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<table>
<thead>
<tr>
<th>Section</th>
<th>Title</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>I.</td>
<td>EXECUTIVE SUMMARY</td>
<td>1</td>
</tr>
<tr>
<td>II.</td>
<td>INTRODUCTION</td>
<td>3</td>
</tr>
<tr>
<td>III.</td>
<td>INITIAL WORKSHOP</td>
<td>5</td>
</tr>
<tr>
<td>IV.</td>
<td>SURVEY QUESTIONNAIRE RESULTS</td>
<td>6</td>
</tr>
<tr>
<td></td>
<td>a. Person-to-person communication</td>
<td>9</td>
</tr>
<tr>
<td></td>
<td>b. Delivery and timing</td>
<td>10</td>
</tr>
<tr>
<td></td>
<td>c. Map effectiveness</td>
<td>12</td>
</tr>
<tr>
<td></td>
<td>d. Preparedness and resiliency</td>
<td>16</td>
</tr>
<tr>
<td></td>
<td>e. Summary</td>
<td>19</td>
</tr>
<tr>
<td>V.</td>
<td>PROJECT END WORKSHOP</td>
<td>21</td>
</tr>
<tr>
<td>VI.</td>
<td>Appendices</td>
<td>24</td>
</tr>
</tbody>
</table>
EXECUTIVE SUMMARY

The Social Science Research Center (SSRC) at Mississippi State University (MSU) participated in a research effort that focused on lessons learned from the use of geospatial products in the aftermath of Hurricane Katrina. The project team was led by the GeoResources Institute (GRI) at MSU and collaborations were also enacted with Oak Ridge National Laboratories (ORNL) and a commercial partner, NVision Solutions, Inc. This research was administered by the Southeast Region Research Initiative (SERRI) for the Department of Homeland Security (DHS) and adheres to the goals and mission of DHS with specific regard to preparedness for future natural or willful disasters. The SSRC’s role in this research effort included an initial survey development workshop, the design and implementation of survey instruments to users and producers of geospatial data, and an end project workshop to gain feedback on the research findings.

The initial workshop was held as an information gathering approach aimed at collecting users and producers’ feedback regarding their opinions and experiences during the initial and subsequent weeks following Hurricane Katrina. The workshop was held at the Mississippi State University Coastal Research and Extension Center on August 7, 2007. The feedback resulting from this workshop served as a guide in developing the survey instrument that polled a much larger sampling of the geospatial product users and producers.

The survey was implemented in a mixed-mode (web-based and postal mail) approach aimed at gaining the largest amount of feedback possible. The survey participants were respondents who were part of a convenience sample population identified for the research project.

Numer of questionnaires sent: 563  
Number of rejected addresses due to false or incomplete addresses: 40  
Number of completed surveys: 60  
Response rate of 11%

Although the exact number of users and producers of geospatial data after Katrina is unknown, the resulting number of user responses (n = 44) and producer responses (n = 16) to the survey was considered acceptable by the project team to draw general conclusions. Likewise, it is impossible to know if the sample of survey respondents constitutes a representative sample of either of these two groups, but the consensus of the project team indicates there is a confidence in the number of participants and the findings resulting from the survey.

The survey focused on (1) person-to-person communication, (2) product delivery and timing issues, (3) map effectiveness in the decision making process, and (4) preparedness and resiliency estimation. From the survey results, the project team identified some major findings that clearly illustrate trends and the need for further research into the area of geospatial product use in disaster response and recovery efforts. The first of these finding is maps are universally considered to be an effective tool by users in the field.
Almost 80% of map user respondents stated that maps were very effective or somewhat effective in the decision-making process. A second finding is the identification of five critical data layers for inclusion on map products. Survey results show that both user and producer respondents feel that roads, emergency services, supplies (food, water, ice), hospitals and telecommunications were the most critical layers for most map products during response and recovery efforts. The third major finding was with regard to data access issues. From the survey responses, more than 50% of map producer respondents stated that data availability or data access issues were very often or often the reason preventing the production of a map product intend for users in the field. A fourth finding is the common belief that standardization of map products is a highly desirable benefit to disaster response and recovery activities. The prevalent opinion among map users is that there should be equal production of both standardized and customized map products, while producers tend to believe that a more standardized approach may yield more beneficial results. The fifth and last major finding was the overall belief that local EOCs outperformed both FEMA and MEMA in response to the needs brought about by the storm.

The survey results also proved to be an invaluable tool for the project team to understand the needs of users and producers as they worked towards the development of a functioning map-viewer web portal.

Following completion of the survey dissemination and information gathering, the project team hosted a 1-day end-of-project workshop at GRI on June 25, 2008. Our guest professionals applauded our research efforts and concluded by encouraging the research team to present three to five top research findings to the Mississippi Coordinating Council for Remote Sensing and Geographic Information Systems (more commonly referred to as the MS GIS Council). This was stated with the hopes that the council would place emphasis on the research results and continue to recognize emergency response issues as a top priority in the State of Mississippi.

This research effort uncovered many other interesting results that can be found on the Katrina Lessons website at [www.katrinalessons.msstate.edu](http://www.katrinalessons.msstate.edu). However, it should be noted that there is a need for more in-depth questioning of geospatial product users in response and recovery efforts. A better understanding of each culture’s standard operating procedures and their beliefs, opinions, and practices with regard to cartography, symbolism and characteristics for overall map effectiveness would be most beneficial to those who produce geospatial products.
INTRODUCTION

Disaster preparation, response, and recovery methods require the coordination of federal, state, and local agencies to effectively and efficiently cope with both natural and willful disasters. The utilization of Geographic Information Systems (GIS) allows individuals at each agency level to visualize disasters and coordinate their responses accordingly. However, as in the case of relief efforts after Hurricane Katrina, the inconsistencies in data collection, reporting, and dissemination coupled with mixed metadata development translate into disrupted and/or unusable data visualizations and information exchange to first responders and emergency agencies.

To gain a better understanding of the effectiveness of spatial data products developed in the wake of Hurricane Katrina, a “Katrina: Lessons Learned” research team was formed. The project team was lead by the GeoResources Institute (GRI) at Mississippi State University (MSU) and collaborations were enacted with Oak Ridge National Laboratories (ORNL), the Social Science Research Center (SSRC) at MSU and a commercial partner NVision Solutions, Inc. This research was administered by the Southeast Region Research Initiative (SERRI) for the Department of Homeland Security (DHS) and adheres to the goals and mission of DHS with specific regard to preparedness for future natural or willful disasters. Each entity was individually assigned a research thrust to be completed and synthesized into a cohesive end product deliverable. SSRC’s role in this research effort included an initial survey development workshop, the design and implementation of survey instruments to users and producers of geospatial data, and an end project workshop to gain feedback on the research findings. Further information
The project team hosted and facilitated a survey development workshop, implemented a survey instrument derived from workshop input, and lastly, hosted a 1-day end project workshop to garner feedback regarding survey results and product usage. The initial workshop allowed the team to gain insight into the perspectives and input of emergency response decision makers at the federal, state and local levels. The feedback resulting from this workshop served as a guide in developing the survey instrument that polled a much larger sampling of the spatial product users and producers. The survey results provided an invaluable tool for the project team to understand the needs of users and producers as they worked towards the development of a functioning map-viewer web portal. The survey also provided the project team with previously unknown factors regarding users’ and producers’ experiences and opinions during the initial and subsequent phases of the Hurricane Katrina response and recovery efforts. Following the completion of the survey dissemination and information gathering, the project team hosted a 1-day end-of-project workshop. This small group of workshop attendees allowed for more personal interactions and candid feedback as the project team visually displayed the survey results. In addition, the group was given the opportunity to explore the virtual showcase developed by the project team; displaying the various spatial products and information gathered during the initial phase of the “Katrina: Lessons Learned” project. As a result, the team was able to synthesize the results of the two
workshops and the survey product, resulting in an initial base of lessons learned in Hurricane Katrina response and recovery efforts.

**INITIAL WORKSHOP**

The initial workshop was held as an information gathering approach aimed at collecting users and producers’ feedback regarding their opinions and experiences during the initial and subsequent weeks following Hurricane Katrina. The workshop was held at the Mississippi State University Coastal Research and Extension Center on August 7, 2007. The workshop was targeted towards a group of “users of spatial product information for decision making”. While this target was not quite realized at the workshop, the workshop did provide insightful and incredibly useful feedback from the perspective of spatial product producers. Despite the lack of participation from first responders, the information from the first workshop was gathered and processed accordingly, providing input into the survey questionnaire development.

The workshop consisted of 2 breakout sessions, one morning and one in the afternoon, which were then divided into two groups. The groups were (1) federal and state agencies and (2) local and first responder agencies. Each group met in separate rooms and was given the same set of question topics for discussion. The concentrations for the morning breakout session were (1) person-to-person communication and (2) timing issues and product delivery. The focus topics of the afternoon breakout session were (3) map effectiveness and (4) preparedness and resiliency. The project team then proceeded to lead the groups in discussions regarding the various question topics and collected the
feedback from the group. The workshop report was compiled detailing the various findings and feedback provided by the breakout sessions and by the general discussion. One encapsulating outcome of the workshop verified the seemingly obvious assumption that natural and willful disaster response and recovery efforts require a unique collaboration among various agencies and organizations working together to contribute to the production of spatial products necessary to first response efforts. Another major outcome of the workshop was that a critical component of effective disaster management is the rapid characterization of the extent of damage both pre- and post-Hurricane Katrina. This workshop focused on collecting this type of feedback from targeted individuals from federal, state, and local emergency response agencies for use as an aid in the development of a broader reaching survey to gain the opinions, beliefs and attitudes of a greater number of disaster response individuals. In turn, the gathered results from this survey provided valuable input for the development of the GIS data delivery system by the project team. A more detailed report regarding the initial project workshop is located in Appendix A.

SURVEY QUESTIONNAIRE RESULTS

Capitalizing on the Social Science Research Center’s extensive history of surveying and their collective social science expertise, the project team developed a survey instrument using feedback from the initial workshop group in addition to input by various GIS and first response individuals. The survey was implemented in a mixed-mode (web-based and postal mail) approach aimed at gaining the largest amount of feedback possible. The survey participants were respondents who were part of a convenience sample population
identified for the research project. A convenience sample was utilized due to the nature of the survey questionnaire and the limited number of known contacts involved in the response and recovery efforts following Hurricane Katrina. The results of the survey proved to be an informative look into the experiences, attitudes, and beliefs of both users and producers of geospatial information with respect to the Katrina aftermath.

The survey instrument was disseminated using contact lists from NVision Solutions, Inc., the GeoResources Insitute, MSU and from the Mississippi State University Extension Service Center for Government Technology and Training. The latter was contacted with the hopes of using their vast contacts in the first responders and public services sectors. With cooperation from the Center for Government Technology and Training, the project team was able to blanket the state of Mississippi with surveys to first response individuals in each of the 82 counties. It should be noted that many of these responders may not have been a part of the Hurricane Katrina response and recovery efforts due to unknown factors. However, since the project team did not wish to exclude potential feedback from any that may have been involved, the project team disseminated the survey to the entire list. Response rates for the questionnaire can be seen in Table 1 below.
Table 1. Online Survey Questionnaire Results.

<table>
<thead>
<tr>
<th></th>
<th>Online Questionnaire</th>
<th>Postal Mail Questionnaire</th>
<th>Overall Questionnaire</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of Requests</td>
<td>121</td>
<td>442</td>
<td>563</td>
</tr>
<tr>
<td>Number of False/Incomplete</td>
<td>32</td>
<td>8</td>
<td>40</td>
</tr>
<tr>
<td>Address Rejections</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Number of Assumed</td>
<td>89</td>
<td>434</td>
<td>523</td>
</tr>
<tr>
<td>Successful Deliveries</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Number of Completed Surveys</td>
<td>34</td>
<td>26</td>
<td>60</td>
</tr>
<tr>
<td>Response Rate</td>
<td>38%</td>
<td>6%</td>
<td>11%</td>
</tr>
</tbody>
</table>

The project team was pleasantly surprised by the response rate of the online questionnaire and by the overall feedback from the survey. Although the exact number of users and producers of geospatial data after Katrina is unknown, the resulting number of user responses (n = 44) and producer responses (n = 16) to the survey was considered acceptable by the project team to draw general conclusions. Likewise, it is impossible to know if the sample of survey respondents constitutes a representative sample of either of these two groups, but the consensus of the project team indicates there is a confidence in the number of participants and the findings resulting from the survey.

The survey focused on (1) person-to-person communication, (2) product delivery and timing issues, (3) map effectiveness in the decision making process, and (4) preparedness and resiliency estimation. These four areas of emphasis break the survey into sections for analysis and reporting. The results of the survey displayed varying experiences and beliefs, both comparable and contrasting, between map users and map producers. From these results, the project team identified some major findings that clearly illustrate trends and the need for further research into the area of geospatial product use in disaster.
response and recovery efforts. A breakdown of the most compelling results is included in this report.

*Person-to-person communication*

Perhaps the most apparent and anticipated finding was that face-to-face communication was the main method of communication when requesting map products during the Hurricane Katrina response and recovery efforts. Of those responding, 59% of the map users and 64% of map producers indicated that face-to-face was the most frequently used method of communicating. When asked about the effectiveness of the above mentioned communication method, approximately 94% of users and 86% of producers found their face-to-face communication to be either very effective or at least somewhat effective (Figure 1). Essentially, users and producers agreed that, although most were reduced to having to communicate face-to-face in this disaster situation, the effectiveness of the communication method was favorable.

![Figure 1. Effectiveness of Chosen Method of Communication.](figure1.png)

Users (n = 44)  
Producers (n = 14)
Delivery and Timing

Timing of the delivery of map products is crucial in disaster response efforts. Responders face numerous obstacles, perhaps the most notable being the lack of time to perform response and rescue operations. Obtaining map products in a timely fashion is critical to the effectiveness of first responders’ efforts. Figure 2 shows the overall opinion regarding the timing of map product delivery. Approximately 70 percent of map user respondents stated that the timing of map products was either very effective or somewhat effective. Therefore, map users indicated they received maps and spatial products in a timely fashion despite the hectic nature of the surrounding circumstances. Producers, on the other hand, were not quite as favorable in their responses. While there was no significant negative feedback regarding the time to produce map products, the producers failed to respond that the timing was very reasonable. Almost 63% of respondents stated that the timing was somewhat reasonable while another 32% said that it was neither reasonable nor unreasonable. These results show an apparent discrepancy between the producers and the users of map products. It seems perceptions of time to produce maps are more restrictive compared to the perceptions of map delivery times. Producers may be more inclined to take additional time to produce the most effective and efficient map products for users while most users seemed content with the timing of map deliveries.
During the initial workshop, individuals indicated data access problems were a common occurrence in their Katrina experience and that this type of barrier prevented the production of map products intended. From the survey responses, more than 50% of map producer respondents stated that data availability or data access issues were very often or often the reason preventing the production of a map product intended for users in the field. The actual response breakdown is shown below in Figure 3.
Data availability, or lack thereof, was a common theme throughout the initial phase of this project. The continuing concern was never more apparent than in the responses given by the survey respondents. Considering the timing of the disaster and the difficulties with field issues due to the devastation, some of the most often referenced problems revolved around data availability and access, both of which arise from areas not affected by the disaster. Those located at EOCs during the first five days after Hurricane Katrina and in the second and subsequent weeks noted very similar problems. Of the nine survey respondents located at an EOC, 67% noted that data availability or data access were very often or often the issues preventing them from making the intended map products.

Map Effectiveness

Map effectiveness proved to be one of the more intriguing and satisfying topics in the survey. As shown in Figure 4, almost 80% of map user respondents stated that maps were very effective or somewhat effective in decision-making.

Figure 4. Effectiveness of Spatial Products in Decision-Making (n = 40)
Most response and recovery decision-makers indicated the use of geospatial products was an effective tool. A majority of map product user respondents (78%) located at or near EOCs stated that the maps were either very effective or somewhat effective in helping meet their needs and making decisions. Only one respondent noted that map products were very ineffective in helping make a decision.

One of the more pointed questions for map users respondents asked how difficult it was to read and/or understand the map products supplied to them. Again, a majority of map user respondents (64%) stated it was very easy or easy to read and understand the map products supplied to them. However, 29% stated that it was either somewhat difficult or neither difficult nor easy to read and understand the supplied map products. Curiously, some users found little or no difficulty in understanding the map products supplied to them while others indicated reading or understanding the map products may have been a problem.

Another issue that arose from our initial workshop was idea of standardizing some map products for use in disaster situations. Map users and map producers were asked whether they think map products should be standardize or customized. They were also given the option to choose equal production of both standardized and customized, or more of one over another. Figures 5 and 5a show the breakdown of both user and producer respondents, as well as a combination of responses from both users and producers.
The prevalent opinion among users is that there should be equal production of both standardized and customized map products, while producers tend to believe that a more standardized approach may yield more beneficial results. One possible explanation may be that map producers believe more standardized maps would streamline production and get useful maps in the hands of decision-makers more swiftly. Users of map products
may be biased towards more customized products that fit their specific needs without having the distraction of data layers which they do not consider to be useful.

Lastly, map users and producers were asked to gauge the importance each of the listed map layers in Figure 6 below. The respondents were given a five point scale from very critical to not critical at all and asked how critical are each of these layers were in disaster response and recovery efforts.

Figure 6. Critical Map Layers
Figure 6 also shows that both user and producer respondents feel that roads, emergency services, supplies (food, water, ice), hospitals and telecommunications were the most critical layers for most map products during response and recovery efforts. Certain layers were considered far less critical in the opinion of the respondents. Prisons, banking, and postal services were all rated far less critical than any of the other layers. One lower layer rating that is noteworthy and unexpected is the rating for parcel data. During the initial workshop, many comments were made regarding parcel data and how useful it would have been in the response and recovery efforts. Contrary to the attention received in the workshop, many respondents felt parcel data was not as critical as many of the other layers. One possible explanation could be some of the respondents may not be familiar with the word “parcel” or know the word’s meaning but may identify with the layer if it were included on a map. While this is a simple hypothetical speculation, it should be noted that parcel data rated fairly low in the survey responses.

Preparedness and Resiliency

The last portion of the questionnaire surveys respondents’ opinions concerning the effectiveness of FEMA, MEMA, and EOCs in the wake of Hurricane Katrina. They were asked to rate the effectiveness of each agency during the first five days after the storm and rate their performance again in the second and subsequent weeks. The scale for rating the agencies was a five point scale from excellent to poor. As can be seen in Tables 2 and 3, the survey results found that many feel FEMA and MEMA were not as effective as the local EOCs in meeting the many needs of this tattered region during the response and recovery efforts after the storm.
Table 2. Respondents Ratings of the Effectiveness of Emergency Response Agencies for the First Five Days after Katrina

<table>
<thead>
<tr>
<th>Effectiveness of Agency</th>
<th>FEMA (n = 58)</th>
<th>MEMA (n = 58)</th>
<th>EOCs (n = 58)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Excellent</td>
<td>8.6%</td>
<td>8.6%</td>
<td>17.2%</td>
</tr>
<tr>
<td>Very Good</td>
<td>13.8%</td>
<td>24.1%</td>
<td>20.7%</td>
</tr>
<tr>
<td>Good</td>
<td>22.4%</td>
<td>27.6%</td>
<td>27.6%</td>
</tr>
<tr>
<td>Fair</td>
<td>22.4%</td>
<td>19.0%</td>
<td>19.0%</td>
</tr>
<tr>
<td>Poor</td>
<td>22.4%</td>
<td>10.3%</td>
<td>0%</td>
</tr>
</tbody>
</table>

Table 3. Respondents Ratings of the Effectiveness of Emergency Response Agencies for the Second and Subsequent Weeks after Katrina

<table>
<thead>
<tr>
<th>Effectiveness of Agency</th>
<th>FEMA (n = 58)</th>
<th>MEMA (n = 58)</th>
<th>EOCs (n = 58)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Excellent</td>
<td>8.6%</td>
<td>6.9%</td>
<td>19.0%</td>
</tr>
<tr>
<td>Very Good</td>
<td>17.2%</td>
<td>25.9%</td>
<td>32.8%</td>
</tr>
<tr>
<td>Good</td>
<td>29.3%</td>
<td>34.5%</td>
<td>25.9%</td>
</tr>
<tr>
<td>Fair</td>
<td>25.9%</td>
<td>20.7%</td>
<td>6.9%</td>
</tr>
<tr>
<td>Poor</td>
<td>17.2%</td>
<td>5.2%</td>
<td>0%</td>
</tr>
</tbody>
</table>

Furthermore, the respondents were asked to offer their beliefs regarding the preparedness of FEMA, MEME, EOCs, as well as themselves for future disasters. Just over half of the map user respondents feel that they are much better prepared for a disaster following their
Hurricane Katrina experience. Map producers as a whole also feel they are better prepared, although there are a few responses of neither better nor worse prepared in the survey findings. While most say they are personally much better or slightly better prepared, there is a slightly downgraded opinion of their agency’s preparedness in the event of another disaster, as seen in Figures 7 and 7a. It is interesting that as a group the respondents do not share quite the same optimism for their respective agencies.

**Figure 7. Personal Preparedness for a Future Disaster (n=58)**

- Much Better: 55%
- Slightly Better: 36.7%
- Neither Better nor Worse: 10%
- Much Better: 3.3%

**Figure 7a. Agency Preparedness for a Future Disaster (n=55)**

- Much Better: 45%
- Slightly Better: 36.7%
- Neither Better nor Worse: 18%
Summary

The Katrina Lessons project team led by the GeoResources Institute at MSU and in collaboration with Oak Ridge National Laboratories, the Social Science Research Center at MSU, and NVision Solutions, Inc. combined their research efforts in an attempt to learn lessons from the use of geospatial products during the Hurricane Katrina aftermath. The SSRC’s role in this research effort included an initial survey development workshop, the design and implementation of survey instruments to users and producers of geospatial data, and an end project workshop to gain feedback on the research findings.

SSRC’s major thrust was the development and implementation of a survey to users and producers of geospatial data (maps) in the wake of Hurricane Katrina. From the survey results, the project team identified some major findings that illustrate the need for further research into the area of geospatial product use in disaster response and recovery efforts. The first of these findings is maps are universally considered to be an effective tool by users in the field. Almost 80% of map user respondents stated that maps were very effective or somewhat effective in decision-making. A second finding is the identification of five critical data layers for inclusion on map products. Survey results show that both user and producer respondents feel that roads, emergency services, supplies (food, water, ice), hospitals and telecommunications were the most critical layers for most map product during response and recovery efforts. The third major finding was with regard to data access issues. From the survey responses, more than 50% of map producer respondents stated that data availability or data access issues were very often or often the reason preventing the production of a map product intend for users in the field.
A forth major finding is the common belief that standardization of map products is a highly desirable benefit to disaster response and recovery activities. The prevalent opinion among map users is that there should be equal production of both standardized and customized map products, while producers tend to believe that a more standardized approach may yield more beneficial results. The fifth and last major finding was the overall belief that local EOCs outperformed both FEMA and MEMA in response to the needs brought about by the storm.

This research effort uncovered many other interesting results that can be found on the Katrina Lessons website at www.katrinalessons.msstate.edu. However, it should be noted that there is a need for more in-depth questioning of geospatial product users in response and recovery efforts. A better understanding of each culture’s standard operating procedures and their beliefs, opinions, and practices with regard to cartography, symbolism and characteristics for overall map effectiveness would be most beneficial to those who produce geospatial products.
PROJECT END WORKSHOP

At the end of the Capturing Hurricane Katrina Data for Analysis and Lessons-Learned Project the research team held a 1-day end-of-project workshop at GRI on June 25, 2008 to gain outside perspectives on the findings and outcomes of the project. The 1-day workshop was conducted in lieu of the 2-day symposium due to the registered attendance of a smaller group. There were eighteen invitations sent requesting participation and we were honored with presence of two outstanding professionals. The following are their names and affiliations:

1. Dr. Henrique Momm, University of Mississippi
2. Mr. Craig Ogeron, Mississippi Department of Information Technology Services

Dr. Momm and Mr. Ogeron provided an array of relevant feedback that was well received by the project team. The team members in attendance at this workshop were as follows:

1. Dr. Bill Cooke, GRI/MSU
2. Ms. Rekha Pillai, GRI/MSU
3. Mr. Joel Lawhead, NVision Solutions, Inc.
4. Mr. J.J. “Dallas” Breen, SSRC/MSU
5. Mr. David R. Parrish, SSRC/MSU

The project team gave presentations commensurate with the findings and developments of the research project. Dr. Cooke gave an overview of the project scope, a recap of the Fall 2007 Workshop in Biloxi, MS, and specifically outlined the objectives of the research. Mr. Breen and Mr. Parrish presented findings from a survey that was developed for users and producers of spatial data in the Katrina disaster. Mr. Lawhead informed the group of the results of the GIS-based, community level application
development for disaster response. And lastly, Dr. Bill Cooke and Ms. Rekha Pillai demonstrated the function and capability of the newly developed interface and enterprise database and analysis system for disaster response.

Throughout the presentations questions and comments enhanced the collaborative discussion. One such topic of discussion was the finding of five critical spatial data layers (roads, emergency services, food/water/ice supplies, hospitals and telecommunications) according to the polling of 60 survey participants. These layers were also thought to be an important discovery by our guest participants. The group noted that these layers should somehow be standardized in terms of their cartographic elements and symbology to allow much faster interpretations by various response cultures in future disaster situations.

Our guest professionals concluded by encouraging the research team to present three to five top research findings to the Mississippi Coordinating Council for Remote Sensing and Geographic Information Systems (more commonly referred to as the MS GIS Council). This was stated with the hopes that the council would place emphasis on the research results and continue to recognize emergency response issues as a top priority in the State of Mississippi.

Although there were not as many workshop participants as anticipated, the overall result of the workshop was believed to be a success. Dr. Henrique Momm and Mr. Craig Ogeron provided the research team with valuable feedback and an outside perspective of
the project results. Their expertise aided in honing our output for future presentations of
the spatial data users/producers survey results, the community geospatial application
developments, and the demonstration of the enterprise database and analysis system for
disaster response.
Appendix A

Initial Workshop Report
Survey Development Workshop for the Southeast Regional Research Initiative (SERRI) Project: Capturing Hurricane Katrina Data for Analysis and Lessons-Learned Research Project

Authors: David R. Parrish and J. J. Dallas Breen

Social Science Research Center, Mississippi State University

Mississippi State University Coastal Research and Extension Center
Gulfport, Mississippi
August 7, 2007
TABLE OF CONTENTS

INTRODUCTION

OPENING/GENERAL SESSION

BREAKOUT SESSION #1
(Human to Human Communication,
Timing Issues and Product Delivery)

Group 1: Federal and State Agencies
Group 2: Local Agencies and First Responders

BREAKOUT SESSION #2
(Map to Human Effectiveness, Preparedness and Resiliency)

Group 1: Federal and State Agencies
Group 2: Local Agencies and First Responders

WRITTEN QUESTIONNAIRES

SUMMARY
INTRODUCTION

Disaster preparation, response, and recovery methods require the coordination of federal, state, and local agencies to effectively and efficiently cope with both natural and willful disasters. The utilization of Geographic Information Systems (GIS) allows individuals at each agency level to visualize disasters and coordinate their responses accordingly. However, as in the case of relief efforts after Hurricane Katrina, the inconsistencies in data collection, reporting, and dissemination coupled with mixed metadata development translate into disrupted and/or unusable data visualizations and information exchange to first responders and emergency agencies.

To gain a better understanding of the effectiveness of spatial data products developed in the wake of Hurricane Katrina, the “Katrina: Lessons Learned” research team hosted and facilitated a survey development workshop. This workshop was proposed to gain the perspectives and input of decision makers from federal, state and local agencies as well as first responders. The feedback resulting from this workshop was intended to serve as a guide in developing a survey instrument for polling a larger group of spatial data users involved in the hurricane aftermath.

Unfortunately, the targeted participation of “users of spatial product information for decision making” was not realized, and a majority of the contributions were from the perspective of the spatial product producers. In fact the only first responder participants who were present for the morning general session departed before any of the breakout sessions began. Nevertheless, the sessions were conducted and information was gathered.

For the breakout sessions, the group was split into (1) federal and state agencies and (2) local and first responder agencies. Each group met in separate rooms and given the same set of guideline questions for discussion. The concentrations for the morning breakout session were (1) human-to-human communication and (2) timing issues and product delivery. The focus topics of the afternoon breakout session were (3) map-to-human effectiveness and (4) preparedness and resiliency. This report contains the ideas,
perspectives and beliefs captured in the breakout sessions as well as a summation of the written feedback from participants.
GENERAL SESSION
GENERAL SESSION

Dr. David Shaw, Project Principal Investigator and Director of the GeoResources Institute (GRI) at Mississippi State University, provided a welcome and asked each participant to introduce themselves to all others at the workshop. Afterwards, Dr. Shaw gave a quick overview of the Capturing Hurricane Katrina Data for Analysis and Lessons-Learned Research Project. He announced the Mississippi Department of Information Technology Services (ITS) is provisioning a GIS data delivery system based on the Mississippi Coordinating Council for Remote Sensing and GIS plan.

Dr. Budhendra Bhaduri, Research Leader of the Geographic Information Science and Technology Group at Oak Ridge National Laboratory (ORNL), highlighted the work of Chelsea DeCapua, Research Intern at ORNL. Ms. DeCapua’s research of all publicly available documents worldwide resulted in only four documents that mentioned geospatial technology. Dr. Bhaduri continued by indicating a need to tie local level information to federal level information. He stated that local map users need legitimate and reliable information that is appropriate for their purposes. Similarly, the national decision makers need information from spatial products that is credible. We must capture the information of who made the decision to make a particular spatial product and why?

Mr. Joel Lawhead, Program Manager and Web Application Developer for NVision Solutions, Inc., acknowledged that NVision had begun establishing a “GIS Best Practices” for maps and geospatial analysis. Asymmetric warfare exercises illustrated that well-conceived maps can bridge gaps between (1) response agencies, (2) first responders and other decision makers, and (2) levels of decision making. Mr. Lawhead also pointed out that quick map productions (immediately post-disaster) and rapid updating are critical components to successful geospatial solutions in the wake of a disaster. Joel finished his opening session remarks by stating that NVision identified twenty basic map layers that were most common based on post-Katrina needs.

Mr. David Parrish, Senior Research Associate for the Social Science Research Center (SSRC) at Mississippi State University, declared the primary focus of the workshop was
to discuss the ideas and experiences of individuals with respect to the production and use of spatial products in the aftermath of Hurricane Katrina. The intent of these discussions was to aid in the development of a web-based survey on how GIS can help (1) human-to-human communication, (2) map-to-human communication, (3) timing in the decision making process and (4) the resiliency of the state of Mississippi in the event of the next natural or willful disaster.
For the most part, users of spatial data understand that there are map tools available but really don’t recognize what these various types of data maps can do for them. Part of the reason for this lack of awareness is the communication gap between the two separate cultures:

1. data users (first responders at all levels)
2. data producers (tech folks).

It was mentioned that a future role of a GIS manager in a disaster situation could be to bridge these disparate groups of individuals (and agencies) for efficiency. A GIS manager could perhaps turn decision-maker needs into a product that fits those needs. It is unfortunate that most of the communicated needs were lost in translation, however, on a positive note, it was stated that the responders from the Mississippi Department of Environmental Quality did know the questions to ask GIS personnel in order to facilitate map production. There needs to be a template that works for the federal folks all the way down the ladder: a nomenclature and ontology that could be adopted by all agencies.

Another major communication disparity involved the levels of government. County, municipal, state, and federal individuals and agencies as a whole did not correspond with one another in a productive sense. The state agencies could not get information to flow in reverse from the federal government. Data restrictions were relaxed for a period but the need was still there when regulations tightened and data access was denied. Similarly, there was too much of a “big brother attitude” from the locals that did not permit data being divulged for the public good.

The issue of delivering maps or data was discussed and most agreed that a physical or electronic map was more suitable than being sent data to be processed on the receiving end. Consequently, it is the main goal of the GIS arm of an EOC to create custom maps for specific purposes in the effort to respond and recover.
In the aftermath of the disaster, a majority of the responders could not orient themselves and navigate. Therefore, the most requested map types displayed roads and functioning cell phone tower locations. The EOC received calls for military and out-of-state police stating they had “tom-toms” and were located at a certain lat/lon. They wanted verification (from aerial imagery) about what they were supposed to be seeing at their particular location. A positive from the data production perspective was that starting points on the maps were known because of coast guard verification in helicopters.

Many references were made concerning the idea that data integrations should be performed before a disaster happens. Parcel data was a highly sought commodity in the wake of the storm and none could be provided. These parcel data should be accompanied by the type of property (industrial park, strip mall, residential, etc.) and how many people should be expected in a dwelling on that property. This information could perhaps be derived from tax assessor data if it were available. Also, 911 records could be pulled in to help verify or complete these tasks. There was also an accord among the attendees concerning the adoption of a common format for operating data.

Discussions about the data to include on a map were encapsulated in two terms: everybody and everything. Although, it was mentioned that maps should not be overloaded with too much information that doesn’t serve a need. The participants agreed that a map tool could be implemented that could address 70 percent of the need in a response effort of a disaster situation. Everyone also agreed that response phase map quality can be less than recovery phase map quality. GIS folks will tend to put more than the needed information on maps and some will try to make the maps aesthetic more so than functional. Simplicity is a key issue to remember.

Some particularly important themes were pointed out:

1. Special needs populations
2. Shelters
3. Distribution points (food, water, ice, etc.)
As stated earlier, there was a lot of controversy surrounding sources and access to data. Should a decision-maker use the first data available or search for more credible data? Responder’s use of GIS services such as Google maps and Mapquest proved to a valuable and identical reference source for communication. Lines of communication were damaged in such a way that packages of maps were shipped out by helicopter from Jackson to the Gulf Coast and hard drives were transported from universities to the EOCs by automobiles. Communication other than face to face could not be conducted with any degree of predictability. Temporary passwords and other limits to access was also a topic of conversation.

It turns out that lack of raster data is not a problem. In fact, the problem was too much raster data! Vendors wanted to give an abundance of data. However, the post-processing of this data would take too much time for its worth. There should be teleconferences to identify flight patterns for aerial imagery.

Reporting and updates were also a major problem. Responders visited the same property again and again because there was no reporting channel. This begs the question, how are any data changes put back into a common system? How do you collect real time data and give to people on the ground? Can you empower the public to add content? It would start with the infrastructure to support the collections. Then there would be the problem of too much data coming in and people working on getting it in versus helping out in the field. Also there would be much data to verify.

Data request priorities were not standardized for focus and efficiency. Data providers agreed that priorities should be placed on map productions. Requests should meet a set of criteria before production begins. Otherwise, time is wasted. Also, tangents from previously made maps can consume an abundance of time with no intended purpose. However, maps were displayed outside EOCs so others could see them and imagine how to use these maps constructively.
FEMA protocol is to find the state lead for geospatial. Often this person is not the one with the answers. GIS personnel and locals can answer questions more accurately.

The change over from the Magic Bus to the JFO took place and it was two weeks before FEMA GIS person was known to be on hand. There were plotters and paper on pallets that were not being used.
Breakout Session #1: Local Agencies and First Responders
Human-to-Human Communication, Timing Issues and Product Delivery

Timing and availability of imagery and data access dominated the majority of the beginning stages of the early morning session. Some of the most perplexing issues the data producers face included 1) availability of accurate data needed to provide accurate products, 2) accessibility to various levels of data in response efforts, and 3) sheer size of data available for use at the time. The timing of the data delivery was not consistent with the needs of the individuals requesting the information. This inaccuracy was further complicated when the provided data proved to be inaccurate with the existing data on hand. This breakdown in accuracy versus timing proved to be a daunting hurdle for the map producers in attendance at the workshop.

Accessibility to the data available also proved to be a large hurdle for those wishing to produce spatial products for the response efforts. Imagery proved to be the most complete information available, but was inaccessible to those who needed the product the most. NOAA flew their planes to collect imagery at the end of August, but the providers were forced to purchase the aerial imagery from Image America due to the inability to contract the NOAA Imagery. In addition to this complication, there were large barriers noted in the needs and collection of the various data between the federal/state agencies and the providers in the field. Many felt the various levels of bureaucracy hindered the immediate response efforts made by those in the field. The result in this delay resulted in an over-abundance of post-event imagery without follow-up imagery for comparison purposes.

The last issue discussed in the early stages of the session was the size of the data provided. Many of the local providers received upwards of 12 gigabytes of data with no real means of processing the data. Many of the local producers were faced with the task of disseminating data without adequate means of processing the available information. As was noted, there were hundreds of computers donated to Mississippi for the response efforts, yet none were able to locate the provided computers in order to use their
computing power. Instead, many were faced with the task of processing this information with the limited processing capabilities previously on-hand.

In addition to these topics, inter-agency cooperation became a heavily contested topic of discussion. Many felt that there was little to no cooperation between FEMA/MEMA and those that were on the ground. These discrepancies came in the shape of incompatible standards, ineffective liaison interactions, and assistance by the participating government agencies. Some noted that when FEMA attempted to be helpful, they were unable to contribute any type of useful information whether through data or spatial products. There was also some discussion about the availability and access to the utility companies’ data and information due to sensitivity issues. Because of the sensitivity of some utility data, the utility companies were unable or unwilling to share the available data with the first responders. These complications proved to be a perplexing hurdle for producers to overcome when trying to provide the most basic information to those on the ground.

Some of the more pertinent issues posed from the group included:

- Timely imagery delivery
- Federal data distribution policies
- Lack of disaster map standards
- Formalization of GIS in ICS
- Inclusion of utility data (namely telephone and electric power)
- Parcel data and street attributed centerline
- Flow of computing resources coming into the State

These topics dominated the majority of the session as a whole. This list was created to give the workshop participants a cooperative understanding of the issues faced across local agencies during this response effort. The producers noted that these were key issues in Katrina’s evaluation process concerning the effective delivery of spatial products in the event of future disasters.

Perhaps the most interesting notion presented in the workshop session was the lack of prior spatial product knowledge before the disaster response. Individuals’ lack of
knowledge pertaining to the various types of information available created an extra layer of communication issues. Also, because the available information was provided online, many did not know where to turn when the connectivity was lost. When faced with questions of where to get the information, producers were forced with the task of directing individuals to available information on the ground. Without the necessary methods of obtaining the online information, producers attempted to inform the responders of the different products that were readily available. Because of the limited working knowledge of the various types of spatial products, this disconnect created barriers to effective communications and response efforts.

Given the expansive needs of spatial products during response and recovery efforts, it may be impossible to overcome certain aspects of these disconnects in the communication efforts. However, addressing issues of timely availability, set policy guidelines, and a formalized method of production and dissemination may provide the proper framework for effective communication between humans in the field and those determining the policies in which to operate in future disaster events.
Maps are intended to take the place of a person telling a story. Reading these stories (maps) always leads to the potential development of parallel or tangent stories. The “wouldn’t this be better if …” or “wouldn’t it be great if …” type of questions are ongoing in disaster situations. Some of these suggestions for additional spatial products are warranted and add value to the response and recovery efforts. Other suggestions tend to deviate focus and would be better suited to post-recovery research efforts. One approach to continuing quality productions while reducing excessive modifications is to develop a “standard but flexible” design or template for about 20 kinds of spatial products. These standards could be the basis for map productions in the next disaster situation and hence evolve during any newly encountered situations.

A few of the map/data requests mentioned in the workshop:

- Blue roof maps with a wind map overlay to validate damages
- Identification of places to put debris
- Demographics
- Enhanced imagery to detect whether homes are in good condition or bad
- Reports on ranges of numbers rather than absolutes (fatalities, evacuees, etc.)
- Locations of food, water, ice supplies and distribution points (very critical)
- Where do people live and where do they work? Will they be available during a disaster or will they be with their family?
- People databases
- Physical infrastructure
- Topography
- Local 911 data

One critical component of effective disaster management is a rapid characterization of the extent of disaster pre-and post-Katrina. Updating maps with temporal changes is also an essential component of spatial product production in a disaster situation. The map users community take the stance of “keep ‘em coming” when referring to the frequency and availability of map products. The map producing community questions for instance,
“Why do I need to update a power map twice a day?” or “How often is change detection needed for forests?”

Assigning priorities to map productions based on a map request form is an interesting topic. A map user could indicate a “use” for the map and the time of production will be dependent upon a previously designed queuing system. Naturally the request form will evolve over time as technologies and situations dictate change. When asked about the value of GIS in an emergency response and recovery effort, a response was “the true value of GIS will be realized when you can say “x” number of lives or millions of dollars are saved by using the technology.”

During the response and recovery efforts, GIS emergency personnel and/or volunteers were derived from the social capital that was already in the geospatial community. Many believe not only the people, but also the equipment, were put together hastily and unsystematically. For instance, GIS operations moved from using ArcView® 3.3 to using ArcGIS® 9.0 in the middle of the aftermath. This was apparently a misguided decision and surely disruptive. Furthermore, even though it took a week to get volunteers to the EOC, some volunteers had to be turned away because of lack of mapping experience. They wanted to learn, but there is very little room for teaching and tutoring GIS in a disorganized setting. Sleep and downtime is actually a much better way to allocate time. The fact plainly is GIS personnel in an EOC must be of sufficient knowledge and flexibility to adapt to changing roles. A disaster situation definitely requires hasty action; however, planning for a disaster can perhaps establishes a systematic and pragmatic order to a chaotic state of affairs.

Also during Katrina’s aftermath, spatial product users in the field were in many ways at the mercy of technology in their correspondence. Some field personnel brought GPS units and wished to know latitude and longitude readings. Other relied on jagged cell phone communication to navigate. Of course the EOC accommodated each request accordingly. However, in retrospect some have indicated a feature that would enhance emergency operations in the future – the implementation of a digital viewing system for
first responders in the field. This system may be possible in the future, but it must be a common system known to all. First responders have also specified that they should only be trained in the systems they will actually use in the field. The use of Blackberrys for the end user is not a widespread, catch-all solution yet.

A related issue was, “How can first responders passively collect data and transfer it back to the EOC?” Of course actively collecting data would not be a justifiable activity compared to trying to save lives. The solution would have to be a system where the collection and transmission of the information is completely transparent to the first responder.

In terms of overall spatial product effectiveness, perhaps the best measure would be a measure of progress – a measure of successes. Sadly, this is a measure that is not currently built into a disaster response and recovery system. Maps tend to fail quietly. Perhaps taking the time to provide feedback would inhibit other activities that are deemed more beneficial and urgent. Nevertheless, a metric of success should not be the number of spatial products produced.

The resiliency of the Mississippi Gulf Coast is apparent and can be attributed to the hand-to-hand cooperation of all those involved in response and recovery efforts. The question that will be continually asked is “Are we more resilient now than we were before Katrina?” It was noted that MEMA has plans in place so Mississippi is better prepared for the next disaster. MEMA had one GIS person before Katrina and now has about eight, and the staff increased from 60 or so persons to about 170. The consensus among the federal and state workshop attendees is everybody is more connected now, and although a new disaster would perhaps be just as chaotic, at least the newly developed connections would serve and benefit the emergency responses of the state.
The primary purpose of maps is to inform individuals of an ongoing event, similar to one telling a story. Discussions surrounding these maps tend to focus on the “what ifs” and “what about this” sentiments. While these can be useful in creating a framework for products, often it is necessary to take into account the practical usefulness of map products when determining an ultimate product. These recommendations in conjunction with recovery research efforts can be utilized to create a standard of spatial products.

Early discussions focused on the different elements needed in the spatial product to create an effective means of recovery response efforts. Many producers felt that in order to have effective spatial products, certain aspects, or layers, were needed to create a useful product capable of being utilized in the field. The group classified these aspects into a listing of the most important spatial data layers.

The list included:

- Population density
- Structure type
- Transportation infrastructure
- Parcels
- Streets
- Post event imagery
- Flood zones
- Updated “standard” topographical maps

Perhaps the most notable comment of the session came during the middle stages of the session. One producer stated, “Are we better prepared now than we were then?” To this, another responded, “We are now aware of what we don’t know”. This is of particular interest to research efforts in the area. There are an abundance of resources available, yet access and information need to utilize these resources is not readily available. There seems to be too much data driven development without enough emphasis placed on application-data development efforts. Individuals do not feel that the availability of
accessible information is a capability of current response and recovery operations. One additional note concerns the accuracy of available information. If there are to be standardized elements of spatial product development, it is essential that the data be accurate and consistent. Population data was one of the areas of noted concern due to its inaccuracy and lack of reasonable population estimates.

Some of the additional requests presented the producers with a unique set of opportunities and feedback segments regarding needs. One noted request was the location of all heads of houses to gauge salmonella outbreak potential. Other requests came from state government agencies requesting power outage and water availability maps. These unique requests present a varied look into the needs of different individuals serving varying purposes in their collective response and recovery efforts.

Politics also played a large role in the production and dissemination efforts. One producer noted that he/she received a request for a power outage map by a government agency. The responder reported being informed that the map was needed to promote encouraging response efforts. Others reported that the products being disseminated deteriorated into political media bait and lost its usefulness. While this type of response is important, it should also be noted that it was not uniformly agreed upon and could represent only a small fraction of the overall response effort. In addition to the political influence, state agencies also posed as hurdles to the individual producers. There was no apparent format as defined by the state mandates. This lack of format was unanimously agreed upon as one of the biggest hurdles to overcome concerning effective delivery of the spatial products.

Concerning all of the useful spatial products available and disseminated, the most sought after and ultimately important products utilized during the efforts were common street maps. Most producers recalled a large amount of street map requests coming from all areas of first response efforts. The one element lacking in this product was simply updates to the available street level information. Most were distributing street maps using 1990 Census-level TIGER files with the street locations. Unfortunately, this
information is largely out of date and produced several basic street maps that were virtually ineffective for first responders. The basic street maps also proved difficult when dealing with extended street signs. Issues where a Main St. sign became Main St. extended were given as examples of standardization issues when dealing with basic street maps without up to date information.

While many producers had difficulties in various areas of product development, most noted their difficulties stemmed from the lack of personnel available to process and respond to such disasters. For instance, Jackson County currently has only two trained GIS personnel on staff. Also, Harrison County noted a lack of available staff with GIS capabilities able to assist during these efforts. Recovery efforts made by various agencies, Mississippi State University included, aided in this lack of personnel but also faced similar communication issues when they arrived to help with the response efforts.

Lastly, as previously noted, standards became the main focus of effective response efforts. The standardization of production, delivery, and use was found to be key among the producers’ opinions. Without standardized processes, the respondents noted that it would prove difficult to effectively manage and respond to disasters in the future. This standardization element was a focus of both local and first responders’ sessions and continues to be the focus of ongoing research into the development of future response and recovery efforts.

Ultimately, the responders provided valuable insight into the different hurdles and successes in their interactions during the Hurricane Katrina disaster response and recovery efforts. The idea of standards and formalized procedures based on emergency response standards proved to be the ideal goal of the individual producers. Also, the lack of identifiable methodologies proved to be a major hurdle in the ongoing response and recovery efforts. While some efforts seem fruitless, others were noted as having good success during these efforts and can be used as reference points for future efforts.
WRITTEN QUESTIONNAIRES
1. In the aftermath of Hurricane Katrina, did YOU or YOUR agency know spatial data were available and how these data could help in decision making processes? Most of the responders said that they did know about the data. One response did, however, say that they were not always sure of what to do with the data. Another stated that while they themselves had access to the data, a lot of the agencies they worked with did not.

2. What individual (job title) and/or which agency made requests for spatial products?
Responders stated that a large variety of agencies made requests for products. Some of the often-cited ones were FEMA, MEMA, and DEQ. A couple of responses just said “everyone”.

3. What overall protocol was followed in making a request? Who was the first person YOU contacted? Did you make a phone call or e-mail your request? If more than one, how many people did you have to contact before your request was channeled to the proper authorities?
There were a variety of responses. Most of the responders stated that basic map-making forms were generally used in making a request. One stated that map requests were handled in group discussion. One stated that most requests were made face-to-face, and that it was due to having a room at the EOC.

4. What was the request, and for what need was the request made?
One responder provided a list of requests that were made: road maps for navigation, points of interest for navigation and planning, damaged areas for decision making, water flow models for search and rescue, and geocoding for emergency locating. Other responders listed rubbish disposal maps, PODs from FEMA for distribution coordination, and imagery from the Air Force for damage assessment.

5. When YOU had a decision to make and you knew a spatial product could possibly aid your in your decision, did you know HOW to ask a GIS person for the specific map product you needed? In other words, what were the communication barriers or failures, if any?
Responders answered that they did know how to ask a GIS person for a specific map and that there generally were no barriers. One response stated that data was occasionally denied.
6. In your opinion, does YOUR agency now know how to access the data available? Are YOU better prepared in knowing who to contact for spatial products in the event of another natural or willful disaster?

   All responders answered that they do now know how to access the data, and that they are now even better prepared for the future.

**TIMING ISSUES AND PRODUCT DELIVERY (10:15 am – 11:00 am)**

1. Were the spatial products YOU requested supplied in time to meet the intended need or help make the decision at hand?

   Four responders stated that the products were supplied in time. One responder answered no.

2. If not, then in your opinion, what were the contributing circumstances that prevented a timely delivery?

   A few different responses were given. One gave data acquisitioning as a reason that data was not able to be provided on time, as they had the hardware, software, and time but not the data. Another cited miscommunication. A third response stated red tape as a reason.

3. Do the spatial data users in YOUR agency determine data request priorities within the agency before submitting requests to data providers?

   All responders answered yes.

4. If so, how do the data users in YOUR agency come to a consensus about data prioritization?

   One response stated that their prioritization list, in order, was EOC director, FEMA, and other agencies. A couple of responses simply stated whatever is needed first is prioritized. Another said that prioritization decisions were mostly made by the department director.

5. To expedite spatial data services, should data providers assign priorities to incoming data requests? If so, how could this be accomplished and what are the potential consequences?

   All but one responder said that data providers should assign priorities to incoming data requests, and said that first responders and most-damaged areas should come first. The other responder said that assigning a priority could limit a decision or action that might later turn out to be more important or time-sensitive that first believed.
6. In lieu of the above, should the data providers accept only authorized requests? Who would serve as the authorizing entity?
   Three of the responders stated that data providers should not accept only authorized requests. Two said that they should only accept authorized requests, including one who was not sure who should authorize and the other who gave the state and FEMA as possible authorizing entities.

7. In your opinion, do the political influences that surround disaster situations mostly improve or hinder the efforts of data providers?
   Four thought that political influences hindered the efforts of data providers. One thought that political influences improved the efforts. Another stated that it was some of both.
8. After being supplied the spatial product YOU requested, was the product appropriate for aiding in the specific decision for which it was intended?
Half of the 10 responders believed that the product was appropriate for their uses, while the other half believed it was not. Some of those who thought that the product was not effective for their needs said that it took too long to receive the imagery. A responder who worked with the organization making the maps said that maps were frequently misinterpreted by the end-users and users had to be told many times that a slosh model was a prediction, and not specifically calculated for the event. This responder also said that the maps had these types of disclaimers, but that no one read them.

9. How effective was the spatial product? Did it exceed or fail your expectations?
Half of the responders, 5 out of 10, felt that it exceeded their expectations. One of these responders, however, did admit that his/her expectations were very low. Out of the other half of the responders, two felt that it failed. One of those two stated that streets were very hard to find on the map due to the missing road signs from Katrina and added that they had to count streets from known landmarks to find a specific one. The other said there were major data problems at the local level. The other three responders were mixed in their response. One of these was a member of the map-making organization and said it took several drafts to create a sufficient product because people often did not fully explain their needs. Another of the responders with a mixed answer said that products relying on very accurate parcel, road, or addressing data could have been better.

10. Was the map useful in other decision making activities?
All of the responders who answered the question said that it was useful if other decision making activities. One said it helped to map road closures and route EMTs. Another said that it helped in identifying parcels over a certain number of areas. A third said it caused more search and rescue operations to be successful. One other responder said that they were continually surprised by the innovative use and reuse of maps by first responders.

11. What improvements would you suggest to make the spatial product more useful?
There were a large variety of improvements suggested. One responder suggested that the maps be created in an easier-to-understand format for end-users. Another suggested that “map books” be used and maps be printed on Tyvek paper with waterproof ink. Others suggested open access to
current and accurate post-event data, faster delivery, rectified imagery, standardized symbology, standardized map requests, longitude and latitude on all points-of-interests, and a sustainable process for local maintenance of the maps.

12. Would you use dated map products (products intended for another purpose) to aid in your decision making instead of attempting to get the most recent product available?
   Most responders, 11, said that they would use dated map products. Almost all agreed, however, that dated products only be used if no updated products were available. A couple of other responders were adamantly opposed to dated products, but still said that they would use them if nothing newer was available.

13. What are the critical map themes that should be considered most important in the resiliency efforts of a region after a disaster?
   Responders gave a lot of themes that they believed to be most important. Some of the most common answers were road maps, parcel maps, maps showing health and survival products (water, ice, etc.), transportation maps, maps showing population density, and utility infrastructure maps.

PREPAREDNESS AND RESILIENCY (1:45 pm – 2:30 pm)

1. In your opinion, do you feel WE, (1) as the State of Mississippi and (2) as a nation, are better prepared for a natural or willful disaster than we were before Hurricane Katrina?
   Most responders felt that the state of Mississippi and the nation are now better prepared for a natural or willful disaster, but many also agreed that more could still be done. A few responders felt that Mississippi is better prepared due to the integration of things such as GIS, but that the nation is not better prepared, mainly due to the lack of communication between local, state, and national levels. Along with this reason, most of those who felt that neither Mississippi nor the nation is better prepared also believed that data and resources need to be stored and allocated more efficiently.

2. Do you consider YOURSELF to be better prepared, less prepared, or about the same level of preparedness for a disaster event since Hurricane Katrina?
   Almost all of the responders, 13 out 16, said they believed themselves to now be better prepared for a disaster event. The other three responders said they were at about the same level of preparedness.
3. In YOUR opinion, does the time consumed requesting and interpreting spatial products increase the vulnerability of a situation to any degree?
   
   About half of the responders believed that requesting and interpreting spatial products increased the vulnerability of a situation. However, some of those responders believed that a misinterpretation of data could make things even worse. The other half of responders believed that it did not.

4. In an ideally design system, does the integration of spatial product production and use in a disaster situation increase the resiliency of the affected region? What are key points to consider?

   All of the responders said that the integration of spatial products does increase the resiliency of the affected region. One of the responders did believe the integration helped but believed the question was too pointed. Responders mentioned lots of key points to consider, including data currency, the timely delivery of products, two-way feedback between production and use, local data levels, and having a backup offsite for data with a local redundant copy.
SUMMARY

Natural and willful disaster response and recovery efforts require a collaboration of various agencies and organizations working together to contribute to the production of spatial products necessary to first responders’ efforts. While this session would have been better served with a greater participation of first responders, it provided a framework for a future web-based survey aimed at gaining more insight into the effectiveness of spatial products during response and recovery efforts in the wake of disasters. The Social Science Research Center at Mississippi State University is implementing these suggestions and ideas in the development of a web-based survey intended to gain a larger response from the community of geospatial users.

While this workshop focused on collecting responses from various federal, state, and local agencies as well as first responders, the implementation of a broader reaching survey will help gain the opinions, beliefs and attitudes of a greater number of individuals. In turn, the gathered results from this survey will provide valuable input for the development of the GIS data delivery system proposed by the research team.

Upon completion of the web-based survey and the GIS data delivery system, the SSRC, along with the GeoResources Institute and Oak Ridge National Laboratories, will host a follow-up workshop aimed at gathering feedback about the newly developed system and potential future implications gained from the insight of the survey instrument.
Appendix B

Map User Questionnaire
SPATIAL DATA USERS
Hurricane Katrina – Lessons Learned Questionnaire

The following questionnaire attempts to capture some of the knowledge, opinions and beliefs of those involved with spatial products (using or producing maps) for Hurricane Katrina response and recovery efforts. Your answers to these questions will help data providers develop systems that could be more beneficial to response and recovery efforts in future disasters. We thank you for your participation!

Read the questions carefully and answer them to the best of your ability. Your answers will be kept in strict confidence and will remain anonymous. You may refuse to answer any question, and you may stop the survey at any time. Again, thank you!

Which of the following best describes your role with regards to using or producing maps (spatial products) during Hurricane Katrina response and recovery efforts?

- I considered myself more of a map user (eg., used maps to aid in my field response and recovery efforts and/or decision-making processes)
- I considered myself more of a map producer (eg., map maker, GIS person, data analyst or data management person)
- I was not using or producing maps (spatial products) related to Katrina
- Don’t Know/Don’t Remember
- I do not want to participate in this study

I. Communication

a. Before Hurricane Katrina, did you know that there was a GIS (map making) arm to Emergency Operations Centers (EOCs)?

- Yes
- No
- Don’t Know/Don’t Remember
- No Comment

b. Where did you first hear of the availability of maps for aid in response and recovery efforts in the aftermath of Katrina? Did you hear it from:

- FEMA or MEMA
- the Emergency Operations Center (EOC),
- within your own organization, or
- a third party also involved in response/recovery efforts?
- Other(Please specify)____________________________________
- Don’t Know/Don’t Remember
- No Comment
c. How often were you in DIRECT CONTACT with the individual(s) responsible for the map production? Would you say:
   - Very Often,
   - Often,
   - Seldom, or
   - Never
   - Don’t Know/Don’t Remember
   - No Comment

d. Where did you spend the majority of your time while contributing to the response and recovery efforts after Katrina? Would you say:
   - in an office setting,
   - outdoors-in the field, or
   - about an equal amount of time outdoors and in an office?
   - Don’t Know/Don’t Remember
   - No Comment

e. What channel of communication did you use MOST of the time when you requested a map? Would you say:
   - Face-to-Face,
   - Telephone (land line),
   - Cell Phone,
   - Internet/E-mail requests, or a
   - 2-way Wireless Communication Device?
   - Other:(please specify) ______________________________
   - Don’t Know/Don’t Remember
   - No Comment

f. How effective was your most of used method of communication? (Were you able to communicate your needs?) Was it:
   - Very Effective,
   - Somewhat Effective,
   - Neutral,
   - Somewhat Ineffective,
   - Very Ineffective?
   - Don’t Know/Don’t Remember
   - No Comment

g. As a map user, did you have trouble communicating your needs to map producers? Would you say:
   - Most of the time,
   - Some of the time,
   - I had no trouble most of the time?
   - Don’t Know/Don’t Remember
   - No Comment
h. Should the role of a GIS Manager in a disaster situation include bridging communication gaps between disparate groups of individuals or agencies, such as the gaps between map users and map producers?

☑ Yes  ☐ No  ☐ Don’t Know/Not Sure  ☐ No Comment

II. Product Delivery

a. How effective was the TIMING of map delivery with respect to meeting your needs or making decisions? Was it:

☑ Very Effective, ☐ Somewhat Effective, ☐ Neutral, ☐ Somewhat Ineffective, ☐ Very Ineffective?  ☐ No Comment

b. Did you or your agency prioritize map requests in any way?

☑ Yes, my agency did  ☐ Yes, I did  ☐ Yes, we both did  ☐ No  ☐ Don’t Know/Not Sure  ☐ No Comment  ☐ Please briefly explain how map requests were prioritized:

________________________________________________________________________
________________________________________________________________________
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________________________________________________________________________
c. In a disaster situation, should data or map requests be authenticated, authorized, or both before work begins to fulfill the requests? Should they be:

- Authenticated Only,
- Authorized Only,
- Both Authenticated AND Authorized, or
- Neither Authenticated NOR Authorized?
- Don’t Know/Not Sure
- No Comment

d. Considering the response and recovery efforts after Hurricane Katrina, please rate how the following effected the availability of map products:

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<thead>
<tr>
<th></th>
<th>Very Negative Effect</th>
<th>Negative Effect</th>
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<td>Technology/Computers</td>
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<td>Data Owners</td>
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</table>

e. Was communication, technology, or denied access the LARGEST barrier to accessing data or maps?

- Communication
- Technology
- Denied access
- Some Other Barrier (Please Specify)
- Don’t know/Don’t Remember
- No Comment

f. How satisfied were you with the delivery of map products during the aftermath of Hurricane Katrina? Were you:

- Very Satisfied,
- Somewhat Satisfied,
- Neutral,
- Somewhat Dissatisfied,
- Dissatisfied?
- Don’t Know/Not Sure
- No Comment
g. During the first 5 days after Hurricane Katrina were you primarily located:
   - On the Gulf Coast south of Interstate 10;
   - On the Gulf Coast north of Interstate 10;
   - In Jackson, MS; or
   - In Washington, D.C.?
   - Other (Please Specify): ______________________________
   - Don’t Know/Don’t Remember
   - No Comment

h. After the first five days following Hurricane Katrina, were you primarily located:
   - On the Gulf Coast south of Interstate 10;
   - On the Gulf Coast north of Interstate 10;
   - In Jackson, MS; or
   - In Washington, D.C.?
   - Other (Please Specify): ______________________________
   - Don’t Know/Don’t Remember
   - No Comment

i. During the first 5 days after Hurricane Katrina, how far were you typically located from the nearest Emergency Operations Center (EOC)?
   - 0 miles (work at or next to an EOC)
   - 1 to 2 miles
   - 2 to 5 miles
   - 5 to 10 miles
   - 10+ miles
   - Don’t Know/Don’t Remember
   - No Comment

j. After the first five days following Hurricane Katrina, how far were you typically located from the nearest Emergency Operations Center (EOC)?
   - 0 miles (work at or next to an EOC)
   - 1 to 2 miles
   - 2 to 5 miles
   - 5 to 10 miles
   - 10+ miles
   - Don’t Know/Don’t Remember
   - No Comment
III. Map Effectiveness

a. How difficult was it to read and understand the map(s) supplied to you? Was it:
   - Very Difficult,
   - Somewhat Difficult,
   - Neither Difficult nor Easy,
   - Easy, or
   - Very Easy?
   - Don’t Know/Not Sure
   - No Comment

b. How effective was the map(s) in helping you make a decision? Was it:
   - Very Effective,
   - Somewhat Effective,
   - Neutral,
   - Somewhat Ineffective, or
   - Very Ineffective?
   - Don’t Know/Not Sure
   - No Comment

c. How effective was the map(s) in helping you meet your needs? Was it:
   - Very Effective,
   - Somewhat Effective,
   - Neutral,
   - Somewhat Ineffective, or
   - Very Ineffective?
   - Don’t Know/Not Sure
   - No Comment

d. How often did you have no alternative but to base your decisions on map information that you believed to be dated, incomplete, or less credible than your expectations? Was it:
   - Very Often,
   - Often,
   - Neither Often nor Seldom,
   - Seldom, or
   - Very Seldom?
   - Don’t Know/Not Sure
   - No Comment
e. To what degree do you think disaster response and recovery map products should be standardized or customized? Do you think they should:
- □ Standardize all map products,
- □ Standardize most map products and customize few,
- □ Equal production of standardized and customized products,
- □ Customize most map products and standardize few, or
- □ Customize all map products?
- □ Don’t Know/Not Sure
- □ No Comment

f. How critical is each theme to response and recovery efforts?

<table>
<thead>
<tr>
<th>Theme</th>
<th>Very Critical</th>
<th>Somewhat Critical</th>
<th>Critical</th>
<th>Not Very Critical</th>
<th>Not Critical at All</th>
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IV. Preparedness and Resiliency

The response efforts put forth by some organizations in the aftermath of Hurricane Katrina have been scrutinized by many people and from several different perspectives. The following questions are intended to gauge how YOU perceive the prior and current preparedness status of some of these organizations in the event of another disaster:

a. Within the first 5 days after landfall of Hurricane Katrina, how would you rate the response of FEMA?
   - Excellent
   - Very Good
   - Good
   - Fair
   - Poor
   - Don’t Know/Not Sure
   - No Comment

b. Within the first 5 days after landfall of Hurricane Katrina, how would you rate the response of MEMA?
   - Excellent
   - Very Good
   - Good
   - Fair
   - Poor
   - Don’t Know/Not Sure
   - No Comment

c. Within the first 5 days after landfall of Hurricane Katrina, how would you rate the effectiveness of the EOCs?
   - Excellent
   - Very Good
   - Good
   - Fair
   - Poor
   - Don’t Know/Not Sure
   - No Comment
d. After the first 5 days following the landfall of Hurricane Katrina, how would you rate the response of FEMA?
   - Excellent
   - Very Good
   - Good
   - Fair
   - Poor
   - Don’t Know/Not Sure
   - No Comment

e. After the first 5 days following the landfall of Hurricane Katrina, how would you rate the response of MEMA?
   - Excellent
   - Very Good
   - Good
   - Fair
   - Poor
   - Don’t Know/Not Sure
   - No Comment

f. After the first 5 days following the landfall of Hurricane Katrina, how would you rate the effectiveness of the EOCs?
   - Excellent
   - Very Good
   - Good
   - Fair
   - Poor
   - Don’t Know/Not Sure
   - No Comment

Compared to the status BEFORE Hurricane Katrina, please answer the following questions below (g-l):

g. Is FEMA (federal level government) currently better prepared for the next disaster whether it is a hurricane or some other disaster? Would you say:
   - Much Better,
   - Slightly Better,
   - Neither Better nor Worse,
   - Slightly Worse, or
   - Much Worse?
   - Don’t Know/Not Sure
   - No Comment
h. Is MEMA (state level government) currently better prepared for the next disaster whether it is a hurricane or some other disaster? Would you say:
  ☐ Much Better,
  ☐ Slightly Better,
  ☐ Neither Better or Worse,
  ☐ Slightly Worse, or
  ☐ Much Worse?
  ☐ Don’t Know/Not Sure
  ☐ No Comment

i. How EFFICIENT will the Emergency Operations Centers (EOCs) be in the next disaster? Do you think they will be:
  ☐ Much More Efficient,
  ☐ Slightly More Efficient,
  ☐ Neither More or Less Efficient (would be the same as Katrina),
  ☐ Slightly Less Efficient, or
  ☐ Much Less Efficient?
  ☐ Don’t Know/Not Sure
  ☐ No Comment

j. How EFFECTIVE will the Emergency Operations Centers (EOCs) be in the next disaster? Do you think they will be:
  ☐ Much More Effective,
  ☐ Slightly More Effective,
  ☐ Neither More or Less Effective (would be the same as Katrina),
  ☐ Slightly Less Effective, or
  ☐ Much Less Effective?
  ☐ Don’t Know/Not Sure
  ☐ No Comment

k. Currently how prepared is your agency for the next disaster, be it a hurricane or some other disaster? Will your agency be:
  ☐ Much Better,
  ☐ Slightly Better,
  ☐ Neither Better or Worse,
  ☐ Slightly Worse, or
  ☐ Much Worse?
  ☐ Don’t Know/Not sure
  ☐ No Comment
l. Are **YOU** better prepared for the next disaster whether it is a hurricane or some other disaster? Would you say:
   - [ ] Much Better,
   - [ ] Slightly Better,
   - [ ] Neither Better or Worse,
   - [ ] Slightly Worse, or
   - [ ] Much Worse?
   - [ ] Don’t Know/Not Sure
   - [ ] No Comment

m. Do you have any ideas we did not cover about how to better use or produce spatial products to improve the response and recovery efforts in future disasters?
   
   If so, please share your ideas:
Appendix C

Map Producer Questionnaire
SPATIAL DATA PRODUCERS
Hurricane Katrina – Lessons Learned Questionnaire

The following questionnaire attempts to capture some of the knowledge, opinions and beliefs of those involved with spatial products (using or producing maps) for Hurricane Katrina response and recovery efforts. Your answers to these questions will help data providers develop systems that could be more beneficial to response and recovery efforts in future disasters. We thank you for your participation!

Read the questions carefully and answer them to the best of your ability. You answers will be kept in strict confidence and will remain anonymous. You may refuse to answer any question, and you may stop the survey at any time. Again, thank you!

Which of the following best describes your role with regards to using or producing maps (spatial products) during Hurricane Katrina response and recovery efforts?

☐ I considered myself more of a map user (eg., used maps to aid in my field response and recovery efforts and/or decision-making processes)
☐ I considered myself more of a map producer (eg., map maker, GIS person, data analyst or data management person)
☐ I was not using or producing maps (spatial products) related to Katrina
☐ Don’t Know/Don’t Remember
☐ I do not want to participate in this study

V. Communication

a. How often were you in direct contact with the individual map user?
   ☐ Very Often
   ☐ Often
   ☐ Seldom
   ☐ Never
   ☐ Don’t Know/Not Sure
   ☐ No Comment

b. Where did you spend the majority of your time while contributing to the response and recovery efforts after Katrina? Would you say:
   ☐ in an office setting,
   ☐ outdoors-in the field, or
   ☐ about an equal amount of time outdoors and in an office?
   ☐ Don’t Know/Don’t Remember
   ☐ No Comment
c. What channel of communication did you use MOST of the time when you requested a map? Would you say:
- ☐ Face-to-Face,
- ☐ Telephone (land line),
- ☐ Cell Phone,
- ☐ Internet/E-mail requests, or a
- ☐ 2-way Wireless Communication Device?
- ☐ Other: (please specify) ______________________________
- ☐ Don’t Know/Don’t Remember
- ☐ No Comment

d. How effective was your most used method of communication? (Were you able to communicate your needs?) Was it:
- ☐ Very Effective,
- ☐ Somewhat Effective,
- ☐ Neutral,
- ☐ Somewhat Ineffective,
- ☐ Very Ineffective?
- ☐ Don’t Know/Don’t Remember
- ☐ No Comment

e. How often did you have trouble translating the needs of others into GIS products? Would you say:
- ☐ Most of the time,
- ☐ Some of the time, or
- ☐ I had no trouble communicating clearly with others?
- ☐ Don’t Know/Don’t Remember
- ☐ No Comment

f. Should the role of a GIS Manager in a disaster situation include bridging communication gaps between disparate groups of individuals or agencies, such as the gaps between map users and map producers?
- ☐ Yes
- ☐ No
- ☐ Don’t Know/Not Sure
- ☐ No Comment
VI. Product Delivery

a. How reasonable was the TIME GIVEN to complete map making tasks? Would you say:
   - Very Reasonable,
   - Somewhat Reasonable,
   - Neither Reasonable nor Unreasonable,
   - Somewhat Unreasonable, or
   - Very Unreasonable?
   - Don’t Know/Don’t Remember
   - No Comment

b. Did you or your agency prioritize map requests in any way?
   - Yes, my agency did
   - Yes, I did
   - Yes, we both did
   - No
   - Don’t Know/Not Sure
   - No Comment
   - Please briefly explain how map requests were prioritized:

   ______________________________________
   ______________________________________
   ______________________________________
   ______________________________________
   ______________________________________

b. In a disaster situation, should data or map requests be authenticated, authorized, or both before work begins to fulfill the requests? Should they be:
   - Authenticated Only,
   - Authorized Only,
   - Both Authenticated AND Authorized, or
   - Neither Authenticated NOR Authorized?
   - Don’t Know/Not Sure
   - No Comment
d. Considering the response and recovery efforts after Hurricane Katrina, please rate how the following effected the availability of map products:

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<tr>
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</table>

e. Was communication, technology, or denied access the LARGEST barrier to accessing data or maps?
- Communication
- Technology
- Denied access
- Some Other Barrier (Please Specify)
- Don’t know/Don’t Remember
- No Comment

f. How satisfied were you with the delivery of map products during the aftermath of Hurricane Katrina? Were you:
- Very Satisfied,
- Somewhat Satisfied,
- Neutral,
- Somewhat Dissatisfied,
- Dissatisfied?
- Don’t Know/Not Sure
- No Comment

g. During the first 5 days after Hurricane Katrina were you primarily located:
- On the Gulf Coast south of Interstate 10;
- On the Gulf Coast north of Interstate 10;
- In Jackson, MS; or
- In Washington, D.C.?
- Other (Please Specify): ______________________________
- Don’t Know/Don’t Remember
- No Comment
h. After the first five days following Hurricane Katrina, were you primarily located:
   - On the Gulf Coast south of Interstate 10;
   - On the Gulf Coast north of Interstate 10;
   - In Jackson, MS; or
   - In Washington, D.C.?
   - Other (Please Specify): _______________________________
   - Don’t Know/Don’t Remember
   - No Comment

i. During the first 5 days after Hurricane Katrina, how far were you typically located from the nearest Emergency Operations Center (EOC)?
   - 0 miles (work at or next to an EOC)
   - 1 to 2 miles
   - 2 to 5 miles
   - 5 to 10 miles
   - 10+ miles
   - Don’t Know/Don’t Remember
   - No Comment

j. After the first five days following Hurricane Katrina, how far were you typically located from the nearest Emergency Operations Center (EOC)?
   - 0 miles (work at or next to an EOC)
   - 1 to 2 miles
   - 2 to 5 miles
   - 5 to 10 miles
   - 10+ miles
   - Don’t Know/Don’t Remember
   - No Comment

VII. Map Effectiveness

a. How often did data availability or data access issues prevent you from making the map product you intended to make for users in the field? Was it:
   - Very Often,
   - Often,
   - Neither Often nor Seldom,
   - Seldom, or
   - Very Seldom?
   - Don’t Know/Not Sure
   - No Comment
b. How much of an effect did long working hours and sleep deprivation have on your ability to affectively produce maps for users in the field?

- A lot,
- Some,
- Little,
- Very Little, or
- None?
- Don’t Know/Not Sure
- No Comment

c. To what degree do you think disaster response and recovery map products should be standardized or customized? Do you think they should:

- Standardize all map products,
- Standardize most map products and customize few,
- Equal production of standardized and customized products,
- Customize most map products and standardize few, or
- Customize all map products?
- Don’t Know/Not Sure
- No Comment
d. How critical is each theme to response and recovery efforts?

<table>
<thead>
<tr>
<th>Theme</th>
<th>Very Critical</th>
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VIII. Preparedness and Resiliency

The response efforts put forth by some organizations in the aftermath of Hurricane Katrina have been scrutinized by many people and from several different perspectives. The following questions are intended to gauge how YOU perceive the prior and current preparedness status of some of these organizations in the event of another natural or willful disaster:

a. Within the first 5 days after landfall of Hurricane Katrina, how would you rate the response of FEMA?
   - Excellent
   - Very Good
   - Good
   - Fair
   - Poor
   - Don’t Know/Not Sure
   - No Comment

b. Within the first 5 days after landfall of Hurricane Katrina, how would you rate the response of MEMA?
   - Excellent
   - Very Good
   - Good
   - Fair
   - Poor
   - Don’t Know/Not Sure
   - No Comment

c. Within the first 5 days after landfall of Hurricane Katrina, how would you rate the effectiveness of the EOCs?
   - Excellent
   - Very Good
   - Good
   - Fair
   - Poor
   - Don’t Know/Not Sure
   - No Comment
d. **After the first 5 days following the landfall of Hurricane Katrina, how would you rate the response of FEMA?**
   - Excellent
   - Very Good
   - Good
   - Fair
   - Poor
   - Don’t Know/Not Sure
   - No Comment

e. **After the first 5 days following the landfall of Hurricane Katrina, how would you rate the response of MEMA?**
   - Excellent
   - Very Good
   - Good
   - Fair
   - Poor
   - Don’t Know/Not Sure
   - No Comment

f. **After the first 5 days following the landfall of Hurricane Katrina, how would you rate the effectiveness of the EOCs?**
   - Very Good
   - Good
   - Neutral
   - Poor
   - Very Poor
   - Don’t Know/Not Sure
   - No Comment

Compared to the status **BEFORE** Hurricane Katrina, how would you answer the following questions (g-l):

g. **Is FEMA (federal level government) currently better prepared for the next disaster whether it is a hurricane or some other disaster? Would you say:**
   - Much Better,
   - Slightly Better,
   - Neither Better nor Worse,
   - Slightly Worse, or
   - Much Worse?
   - Don’t Know/Not Sure
   - No Comment
h. Is MEMA (state level government) currently better prepared for the next disaster whether it is a hurricane or some other disaster? Would you say:
- [ ] Much Better,
- [ ] Slightly Better,
- [ ] Neither Better or Worse,
- [ ] Slightly Worse, or
- [ ] Much Worse?
- [ ] Don’t Know/Not Sure
- [ ] No Comment

i. How EFFICIENT will the Emergency Operations Centers (EOCs) be in the next disaster? Do you think they will be:
- [ ] Much More Efficient,
- [ ] Slightly More Efficient,
- [ ] Neither More or Less Efficient (would be the same as Katrina),
- [ ] Slightly Less Efficient, or
- [ ] Much Less Efficient?
- [ ] Don’t Know/Not Sure
- [ ] No Comment

j. How EFFECTIVE will the Emergency Operations Centers (EOCs) be in the next disaster? Do you think they will be:
- [ ] Much More Effective,
- [ ] Slightly More Effective,
- [ ] Neither More or Less Effective (would be the same as Katrina),
- [ ] Slightly Less Effective, or
- [ ] Much Less Effective?
- [ ] Don’t Know/Not Sure
- [ ] No Comment

k. Currently how prepared is your agency for the next disaster, be it a hurricane or some other disaster? Will your agency be:
- [ ] Much Better,
- [ ] Slightly Better,
- [ ] Neither Better or Worse,
- [ ] Slightly Worse, or
- [ ] Much Worse?
- [ ] Don’t Know/Not sure
- [ ] No Comment
l. Are **YOU** better prepared for the next disaster whether it is a hurricane or some other disaster? Would you say:
   - □ Much Better,
   - □ Slightly Better,
   - □ Neither Better or Worse,
   - □ Slightly Worse, or
   - □ Much Worse?
   - □ Don’t Know/Not Sure
   - □ No Comment

m. Do you have any ideas we did not cover about how to better use or produce spatial products to improve the response and recovery efforts in future disasters?

   If so, please share your ideas: