A Study of the Effectiveness of Commercial Usability Methods When Applied to a Military Web Environment

GRADUATE PROJECT REPORT

Submitted to the Faculty of
The Department of Computing and Mathematical Sciences
Texas A&M University-Corpus Christi
Corpus Christi, Texas

In Partial Fulfillment of the Requirements for the Degree of
Master of Science in Computer Science

By

Harold E. Marksbury
Spring 2002

Committee Members

Dr. Holly Patterson-McNeill
Committee Chairperson

Dr. David Thomas
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Dr. Dulal Chandra Kar
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ABSTRACT

This project studied the usability issues surrounding a redesigned implementation of an existing Web site utilizing commercially developed methods to maximize its usability. During the process accepted metrics were used to compare the two sites for usability and function. The comparisons took into consideration not only the user perspective, but also the perspective of those in charge of maintaining the site. This site is currently in use by the Chief of Naval Air Training, United States Navy, to disseminate information to his command. This required the development of easy-to-understand user interfaces for all computer skill levels. Usability testing throughout the design process was used to maximize functionality and ease of use.
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1. BACKGROUND AND RATIONALE

There are many books, Web sites, magazine articles, and other references on usability, user interfaces, and testing. These are almost without fail written with commercial Web sites in mind. The intention of this project was not only to rely on accepted usability methods to develop a new government site, but to also use usability testing methods in the development. By conducting usability testing on the newly developed site in conjunction with the currently operating site, it could be determined if any improvement had been achieved and to evaluate how readily commercial standards can be applied to a government site.

1.1 The Naval Air Training Command Web Site

In 1995 the Naval Air Training Command developed a Web site to serve as a publicly-accessible informational site for the purpose of recruiting and making available details of their training programs, aircraft, command leaders, and news related to the command. In 1998 the command realized the ease of making information available through the use of this site. A Web site was then developed to allow analysis team members to share information. As utilization of this site increased with the posting of more reports, agendas, and minutes from meetings, items were added to the pages as needed without an overall design template in place. This caused an ad hoc appearance and confusing user interface. Additionally the site contained information that, as defined by Navy instruction, was not proper for a publicly accessible site. A temporary fix for this situation was to place this page behind a password protected directory until a more suitable site could be developed.
The development of a privately accessible site would ensure security of the Web site and allow a site to be developed with an overall design in place. The original site had stabilized to a point where, with future growth kept in mind, a functional design with usability as a focal point could be developed and tested using accepted methods and testing procedures.

This project concentrated on the Cross Functional Team 2 portion of the Naval Air Training Command Web site. It held links to a wide variety of documents used by the command’s analysts. Documents have been added and the overall use of the page has changed drastically without keeping the overall design in mind. This led to the use of long disjointed pages that created confusion for the user. The site was not being used as effectively as the command had expected, and users were experiencing difficulty in locating the desired information. It was believed a better design would increase the site’s use.

1.2 Design Methodology

The consideration of usability in the development of Web sites has increased substantially in the last few years. Understanding what usability is and what benefits can be gained by its inclusion in the design process is now more important than ever. Usability, as defined by Mark Pearrow [Pearrow 2000] is:

“The broad discipline of applying sound scientific observation, measurement, and design principles to the creation and maintenance of Web sites in order to bring about the greatest ease of use, ease of learnability, amount of usefulness, and least amount of discomfort for the humans who have to use the system.”
As this definition implies, not only should usability be considered in the design of a Web site, but also in its maintenance.

One of the major philosophies of usability is User-Centered Design or UCD. For any computer system, Web based or otherwise, to be successful its users have to be productive and want to use the system. Otherwise, the system fails. This project, using proven methods has created a site, centered on the user, destined to succeed and improve on the site it replaced. As the new site was developed, usability testing was conducted on both sites to measure the change in usability.

1.3 Web Page Development

The development of the actual pages took into consideration ideas and design methods from a variety of sources. Although one of the objectives of this project was to determine the effectiveness of commercial usability methods on a military site, most of the sources noted were commercially oriented publications. A few, however, came from academic studies. Studies like those performed to determine maximum efficiency of menu width and depth for varied situations as chronicled in *The International Journal of Human-computer Interaction* [Sears 2000]. Though these studies were academic in nature, the results still applied to commercial application and therefore are applicable to this project. As with any real world applications the development of the site must be conducted at the pleasure of its owners. Even if testing proves there are more effective means to implement features, the desires of those in control of the site must be adhered to. This factor plays a huge part in the end product, and is especially true on a military site where style and content are sometimes dictated by a higher-level command.
Commercial Web sites must capture the attention of a visitor within seconds. Keeping users there relies on the impression of ease of use and the user’s ability to achieve their individual goals. To help insure users have a satisfactory experience, Steve Krug [Krug 2000] suggests:

1. Create a visual hierarchy on each page.
2. Take advantage of conventions.
3. Break up pages into clearly defined areas.
4. Make obvious what is clickable.
5. Minimize noise.

Simply following these generalized guidelines, the developer can create a page with a high degree of usability.

1.4 Other Considerations and Restrictions

There were certain restrictions with which this project was forced to comply. Since this is a functioning tool of the Naval Air Training Command, it had to be developed on their servers, using the operating system currently in use by the Navy, and developed within the guidance of instructions of the Secretary of the Navy.
2. A Study of the Effectiveness of Commercial Usability Methods When Applied to a Military Web Environment

This project studied the application of certain usability concepts in the redesign of a major portion of a functioning military Web site, and compared the results of testing the original site to the redesign to determine if current commercially oriented usability methods perform well in the design of a military Web site. Several usability methods were evaluated and those deemed most appropriate for the development of this site were applied in the design and testing phases. User feedback was considered during the entire design process. One fact that always holds true in this type of development environment is the site’s owners have final say over the content and feel of the final product. The future users as well as people without prior knowledge of the site were involved in the design and testing phases. As with the design methods, the testing methods were evaluated and chosen for the site at the appropriate design phase.

2.1 The Birth of Usability Methods and Guidelines

With the explosion of the use of the World Wide Web in the 1990’s, the primary concern of the majority of companies in the United States and abroad was merely to establish a presence on the Web. This led to a boom in the population of individuals claiming to be Web developers. Most were individuals who learned a little HTML and went into business as professional Web designers. This led to a hodge-podge of poorly designed sites that were both unattractive and difficult to use. Some actually hurt the eyes when viewed. This inspired studies to be conducted on ways to increase the ease of use and lead to overall improvement in the experience of Web use.

Some users found many early Web sites difficult to use. Computer programmers, who by default were the first of the Web developers, designed pages for people with
technical expertise rather than the average user. These developers made the transition to HTML coding easily. Although these sites were technically sound and understood by computer savvy users, the average user found them to be cryptic and hard to glean the information they were seeking.

Some Web designers used bright colors, blinking text, multiple fonts, and dark backgrounds. These sites, while being dynamic and attention getting, would have a tiring effect on the viewer. The effect is demonstrated well in Figure 2.1 from Flanders and Willis, *Websites That Suck: Learning Good Design by Looking At Bad*. After one look at this site it is doubtful a user would return.

![Figure 2.1 Example of poorly designed text-based Web page](image)

This project applied the techniques and design methodology of recognized experts in Web usability and interface design the like Jakob Neilson [Neilson2000a], Steve Krug [Krug 2000], and Alan Cooper [Cooper 1995] to create a site that allows its visitors a
pleasant experience, while providing easy access to the information the user wishes to obtain.

2.2 Various Usability Methods and Design Considerations

Alan Cooper in *About Face: The Essentials of User Interface* states, “Successful interfaces are those that focus on the user’s goals even if they have to ignore the technology of the implementation”. Sometimes a simple graphic or brief text is the most effective manner to make a statement. Many of the flashy techniques developed in the last few years have proven to be overkill. The temptation to use “cutting edge” technology is always there, but care must be taken to not use the technology for technology’s sake.

There are several methodologies to assist developers in the design of their sites. There are methods such as the “Card Sort” where the only hardware used in the initial development stages is a couple of decks of index cards. Some methods rely almost solely on interviews with potential users. Others, like prototyping, require “straw man” type-sites to be constructed. Prototyping is best used in the early stages and can help introduce concepts to the users.

This project has utilized several methods to obtain usability feedback throughout the development of the new site and tried to determine the effectiveness of each method. One-on-one interviews were conducted, group meetings were held, questionnaires were evaluated, and verbal responses of the test participants were noted. Simple comments are sometimes the best indicators of how well the site is being received.
2.3 Testing Methods and Considerations.

In testing for usability the developer must determine what functions the site should perform, who the target audience is, and what future enhancements may be required. All these things need to be considered to develop testing methods that measure the effectiveness of the site. The goals of usability testing are straightforward. Are tasks completed successfully? How fast are they completed? Do users follow the same path in order to complete the tasks? Are there stumbling blocks anywhere along the way that need to be removed? What is not there that needs to be there? These are goals that give the developer an idea of the overall effectiveness of the site.

Testing can be done at various times during the development process for different purposes. Early testing can help diagnose problem areas. This allows the developer to concentrate on the problem areas and not disturb the ones that are functioning well. Later in the development stages comparisons of pages being replaced or alternately developed can be made with the earlier pages to determine if improvement has been achieved. Towards the end of the development process testing can be used to verify that the desired goals have been achieved.

Although there are other opinions on how many testers should be used to perform usability testing, Jakob Neilson makes a strong argument for using five testers in his March 1999 Alertbox article “Why You Only Need to Test With 5 Users.” According to Neilson, testing with a single user will find almost a third of all there is to know about the usability of the design. The second tester does many of the same things the first tester did but, people being different, will do a few things differently and add some new insight. The third will add a small amount of insight, but not nearly as much as the first and second testers. After five testers you are essentially finding the same things about the
page but not learning much else. Neilson does point out in his article; however, if the site will have several distinct groups of users that testing should be done with testers from each group. He recommends three to four testers if there are two groups and three testers from each group if there are more than two groups. This project performed tests on two typical groups of users, those familiar with the content of the site, and those less familiar to determine the ease of use from both groups. As with most Web sites, users come and go, making ease of use for beginning users of the site important, while necessitating speed and productivity for experienced users.

2.4 Other Considerations

Although they are beyond the scope of this project, issues such as the development environment, Web security, and compliance with government regulations are discussed throughout the project report. Since the current site is in use and the new site will replace the current site, the new design is required to operate in the current environment and meet the U.S. Naval regulations and instructional guidance.
3. System Design

This section describes the overall plan for the comparison of the two Web sites, one, which was currently in use and the one developed by the project. It examines the evaluation and testing of the original site and follows the development, testing, and implementation of the new site for the Naval Air Training Command. The project tested the original site to discover ways of increasing the usability in the new design. The testing methods varied depending on the stage of the development at the time of testing. The testing methods were derived from and were used at the most appropriate stage of development for the individual test. Development of the Consideration of usability methods and guidelines gleaned from a number of sources were combined to create pages with maximum functionality and ease of use.

3.1 Testing and Testing Methods

Steve Krug states: "The reason for testing is not to prove or disprove something. It’s to inform your judgment" [Krug 2000]. In order to determine if your efforts at improving the usability of a site are successful, there must be some form of measurement to gauge your success. Early testing keeps the developers informed as to what is working and where improvement is needed. Most sources, [Neilson 2000a] [Krug 2000], agree that testing with three to five people and testing several times throughout development is preferable to testing at the latter stages of development with a large number of people. Usability tests in the past tended to be expensive and complicated with voluminous reports that took days to interpret. Today even smaller companies can benefit from testing with a few people, simply observing them and taking notes. Videotaping is good to have to review, but not necessary. In a nutshell the consensus is to test. Test early.
Test often. Test again. The earlier in development you learn of possible problems the easier it is to fix the problem and move on in the process.

3.2 What to Test

The type of Web site is a determining factor in exactly what you will be looking for in your tests, but there are several generic things to cover. Does the participant understand what the site is all about, what they can do on the site, and where to start? Is the method of navigation clear and are the names of links self-evident? How difficult is it to complete a series of tasks that will be routine in the daily operation of the site? The emphasis on commercial sites in source material for this project is obvious except for a few academic studies that centered on menu depth, usability for challenged users, and graphics for the Web. This project developed tests to determine if the same usability methods used to help sell products can be applied to a site where the prime goal is to make information readily available and easy to find by a widely diverse group of users.

3.3 Data Collection Items and Methods

Data collected included the following:

1. The average time required to complete a given task.
2. The number of mouse clicks required to complete each task.
3. Whether or not the task was successfully completed.
4. Number and type of errors encountered during the tests.
5. Any detectable moments of frustration or discovery the participant might display verbally or physically.
6. Comments from the participants whether positive or negative.
The usability testing was performed on location at the headquarters of the Chief of Naval Air Training. The area chosen for the testing, illustrated in Figure 3.1, was typical of an office environment with the normal distractions, such as email notification pop-up screens, telephone calls, and people coming and going. The computer system used in the testing was one typical of those used throughout the building with a standard keyboard and a two-button mouse. A video camera was placed in an overhead position to allow capturing the keyboard and mouse actions.

Two people monitored each test, one recorded times and scrolling maneuvers, the other recorded mouse clicks and issued the tasks. After the task portion of the test a questionnaire was given to the participant to capture feedback immediately following the testing.

3.4 Development Environment

As this project utilized a live Web site development environment owned by the Chief of Naval Air Training and the United States Navy, it was a requirement to use the current technology in place. The operating system for the Web servers is Window NT.
4.0 Server running on a Hewlett Packard 3000. The Web server software is Internet Information Server 4.0 from Microsoft. The server is controlled and maintained by the SPAWAR detachment at Naval Air Station, Corpus Christi. The page development tools are running on Windows 2000 Professional and consist of Ultradev 4.0 by Macromedia, Photoshop 6.0 and Acrobat 5.0 by Adobe, Corel Draw 10.0, and various add-in programs, extensions, and filters for those development tools. Javascript and VB Script are used as scripting languages and ASP is the server model for server side processing. Backward compatibility with hardware and operating systems was a necessity.

As always in a military environment direction from higher-level commands can have far ranging effects on both hardware and software. Changing conditions of national security cause a constant evaluation of Web policy, security, and overall administration of local and wide area networks within the Naval community.

3.5 Original Site Status

This project concentrated on the Cross Functional Team 2 portion of the Training Command’s Web site. While the site was originally part of the command’s public site the content of this portion of the site was not targeted to the general public. As it held links to a wide variety of documents used by Naval Air Training Command Analysts its usefulness made it necessary to develop a site specifically used for this purpose. Documents and links have been added on an as-needed basis and have caused the overall layout of the page to change drastically without keeping any overall design in mind. This lead to the long disjointed presentation illustrated by the Figure 3.2. The site was not being used as effectively as the command had expected; new users experienced difficulty in locating the desired information. It was believed a better design would increase the
site’s use. This project was to be one of the components of the new site’s design and implementation to achieve that goal.

Figure 3.2 Disjointed appearance of original page

In contrast to the previous example Figure 3.3 illustrates a well-designed, well-laid-out, easy-to-use page.

Figure 3.3 Amazon.com books section
The logo in the upper left potion of the page lets the user know whose site this is. The menu system below tells the users where on the site they are and how to get to other portions of the site. The large centered ad is this page's important message. The vertical side sections give the user more in-depth links to related areas. All this is in the top most portion of the page making maximum use of the screen real estate available. This site displays a high degree of usability compared to the previous site.

3.6 Web Site Security

Although security functions involved with a Web site are not generally considered usability issues, they do have an effect on the user’s perception. While commercial sites are mostly concerned the financial and transactional aspects of Web site interaction, military sites are more concerned with information and privacy protection. To insure this protection several steps have been taken with the CNATRA site.

Besides the normal protection afforded by the Microsoft Windows NT 4.0 and Microsoft Internet Information Server 4.0, site-specific measures have been implemented to further enhance security measures.

User names and passwords have been utilized along with a session variable. The logon names and passwords are stored in a Microsoft SQL 7.0 database on a server separate from the Web server. The separation of data across servers further enhances the security of that data. The security between the Web server and the SQL server uses the Windows NT Authentication so text user names and passwords are not passed between the servers or included in the code of the pages.

The session variable is used to confirm that the current user is logged in and, if that is not the case, the user is referred to the logon page and thereby forced to use the
logon procedure. It is also used with a session timer that automatically logs off a user after twenty minutes of inactivity. This is accomplished by the inclusion of a code snippet on each page that checks for the existence of the session variable and the length of time the user has been logged on without activity. Contents of the Global.asa file can be viewed in Appendix C.

These measures are adequate for this particular site since the data stored on it only reaches the sensitive level and no classified data is available. Currently no classified data is allowed on any Department of Defense Web site.

Usability issues directly related to the security of the site include use of generally accepted conventions such as the logon procedure. The logon page is a separate page containing text boxes for inputting the username and password as shown in Figure 3.4.

![Figure 3.4 Logon screen](image)

If the username and password do not validate properly the user is presented an error message to that effect and forced to repeat the logon process. In the event the user cannot
gain access to the site an email link to the Webmaster of the site is available so the user can contact site maintenance personnel to resolve the problem. Both the logon page and error message, shown in Figure 3.5 are standard practices for Web sites that require this type of logon procedure. This presents the user with a familiar and thus comfortable process while ensuring the protection of the site content.

![Logon error screen](image)

**Figure 3.5 Logon error screen**

Since this is a restricted site with its use limited to a select audience there was no need to be listed on public search engines. To limit the intervention of search engine tools such as spyders and robots the code below was inserted on each page.

```
<META NAME="robots" CONTENT="noindex, nofollow">
```

This is by no means a fix-all merely one more step taken to protect the site and round out the security measures implemented to provide some protection for the site.
4. Evaluation and Results

To establish a baseline for comparison, the original site was tested using a list of tasks the test participants were to complete. The participants were encouraged to speak their thoughts during the test, a method known as the “think-aloud protocol” in order to improve the chances of documenting subjective reactions. If a task could not be completed the time spent in the attempt was recorded as if completed and the incompletion recorded. The results were then compiled and became the baseline metrics to measure the success of the new design.

While most results fell within expected ranges, some surprises were recorded during the testing procedures. On more than one occasion the participants found entirely new paths to achieve the required result. This is indicative of the usefulness in performing this type of testing. The user’s perspective and that of the site developers are not always in agreement and many time users actually circumvent the developer’s original intent.

The participants for this phase of testing were chosen for certain attributes. The main determining factor was the familiarity with the site itself and the content it presents. One was chosen for knowledge of the content, not familiar to the Web site. One was familiar with the site, but had little working knowledge of the content. One had knowledge of both the site and its contents. One had little knowledge of either the site or content. The varied range of experience gave an overall better average since users will also have different levels of expertise.

A summative evaluation of the site was performed using feedback acquired during the testing. Although the site did receive positive responses in a few areas, mostly related to graphics and use of color, the majority of responses depicted an overall
negative reaction. Where the site received the worst responses were in the areas of information organization and site navigation. The reason for the lower marks is demonstrated in Figures 4.1 and 4.2. Multiple methods of navigation and pages that require excessive scrolling create a sense of confusion.

Figure 4.1 Four different navigation methods in one screen

They also illustrate the how the haphazard method of making additions to the page has created site unpleasant to the eye. While testing this site the observation was made that the testers would scroll past their target, sometimes missing it multiple times while scrolling in each direction.

Another problem with this page is the manner in which the information is organized. Instead of grouping links in a way to help the user to find the document or link needed, individual links are scattered the length of the page. This further aggravated
the scrolling problem and was the proximate cause of one of the tester’s failure to complete a task. The level of the user’s frustration seems to further aggravate this problem. When users become frustrated they tend to scroll faster and in a more erratic fashion, which causes them to overshoot their target.

Figure 4.2 Entire screen used for only one document type.

One interesting aspect of the questionnaire results was one of the testers, as is obvious looking at the results in Table 4.1, did not feel right about giving the site poor marks. The lowest mark given for applicable questions was seven and the average marks was 7.86. When giving oral instructions for later tests the point was stressed that the opinions given should be an honest opinion and not to feel as if poor marks would be taken personally by the developers. When performing tests of this nature in unfamiliar surroundings with unknown participants it lessens the chances of responses of this type.
It is, however, the reasoning behind eliminating the high and low scores in order to
further stabilize results when using larger test groups. In a larger test sampling, the result
from this tester could have simply been thrown out in order not to skew the final result. In
this case, however, with the size group used in this evaluation the upward skew of the
results can be noted and taken into consideration when compared to the newly developed
site’s results.

Table 4.1 Results from Original Site Questionnaire

<table>
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<th>Tester 1</th>
<th>Tester 2</th>
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<td>3</td>
<td>4.8</td>
</tr>
<tr>
<td>17</td>
<td>Y</td>
<td>Y</td>
<td>N</td>
<td>Y</td>
<td>Y</td>
<td>80%Yes</td>
</tr>
<tr>
<td>18</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>N</td>
<td>Y</td>
<td>80%Yes</td>
</tr>
<tr>
<td>19</td>
<td>8</td>
<td>7</td>
<td>9</td>
<td>8</td>
<td>7</td>
<td>7.8</td>
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<tr>
<td>20</td>
<td>2</td>
<td>2</td>
<td>0</td>
<td>8</td>
<td>4</td>
<td>3.2</td>
</tr>
</tbody>
</table>

* A score of 0 indicates not applicable or not observed

Probably the most discussed usability metric is that of counting mouse clicks. In
many ways this is justified, however, while observing the participant it was noted there
are two diverse groups of mouse users, “Clickers” and “Draggers.” Clickers depress the
left mouse button repeatedly with the cursor positioned over the scroll bar track.

Draggers, on the other hand, depress the left mouse button once and drag the scroll bar up and down until they locate their target. This had a significant impact on the number of clicks required to complete a task. When comparing pages of similar length and requiring approximately the same scrolling maneuvers this would have less effect on the results, however, scrolling has been identified as one of the original site’s major downfalls and its necessity will be held to a minimum. Therefore, the results may appear more dramatic due to the significant elimination of scrolling necessity.

Mouse clicks and scrolling maneuvers have something in common, they both take time, and time to task completion can be a major factor in a site’s usability. A decrease in time required to accomplish your goal, especially in a military environment, is critical to the success of the Web site, and also a goal of this project. Further discussion of the time element will be contained in the comparison of the two sites.

Mention must be made concerning the value of videotaping the tests. While furnishing the ability to review the test blow-by-blow, the tapes did not really reveal any information the monitors had not noticed, and most time discussed immediately following the test. Reviewing the tapes also takes exactly the same amount of time it took to do the tests in the first place, which might be time better spent in performing another test or interviewing the testers for one-on-one feedback discussion. In an academic study for documentation and demonstration purposes taping may be appropriate, but in the military and commercial arenas where time is a precious commodity the value swiftly declines.
With the summative style evaluation of the original site completed, the informed development of the new site began.

**4.1 New Site Development**

Development of the new site began by listing everything available on the original site and attempting to prioritize the documents, graphics, and links. Copies of the list were distributed to the Training and Operations Officer and to his division support officers. This served two purposes. One, to help with defining the major areas the site required and two, to make sure there was still a need for each of the items on the list. After interviewing the officers involved the actual site design began.

The logon page was to remain the same. This page was not designed with usability in mind, but this site still has a need to help keep a level of excitement associated with its function. Retention is becoming a problem for the Navy this day and a bit of propaganda and splash has some usefulness.

For the overall design the logo header with a horizontal menu bar below was chosen to be used on all the core pages. The area below the menu bar would change with the menu selection. That area would be divided into three distinct and identifiable areas. The center would hold new or important information. On either side of the screen vertical menus would hold required links. This design creates a visual hierarchy on the pages, which is a goal in usability design. It also breaks the pages into defined areas, another method used to achieve usability goals. With this design in mind the first prototype was developed and demonstrated to the Training and Operations Officer. He then scheduled a meeting with his staff for a demonstration of the newly developed
prototype. At this meeting he requested feedback from the staff and asked them to compile any other information they would like made available on the site.

Figure 4.3 Opening screen of new site

With his enthusiastic approval of the initial design, development continued utilizing this design as a guide. Figure 4.3 illustrates this working design and how it allowed experimenting with different navigation methods.

A white background was chosen to maximize contrast between it and the text. It was decided to use the default link colors as to remain with convention as much as possible, and the white background works well with the default colors.

Color for the site was based on the blue color range, which is representative of the Navy and the purples being representative of royalty.

Font choice was considered to be extremely important. The clarity of the text is critical in Web use. The Arial typeface was chosen because of its clear appearance on
screen. The absence of serifs helps it retain its clarity even in smaller font weights. It was also decided to stay with only one font type except for the use of italic and bold typefaces.

All the above factors are consistent with quick loading pages. A quick loading page is one of the most important attributes contributing to a high level of usability.

One of the most significant concerns of those who tested the original site was site navigation and the amount of scrolling maneuvers required. These concerns were addressed in the new design by the creation of pages with the goal of little or no scrolling required. Of course screen resolution and windowed browsers affect the need for scrolling. In today’s computing environment most systems use at a minimum 800x600 pixel resolution. With this resolution in mind and careful placement enough information can be presented and still not require scrolling.

As with most military publications acronyms are used prolifically. This factor added a nuance to this project that most commercial sites are not required to deal with, labeling. Whether the user is a civilian not familiar with acronyms or military personnel new to a duty station, cryptic labels can cause much confusion and difficulty in accomplishing tasks. Even with close attention paid to each and every button label or link, many still remained questionable by the testers.

4.2 Testing of the Newly Developed Site

Testing of the new site was done exactly in the same fashion as the original using the same participants at the same location. This was done to keep extraneous distractions and overall environment as equal as possible. The same measurements were taken and the results used as feedback to perform a formative evaluation of the new site. The
results were then compared to the original site’s results to determine if an increase of the site’s usability had, in fact been achieved.

Although there was an expectation of improved results from testing the new site, the actual results were far more dramatic than expected. All metrics recorded pointed to a significant improvement in usability. Mouse clicks were reduced, scrolling maneuvers were reduced, and time required for completion of the tasks was reduced dramatically.

The total number of mouse clicks required to accomplish the tasks was reduced by over one hundred percent. Actual counts are listed in Table 4.2 for the original site and the new site’s results follow in Table 4.3.

Table 4.2 Mouse Click Count From Original Site

<table>
<thead>
<tr>
<th>Task</th>
<th>Tester 1</th>
<th>Tester 2</th>
<th>Tester 3</th>
<th>Tester 4</th>
<th>Tester 5</th>
<th>Total</th>
<th>Average</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>14</td>
<td>3</td>
<td>48</td>
<td>19</td>
<td>4</td>
<td>88</td>
<td>17.60</td>
</tr>
<tr>
<td>2</td>
<td>8</td>
<td>11</td>
<td>9</td>
<td>6</td>
<td>7</td>
<td>41</td>
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<tr>
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<td>3</td>
<td>18</td>
<td>3</td>
<td>3</td>
<td>31</td>
<td>6.20</td>
</tr>
<tr>
<td>4</td>
<td>4</td>
<td>2</td>
<td>38</td>
<td>2</td>
<td>2</td>
<td>48</td>
<td>9.60</td>
</tr>
<tr>
<td>5</td>
<td>4</td>
<td>2</td>
<td>6</td>
<td>2</td>
<td>4</td>
<td>18</td>
<td>3.60</td>
</tr>
<tr>
<td>6</td>
<td>3</td>
<td>8</td>
<td>45</td>
<td>3</td>
<td>5</td>
<td>64</td>
<td>12.80</td>
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<tr>
<td>7</td>
<td>4</td>
<td>3</td>
<td>38</td>
<td>17</td>
<td>4</td>
<td>66</td>
<td>13.20</td>
</tr>
<tr>
<td>8</td>
<td>5</td>
<td>6</td>
<td>19</td>
<td>2</td>
<td>5</td>
<td>37</td>
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<td>9</td>
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<td>52</td>
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<td>2</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>14</td>
<td>2.80</td>
</tr>
</tbody>
</table>

Total Number of Mouse Clicks 497
Average Mouse Clicks - All Tasks Combined 9.94

The major reason for the large decrease was due to the reduction in the number of pages requiring scrolling. Even when considering the Clickers and Draggers discussed earlier, a huge improvement was achieved in this metric. In Table 4.1 Tester 2 and Tester 3 illustrate the disparity in click counts of each of these types of users. The result must be tempered, however, by the knowledge there was a different level of familiarity with the
site. The newly designed site has been organized in a manner where task completion can be accomplished with less searching by the user, no matter the skill level, thus reducing the number of mouse clicks required.

Table 4.3 Mouse Click Count From New Site

<table>
<thead>
<tr>
<th>Task</th>
<th>Tester 1</th>
<th>Tester 2</th>
<th>Tester 3</th>
<th>Tester 4</th>
<th>Tester 5</th>
<th>Total</th>
<th>Average</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2</td>
<td>2</td>
<td>6</td>
<td>2</td>
<td>4</td>
<td>16</td>
<td>3.20</td>
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<tr>
<td>2</td>
<td>6</td>
<td>3</td>
<td>7</td>
<td>3</td>
<td>5</td>
<td>24</td>
<td>4.80</td>
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<tr>
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<td>7</td>
<td>14</td>
<td>10</td>
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<td>4</td>
<td>2</td>
<td>7</td>
<td>5</td>
<td>20</td>
<td>4.00</td>
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<td>1</td>
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<td>1</td>
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<td>5</td>
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<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>5</td>
<td>1.00</td>
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<td>6</td>
<td>2</td>
<td>15</td>
<td>3.00</td>
</tr>
<tr>
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<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>5</td>
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<td>2</td>
<td>4</td>
<td>2</td>
<td>13</td>
<td>2.60</td>
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<td>6</td>
<td>8</td>
<td>6</td>
<td>6</td>
<td>6</td>
<td>32</td>
<td>6.40</td>
</tr>
</tbody>
</table>

Total Number of Mouse Clicks 196

Average Mouse Clicks - All Tasks Combined 3.92

Commercial sites are discouraged from the implementation of pages that require scrolling. It is preferable to use good navigation and the use of more pages. While the count of scrolling maneuvers seemed somewhat subjective on the original site, scrolling was almost eliminated on the newly designed site. Although it is harder to measure the improvement achieved by the reduction in scrolling, it is assured it had a significant impact on the overall results of the tests.

Time to complete assigned tasks is one of the best indicators of the usability of a Web site. In this case, using testers with a wide range of familiarity with the site and its content, the reduction in time required to complete the same list of tasks was virtually cut in half. The data listed in Table 4.4 give the original site’s results, which were used to determine if improvement was achieved by the new design.
Table 4.4 Time Take to Complete Assigned Task or Declare Failure- Original Site

<table>
<thead>
<tr>
<th>Task</th>
<th>Tester 1</th>
<th>Tester 2</th>
<th>Tester 3</th>
<th>Tester 4</th>
<th>Tester 5</th>
<th>Total</th>
<th>Average</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>123.58</td>
<td>30.71</td>
<td>240.5F</td>
<td>180</td>
<td>44.23</td>
<td>619.02</td>
<td>123.80</td>
</tr>
<tr>
<td>2</td>
<td>23.97</td>
<td>112.45</td>
<td>68.28</td>
<td>44.28</td>
<td>28.9</td>
<td>277.88</td>
<td>55.58</td>
</tr>
<tr>
<td>3</td>
<td>27.36</td>
<td>18.78</td>
<td>96.13F</td>
<td>26.66</td>
<td>25.54</td>
<td>194.47</td>
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<tr>
<td>4</td>
<td>31.62</td>
<td>10.69</td>
<td>143F</td>
<td>12.9</td>
<td>16.12</td>
<td>214.33</td>
<td>42.87</td>
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<td>29.51</td>
<td>43.17</td>
<td>41.59</td>
<td>6.81</td>
<td>25.98</td>
<td>147.06</td>
<td>29.41</td>
</tr>
<tr>
<td>6</td>
<td>14.82</td>
<td>9.86</td>
<td>136.45F</td>
<td>19.93</td>
<td>17.63</td>
<td>198.69</td>
<td>39.74</td>
</tr>
<tr>
<td>7</td>
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<td>82.75</td>
<td>141.84</td>
<td>140.75</td>
<td>66.52</td>
<td>449.22</td>
<td>89.84</td>
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<tr>
<td>8</td>
<td>14.3</td>
<td>8.91</td>
<td>40.93</td>
<td>6.8</td>
<td>12.2</td>
<td>83.14</td>
<td>16.63</td>
</tr>
<tr>
<td>9</td>
<td>51.95</td>
<td>6.3</td>
<td>155.82F</td>
<td>133.92</td>
<td>22.36</td>
<td>370.35</td>
<td>74.07</td>
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<tr>
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<td>7.71</td>
<td>20.23</td>
<td>7.05</td>
<td>12.74</td>
<td>64.56</td>
<td>12.91</td>
</tr>
</tbody>
</table>

Total Time 2618.72

All time recorded in seconds
The letter F following a time designates a failure to complete the task

As Table 4.5 illustrates in all but a couple of instances the time required to complete the tasks was reduced significantly.

Table 4.5 Time Take to Complete Assigned Task or Declare Failure- New Site

<table>
<thead>
<tr>
<th>Task</th>
<th>Tester 1</th>
<th>Tester 2</th>
<th>Tester 3</th>
<th>Tester 4</th>
<th>Tester 5</th>
<th>Total</th>
<th>Average</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>42.81</td>
<td>30.8</td>
<td>14.91</td>
<td>7.78</td>
<td>25.7</td>
<td>122</td>
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<tr>
<td>2</td>
<td>11.23</td>
<td>16.27</td>
<td>22.68</td>
<td>9</td>
<td>14.26</td>
<td>73.44</td>
<td>14.69</td>
</tr>
<tr>
<td>3</td>
<td>35.14</td>
<td>52.74</td>
<td>85.07</td>
<td>189.09</td>
<td>57.75</td>
<td>419.79</td>
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<td>21.38</td>
<td>64.64</td>
<td>105.15</td>
<td>18.9</td>
<td>214.54</td>
<td>42.91</td>
</tr>
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<td>0.5</td>
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<td>12.81</td>
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</tr>
<tr>
<td>7</td>
<td>9.11</td>
<td>74.82</td>
<td>2.56</td>
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<td>22.7</td>
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<td>0.5</td>
<td>0.5</td>
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<td>0.5</td>
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<td>0.69</td>
</tr>
<tr>
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<td>96.31</td>
<td>19.26</td>
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<tr>
<td>10</td>
<td>26.57</td>
<td>23.97</td>
<td>29.53</td>
<td>53.98</td>
<td>24.45</td>
<td>158.5</td>
<td>31.70</td>
</tr>
</tbody>
</table>

Total Time 1313.57

All time recorded in seconds
The letter F following a time designates a failure to complete the task
4.3 Continuing the Site Development

After the evaluation and testing of the new design was completed some minor changes were made in order to receive further feedback from the users. Figure 4.4 shows the change in appearance of the links listed on the left-hand side of the “What’s New” page versus on the “N-3” page.

![N-3 page showing alternative menu system for Training Wings](image)

The “What’s New” page has not only links to the Training Wings, but also to the individual squadrons attached to that wing. While giving a quick one-click method of reaching the squadron sites, it makes for a more cluttered appearance than on the “N-3” page, which just holds the links to the wings. By obtaining user feedback on issues of
this nature you allow the users to make the trade-off decisions. This perpetuates User Centered Design (UCD), a usability mainstay.

The content issues, while being controlled by the staff officers, was placed as effectively as possible for the most logical implementation of the site. As with most Web sites, the development of this site will continue long after this project is completed. The intent was to make the site fully functional, while meeting all the requirements of the staff. The cosmetics can then be adjusted at the pleasure of the section heads and the Web developers. This allows the individual section leaders to made the decisions about their sections. Trade-offs concerning load time, buttons versus underline links, the use of heavy graphics, and whether more pages should be created to support deeper levels.

Just as commercial Web sites, the military sites have many people involved in their content and appearance. Each person is assured their way is the right way and the developers must perform a juggling act to appease the different personalities, while still keeping the usability factor as high as possible.
5. Future Work

This project is merely a first step in examining the benefits of improving the usability of military Web sites. The military’s ventures into the use of the World Wide Web has paralleled the private sector in the lack of standards, the rush to implementation, and the development of sites with little regard for the user experience.

The military does not have the ability to easily hire consultants to give express directions on maximizing the usability of its Web sites. But if those tasked with the development and maintenance have direction to make the usability issues concerning the sites under their control a priority, a dramatic improvement could be achieved.

Although it was out of the scope of this project to do a complete revision to the entire Naval Air Training Command Web site it is hoped that this project would demonstrate how usability methods could improve future design projects. As most Web sites this one will evolve. Developers and philosophies will change, but as long as usability is considered in any design changes, this site should maintain a high satisfaction level.

5.1 Development of Usability Policies and Standards for Military Sites

The military has created thousands of Web sites. The Navy alone has hundreds of public and secure sites. The development of a set of usability policies and standards for one or all branches of the military could have a major impact on improving the quality of Web site developed for military use. This would, under current protocols, best be done for each individual branch of the military rather than one all encompassing policy.
6. Conclusion

It was the expectation of this project that the application of commercially developed usability methods and procedures when applied to a military site would produce similar effects. In a commercial Web site the users' attention must be seized and held to effectively promote the product or service offered. Although the military site does not have a sales function, it needs to be effective in the manner it presents information. If the information is not readily available and clearly presented, the users will resist using the site, and the usefulness of the site to the command will be diminished.

The original Cross Functional Team 2 section of the Web site required scrolling, had different linking methods, and did not present a clearly defined view of what information was available. A replacement page designed with usability as the major emphasis has yielded a far easier site to use. It has also given the users a far more pleasant experience. With these measures taken and tempered with the opinions of the user during the testing phases, the final result has yielded an easy to use and technically functional site, which is in fact the goal of usability design. Although much of the cosmetic work is still to be done, the site is functional and has received widespread acceptance throughout the command.

It is the opinion of this project that, if properly implemented, the majority of Web usability tools apply equally well in a military environment as to a commercial. Dividing pages into clear and distinct sections, using white space effectively, choosing fonts for readability, using color properly, and making sure pages load quickly are all elements which improve the usability of any site. It is clear by the test results the using these and other guidelines there has been a dramatic improvement in the use and function of the
Naval Air Training Command’s Training and Operations Web site. There is no doubt that other similar military sites could benefit in the same way. Even if the results increase the productivity half as much as the improvements experienced in this project, that would be a meaningful increase in usability and function, making the implementation well worth the time and effort.
BIBLIOGRAPHY AND REFERENCES


APPENDIX A – TEST TASK LIST

1. Display the N32 organizational chart.
2. Display the first page of CNATRA instruction 3710.8G
3. Display the read-ahead for Training Wing 5 for January 2002
4. Display the current Projected Wingings for the NFO pipeline
5. Find the link to VT-35’s Web site.
6. Display the agenda for the upcoming face-to-face meeting.
7. Display the API login Screen
8. Find the link to the U.S. Navy Web site.
9. Display the current selection letter.
10. Display the oldest Cockpit Chart available for Training Wing 4.
APPENDIX B – TEST QUESTIONNAIRE

CNATRA Web Test

Thank you for participation in this test. You will be given a series of tasks to perform. As you work through the task feel free to speak your thoughts. After the task is given to you no questions can be asked. If for any reason you feel you cannot complete a task, notify the monitor so that a time can be recorded and move on to the next task. At the completion of the tasks there will be a short questionnaire for the purpose of evaluating your response to some specific areas of interest as well as your general opinion of the site.

Again, thank you for your participation and opinions.
For the following questions please circle the appropriate number from 0 to 9 to rate your level of satisfaction with the site:

1. What was your overall opinion of the site?
   Terrible 0 1 2 3 4 5 6 7 8 9 Excellent

2. Were the screens easy or difficult to read?
   Difficult 0 1 2 3 4 5 6 7 8 9 Easy

3. Was the information organized effectively?
   Poorly Organized 0 1 2 3 4 5 6 7 8 9 Well Organized

4. Was learning the system easy?
   Hard 0 1 2 3 4 5 6 7 8 9 Easy

5. Is it easy to find the information you need?
   Hard to Find 0 1 2 3 4 5 6 7 8 9 Easy to Find

6. Do you like the user interface of the site?
   Dislike 0 1 2 3 4 5 6 7 8 9 Like

7. Was navigating the site easy or difficult?
   Difficult 0 1 2 3 4 5 6 7 8 9 Easy

8. Is exploring new features by trial and error easy or difficult?
   Difficult 0 1 2 3 4 5 6 7 8 9 Easy

9. Was the help system effective?
   Ineffective 0 1 2 3 4 5 6 7 8 9 Effective

10. Were the help messages clear or confusing?
    Confusing 0 1 2 3 4 5 6 7 8 9 Clear
11. Did the use of graphical icons help in navigating the site?
   Hindered 0 1 2 3 4 5 6 7 8 9 Helped

12. Were the graphics clear and sharp?
   Dull 0 1 2 3 4 5 6 7 8 9 Sharp

13. Was color used effectively?
   Poorly Used 0 1 2 3 4 5 6 7 8 9 Well Used

14. Was the use of color consistent throughout the site?
   Inconsistent 0 1 2 3 4 5 6 7 8 9 Consistent

15. Were the methods of navigation easy to understand?
   Easy 0 1 2 3 4 5 6 7 8 9 Difficult

16. Were the methods of navigation consistent?
   Inconsistent 0 1 2 3 4 5 6 7 8 9 Consistent

17. Was there too much information presented on any individual pages?
   Yes       No

18. Was there too little information presented on any individual pages?
   Yes       No

19. Overall, did the pages load quickly?
   Slow 0 1 2 3 4 5 6 7 8 9 Fast

20. How would you rate this site for usability?
   Poor 0 1 2 3 4 5 6 7 8 9 Excellent
Briefly answer the following questions. If more space is desired, feel free to use the back of the forms.

What is your overall opinion of the site?

What are some things you liked about the site?

What are some of the things you disliked?

Do you have any suggestions on improving the site?
APPENDIX C – GLOBAL ASA FILE CONTENTS

<SCRIPT LANGUAGE=VBScript RUNAT=Server>
Sub Application_OnStart
    Application("visits")
    Application("Active") = 0
End Sub
Sub Application_OnEnd
End Sub
Sub Session_onstart
    Session.Timeout = 20
    Session("Start") = Now
    Application.Lock
        Application("visits") = Application("visits") + 1
        intTotal_visitors = Application("visits")
    Application.Unlock
    Session("VisitorID") = intTotal_visitors
    Application.Lock
        Application("Active") = Application("Active") + 1
    Application.Unlock
    Session("MM_Username") = ""
    IF (Session("MM_Username") = "") then Response.redirect "default.asp"
End Sub
Sub Session_OnEnd
    Application.Lock
        Application("Active") = Application("Active") - 1
    Application.Unlock
End Sub
</SCRIPT>