FINAL REPORT

Findings and Recommendations from HTI Website Usability Testing

July 2016

Eastern Research Group, Inc.

Arlington, Virginia

Written under contract for the

NOAA Office for Coastal Management

www.coast.noaa.gov

Eastern Research Group, Inc. (ERG)

ERG provides environmental, social science, and engineering solutions to climate, weather, and coastal management issues. Learn more at *www.erg.com.*

NOAA's Office for Coastal Management

"Coastal management" is the term used by communities and organizations striving to keep the nation's coasts safe from storms, rich in natural resources, and economically strong. The national lead for these efforts is NOAA's Office for Coastal Management, an organization devoted to partnerships, science, and good policy. This agency, housed within the National Ocean Service, oversees major initiatives that include the National Coastal Zone Management Program, Coral Reef Conservation Program, Digital Coast, and National Estuarine Research Reserve System.

Contents

Findings and Recommendations from HTI Website Usability Testing — Executive Summary

From April 27–April 30, 2016, a team of researchers from Eastern Research Group, Inc. (ERG), conducted usability testing on the National Weather Service (NWS) Hurricane Threats and Impacts (HTI) website at the Miami-Dade Emergency Operations Center (EOC). The participants included federal, state, and local emergency management personnel, meteorologists, and broadcast meteorologists.

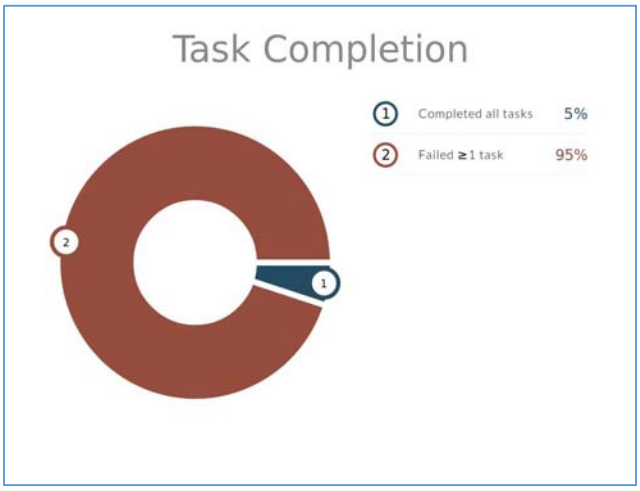

Figure 1. Only one (out of 21) user successfully completed all tasks.

ERG's testing uncovered several serious usability issues. Of the 21 test participants, only one successfully completed all 10 tasks (see Figure 1). The majority of users struggled to find even basic storm information—for example, 95 percent of users failed to discover the location of the hurricane. A full 14 percent failed to click on a point on the map, and as a result, got no information at all from the site.

More disturbing, however, is that roughly 90 percent of participants ended up getting incorrect information. Of the 18 participants who clicked on the map, 16 failed to use the area/county/ neighborhood toggles properly (see Figure 2). As a result, participants almost always had information of the wrong spatial scale (e.g., they were seeing a county-wide view of the map when looking for area-wide results, or neighborhood-level data when looking for county results).

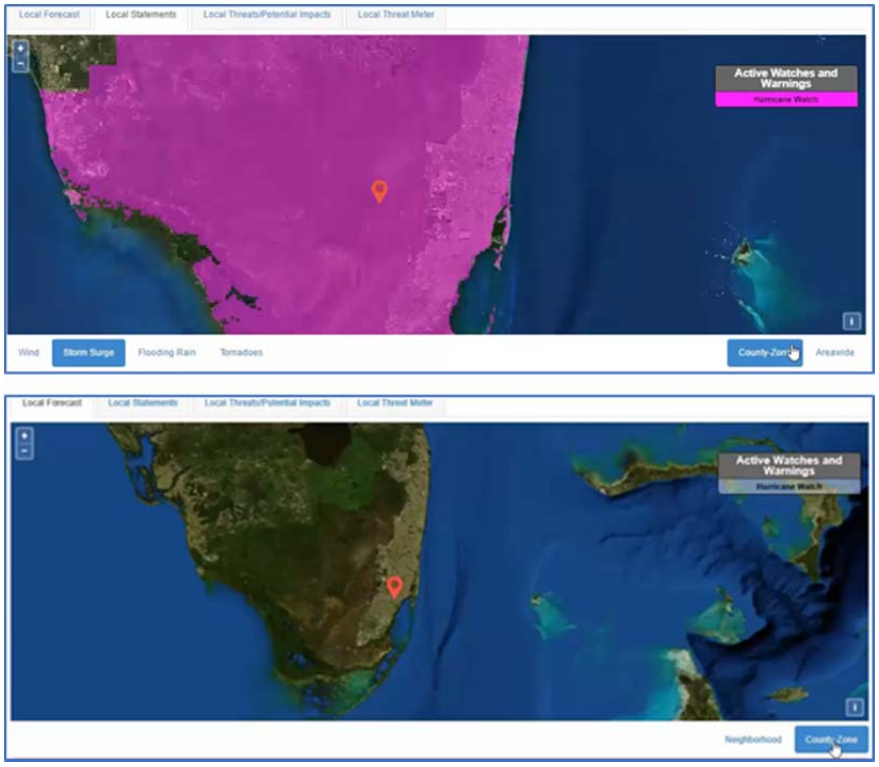

Figure 2. "County-Zone" and "Areawide" toggles at bottom right (top image). "Neighborhood" and "County-Zone" toggles at bottom right (bottom image).

Although every participant struggled with at least one task, most expressed the view that the site would be useful, both to explore a visual interface of different hazards and to have information aggregated in one

place that they would otherwise have to seek out from multiple sources. But nearly all participants expressed some reluctance to use the site in its current form. Based on the usability testing, ERG's recommendations are listed below in Table ES.1. The full report provides a detailed analysis of these topics. If the NWS decides to pursue development of the HTI website, we recommend that it be reconsidered from a conceptual perspective and then be developed in an Agile environment with ongoing user testing.

Table ES.1. Summary of Recommendations and Next Steps	
Release	Postpone release of the HTI website until after the 2016 hurricane season to avoid disseminating incorrect information.
Process	Adopt an Agile development process in which stakeholders and developers collaborate through all stages of development.
	Implement ongoing user testing throughout the development process; can minimize costs by testing on sketches, wireframes, static visual designs, or simple prototypes in HTML or PowerPoint.
Concept	Rethink mashup between visual interface (map) and text products that appear below the map (e.g., local statement).
	Remove text products that appear below the map. Scrape out the storm information, threats, and impacts from the local statement and show this information on the map when the user clicks on the associated navigation tab.
	Rethink how to display information at different geographic scale.
	Consider if it is appropriate to display a neighborhood-level scale.
	Eliminate redundancy of threat/impact information, which appears in multiple places on the site.
Map	Do not require users to click on the map to obtain information. Instead, include information on the map upon initial page load to avoid confusion.
	Consider a dropdown menu of counties.
	Include depiction of the hurricane and its projected track on the map or link to the NHC.
	Change map to a political map or a road map that includes city labels and county boundaries, or allow users to switch to this kind of view.
Navigation	Eliminate the need for users to scroll below the map to find threat (wind, storm surge, flooding rain, tornadoes) information. This information should appear on map itself.
	Delete County-Zone/Areawide/Neighborhood buttons.

Findings and Recommendations from HTI Website Usability Testing —Full Report

Background

The NWS has been developing a new Internet-based decision-support tool, the HTI website, to help its partners and customers more quickly interface with local hazard information whenever tropical storm and/or hurricane watches and warnings are in effect along the United States East and Gulf coasts. The site provides local threat assessments and corresponding potential impacts information about tropical storm or hurricane wind, storm surge, flooding rain, and tornadoes.

The target audience for the tool includes federal, state, regional, and local decision-makers and emergency management personnel; military, police, and transportation officials; school officials; private sector meteorologists; representatives of disaster relief organizations; and the public.

The NWS wanted to conduct usability testing on the site with prospective users to ascertain if the website was ready to go live for the 2016 hurricane season. It contracted with ERG to conduct preliminary usability testing of the site in the Miami-Dade region in April 2016.

Methodology

The testing was conducted at the Miami-Dade EOC on April 28–29 (ERG also met separately with a member of the media on April 27) through a set of moderated one-on-one sessions, approximately 20 to 40 minutes long. The Miami location was chosen for a number of reasons, including the geographic relevance of the location for tropical cyclones, the fact that the initial prototype of the site was centered on the state of Florida, and the availability of suitable testing space.

Each testing session paired one moderator with one participant. Participants were asked to complete a set of tasks that correlate to the main types of information provided by the website. The moderators observed the sessions and kept the participants moving through the tasks. They prompted participants to narrate their thought processes as they completed each task. The moderators did not provide ancillary information about the site or answer participant questions about how to perform any of the tasks.

Sample

ERG worked with the Warning Coordination Meteorologist (WCM) and Meteorologist in Charge in the Miami Weather Forecast Office (WFO) to recruit participants from South Florida for the testing. This initial testing was designed to target the primary partners who use and rely on the Hurricane Local Statement (HLS) and Tropical Cyclone VTEC (TCV) text products developed by the local WFOs. The Miami WCM provided ERG with an initial list of 64 names in six categories for recruiting purposes. ERG reached out to 48 individuals, and 21 respondents participated in the testing (see Table 1 on the next page).

Table 1. Usability Test Recruiting Information

Category	Number of People Contacted	Number of Final Participants
Federal Officials	11	3
State Officials	9	4
Local/County Officials	13	9
School Officials	5	2
Media	4	2
Other (local safety organizations/private meteorologists)	6	1
TOTAL	**48**	**21**

Goals

The primary goal of the usability testing was to uncover any potential problems users may experience with the website before it goes live during an actual hurricane. The testing helped to gauge:

- Can new users efficiently navigate and extract information from the site?
- If they encounter errors, where and when do they occur?

More specifically, the testing addressed how well users could carry out the following objectives:

- Find a location of interest on the map.
- Access information at a desired geographic scale (neighborhood, county, and area).
- Locate general information about the storm (e.g., intensity, location, timing, watches/warnings in effect).
- Locate forecast/meteorological information for a hazard of interest (tornado, flooding rain, storm surge, wind) for a location of interest.
- Locate the potential impacts for a hazard of interest.

Participants were presented with three general scenarios based on different geographic points of interest. They were asked to perform several tasks related to each scenario (see the interview guides in Appendix A: Usability Testing Scripts). For each session, ERG recorded the conversation and the computer screen (and associated clicks) through a software program.

Findings and Analysis

ERG's findings fall into two broad categories: problems related to the map, and problems related to internal navigation. These issues are discussed below, while a summary of how participants performed on specific usability tasks is presented in a table in Appendix B at the end of the report.

Map

The full-bleed map is the key interactive feature of the site—all other information on the site is keyed to particular locations on the map, meaning that a user's first stop in interacting with HTI should be to engage with the map. Every user was immediately drawn to the map, though 14 percent failed to click on a location on the map.

Major issues ERG uncovered included:

- **The lack of information on initial page load confused many users.** To retrieve any information at all, users must first click in an area on the map. While most participants interacted with the map, 14 percent did not, and as a result, obtained no information from the website at all.

- **The lack of a hurricane symbol or hurricane track confused many user**s. The first task asked that users locate the hurricane. Fully 95 percent were unable to do so. Every user began by searching the map for the hurricane's location. One participant spent over 10 minutes looking for the hurricane location before ultimately giving up. All expressed surprise at not finding a depiction of the hurricane or its projected track anywhere on the map.

- **The physical map hindered users' abilities to find locations.** Every single user spent at least some time searching for a way to switch to a political map or a road map. Nearly 30 percent were unable to locate Metro Broward County, and 57 percent were unable to locate Naples.

- **Users did not access information at the intended geographic scale.** The map's user interface is designed for pinpointing specific locations. That is, the pins that users drop are designed to pick out locations at the street address level. That makes this style of map an ideal user interface for collecting very local information. But it is a suboptimal choice for discovering information at a county or regional level. As a result, most users, when asked to locate information about, say, South Florida or Broward County, were in fact offering answers that applied to specific towns in South Florida or in Broward County.

Navigation

After selecting a location on the map, users needed to engage with three different sets of buttons to complete specific tasks. One set resides above the map. Two additional sets reside just below the map, one on the left side and another on the right side of the screen. Many users had difficulty finding one or more sets of navigation, and only two were able to correctly interact with all three sets to complete tasks (see Figure 3).

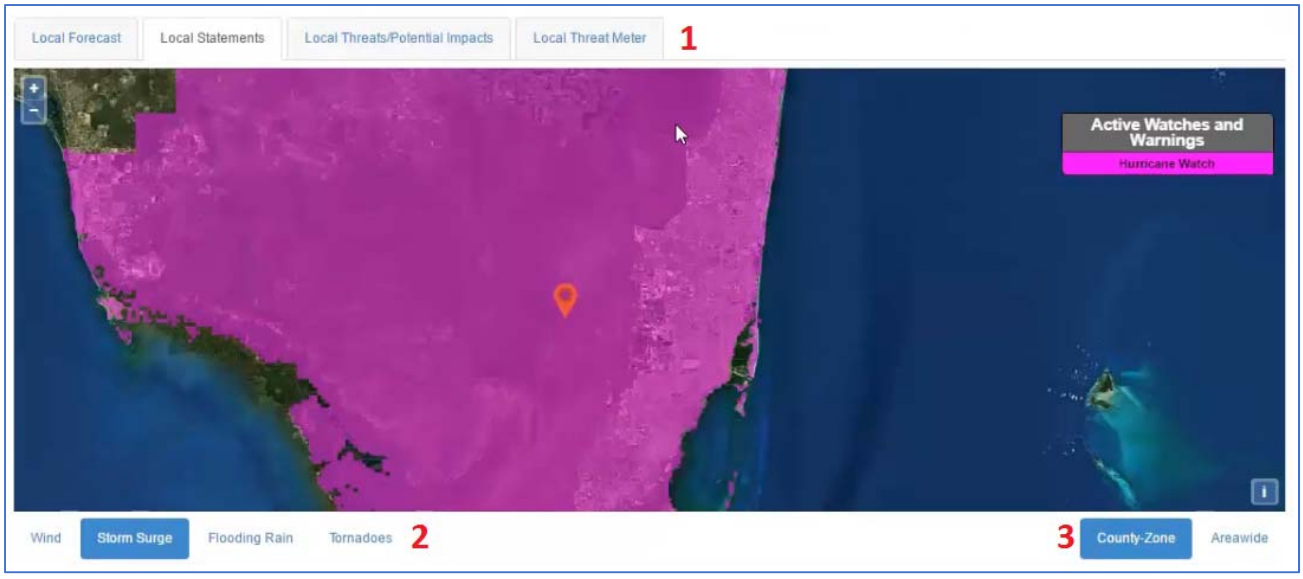

Figure 3. The three different sets of navigation are numbered above.

Major issues ERG uncovered included:

- **Several users failed to discover anything below the map.** Most users located the navigation above the map, but 24 percent of participants did not ever scroll below the map to discover either the lower sets of navigation or the text content of the site. Another 33 percent found the lower navigation but failed to discover how to use it in conjunction with the navigation above the map to find information.

- **Very few users found the County-Zone/Areawide/Neighborhood buttons**. The vast majority of users neither mentioned nor explored these buttons. Only two users correctly identified the information that the buttons deliver after a great deal of exploration on the site.

- **Several users got "stuck" on the bottom navigation.** Some users that discovered the bottom navigation never returned to the top navigation. Some repeatedly clicked on the navigation for downloading data in an attempt to complete a task (see Figure 4).

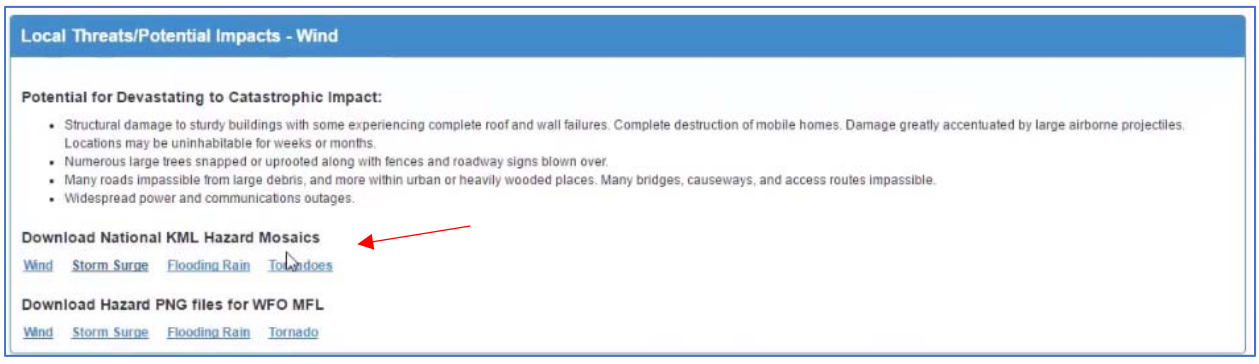

Figure 4. Some users got stuck on the bottom navigation and repeatedly tried to complete the tasks using the data files.

Recommendations

On the basis of its analysis, ERG strongly recommends that THE NWS not release the HTI site during the 2016 hurricane season. In all, 95 percent of users failed to complete at least one task. But more worrisome is that 90 percent received incorrect information. Ultimately, a system that inadvertently provides emergency managers and broadcasters incorrect information is much more dangerous than one that fails to provide information.

That said, participants universally agreed that the idea of the site holds promise, particularly in its ability to aggregate information that they would otherwise have to get from multiple, individual sources. Therefore, ERG recommends a complete reworking of the HTI user interface. ERG's suggestions for the user interface revamp fall into two categories: process changes and conceptual changes.

Process Changes

Replace the waterfall development process with an Agile development process. In traditional waterfall software development, the developers work with stakeholders to identify a detailed list of product requirements and specifications. Once both sides have agreed upon these specifications, the developers then go build software, returning a complete working product to stakeholders at the end of the process.

The major limitation to the waterfall process is that project stakeholders and developers sometimes understand requirements differently. And because products are not returned until they are fully completed, these misunderstandings between stakeholders and developers often result in software that does not accomplish the business goals that stakeholders initially envisioned.

Agile development processes, by contrast, involve project stakeholders throughout the development process. Together, stakeholders and developers identify the highest-value pieces of functionality, and then developers build those pieces in short (usually two- or four-week) "sprints." Developers and stakeholders meet briefly each day to discuss progress. At the end of each sprint, developers provide fully working software for review. Subsequent sprints add additional functionality, or revise work from previous sprints that failed user acceptance testing. In this way, Agile development allows for continuous course-correction.

Implement ongoing user testing. Traditionally, usability testing has happened at the end of the software development phase, often as part of the quality assurance or user acceptance testing phase of a project. That approach can work well if the software in question is a familiar type with a well-understood user interface (e.g., an email client with clear send, forward, and reply buttons).

But for Web applications that either present unfamiliar information or that repackage familiar information in novel ways, holding user testing to the end of the development process is much riskier.

Therefore, ERG recommends small-scale, ongoing usability testing throughout the development process. Indeed, it is not even necessary to have working software for usability testing. One can conduct usability testing on sketches, wireframes, static visual designs, or simple prototypes in HTML or PowerPoint.

This type of testing usually needs only three or four participants per round. The iterative nature of the process ensures that the product is continuously improved. Moreover, small-scale iterative usability testing dovetails nicely with Agile development methods.

Conceptual Changes

Rethink the mashup between a visual interface and a text product (see Figure 5). Maps are fundamentally a visual user interface. They encourage interactivity by asking users to choose specific areas of interest.

But much of the information in the HTI site is contained in already-existing text products. Moreover, the content of those text products does not entirely line up with the items in the map's navigational elements. For example, the document that users see when clicking on "threats" also discusses impacts—despite the fact that there is an entirely different navigation item for impacts.

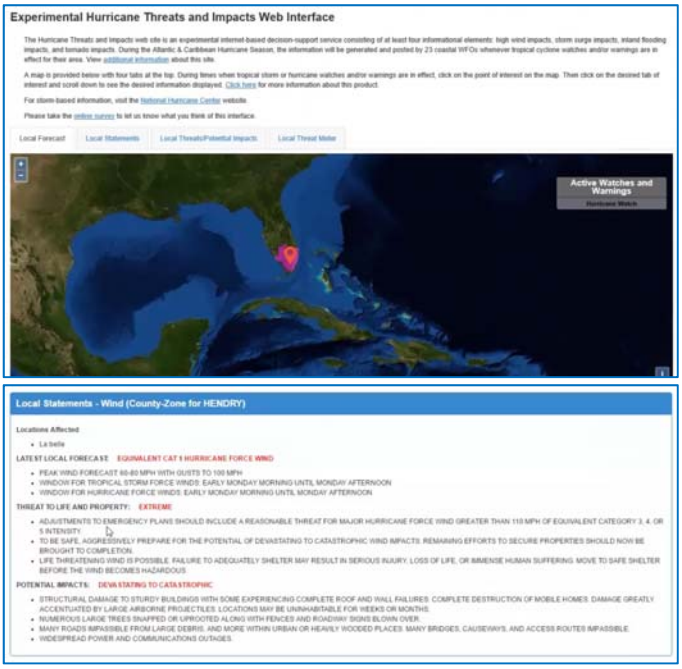

Figure 5. To find information, users must scroll down below the map (visual interface) and parse through a text product (local statement).

ERG recommends that the NWS remove the text products from the HTI site. Instead, the NWS should scrape the content from those text products and present the different pieces more in accord with the navigation elements in the map. So, for example, rather than presenting the entire HLS in text form, scrape out the storm information, the threats, and the impacts. Then show the storm information when a user clicks on the storm, show the "threats" text section when users click the "threats" navigation button, and the "impacts" text when users click the "impacts" navigation button.

Summary

The NWS has invested many years of stakeholder engagement, design, and development in improving the HLS and creating a decision-support tool to help visualize the information in this text product. Prior research with stakeholders (both on this project and others) has shown that they value the HLS, and some have stated it is their go-to product during a hurricane. Additionally, many stakeholders have repeatedly provided feedback to the NWS that they desire more high-resolution, interactive and Web-based tools from the agency.[1]

[1] ERG, June 27, 2013, *Storm Surge Marketing: Audience Analysis Final Report* prepared under NOAA Contract, #EAJ33C-09-CQ-0034, Task Order #25; ERG, April 4, 2014, *Summary of Hurricane Local Statement Research Report* prepared under NOAA Contract, #EAJ33C-09-CQ-0034, Task Order #40; ERG, April 18, 2014, *Summary of Tropical Cyclone Impact Graphics Exploratory Social Science Research Report* prepared under NOAA Contract, #EAJ33C-09-CQ-0034, Task Order #17.

The HTI website shows great promise in being able to provide a new decision-support tool to its partners and other users in that it helps to visualize the HTI information and aggregate important information about local threats and impacts of a hurricane. The tool has the potential to bring the text-heavy TCV and HLS to life and provide valuable data to users during an event. The site may also reduce the amount of time users have to spend looking across multiple sites for information, thereby saving valuable time during an event when stakeholders are already under a great deal of pressure.

If the NWS decides to pursue development of the HTI website, we recommend that the site be reconsidered from a conceptual perspective and it be developed in an Agile environment with ongoing user testing.

Appendix A: Usability Testing Scripts

Emergency Manager HTI Usability Testing Script

[Web browser should be open to Google]

Hi ___. My name is ___. I am with Eastern Research Group, Inc. (ERG) working under contract with NOAA's National Weather Service. I'm going to be walking you through this session today. Before we begin, you probably are wondering why we asked you here. We're asking people to try using a website that the National Weather Service is developing so we can see whether it works as intended. You will be evaluating the initial version of the website. The session should take about 50 minutes.

Keep in mind we're testing the *site*, not you. As you use the site, I'm going to ask you as much as possible to try to think out loud: to say what you're looking at, what you're trying to do, and what you're thinking. This will be a big help to us. Also, please don't worry that you're going to hurt our feelings. We're doing this to improve the site, so we need to hear your honest reactions. If you need to take a break at any point, just let me know.

You may have noticed the microphone. With your permission, we're going to record what happens on the screen and our conversation. The recording will only be used to help us figure out how to improve the site, and it won't be seen by anyone except the people working on this project. We also will not release your name or information that could identify you as part of this testing process in our reports to the National Weather Service. Is this alright with you?

[*BEGIN RECORDING: New > Video Demo > Record > Full Screen; Audio > Microphone]*

Before we look at the site, I'd like to ask you just a few quick questions.

1. First, what's your occupation?
2. Now, roughly how many hours a week altogether—just a ballpark estimate— would you say you spend using the Internet, including Web browsing and email, at work and at home?
3. And what's the split between email and browsing—a rough percentage?
4. Finally, how familiar are you with the current suite of tropical products and services provided by your local Weather Forecast Office?

We're done with the questions, and we can start looking at things.
[Click on the bookmark for the Home page. http://preview.weather.gov/hti/]

First, I'm going to ask you to look at this page and tell me what you make of it: what strikes you about it, whose site you think it is, what you can do here, and what it's for. Just look around and give me your impressions. You can scroll if you want to, but don't click on anything yet.

Now I'm going to ask you to try doing some specific tasks. I'm going to read each one out loud and give you a printed copy so you can follow along. Keep in mind there are no right or wrong answers. And again, as much as possible, it will help us if you can try to think out loud as you go along.

EM Scenario 1: Your area of responsibility is the state of Florida. You have been notified that a hurricane watch has been issued for some portions of the state and you want to learn more about the storm so you can plan accordingly.

1. Which counties are under a hurricane watch?
2. Where is the hurricane currently located?
3. Which storm hazard or hazards are of most concern in South Florida?
4. What road conditions should people be prepared for in those areas that are under a moderate threat of wind?

EM Scenario 2: Your area of responsibility is Metro Broward County. You want to know if you should be more concerned about flooding rain or tornadoes so you can prepare accordingly.

1. How much rainfall is possible for Metro Broward County?
2. W**hat is the threat level for tornadoes in Metro Broward County?**

EM Scenario 3: You are based in Naples. You want to know about the potential storm surge from the impending hurricane so that you can factor this into your evacuation decisions.

1. How much storm surge should you prepare for in the city of Naples?
2. Should you be more concerned about storm surge or rainfall in the city of Naples?

Now that you've had a chance to look around the site, how do you think this site might complement (or complicate) what you currently do when a hurricane is threatening your area.

[Stop > File > Publish > File Record (Last Name_Date]

Media HTI Usability Testing Script

Hi ___. My name is ___. I am with Eastern Research Group, Inc. (ERG) working under contract with NOAA's National Weather Service. I'm going to be walking you through this session today. Before we begin, you probably are wondering why we asked you here. We're asking people to try using a website that the National Weather Service is developing so we can see whether it works as intended. You will be evaluating the initial version of the website. The session should take about 50 minutes.

Keep in mind we're testing the *site*, not you. As you use the site, I'm going to ask you as much as possible to try to think out loud: to say what you're looking at, what you're trying to do, and what you're thinking. This will be a big help to us. Also, please don't worry that you're going to hurt our feelings. We're doing this to improve the site, so we need to hear your honest reactions. If you need to take a break at any point, just let me know.

You may have noticed the microphone. With your permission, we're going to record what happens on the screen and our conversation. The recording will only be used to help us figure out how to improve the site, and it won't be seen by anyone except the people working on this project. We also will not release your name or information that could identify you as part of this testing process in our reports to the National Weather Service. Is this alright with you?

[*BEGIN RECORDING: New > Video Demo > Record > Full Screen; Audio > Microphone]*

Before we look at the site, I'd like to ask you just a few quick questions.

1. First, what's your occupation?
2. Now, roughly how many hours a week altogether—just a ballpark estimate— would you say you spend using the Internet, including Web browsing and email, at work and
3. And what's the split between email and browsing—a rough percentage?
4. Finally, how familiar are you with the current suite of tropical products and services provided by your local Weather Forecast Office?

We're done with the questions, and we can start looking at things.

[Click on the bookmark for the Home page. http://preview.weather.gov/hti/]

First, I'm going to ask you to look at this page and tell me what you make of it: what strikes you about it, whose site you think it is, what you can do here, and what it's for. Just look around and give me your impressions. You can scroll if you want to, but don't click on anything yet.

Now I'm going to ask you to try doing some specific tasks. I'm going to read each one out loud and give you a printed copy so you can follow along. Keep in mind there are no right or wrong answers. And again, as much as possible, it will help us if you can try to think out loud as you go along.

Media Scenario 1: You have been notified that a hurricane watch has been issued for some portions of the state and you want to learn more about the storm so you can develop some social media posts.

1. Which counties are under a hurricane watch?
2. Where is the hurricane currently located?
3. Which storm hazard or hazards are of most concern in South Florida?
4. What road conditions should people be prepared for in those areas that are under a moderate threat of wind?

Media Scenario 2: Your area of responsibility is Metro Broward County. You want to know if you should be more concerned about flooding rain or tornadoes so you can prepare your broadcast.

1. How much rainfall is possible for Metro Broward County?
2. What is the threat level for tornadoes in Metro Broward County?

Media Scenario 3: You are based in Naples. You want to know about the potential storm surge from the impending hurricane so that you can communicate this information to your listeners.

1. How much storm surge should people prepare for in the city of Naples?
2. Should you tell them to be more concerned about storm surge or rainfall in the city of Naples?

Now that you've had a chance to look around the site, how do you think this site might complement (or complicate) what you currently do when a hurricane is threatening your area.

[Stop > File > Publish > File Record (Last Name_Date]

Appendix B: Usability Checklist

User	Clicked on Area in Map	Located Hurricane	Located Metro Broward Co.	Located City of Naples	Moved between Region/City Level	Used Region/City Level Correctly	Found Lower Navigation	Found County/ Areawide buttons	Found Info Below Map
1	✓	✗	✗	✗	✗	✗	✓	✗	✗
2	✓	✗	✗	✓	✗	✗	✓	✓	✓
3	✓	✗	✓	✗	✗	✗	✓	✓	✓
4	✓	✗	✓	✗	✗	✗	✓	✗	✓
5	✓	✗	✓	✓	✗	✗	✓	✓	✓
6	✓	✗	✓	✗	✗	✗	✓	✗	✓
7	✗	✗	✗	✗	✗	✗	✓	✗	✗
8	✓	✗	✗	✓	✗	✗	✓	✗	✗
9	✗	✗	✗	✗	✗	✗	✓	✗	✗
10	✗	✗	✓	✗	✗	✗	✗	✗	✗
11	✓	✗	✓	✓	✗	✗	✓	✗	✓
12	✓	✗	✓	✓	✓	✗	✓	✗	✓
13	✓	✗	✓	✗	✗	✗	✓	✗	✓
14	✓	✗	✓	✓	✗	✗	✓	✓	✓
15	✓	✗	✓	✗	✓	✗	✓	✗	✓
16	✓	✗	✓	✓	✓	✗	✓	✓	✓
17	✓	✗	✓	✗	✓	✓	✓	✓	✓
18	✓	✓	✓	✓	✓	✓	✓	✓	✓
19	✓	✗	✓	✗	✗	✗	✓	✗	✓
20	✓	✗	✗	✓	✗	✗	✓	✗	✓
21	✓	✗	✓	✗	✗	✗	✓	✗	✓