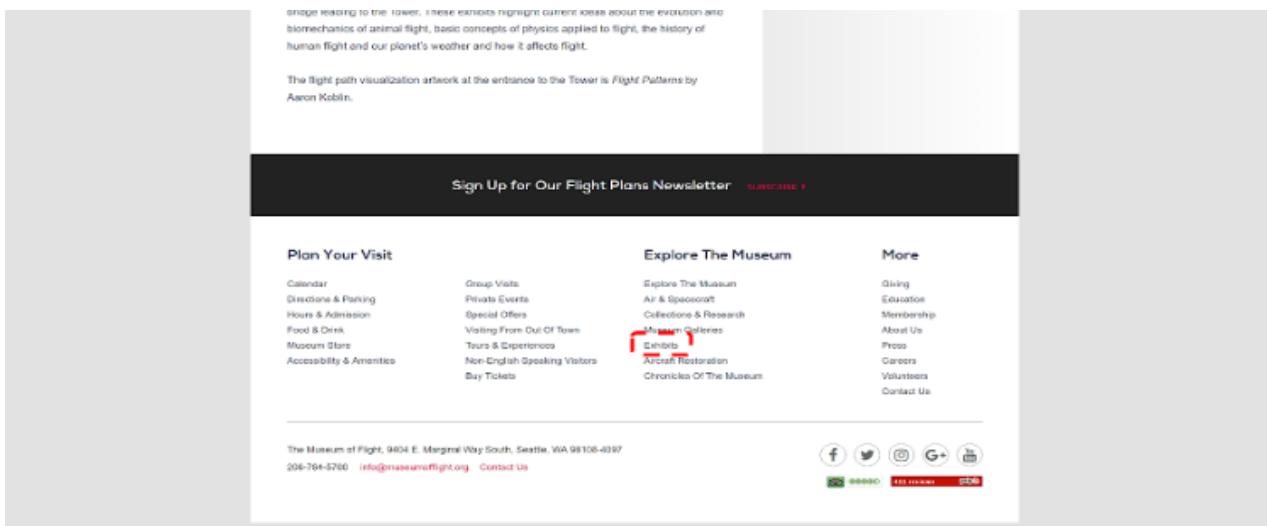
### Task 3: Open-ended tasks

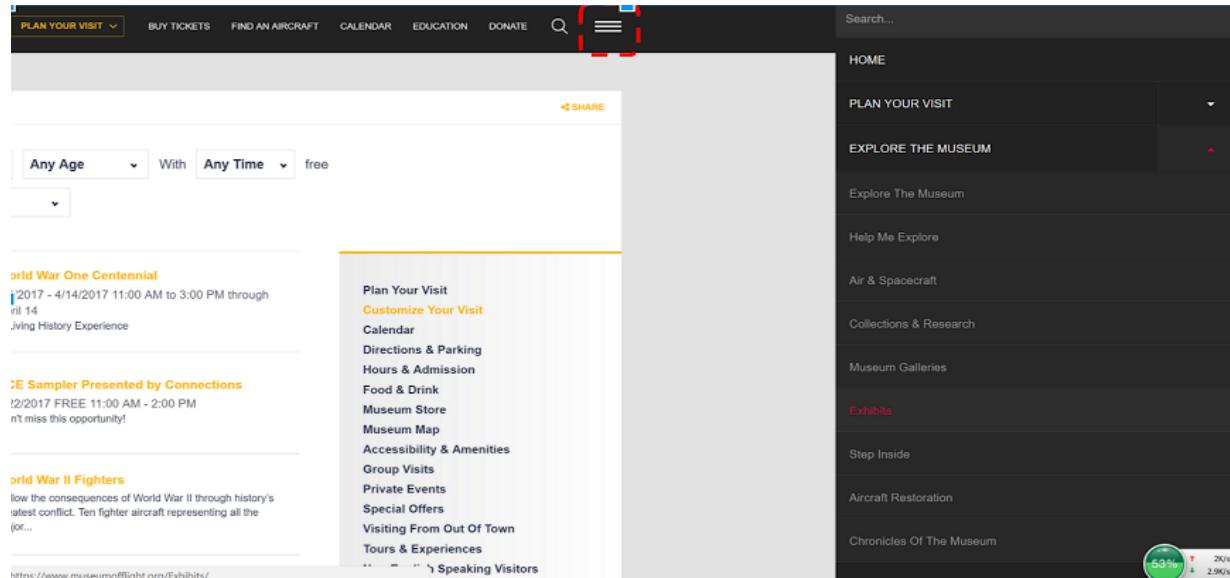
In the first open-ended task, Participant A went through events after she clicked on “customize your visit” and then she entered age and time through the filter. She likes the restoration tour which gives an introduction of the process of airplane restoration, but she found it does not provide information on when the extra fee of the tour will be paid.

Another participant explored events through the same way, but he read through the events without applying the filter. He explored “The Tower at Boeing Field” and “Shuttle Trainer Hours”. The one that he is most interested in is “The Tower at Boeing Field” which is about traffic control.



It is pretty interesting that when the two participants were exploring exhibitions, they used different navigations. Participant A looked at “exhibits” on the bottom of the page and Participant B clicked on the top-right menu button to navigate. It indicates that the website provides multiple navigation menus for users.



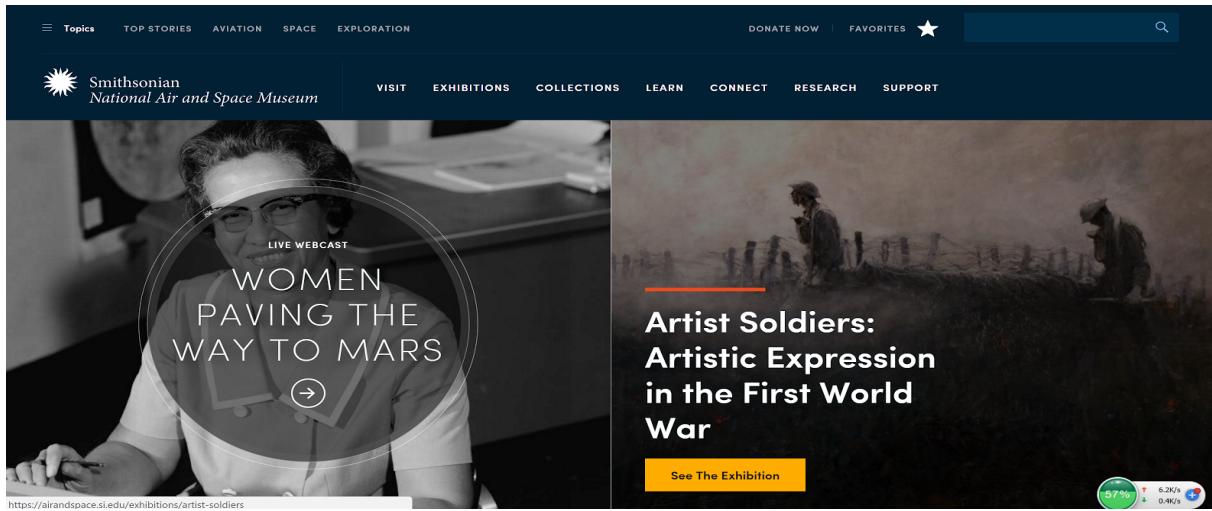


When asked to explore something on the membership, they used the same navigation that they have used to find exhibitions: one at the bottom of the page and one at the right side of the page. Both participants put most of the time to read the membership benefits and levels and compare the benefits between different levels. Participant A also looked at membership F&Q, including how to purchase the membership and how many cards will they receive. He said he likes the list of various membership because the benefits are compared clearly.

## National Air and Space Museum:

### *Task 1: General impression.*

When looking at this website for the first time, participants browsed the website by looking at the navigation bar and scrolled down the page. They both noticed that the museum actually include two locations: one is D.C. and the other is located in Virginia. Participant A looked through the collections and found people can share stories to the website. He also found there is an app available and said this is pretty amazing for him. Participant B was amazed by the nice and clear photos on the first page. When talking about the first impression, they both used words like "formal", "professional", and "industrial". Therefore, they thought the target audience is more for adults who are visiting the museum and professional researchers who are looking for data and anything in air and space. They are said the website would provide useful information to them.

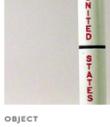


### Task 2: Specific tasks.

The first task is to find a model of *Mercury-Redstone 3*, which is the first human spacecraft of the United States, and the location of its display. In order to do that, participants both clicked on “collections” on the navigation bar and then went to “search for the collection”. Participant A tried to use the filter to reduce his choices, but he failed since the database is so large.

Then he typed in the name of the spacecraft and there are several objects available, including models and other related objects of the spacecraft, such as patch and model kit. There are several types of model available, so he was not sure which one it should be. He randomly clicked on one model and found that collection was not on display.

Showing 1 - 16 of 41

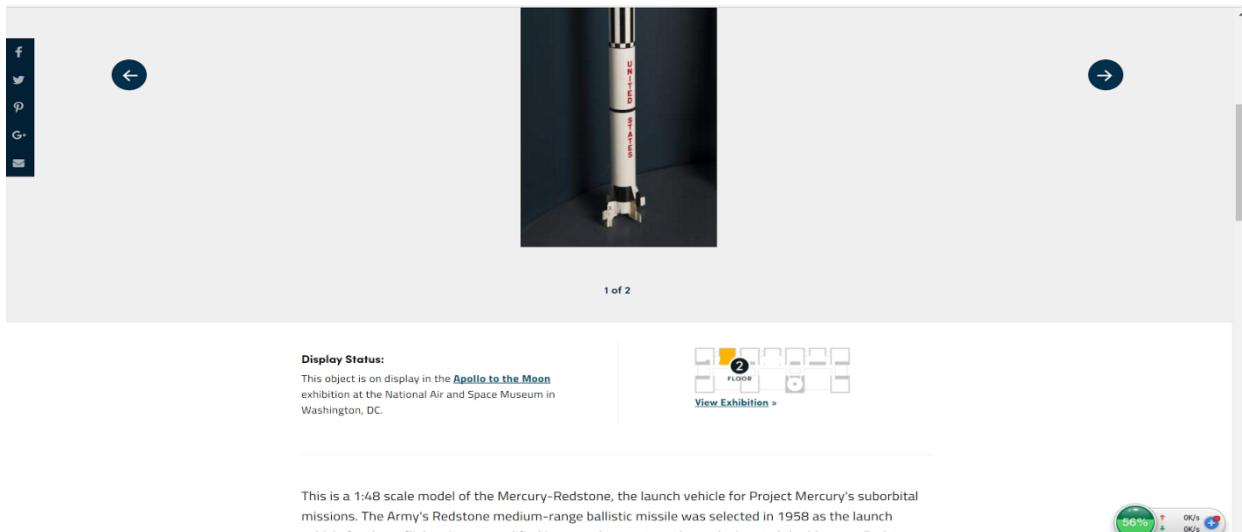
			
OBJECT Model, Rocket, Mercury Redstone	OBJECT Model Kit, Rocket, Mercury Redstone	OBJECT Patch, Mission, Mercury-Redstone 3	OBJECT Model, Rocket, Mercury Redstone, 1:48
			
OBJECT Model, Rocket, Mercury Redstone, 1:48	OBJECT Rocket, Liquid Fuel, Redstone, with Mercury	ARCHIVAL RECORD Mercury Project, Redstone Launch Vehicle	OBJECT Rocket Engine, Liquid Fuel, Redstone Missile

1 of 8

**Display Status:**  
This object is not on display at the National Air and Space Museum. It is either on loan or in storage.

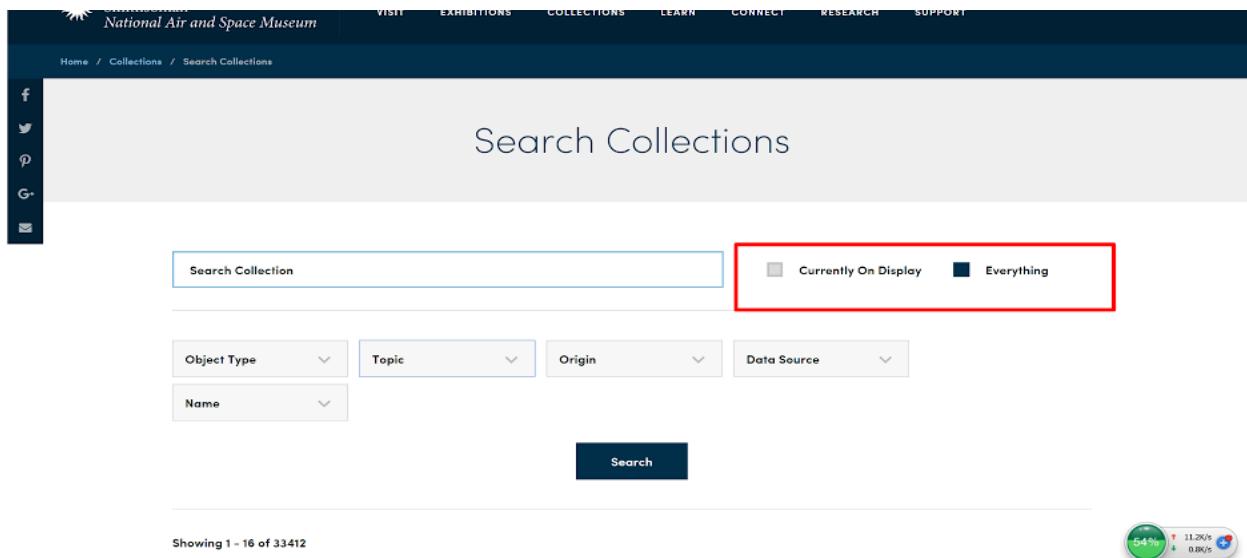
This is a model of unknown scale of the Mercury-Redstone, the launch vehicle for the initial missions in the nation's first manned spaceflight program, Project Mercury. NASA modified the Army's Redstone medium-range ballistic missile to develop the Mercury-Redstone. It launched America's first astronaut in space on May 5, 1961. Alan Shepard, Jr., and the Freedom 7 capsule were lifted to a height of nearly 140 miles and a range of almost 600 miles in a flight lasting a little less than 16 minutes. The rocket was then used for the last time in the program when on July 21, 1961, it launched Virgil Grissom on another suborbital flight. Chrysler Corporation made this model and donated it to NASM in 1963.

Then he returned to the filter page and looked back. He found there is an option besides the search bar which indicates and “everything” and “currently on display”, so he changed from “everything” to “display”. After this, he was able to find the model on display and its location. He said he likes the feature to show the location on the map so that it would be easier for visitors.

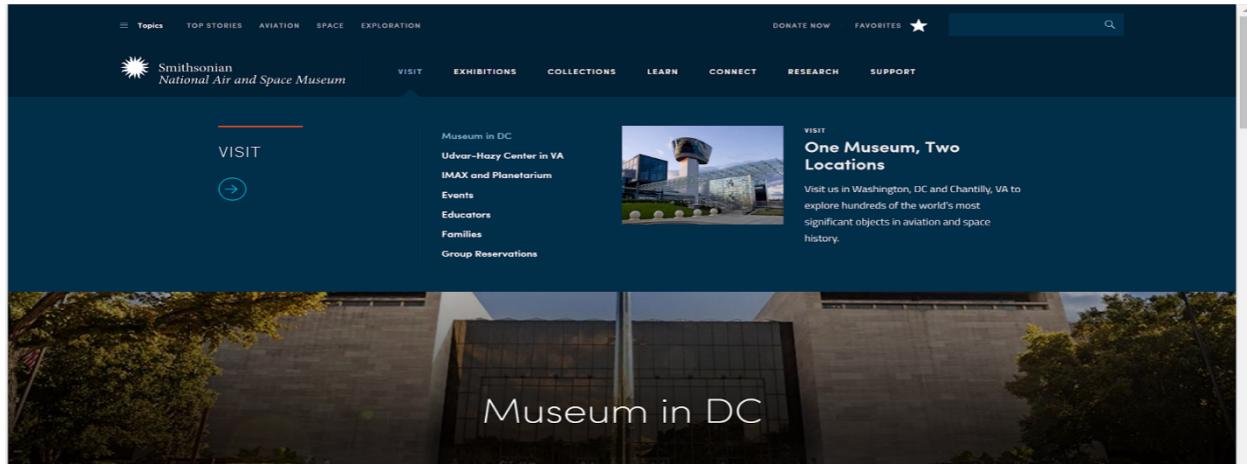


Participant B follows the same thing. She also found it is hard to just use the filter so she entered the name and looked at the filter for more specific choices. Then she just closed the drop-down menu after taking a look at it, saying it is a little hard to choose. After clicking on search, she also found several models available and opened one, finding it is “not on display”. She went back to the last page and still did not notice the filter to choose between “currently on display” and “everything”. Finally, she found the model on display by choosing another model. It is pretty interesting that she did not notice the filter even at the end of the task.

The screenshot shows the Smithsonian National Air and Space Museum's collections search interface. The top navigation bar includes links for Home, Collections, and Search Collections. The main content area is titled "Search Collections". On the left, there is a sidebar with social sharing icons and a "Search Collection" input field. The central part of the page displays a list of topics under the heading "Topic", which includes Aeronautics, Airplanes, Military, Air pilots, Popular culture, World War, 1939-1945, Avionics, Astronautics, Aircraft industry, National Championship Air Races, World War, 1914-1918, Rocketry, Airlines, Propulsion systems, Women, Space flight, Airships, Balloons (Aircraft), and Helicopters. Below this is a search bar with dropdown menus for "Object Type", "Topic", "Origin", "Data Source", and a "Name" field. A red box highlights the "Object Type" dropdown menu. At the bottom right is a "Search" button.

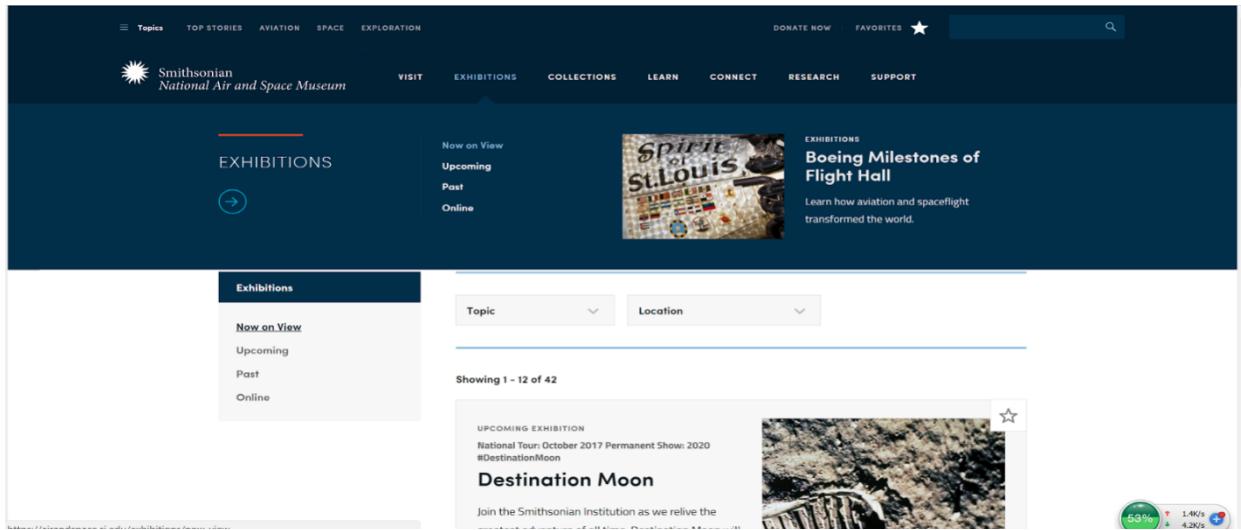


The second task is to find the admission ticket price, the open hours, and directions to go there. Participant A found it is pretty easy since he has already noticed this when browsing the site for the first time. He searched it under “visit” of the navigation bar and found it is free to the public. Participant B, though has not been to the website before, actually knows it is free to everyone. She also found out the result pretty easily. For the open hours, she also found it under the same tab and got the information easily.

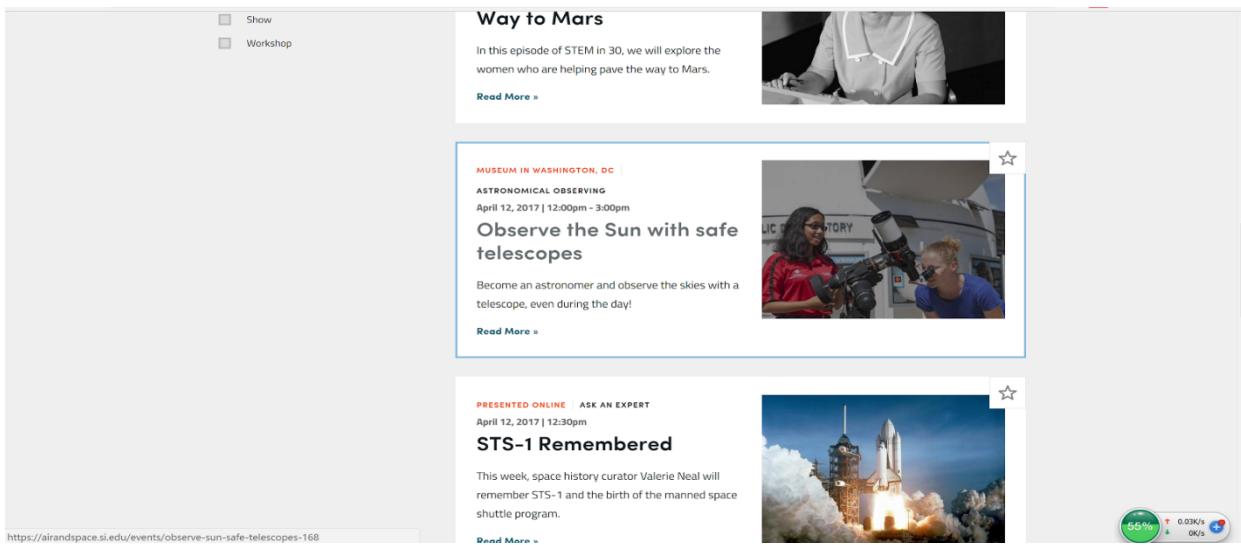


### Task 3: Open-ended task

For the first open-ended task, participants were asked to find events or exhibitions that they will be interested in. In order to explore, Participant A clicked on “exhibitions” - “now on view”. Then he read the exhibition “Military Unmanned Aerial Vehicles” and “America by Air” in details.



As for events, he found them under the “visit” and he explored the event “observe the sun with safe telescopes” and “Dog in Space”. He found there are several events with the same name and image and later realized they are the same event with different dates.



Participant B went to the exhibition list through the same navigation and she used the filter to reduce her choices. She said she like the “exhibition highlights” in each exhibition so that it gives her a good sense of where should be the must-go. As for events, she made her choices by using the calendar on the left side and she found it is really nice that the calendar tells you when there will be events. She is interested in “making the stem magic” and likes the feature that users can add the event to their own calendar.

Screenshot of the Smithsonian National Air and Space Museum website showing the "Now On View" exhibition page.

The page features a navigation bar at the top with links to Topics, Top Stories, Aviation, Space, Exploration, Donate Now, Favorites, and a search bar. Below the navigation is the Smithsonian National Air and Space Museum logo. The main content area has tabs for Visit, Exhibitions, Collections, Learn, Connect, Research, and Support. A sidebar on the left shows social sharing icons (Facebook, Twitter, Pinterest, Google+, Email) and a menu for Exhibitions with options: Now on View, Upcoming, Past, and Online. The main content area displays a search interface with dropdown menus for "Space" and "National Air and Space Muse". A red box highlights this search area. Below it, a message says "Showing 1 - 10 of 10". A thumbnail for the "Time and Navigation" exhibition is shown, labeled as a "MUSEUM IN WASHINGTON, DC | ON VIEW EXHIBITION". The exhibition title is "Time and Navigation". To the right of the thumbnail is a small star icon. Further down, there is descriptive text about the exhibition, a floor plan, and a "Plan Your Visit" button. A "Curators" section lists Roger Connor. A red box highlights the "Exhibition Highlights" section, which contains four items: "Antenna, Loop, Radio Compass, Winnie Mae" (OBJECT), "Mariner 10" (OBJECT), "Stanley Nomad" (OBJECT), and "Lockheed Vega Winnie Mae" (OBJECT). Each item has a thumbnail image and a star icon.

About the membership exploration, he explored the benefit of each level of member. He said it is hard to compare the benefits between levels at the first sight because there are lots of overlap. He had to compare different benefits by reading everything. After that, he also checked “member only events” through the navigation bar on the left. But it is quite disappointing that there is no upcoming event.

The screenshot shows the 'Support' section of the National Air and Space Museum's website. It lists two membership levels:

- \$35 - Wright Flyer**
  - One-year subscription to [Air & Space magazine](#)
  - National Air and Space Society membership card
  - Invitation to the Society's annual [Flight Jacket Night lecture](#), events, and exhibition previews
  - Annual Member Orientation
  - Advance notice about Museum [programs and lectures](#)
  - Member discount at [Smithsonian Museum Stores](#), IMAX® Theaters, and Planetarium
  - Wall Calendar featuring highlights of the Museum's incomparable collection
- \$50 - Spirit of St. Louis**
  - One-year subscription to [Air & Space magazine](#)
  - National Air and Space Society membership card
  - Invitation to the Society's annual [Flight Jacket Night lecture](#), events, and exhibition previews
  - Annual Member Orientation
  - Advance notice about Museum [programs and lectures](#)
  - Member discount at [Smithsonian Museum Stores](#), IMAX® Theaters, and Planetarium
  - Wall Calendar featuring highlights of the Museum's incomparable collection
  - Limited-edition annual [National Air and Space Society lapel pin](#)

Below each level are 'Join Or Renew' and 'Give As A Gift' buttons.

Participant B found membership under “support” tab and also read through the different levels. She was amazed by the number of levels and likes the name of each level, which is named after spacecraft or aircraft. She also clicked the link to “Air and Space magazine” to check if it is something that she would be interested in. It led her actually to another website. Then, she also found “member only events” but found there is no event now, but she said it would be really great to enjoy some VIP benefits.

## Discussion:

This part will discuss each website from the perspective of information, interaction, and interface design. First, results of the feedback questionnaire (See Appendix B) was generated in the table. The questionnaire is based on overall impression, information design, interaction design, and interface design and 5 points Likert scale was used where 1 = very unsatisfied and 5 = very satisfied. The average result is presented in the table below.

	Museum of Flight	National Air and Space Museum
Overall	4.5	4.5
Information	5	5
Interaction	4.5	4
Interface	5	4.5

## Overall Impression:

The overall impression asks if users are impressed by the website and would like to revisit the website or recommend it to friends. Two museum websites receive the same score. Users both express their willingness to visit the website again someday and would like to

recommend the website to other people. Both websites have different features to attract users and provide users with a satisfying experience.

### Information Design:

Although Information Design cannot replace graphic design or visual designs, it actually is the structure that these capabilities are presented (Shedroff, 1999). Information design provides organized and meaningful information to users. It makes target audience understand key information that the website is trying to convey. Therefore it is especially important to provide high-quality content material to users and present information in a way users can understand easily.

For museum websites, one of the key functions is to convey important information to users, including museum-related information and collections in the museum. As for museum-related information, both websites provide clear information on open hours, ticket prices, and directions to go there via multiple transports, such as by bus and by car. The Museum of Flight, for example, put this kind of information under “Plan your visit” tab on the navigation bar so users can find everything in an efficient manner. NASM also put it under “visit” - “museum in DC” so that the audience has no problem finding it. Based on the feedback from users, Museum of Flight does not provide an introduction on the museum itself. For first-time visitors, this information would be helpful to give them a brief description of what collections the museum has and highlight attractive events.

Moreover, both websites present meaningful and comprehensive information about their collections, including aircraft and spacecraft, to their audiences. Information on the collection includes its introduction, specific information (size, weight, and height), and location in the museum. This information is helpful for users to look through collections and plan ahead.

Another crucial element of a museum is its current or upcoming events and exhibitions. Both websites provide information on future events, including locations, dates, and detailed description. It enables users to better manage their tours and plan ahead. Since some tours may charge extra money, Museum of Flight also provides information on that, but the website does not indicate how to pay for the ticket on some events. Can they buy online or they have to purchase on-site? It would be better if they clarify on this point.

### Availability & Price

This tour is available Wednesday through Sunday in the summer and Tuesday through Thursday and Saturday in the winter, from 9:00 AM – 4:00 PM.

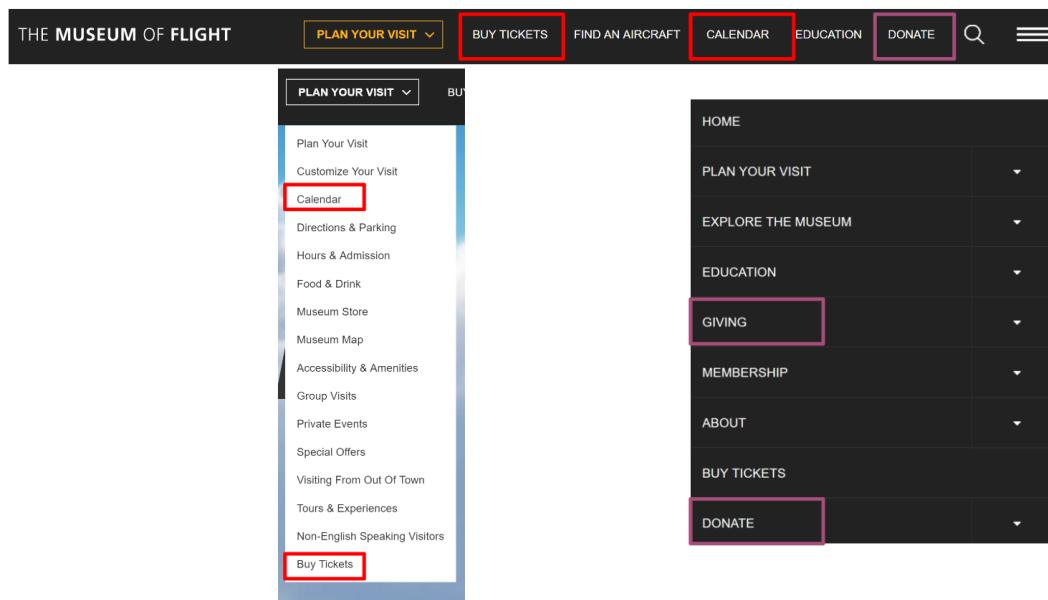
- Children (4 and under) **FREE**
- Youths (5-17) \$3
- Adults (18 +) \$5
- Museum Members **FREE**

[View Restoration Center and Reserve Collection](#)

## Interaction Design:

Interaction Design provides a way of communication between users and the website. A good interface design gives satisfying experiences to users and facilitates effective delivery of information. Overall, the interaction on both website is simple and intuitive and users are able to navigate between categories easily. They both provide multiple navigations, including navigation on the top and on the left/right side of the page so users won't get lost. The interaction between users and graphics is also simple and easy.

According to Krug (2014), a good visual hierarchy saves users' time by helping them to organize and prioritize its contents in a way that they can understand immediately. NASM provides a pretty clear hierarchy of navigation and users can see where they are by looking at the path on the top left of the page. Compared with NASM, the hierarchy of the Museum of Flight is not that clear. For example, as you can see, "Calendar" and "Buy tickets" are both on the top navigation menu and they are also under the "plan your visit" tab. "Donate" is on the top menu, while if the user clicks on the menu button at the top right corner, he can see both "Donate" and "Giving". It turns out that "Giving" is of a higher level than "Donate", but why "Donate" is on the top navigation bar and "Giving" is not? This might lead to confusion among users and make them go back and forth in order to find the correct information.



Another feature of interaction is that museum websites should provide an effective search engine for users to search collections. Museum of Flight gives a pretty good example by "customizing your visit". By entering age, time, and interest, users will see recommended events, exhibitions, and tour and save lots of time browsing everything. The search engine for collections is also effective by providing filters like "manufacturer" and "years". Therefore, users can be able to find aircrafts they are looking for effectively.

NASM, however, designs a pretty confusing search engine for collections. First, the filter of “on display” and “everything” is displayed as a radio button on the right side of the text box. It is also not in the same form as others, which are drop-down lists. This being the case, none of the users can find it at first sight. Moreover, when reading through the drop-down lists, users did not find it helpful. The topics have plenty of overlaps, like “airplanes”, “airships”, and “balloon”; the order of countries is logical, and it is pretty confusing that it contains both “United States” and “Cleveland, Ohio”; under the name column, most users can not make sense of these names.

The screenshot shows the 'Search Collections' interface. At the top, there is a search bar labeled 'Search Collection'. To its right are two radio buttons: 'Currently On Display' (unchecked) and 'Everything' (checked, indicated by a red box). Below the search bar are four dropdown menus:

- Object Type:** A dropdown menu with 'Name' selected (indicated by a blue highlight).
- Topic:** A dropdown menu listing various categories: Topic, Aeronautics, Airplanes, Military, Air pilots, World War, 1939–1945, Popular culture, Avionics, Astronautics, Aircraft industry, National Championship Air Races, World War, 1914–1918, Airlines, Rocketry, Propulsion systems, Women, Space flight, Airships, Balloons (Aircraft), and Helicopters.
- Origin:** A dropdown menu listing countries and locations: United States of America, France, Germany, United Kingdom, Union of Soviet Socialist Republics, Japan, Saudi Arabia, United States, Cleveland, Ohio, Canada, Italy, Australia, Switzerland, Netherlands, Sweden, China, USSR, Philippines, and Russia.
- Data Source:** A dropdown menu.

### Interface Design:

Interface Design facilitates Information Design and Interface Design by providing appropriate fonts, consistent styling, and attractive color schemes. Although the interface style of two websites is different: one is more kids-friendly and the other one is more professional, they both adopt dark blue and light gray in the color scheme and make users think of the sky and the Universe.

The interface of both websites is clean and font sizes are proper for users to read. The balance between text and graphics is controlled pretty well. In order to attract users, they both use images and multimedia with high quality. The homepage of the Museum of Flight is pretty immersive for users because it is a 3D dynamic graphic of the sky. The homepage of NASM is also attractive by using two large images with high quality. On the other hand, Museum of Flight only highlighted some events on the first page and users won't feel too much pressure when reading it, while NASM provides many things on the first page, including stories, events, and social networking tools. First-time visitors would be a little overwhelmed by the amount of information.

## Recommendations

Recommendations are provided based on the observation of usability testing and users' feedback questionnaires. Both websites can improve their features from different perspectives.

### 1. Museum of Flight

In general, the website of Museum of Flight did a pretty good job in information design and interface design. Most necessary information is provided and the homepage is neat and simple. There is some information can be added and something that can be improved:

The biggest thing that needs to be changed is the navigation. Currently, the top navigation includes the following tabs: "Plan your visit", "Buy tickets", "Find an aircraft", "Calendar", "Education", and "Donate". As we have pointed out, "Calendar" and "Buy tickets" are both on the top navigation menu, but they are also under the "plan your visit" tab. "Donate" is also on the top navigation menu. However, if the user clicks on the menu button at the top right corner, he can see both "Donate" and "Giving". It turns out that "Giving" is of a higher level than "Donate", but why "Donate" is on the top navigation bar and "Giving" is not? The hierarchy among pages is confusing to users and is not intuitive enough. In order to change that, it is suggested that we use a consistent chunking of information and indicate the hierarchy of the navigation menu. It can be put into: "Plan your visit", "Explore the Museum", "Education", "Support", "About", and "Museum Store". In this way, there won't be overlapping between tabs.

Another issue is that users cannot find related information of the museum, including its history and its purpose. It is suggested the information should be provided under the "About" tab on the navigation menu so that users can find it easily and then get a basic understanding of the museum forehead.

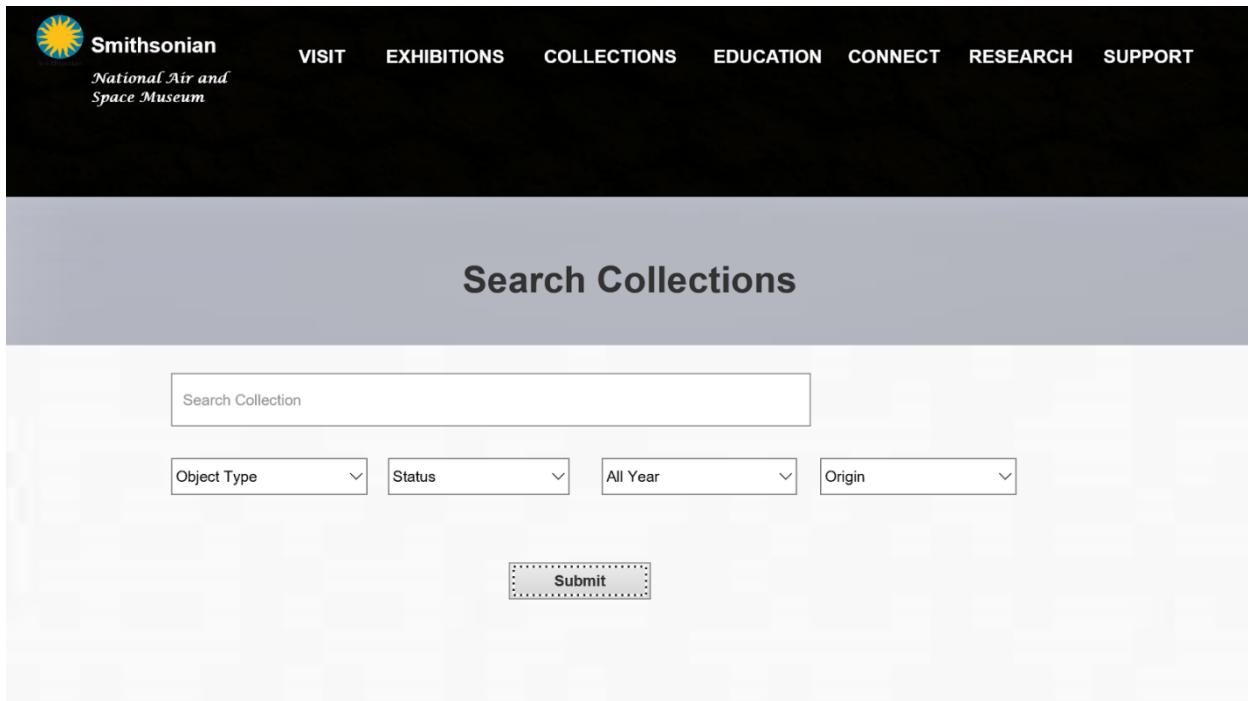
Although most details of events are provided, the website does not tell where extra ticket fee should be paid on special events. Therefore, it is better to indicate that under the ticket price.

### 2. National Air and Space Museum

NASM is really professional in its design and it also provides useful information on space and science for users. The navigation menu is intuitive and simple and users can navigate easily between pages. There are something that can be changed:

The search engine of collections, as we have talked about, is really confusing for users. As Norman (2013) has pointed out, if users try so many times and fail, they would give up, so it is really important to revise things that hinder effective communication. First, it is suggested that we give a consistent form of filter to the search engine. So the filter between "everything" and "on display" is also put under the textbox as other filters. Moreover, instead of using "names" and "data source", it is better to choose filters that audience can all make sense of,

including object type, status (on display or not), year, and origin. Original countries are listed from A-Z so that users can find it easily.



After they submit their choices, the result should also be clear to users at first sight. Currently, everything is returned as “Object” and it is hard for users to identify which object it is without going to the next page. Therefore, the suggestion is to put the object type under the graphic so that users can see immediately and then make choices.

**OBJECT**

**Model Kit, Rocket,  
Mercury Redstone**

**MODEL**

**Rocket, Mercury  
Redstone, 1:48**

**Everything is marked as  
OBJECT**

**Revision: Label the object  
with its type.**

Another thing is the repetitive information on membership. Currently, the website lists all benefits of all levels of membership, which makes it hard for users to compare. There are lots of benefits that actually are the same information. Therefore, it is suggested that we reorganize the description as below:



In addition, the homepage of NASM has lots of information, including stories, events, and social networking tools. For first-time visitors, they will be pretty overwhelmed by the large amount of information. So it would be better to highlight only a few important things, like current events and then give users access to another information if they would like to see.

## Conclusion

Much as the testing is done with only a small number of users, it provides helpful information on how to design a good museum website from the 3I's perspective. Based on the testing, general guidelines are listed below:

### Information Design:

- Provide general information about the museum, including purposes, histories, and educational programs;
- Provide necessary information to museum visitors, including ticket price, open hours, and directions (parking);
- Avoid presenting too much information on the homepage;
- Provide information on future events and exhibitions and present it on the calendar

### Interaction Design:

- Be sure to indicate the hierarchy of navigation menu;
- Make it consistent if there are multiple navigations menus;
- Adopt interactive graphics and multimedia (e.g. zoom-in and zoom-out, carousel)

- Present search function of collections in a way that can be understood by the majority of users, such as years, locations, and object types;

#### Interface Design:

- Design a simple, clean, and attractive homepage;
- Apply color schemes based on the topic of the museum;
- Keep the text and graphics in a balanced manner;
- Make the styling consistent and enough contrast between background and texts;
- Present high-quality graphics and videos if possible.

#### URLS for Sites Evaluated:

Museum of Flights: <http://www.museumofflight.org/>

National Air and Space Museum: <https://airandspace.si.edu/>

#### References:

Krug, S. (2014). *Don't make me think: revisited, A Common Sense Approach to Web Usability*. Pearson Education.

Nielsen, J., Snyder, C., Molich, R., & Farrell, S. (2000). *E-Commerce user experience: Methodology of the study*.

Norman, D. A. (2013). *The design of everyday things: Revised and expanded edition*.

Shadroff, N. (1999). Information interaction design: A unified field theory of design. *Information design*, 267-292.

## Appendix A

### Background Questionnaire

Thank you very much for participating in this research study. Before you start your usability testing, please answer the following questions. This information will be kept strictly confidential. Please circle the appropriate answer.

User ID: \_\_\_\_\_ Date: \_\_\_\_\_

#### I. Participant Information

1. Your age: under 18    19-24    25-30    31-35    36 or older

2. Gender:    Male    Female

3. Please state your current occupation:

4. If you are a student, state your field of study/research:

#### II. Computer Experience

5. Where do you access the Internet?    Home    Work    Both

6. How many hours a week do you use the Internet? \_\_\_\_\_

7. What do you use the Internet for?(Choose all that apply)

E-mail    Research    Shopping    Entertaining    Information

Other, Please specify \_\_\_\_\_

#### III. Interest

8. How's your interest level about air and space?    Low    Medium    High

9. Do you enjoy visiting museums whenever you have chance to go?    Yes    No

10. What is your most impressive museum you've visited?

11. Have you visited art museum web site before? If yes, please list them.

## Appendix B

### Art Museum Web Site Usability Questionnaire

#### Art Museum Web Site Usability Questionnaire

User ID:

---

Date:

---

Circle the website being tested.

**Museum of Flight      National Museum of Air and Space**

<b>Overall impression</b>	Strongly Disagree					Strongly Agree				
I feel comfortable when browsing the website.	1	2	3	4	5					
I would like to revisit this website in future	1	2	3	4	5					
I had no problem when using this site.	1	2	3	4	5					

<b>Information Design</b>	Strongly Disagree					Strongly Agree				
The information is well organized and structured.	1	2	3	4	5					
I find it is easy to find necessary information.	1	2	3	4	5					
The information of this website is meaningful and valuable.	1	2	3	4	5					
The amount of information shown on the homepage is moderate.	1	2	3	4	5					

<b>Interaction Design</b>	Strongly Disagree					Strongly Agree				
I can figure out where I am and where should I go in an efficient manner.	1	2	3	4	5					

The website provides different functions based on different visitors' needs.	1	2	3	4	5
They provide effective search functions to look for their collections.	1	2	3	4	5
<b>Interface Design</b>					Strongly Agree
They use consistent visual style (color, font, graphic etc.).	1	2	3	4	5
I am attracted by the visual elements of the site.	1	2	3	4	5
The design of the screen is simple and neat.	1	2	3	4	5
Texts and graphics are well-balanced.	1	2	3	4	5
	6	7			