

National Aeronautics and Space Administration



JSC Hurricane Ike Lessons Learned Report

Office of the Center Director
Lyndon B. Johnson Space Center
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It is hard to believe that we are still recovering from the devastation of Hurricane Ike, and yet the start of hurricane season is just a few weeks away. Before the next hurricane season begins, I want to ensure that we capture and share the invaluable lessons that we gained through the devastation of Hurricane Ike.

It was late on September 9, 2008 that Hurricane Ike moved into the southeastern Gulf of Mexico and developed a large wind field as it moved northwestward over the next 3 days. Tropical-storm-force winds, extending up to 275 miles from the center, and hurricane-force winds, extending up to 115 miles from the center, continued over the next 3 days. The hurricane gradually intensified as it moved across the Gulf and made landfall over the north end of Galveston Island around 2 a.m. the morning of September 13 at category 2 strength with maximum sustained winds of 110 mph.

Storm surges of 15 to 20 feet above normal tide levels occurred along the Bolivar Peninsula of Texas, much of the Galveston Bay area, Kemah, Nassau Bay, and many other communities with surges of up to 10 feet above normal occurring. The storm surge devastated the Bolivar Peninsula of Texas; and surge, winds, and flooding from heavy rains caused widespread damage in other portions of southeastern Texas, western Louisiana, and portions of Arkansas. Twenty people were killed in these areas, with 34 others still missing. Property damage in the U. S. from Ike as a hurricane is estimated at \$19.3 billion.

The JSC team did an outstanding job of preparing prior to the storm and recovery afterwards – through these difficult experiences our collective knowledge was expanded. In the weeks after Hurricane Ike, a facilitated discussion with JSC senior staff was held. In this session, participants were asked to provide feedback on what went right or could be improved in the periods before, during, and after the hurricane. The same approach was used with the JSC Joint Leadership Team a few days later to capture the thoughts and perspectives of the team members. For 6 weeks after the hurricane, a Web-based discussion forum was in place to provide feedback on both lessons learned and best practices for Center and home issues. In all, more than 216 comments were received. Many improvements to our processes and planning are attributable to those inputs.

The goals of this report are to incorporate the knowledge that was gained into our planning for, execution during and recovery from future natural disasters to highlight what we did right and improve on what did not go exactly according to plan.

As you read this report, please keep in mind the safety of your family as well as that of the Center and begin preparing now for the next hurricane season.



Michael L. Coats

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Acronyms



AK	Lessons Learned Website (mail code)
BA	Office of Procurement (mail code)
CMM	Contract Management Module
CO	contracting officer
COD	Center Operations Directorate
CS	contract specialist
DMAT	Disaster Medical Assistance Team
EAP	Employee Assistance Program
EOC	Emergency Operations Center
ERA	employee recovery advocate
ERCC	employee recovery call center
FY	fiscal year
HR	Human Resources
HRO	Human Resources Office
HRT	Hurricane Rideout Team
ICS	incident command system
IDIQ	indefinite delivery indefinite quantity
IRD	Information Resources Directorate
IT	information technology
LA	Chief Financial Officer (mail code)
MOD	Mission Operations Directorate
MSFC	Marshall Space Flight Center
NDMS	National Disaster Medical System
NIMS	National Incident Management System
NTE	not to exceed
OCIO	Office of the Chief Information Officer
PAO	Public Affairs Office
SAP	Simplified Acquisition Procedure
SSC	Stennis Space Center
UTMB	University of Texas Medical Branch

1. INTRODUCTION

The goals of this report are to incorporate Hurricane Ike lessons learned into planning for , execution during, and recovery from future natural disasters (such as hurricanes); integrate across the Center workforce to develop solutions that will enable personnel to successfully improve the planning and recovery process; and close actions resulting from lessons learned that were provided by senior staff, contractor partners, and employees.

2. SAFETY

The overarching emphasis in preparing for, riding through, and recovering from Hurricane Ike was the safety of our personnel. To do this, each person looked at the tasks he/she had to do in two ways: One, how will this protect the Center from harm in the storm; and, two, how can I do this safely so I can go do the next thing? This held true from the Center Director to the folks tying down our loose objects. The results of this emphasis were no lost work-day case injuries during preparation, rideout, and recovery, and only minor injuries, mainly due to insect bites. The safety culture at JSC has truly become embedded in leadership, and in all of us.

After the hurricane had passed, JSC Senior Staff focused on safely returning the Center to operations and bringing employees home. To that end, JSC assembled and distributed daily safety messages to prepare employees to return to work. The messages covered a range of topics such as what physical damage the Center had sustained, how to report additional damage, how the Center could help the individual employee recover through the Refresh Station at the Gilruth Center, the employee recovery advocates (ERAs), the Ike Swap Shop, and the Employee Assistance Program (EAP). The result of these communications was a smoother and more informed return to work for employees.



As a notable best practice, JSC also used communications to remind employees of the dangers that they faced outside of work as the area began recovery. Short messages were issued concerning traffic safety when intersection control methods were not working, how to safely use a chainsaw, reminders to protect the back while cleaning debris, and where in the community individuals could go to receive help. These messages not only provided timely reminders, but also showed the deep concern that Center employees have for each other, something that makes the JSC Family culture so strong.

3. EMPLOYEE DIRECTION AND ACCOUNTABILITY

The Human Resources Office (HRO) formed an Employee Accountability Team that included members of the HRO and the contractor community. This team analyzed and reviewed the Center employee accountability processes and systems. From this analysis and review, an employee accountability system was established that will be used to communicate with employees prior to, during, and immediately following a catastrophic event such as a hurricane. The team also refined the accountability processes and developed an implementation plan that will be communicated to all Center employees.

Employees in the HRO captured lessons learned and identified opportunities for improvement. In the wake of Hurricane Ike, HRO staff met with Human Resources (HR) principals from contractor companies to collaborate and share lessons learned. These lessons learned, and subsequent corrective actions, addressed the areas of communication, employee accountability, post-event efforts at the Gilruth Center, employee training, and information technology (IT) systems. The result of this is a comprehensive HRO Emergency Response Plan/Document that is to be used for most Center emergencies.

HRO personnel have also been working with personnel from the External Relations Office, the Information Resources Directorate (IRD), and the Center Operations Directorate (COD) to update procedures pertaining to internal communication with employees as well as employee-accountability requirements. Internal communication processes are being reviewed, revised, and updated.

3.1. Lessons Learned

- Several systems and processes were already in place to account for employees when Hurricane Ike struck. However, a single system and process needs to be identified and established to account for all JSC employees in future.
- Employees made several calls to various systems and people (i.e., Marshall Space Flight Center (MSFC) Emergency Operations Center (EOC), their supervisors) as well as receiving information via SyREN. However, some confusion arose out of this multiplicity of systems and people. A clear communications process must therefore be developed and conveyed so that all employees know exactly what to do in the event of a catastrophic event.
- Employee contact information was not up-to-date. The importance of maintaining up-to-date contact information needs to be stressed to all employees. In addition, first-line supervisors need to be advised to obtain as much information as possible on their employees' evacuation locations and contact information.
- Contact and communications between local contractor companies and the HR Directors was inadequately instituted prior to the start of the 2008 hurricane season. Continual contact and communications with the HR Directors from local contractor companies prior to June 1, 2008 would have ensured that contact lists, information, and communications procedures were up-to-date.

3.2. Best Practices

- HR Directors from local contractor companies were part of an integrated plan and approach that was used to locate and assist contractor employees effectively.
- The HR Director formed an Employee Accountability Team to account for all JSC employees immediately following Hurricane Ike, before the Center reopened.
- The assignment of directorate ERAs was critical in tracking all employees and contractors and, subsequently, in ranking and applying a status to employee situations (green, yellow, red), as well as to ensuring that JSC employees who were in serious need received assistance.
- Each directorate was accountable for validating the location and condition of all employees in a reasonable period of time, before the Center reopened.

3.3. Actions and Mitigation Plans

- Identify and implement an employee accountability system by June 1, the start of hurricane season. To achieve this, the HRO Director has formed a working group, which includes members from several Center organizations, to implement an employee accountability system.
- Develop and communicate employee accountability procedures to all JSC employees and supervisors by the start of the 2009 hurricane season. The HRO working group will be assisting in developing these procedures.
- Ensure that employee contact information is updated and current. A representative from the JSC Legal Office is advising the working group so that this goal can be achieved.
- Communicate the JSC evacuation process and employee accountability procedures to HR Directors of local contractor companies prior to the start of the hurricane season. The newly designated communications officer and recovery officer within the HRO will be responsible for disseminating information to the HR contractor community before, during, and after a hurricane.
- Evaluate other systems for employee accountability.
- Implement new, more comprehensive accountability processes to include IT, supervisor/employee contact, etc.



4. COMMUNICATIONS

4.1. Lessons Learned

4.1.1. Prior to the Hurricane

- JSC Public Affairs Office (PAO) did not have a representative at the Round Rock EOC in Round Rock, Texas. To provide timely and accurate Center status and closure information, the JSC PAO needs to be in close proximity to the COD Director for access to the most up-to-date information.
- JSC PAO did have internal or external communications networks established prior to the hurricane.

4.1.2. During the Storm

- No JSC PAO personnel were co-located with the Round Rock EOC team. Without personnel located with the Round Rock EOC team, there was no easy way to coordinate with the HQ EOC PAO to release information.

4.1.3. During Recovery

- The “JSC Today Hurricane Emergency Edition” was established a few days after Hurricane Ike passed. It was an excellent clearinghouse in which to consolidate and edit all incoming information for employees. The lesson learned is to have the capability ready to begin as soon as the storm passes.

4.2. Best Practices

- One of the most helpful “best practices” was the PAO collaboration with COD on writing, editing, packaging, and distributing important post-hurricane information. Multiple means of distribution were used, including several types of systems that had size and style constraints for text and information. By partnering with personnel from COD/HR, External Relations personnel served as an information clearinghouse that ensured that messages were sized appropriately for the distribution means that was used. This contributed to the timely dissemination of important information.
- Another best practice put the onus on the submitter to obtain approvals for information that was to be disseminated. This was achieved by predetermining organizational liaisons who either had, or facilitated, approval authority. This streamlined the process so that when PAO personnel got information prior to an established deadline, they knew that they could package the information for distribution.
- Feedback has shown that production of a four-page, brochure-type hurricane information guide was an extremely valuable best practice. Employees used the guide to locate important telephone numbers for emergency officials and services. The PAO updates this guide annually, prior to each hurricane season, and distributes it in concert with Roundup magazine production.

4.3. Actions and Mitigation Plans

4.3.1. Prior to the Hurricane

- Well in advance of a hurricane making landfall on the upper Texas coast near the Center, the JSC PAO will send a PAO officer to the Round Rock EOC in Round Rock, Texas, northeast of Austin. The PAO officer should be in close proximity to the COD Director to have access to the most up-to-date information.
- After the EOC is set up in Round Rock, PAO personnel should establish internal and external communications networks. This will lay the groundwork for passing information on to media and employees. The PAO officer should maintain close contact with all Round Rock EOC decision-makers to be able to update or change information that is provided on Center status and closure. Personnel at the Round Rock EOC will communicate with Center employees via JSC Today until the Center servers shut down.

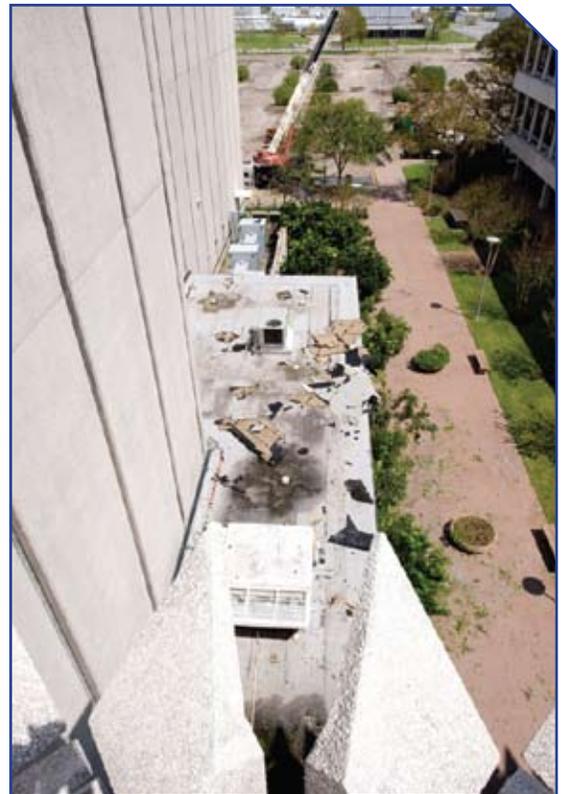
4.3.2. During the Storm

- During the storm, PAO personnel who are at JSC should have transferred distribution of information for the media to the PAO Communication Team that is in Round Rock. The JSC Round Rock PAO team will work in concert with the HQ EOC PAO to coordinate the release of information. Personnel in the HQ PAO will provide backup and assistance to the JSC Round Rock PAO team. During the storm, the JSC Round Rock PAO Communication Team will assist in crafting messages that will be sent to employees by the EOC via SyREN.
- It will be crucial during the storm to keep messages very short because all of the distribution circuits will be overloaded. At this time, radio and TV stations will only broadcast about a sentence of information for each organization that is submitting information.

- Immediately after the storm passes, the JSC Round Rock PAO team will establish a “JSC Today Hurricane Emergency Edition” and coordinate its distribution with the EOC that is also in Round Rock. The PAO team will act as a clearinghouse to consolidate and edit all incoming information. This effort will continue unabated until the systems are back up on site and the PAO Communication Team can return to JSC.

4.3.3. During Recovery

- Open the JSC newsroom with a skeleton crew as soon as possible after it is safe to return to site. At this time, a “JSC Today Hurricane Recovery Edition” will be published that contains daily updates. Inputs will be coordinated with individual organizations; only items that are cleared and approved prior to submission should be provided to JSC Today. When JSC Today staff members receive information, they will assume that the information has already been cleared and approved.
- Evaluate additional avenues of communicating Center status via TV, radio, printed news, internet, etc.
- Provide more reliable call-in telephone numbers that are appropriately staffed, and ensure that the information that is provided is current.
- Ensure that, after normal operations have been restored, the JSC Today staff begins to transition to normal operations as soon as possible.



5. TIMELINE FOR CLOSURE AND REOPENING

Much work has gone into formulating the decision-making process that leads to the Center being closed. While numerous variables enter into this process, Mother Nature cannot be counted on to provide us with a well-behaved storm. We learned a lot during Hurricane Ike, and are trying to analyze and incorporate all of our after-the-fact lessons to improve on the system that we have today.

The incident command system (ICS) manages the closure, rideout, and reopening of the Center. This system is based on one that is used by fire departments, police agencies, and other emergency organizations to respond to and manage critical events, natural disasters, emergencies, etc. It is a flexible and well-thought-out system that has been proven through the years and has, therefore, been adopted for use by the federal government.

5.1. Lessons Learned

- Our first major lesson learned is that no Center-wide integrated timeline details all of the organizational tasks and the resulting impacts on decision-making. Center systems are very interdependent, and the actions of one organization to reduce its own risk can

seriously impact the ability of another organization to operate effectively during closure; e.g., shutting down one computer server may affect multiple organizations, cutting power to one building may affect many organizations, etc. We are working to further define all organizational tasks into one project timeline and identify major activities with significant implications. This will help us to both better understand the impacts of moving to different preparedness levels, and communicate those impacts to Center personnel.

- We recognize that the current preparedness levels (i.e., Levels 4, 3, 2, and 1) are confusing to the workforce and not easily understood. The four levels have been assigned different durations (36 hours, 12 hours, 24 hours, etc.), which compounds the confusion. While those who are specifically involved in preparedness activities may fully understand the checklists and tasks that must be performed at the various levels, employees in general are less familiar with differences in the levels, and the system is not intuitive. We are therefore examining different ways of communicating preparedness activities and how close we are to closing the Center, what an employee should be doing, etc. We may move to more of a countdown type of system that is based on projected landfall in days, and may also incorporate built-in “holds.” An easy-to-understand-and-communicate “preparedness level” will help employees to better prepare their offices and operations, and to make personal decisions when a hurricane landfall is imminent.
- We need to develop a better reopening timeline. While we initially thought that we would need only specific recovery personnel to staff JSC until the Center reopened, we now realize that there are many intermediate steps to take before the Center can be fully reopened. Organizations also need to phase in the returning workforce. We now believe that our original timeline will function better as a multiphase timeline, with critical folks returning first, essential folks next, etc., until the Center reopens.
- Some team members had not been adequately trained on ICS and were unfamiliar with their role in the system. Some system nuances must be understood so that an event can be effectively managed without confusion. We conducted familiarization training for many of the responders, but we need to do more. It is imperative that key employees understand their role within the system. We will need to provide further intensive training for key staff, as well as more awareness training for the general population.
- The senior staff relocation plan, which was a part of the 2008 hurricane plan, was neither practical nor necessary. Senior managers have the same personal situations that make taking specific actions during a storm difficult. It has been determined that a smaller team, which will be designated the Communications Team, can successfully coordinate and disseminate information during a storm. Team members, who will be relocated outside of the impact zone (i.e., in Round Rock), will ensure that they can stay in touch with the Rideout Team, which will remain on site, and coordinate any efforts with the outside world. Communications Team members will be responsible for keeping Center employees and management informed as the storm passes and the situation changes. This has the additional benefit of freeing up other resources to return to JSC to support recovery efforts on site.
- The transition from Rideout Team to Recovery Team was not as well executed as it should have been. Some Rideout Team members stayed on the job much longer than we would have desired. The new timeline for recovery will include specific points for transition

from rideout to recovery. We need to ensure that this process is smooth, and that it allows those employees who have been through rideout activities to hand over responsibilities to Recovery Team members. This will let Rideout Team members take care of any personal situation that they might have and get needed rest.

5.2. Best Practices

- Many information sources – including the Spaceflight Meteorology Group, local weather reports, various Web-based weather sites, local communities, and other local EOCs – were consulted before the decision was taken to close the Center.
- The Center was prepared per the Emergency Preparedness Plan, with most of the tasks being completed (including all critical tasks) before closure was announced. We believe that this reduced the damage that the Center sustained from the storm, and was a significant contributor to our ability to reopen JSC as quickly as we did.
- Pre-established telecom times and numbers allowed Center management and staff to check in and stay informed even when their personal situations fluctuated. When cell batteries started dying, personnel could turn on a cell phone and dial in, and then turn off the phone. Cell phones did not have to stay constantly activated for their owners to be kept in the loop regarding Center recovery activities.



5.3. Actions and Mitigation Plans

- Emergency Preparedness and Hurricane Preparedness Plans will be rewritten to revise functional areas of responsibility and timelines for preparations.
- A project schedule timeline will be created that lists all Center tasks in detail. This timeline will be used to track preparedness progress, and to evaluate decisions on closure activities.

6. RECOVERY AND DAMAGE ASSESSMENT

Numerous lessons were learned throughout the post-storm activities. The general recovery and damage assessment plan worked fairly well, and was flexible enough to adapt to changing and unknown conditions. Some specific areas of the plan need to be strengthened and further defined, however. These improvements will help to ensure a faster and more efficient recovery operation in future.

6.1. Lessons Learned

- The first lesson learned was when we found, during recovery, that the IT infrastructure is even more important and critical to operations than we had previously thought it was. It was very important to get the JSC Data Center (B46) up and running as soon as possible after the storm so that we could use our IT infrastructure to help communicate, organize, and prioritize recovery efforts. We were able to provide electricity to the

JSC Data Center (B46) and, through creative efforts, get chilled water to the building, thereby enabling those systems to come on line and remain protected afterwards. Had the JSC Data Center (B46) not come on line, we would have been in manual mode for organizing and prioritizing relief efforts as well as for communicating statuses. In addition, so many of our utility systems have digital controls and can be operated remotely that resorting to manual mode was another complicating factor in our efforts to bring the Center IT infrastructure back on line. We plan to document the best process for keeping the JSC Data Center (B46) active as long as possible.

- The second lesson learned is that our process for conducting early damage assessments needs additional work. We spent more time than was necessary in evaluating the conditions of buildings and re-examining rooms that had already been visited. We did not have an easy data-capture method that would have made this process more efficient. We believe we can improve this inspection process by using some additional IT tools that can capture photographs and work orders “on the fly” and download these to our damage assessment system. This should improve the efficiency and speed of the assessment process.
- The third lesson learned is simply that our Recovery and Damage Assessment Plans need more detail, and to incorporate a number of specific suggestions and lessons learned from this storm. These “sub-lessons” include involving facility managers in the process much earlier, pre-designating all recovery personnel and their desired reporting times, providing more detail for Ellington Field recovery, refining our list of pre-positioned equipment, etc. Numerous examples of these kinds of lessons will be better defined and captured within our future plans.

6.2. Best Practices

- Holding daily status meetings (at 9:00 a.m. and 3:00 p.m.) provided an excellent venue in which to set daily work priorities and status daily accomplishments to be forwarded to senior staff, NASA HQ EOC, etc.
- Publishing an Incident Action Plan each day kept management and employees informed before the storm of preparation levels, and was critical after the storm in informing management and employees of recovery priorities and progress.
- Documenting all meeting actions and discussions as a record for future storm lessons learned proved invaluable, and will be invaluable in future.
- Using Facilities, Occupational Health, and Environmental personnel in the initial assessment and bringing in organizational facility managers to validate that their specific work areas were habitable before the Center reopened was effective.
- Providing real-time occupational health training for damage assessors and facility managers was advantageous. We spent a lot of our training in real time focused on asbestos operations and safety concerns.

6.3. Actions and Mitigation Plans

- Rewrite Damage Assessment Plan to incorporate Hurricane Ike lessons learned.
- Rewrite Recovery Plan to incorporate Hurricane Ike lessons learned.

- Evaluate IT tools to assist in damage assessment process and documentation.
- Address JSC Data Center (B46) availability, and create a plan to maintain utility feeds to the JSC Data Center (B46).

7. EMPLOYEE ASSISTANCE

7.1. Lessons Learned

- Supply a more comprehensive internal Emergency Procedures Plan for the HRO, and identify specific HR roles and responsibilities before a hurricane.
- Provide multiple avenues to account for employees as soon as possible after an incident.
- For the employee recovery call center (ERCC), have a room with a bank of telephones (with rollover numbers), computers, whiteboards, TVs, etc. available during hurricane season so that it is up and running, if needed. (It took 2 days before the ERCC was in working order.) If possible, have an inventory available during hurricane season of generators and chainsaws that can be loaned out. And, have an easily manageable database available before the season to accept requests from those in need and match with those who have services/items to donate.

7.2. Best Practices

- The HRO mobilized to perform a quick assessment of employees' living status in the wake of Hurricane Ike. Office personnel designed the following scorecard assessment, which was used by JSC directors and program managers for civil service employees and by contractor leaders for their employees:
 1. Red: Employee's primary residence was unlivable following the hurricane.
 2. Yellow: Employee experienced significant damage to his or her home, and/or the home was without power or water.
 3. Green: Employee was able to live in his or her home with power.
- The HRO quickly mobilized several support efforts, including establishing ERAs; i.e., fellow employees who knew the "red zone" employees well. The ERAs provided information concerning Center assistance efforts and kept their management apprised of their assigned employees' status and needs. In addition, the ERAs were especially helpful in ensuring that affected employees thought through the type of assistance that they needed from their insurance companies, as well as from state and federal agencies.
- The HRO and IRD collaborated in the establishment of an Ike-only "Swap Shop" for the 380 employees who lost their homes. This Center-run, Web-based shop for furniture, clothes, appliances, and even volunteer labor was set up to connect employees who wanted to help with employees who needed help.



- The HRO transformed the Gilruth Center Recreational Facility into a recharge-and-refresh station that ultimately was used by 500 area employees who needed internet access, electrical outlets, and/or shower facilities. Approximately 100 employees per day came in to use computers that had been provided to check e-mail and communicate with friends and family.
- The HRO established a process, through the JSC Exchange Office, whereby monetary donations could be accepted and distributed to employees who were in need.
- The HRO collaborated with EAP representatives to set up several debriefings with hurricane-impacted employees following the Center reopening.
- An ERCC was established for JSC employees (civil service and contractor) to access after the hurricane to receive assistance as well as information concerning other support that was available from the Center. Services provided by the ERCC included accepting and scheduling volunteers for the ERCC and the Gilruth Center; fielding calls and researching local services; and matching needs with volunteers who called in to the Center (i.e., housing, debris clearing, generator sharing, pet care, etc.). The Hurricane Ike Employee Swap Shop was initiated (accessible to employee advocates only) and greatly facilitated matching the needs of affected employees with those who had services or items to donate.

7.3. Actions and Mitigation Plans

- The HRO has reviewed its internal processes and is currently updating its Emergency Response Plan by identifying and defining specific roles and responsibilities within the organization to prepare and respond quickly and efficiently to a hurricane-type event.

8. PROCUREMENT

The Office of Procurement (BA) Hurricane Ike Team identified multiple lessons learned, and began to formulate mitigation plans. Once approved, these mitigation plans will be combined into an official, living document that will be known as the BA Continuity of Operations Plan. This will ensure that lessons learned from Hurricane Ike are, in fact, captured, and that mitigation strategies will be adhered to in future times of emergency.

8.1. Lessons Learned

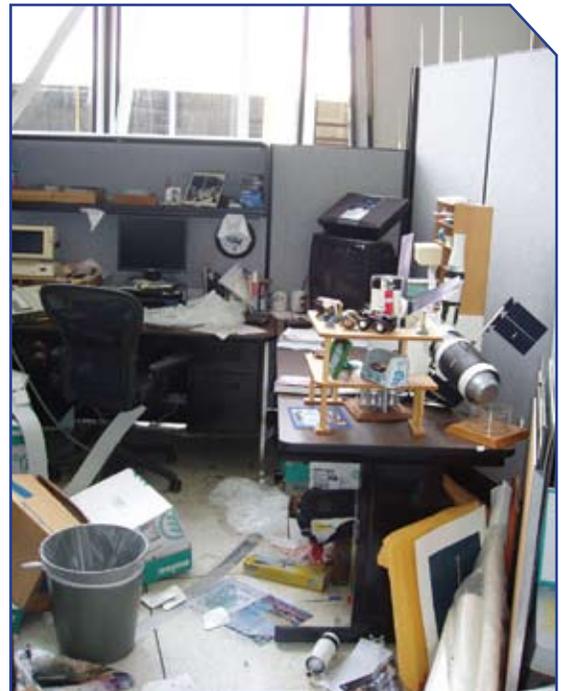
8.1.1. People

In the wake of Hurricane Ike, after limited access was granted to enter JSC, a skeleton crew of BA personnel, primarily from the Construction group in BJ3, performed essential duties to ensure that the entire Center could be reopened in a timely, and safe, manner. The following items represent a sample of some of the issues that were faced by those BA personnel who first returned to the Center:

- BA personnel encountered difficulty in finding budget analysts with a working knowledge of their financial system to release emergency purchase requisitions. Furthermore, personnel were challenged to locate and secure emergency funds.
- The Post-Ike recovery participant pool did not consist of the contract specialists (CSs) who normally have the most current working knowledge of our contractual information systems (Contract Management Module (CMM), Simplified Acquisition Procedures (SAPs), etc.).

- Few of the post-Ike participants were trained in the National Incident Management System (NIMS).
- Post-Ike participants required more assistance with the heavy, wide-reaching workload.
- Procedures, processes, and tools were not clear or easily accessible. Full access to contracts in the CMM was not granted prior to JSC closure.
- Hurricane Ike hit as JSC was approaching the end of the fiscal year (FY). Several Procurement employees were thus busy working on hurricane-related emergency items, which meant that traditional year-end items were left to stack up. Although BA personnel pulled together to ensure that no work was left unattended and the FY ended well, this lack of an emergency plan resulted in unusually long and stressful days (i.e., more stressful than those experienced at the end of the ordinary FY).

Fortunately, JSC was not damaged catastrophically by a direct hit from Ike; this allowed BA personnel to return to site relatively quickly. A direct hit by a future hurricane might inflict more damage to the Center, and access would be restricted for an extended period of time. An alternative plan must therefore be in place to remotely restore procurement activities to assist with the recovery of the Center.



8.1.2. Work Requirements

- Provide NTE [not to exceed] task orders. Several of these were issued for services that were required by the Hurricane Rideout Team (HRT) prior to the Center closing. These NTE task orders, which included requests for security support services and hurricane damage assessments, worked very well during Hurricane Ike to get the immediate support that was necessary.
- In addition to requirements that are specified for the HRT, provide the requirements for hurricane assessment and hurricane recovery to all applicable contracts/task orders.
- Ensure that the JSC Severe Weather Plan becomes consistent. It is now inconsistent; e.g., very detailed in some areas and high-level in other areas. Requirements primarily address hurricane preparation, not assessment or recovery activities for all offices.
- Provide a Mitigation Plan.
- Clearly define JSC hurricane rideout, hurricane assessment, and hurricane recovery activities.

- Identify all Center support services that will be required to perform hurricane rideout , hurricane assessment, and hurricane recovery activities. Ensure that the scope of contracts includes required services, and clearly communicates requirements to perform even if the Center is closed. For IDIQ [indefinite delivery indefinite quantity] contracts, draft NTE task orders annually for required services to be issued by the contracting officer (CO) when the Center reaches Level 3.
- Revise the JSC Severe Weather Plan to include responsibilities for hurricane assessment and hurricane recovery. Provide the same level of detail for all of the offices that are on site.

8.1.3. Funding

During the assessment/recovery phase after Hurricane Ike, no funds were immediately available to distribute to the Hurricane Recovery Team for procurements. This created a chaotic course of events in which personnel were scrambling to find funds that were available to use in assessment/recovery efforts. The personnel who were needed to process procurements were also unavailable.

8.1.4. Communication within BA

Some communication issues relating to what to do before and after Hurricane Ike arose within BA. Since the projected path of the storm continued to change, it was initially unknown whether Ike would make landfall in the Houston-Galveston area. Once the path was clear, and it was leading to our area, many employees began to panic and act as humans normally act in stressful situations. Thus, communication needs to be formalized and improved to facilitate a smoother process for such a condition as a hurricane or any other emergency situation.

- The emergency contact information for many employees was not up-to-date, workstations were not prepared, employees were not sure what to do once the Center reopened, and managers did not know that they were to contact each employee after the storm. Furthermore, some employees were not receiving calls from the automated SyREN system to update them on the status of the Center, others did not know that they were supposed to call in to the MSFC number, and a few did not know that the MSFC number existed.
- Employees who did call in to the MSFC number were under the impression that MSFC would report to each JSC directorate on the status of employees from whom they had received a call. Since no report was generated by MSFC, managers had to call each of their employees while also focusing on their own immediate situations. In addition, although there was a JSC hotline number to call for a status, telephone lines were down and cellular telephone batteries only last so long and could not be counted on.

8.1.5. Infrastructure and Information Technology

Procurement personnel were temporarily moved on site to B12 as a result of the damage that was sustained by the 1100 NASA Parkway building in which they are usually located. Although access to the BA share drive was provided, prior to the storm (and due to the limited space that was available on the share drive) some employees had

been storing documents on their hard drives. This led to the relocated BA employees being unable to access essential documents that were required to perform their jobs from B12.

8.2. Best Practices

- The process that was developed prior to Hurricane Ike to gather and protect Source Board proposal information worked efficiently and expeditiously. The Acquisition Procurement Advisory Team contacted each of the Source Evaluation Board chairpersons/COs 24 hours in advance to gather their proposal data on an electronic medium. Each CO/chairperson was responsible for signing a log sheet. All Source Board proposal data were protected using waterproof cases and stored in a safe in an inner locked storage room in one of the Source Board buildings.
- Prior to Center closure, several NTE dollar values and limited-duration task orders were put in place under the Facilities Operations Support Services Contract “to provide (hurricane) damage assessment to the COD HRT as directed by the [EOC], the Incident Commander, the CO (who signed the task order), or the Chief, Facilities Management and Operations Division.” These task orders worked well to get the immediate support that was necessary to reopen the Center.
- Following the storm, BA Management met with contractors to ensure that communication lines were established early in the recovery process. Discussing the damage to off-site buildings, ensuring that the most up-to-date information on the status of the Center was provided, and answering questions all helped to alleviate concerns that were expressed by our contractor community.



8.3. Actions and Mitigation Plans

- Create an Emergency Buy Team that will be relocated to Pflugerville, Texas during times of extreme JSC distress.
- Resolve the funding concerns by:
 - Having HQ create by June, which is considered the beginning of hurricane season, a contingency fund that is allocated a specific amount and funding site.
 - Having HQ create an agency fund or pot of money that could be shared by the various NASA (coastal) centers that could be impacted by a hurricane.
 - Helping to ease the burden of trying to find someone available during the assessment/recovery phase by identifying personnel who are to be a part of the NIMS in advance. These people would have the authority and experience to provide the necessary support (i.e., write and release emergency Purchase Requests) while adhering to Appropriations guidelines.

- Solicit volunteers from various JSC Procurement offices to work split-time between their offices and those offices that require additional help to process the traditional year-end items. This would alleviate some of the burden that is imposed by Center closure, and help to ensure that all items are processed in a timely manner. This concept mirrors the mitigation plan that is outlined in section 5.3.1.2, but a trip to Pflugerville is not necessarily required.
- Have a cross-office volunteer list already populated, even if the end of the FY is not aligned with a future Center closure. This is because the need to process even the smallest funding modification could take time away from those who are attempting to restore the Center to normal working conditions. Naturally, an employee's capabilities and working knowledge of the various contract types and regulations should be taken into account when building the volunteer list and, ultimately, deciding who backfills in what office.
- Provide a CMM certified financial services auditor who has full access to a pre-determined group of individuals at another NASA center as a second mitigation plan, which would be used in cases of extreme emergency (i.e., JSC receives a direct hit from a Category 4 or 5 hurricane, etc.). This non-JSC group, which would be combined with a select group of JSC resource analysts (cf. section 5.3.1.2), would work to ensure that nonemergency-related contracts would be adequately funded to keep them running, thus freeing up the cross-office volunteers to focus primarily on supporting the applicable emergency procurement items here at JSC.
- Make certain that, before hurricane season, all employees respond to SyREN when it appears on their desktops to ensure that all emergency contact information is correct and up-to-date. Employees should also be encouraged to list their cell phone numbers as an emergency contact. Employee badges should also include a new card labeled "Important Hurricane Information," which will include the MSFC number, the JSC hotline number, and any other standard instructions, policies, or procedures that are related to hurricanes. The "Why I Work Safely" badges should also contain this information.
- Ensure that each BA organization creates an Emergency Contact list and saves it on the shared drive for that organization. Each employee should be directed to update the Emergency Contact list as needed. The list should include the employee's name and that of his/her spouse (as applicable), address, home and cellular telephone numbers, next-of-kin (i.e., someone who is not living or evacuating with the employee, possibly someone who does not live in the immediate area), and anticipated evacuation destination. The anticipated evacuation destination column does not have to be completed prior to the start of hurricane season unless the employee has an evacuation plan that will not change. Before June 1, each employee should also have been provided with a hurricane kit, which includes the hurricane checklist, plastic bags, and rubber bands.
- Hold, in each office, a 15- to 30-minute staff meeting to review what is expected as the Center begins to prepare for closure, or when a storm enters the Gulf of Mexico and has a projected path to the Houston-Galveston area, as well as when the Center will reopen (if applicable). During this meeting, managers should ensure that all of their employees have populated the "anticipated evacuation destination" column and made any other necessary updates to personal information. Managers should also ensure that all of their employees

have a complete hurricane kit, and that they know how to use it while stressing the importance of the employees preparing their own workstations so that no one else has to do it for them. Finally, managers should remind their employees to call in to the MSFC hotline number to report their status no later than 48 hours after the storm has passed.

- Establish a BA “Meet-Me Number” that is similar to what the Chief Financial Officer (LA) coordinated. Using this, BA should hold a daily teleconference between BA Managers and Office Managers following the Senior Staff daily updates. Note: A number for BA currently exists and can hold up to 20 lines. To date, the number has only been used for internal procurement policy teleconferences, but would be an ideal means of getting members of management in touch with each other following an emergency situation.
- Ensure that each directorate across the Center establishes a standing meeting time and location at which to meet when the Center reopens. This eliminates any confusion among employees of where to report to when the Center reopens.
- Identify, justify, and approve the additional space that is needed on the share drive before another potential Center closure; this is imperative. After the justification is approved and the share drives are updated, a determination must be made as to what needs to be, and should be, stored on the share drive. Each employee should then be held accountable and required to adhere to the policies and procedures for storing information on the share drive.



9. FACILITIES

Facilities (infrastructure) planning, preparation, recovery, and lessons learned were significant for Hurricane Ike. Many resources were used in preparing the Center for the storm. Some of the time requirements that were needed to complete Center preparation affected many of the timeline decisions. Assumptions were made before Ike made landfall as to the priority of recovery activities and which systems and buildings needed to be accessible first. Several lessons were learned in establishing facility recovery priorities, as well as how to best take down on-site utilities prior to a storm to recover the infrastructure quicker afterwards. These lessons learned are being worked in various teams that are rewriting the appropriate Emergency Preparedness Plan annexes.

9.1. Lessons Learned

- Preparedness plans need to be restructured to functional responsibilities vs. organizational responsibilities. This will permit maximum use of limited personnel resources, streamline reporting, and allow for improvement in completion time of tasks between preparedness levels.
- Failure of the fixed-price contractors to remove scaffolding or secure it increased the workload for the Support Service Contractor and slowed completion of Level activities.

- Better communication with facility managers is required. Many tasks that are typically performed by building occupants and their facility managers were not completed (e.g., tie down of bicycles, boxes and trash cans left on docks, biohazard material left at B37), which increased the workload for the Support Services Contractor and either slowed completion of preparedness-level activities or created serious health hazards.
- The recovery plan should address general recovery activities and have sufficient detail to show how the various systems work and which systems and facilities are most vital to the majority of critical site activities. The plan should be flexible enough to allow for the rearrangement of priorities based on critical upcoming activities at the Center near the time of the incident.
- Center preparation plans are crucial to the implementation of a successful recovery plan. Processes, equipment, and personnel must be pre-planned or pre-staged to efficiently bring the Center back after a major incident.
- An unplanned loss of site power during a storm adversely affects the utility systems, making recovery that much more difficult to effect. Center plans should be revised to implement a “soft” shutdown on many utility systems based on the strength of the storm and the availability of trained operators.
- The ranking of critical facilities should be evaluated, and efforts should be made to secure the utilities to those facilities that are deemed most critical prior to a storm.

9.2. Best Practices

- Supplying the JSC Data Center (B46) chilled water backup from B48. This will allow cooling stability should power to the Center be lost.
- Establishing an NTE task order on all Facilities Support Services contractors at Center closing. This allowed a quicker response in the recovery period.
- Establishing NTE task orders with an outside roofing contractor at Center closing. This allowed a quicker response to roofing damage, thereby taking advantage of the supply store of materials that the roofing contractor had without incurring delays at recovery.
- Partnering internally with fixed-price contractors at the Center for construction projects with our Support Services Contractors. This provided a two-fold benefit: First, we were able to use the heavy equipment that was stored on site and did not need to suffer delays while trying to locate or procure equipment, such as the very specialized scissors that are used to remove T-38 canopies and the Guppy hangar. Second, we were able to use our on-site rigging crew to deliver and lift roofing materials for the roofing contractor, which increased the contractor’s ability to complete more roofing repairs in a shorter period.
- Having in place a dedicated facility procurement and budget staff. By having a facility contract that was adequately staffed on site the Monday after Ike, we were able to ensure that the construction contractor could begin work, which allowed other critical mitigation work to take place.
- Basing the orderly and prioritized return of site utilities on pre-Ike priorities. By establishing this accurate set of pre-Ike priorities, we were able to keep JSC on a

potable groundwater system while the surrounding communities were prohibited from using city water. We also found the use of direct-reading Colilert® kits for potable water monitoring was very successful, and provided a quick and reliable method for testing.

- Completing a thorough inspection and validation of facility habitability in a short time period. Facility managers were used to validate the condition of their work areas, a procedure that worked very well.

9.3. Actions and Mitigation Plans

- Review and update Utilities Annex in the Emergency Preparedness Plan.
- Revise Attachment A (Hurricane Management Plan) of JWI 1040.24, *JSC Emergency Preparedness Plan*, to align functionally.
- Obtain aerial photographs of site capability following a significant weather event. Early identification of the damage that is inflicted on facility roofs and roof-mounted equipment through analysis of high-resolution aerial photographs immediately after a significant weather event would aid in prioritizing assessment activities and initial mitigation actions.



10. INFORMATION TECHNOLOGY

Based on Hurricane Ike events, IRD captured its best practices and lessons learned, and identified opportunities for improvement to ensure an orderly shutdown and restart of IT systems and applications at JSC. The lessons learned, and subsequent corrective actions, include pertinent functions within IRD such as maintenance of the servers, databases, applications, e-mail system (NOMAD), telephone system, and media components that directly support our mission.

The IT/Tools Team is continually engaged with other organizations (e.g., HR, COD, the Program Offices, and the Mission Operations Directorate (MOD)) to gather requirements and integrate technology solutions to support its emergency operations planning and execution.

10.1. Lessons Learned

Three key lessons learned were of specific interest to the IT/Tools Team and the IRD.

- The first is that our e-mail system (NOMAD) is critical in communicating with JSC civil servants and contractors. In addition, vital work is completed using NOMAD as the prime vehicle for integration and collaboration. During Ike, the agency NOMAD Team changed our plan midcourse, which resulted in loss of e-mail to all users who were not VIPs approximately 12 hours before the Center lost power. Although we communicated alternative methods (e.g., text messaging) to our customers, this decision resulted in great frustration.

A face-to-face meeting was held at the Center with key members of the agency NOMAD

Team, including the program manager and deputy program manager, to discuss lessons learned and establish a clear pathway for moving forward that would ensure continued service during critical times, including natural disasters such as hurricanes. In addition, a solution for providing a shutdown and startup process for the JSC HRT to support recovery was discussed, and the need to ensure that the critical user list is up-to-date with all emergency response personnel, flight personnel, and Rideout Team members to provide nonstop connectivity to e-mail.

NOMAD is currently redefining its architecture, which we believe will alleviate the need to shut down e-mail for our users. Finally, the IT/Tools Team, which has been working with the NOMAD Team since Hurricane Ike, has determined that JSC e-mail should be re-categorized by the Office of the Chief Information Officer (OCIO) as an agency mission-critical IT asset.

- The second is that SyREN limited our ability to successfully communicate beyond JSC. While robust in its capabilities, SyREN was configured to be an action-oriented notification system (“Shelter in place; active shooter in Bldg. XX,” etc.). It requires its users to register a non-work telephone number or e-mail address to be fully accessible; only 40% of the JSC workforce voluntarily provided this necessary personal contact information. SyREN also only targets the on-site community; it does not provide communication to off-site contractors, some of whom are key providers of JSC IT services. Since SyREN was the primary tool for communicating information to JSC personnel, we had no effective mechanism by which to provide in-depth information. This is because, ideally, SyREN sends a one-line message to its users and a link to a Webpage or telephone message site for users who need further elaboration. Although we have an HQ Webpage that is suitable for longer communiqués, there is a time lag for distribution of notices that does not meet a key requirement during an emergency – to provide real-time information sharing.
- The third concerns the timeline that is ascribed to systems shutdown. Although our team has a very detailed plan outlining the timeline for shutting down the systems in an orderly fashion so as to avoid loss or corruption of data, many factors come into play that can, and do, affect this plan. It takes our technical team approximately 6 to 8 hours to completely shut down the applications and systems. IRD must coordinate with COD, the program offices, MOD, and other technical organizations in real time to determine the start time for shutdown and whether any applications/systems should remain operational. IRD personnel are now developing a business case to determine the maximum amount of equipment that can be left running during an evacuation to minimize system downtime. This will expedite evacuation of IRD team members by shortening the time that is needed to prepare for a hurricane. IRD is also developing an approach for providing backup power for the JSC Data Center (B46) for the 2009 hurricane season. If backup power is provided, the need to shut down systems and applications is minimized. Finally, IRD is developing scenarios for virtual shutdown and startup processes for all IRD JSC Data Center (B46) equipment to provide the Rideout Team with the ability to start up and shut down equipment from geographic locations that are away from JSC.

10.2. Best Practices

- IRD developed an Emergency Operations Handbook several years ago to document step-by-step procedures for the orderly shutdown and startup of our IT resources

during an emergency. This comprehensive, flexible plan lays out organizational (by contract) tasks on a specified timeline in a step-by-step manner. Emergency operations simulations are run at least annually, but specifically prior to hurricane season. We have found that these simulations are invaluable for gathering information to improve our plans, and for allowing our team members to understand critical decision points during shutdown and startup activities. Our checklist is updated from this simulation exercise. Team members gain an understanding that each scenario is unique, and that flexibility is essential to preparation so that their response is exceptional for each event.

- As Hurricane Ike approached the upper Texas coast, several key leaders in our organization evacuated. This decision allowed us to provide real-time decision-making from remote locations that were “outside of the affected area” with continuous access to communications via the internet, cell phones, landlines, etc. Due to the inordinate number of Houston/Galveston residents losing power, experiencing cell tower degradation or complete loss, and losing landlines, our ability to continue teleconferencing and connecting with our team allowed for a smoother transition between shutdown and startup activities. In addition, key decision-makers were plugged in to the activities of other organizations that were affecting us (e.g., COD, Safety) and were able to pass on pertinent information that was needed to successfully recover the networks and systems for JSC. We believe that this process was so effective that we recommend it as a “best practice,” and intend to continue setting up “remote” management during future natural disasters.



- Included in our Emergency Operations Handbook is a common teleconference number for IT personnel to use to minimize confusion and optimize work time. In advance of the arrival of Ike, team members were prepared to participate in regularly scheduled teleconferences to discuss status, plan steps forward, and share critical information with each other.

10.3. Actions and Mitigation Plans

- The overall mitigation strategy for IRD is to obtain all available data that are collected by the senior staff, the contractor community, the Lessons Learned Website (AK), and the various organizations, including results of our internal assessment. Using this information, our team will update our existing Emergency Operations Handbook and integrate our plans with other pertinent disaster plans (COD, EOC, etc.). Team members will coordinate disaster planning and recovery with key organizations and then simulate an event, prior to hurricane season, to ensure that all known items are incorporated into the Emergency Operations Handbook.
- Discussions with the agency NOMAD (e-mail system) Program Manager and team will

ensure that the application is re-categorized as mission critical, which will ensure the smooth transition of the application before and after an event such as Ike. Updates to NOMAD are currently under way to improve its portability; these updates are to be in place in May 2009. Continual communications will be paramount to how effective we will be in ensuring that JSC is included in agency decision-making regarding NOMAD.

- The IRD team realizes that effective communication mechanisms are a key priority for JSC during a disaster and, therefore, will fully determine SyREN system capabilities. Once requirements stemming from the Ike lessons learned sessions are fully captured and vetted with participating organizations, such as COD and HR, IRD can recommend SyREN system enhancements and/or new tools to satisfy requirements. Implementation of these upgrades and tools will facilitate a more effective means of communicating, and help to ensure that all employees (both civil servant and contractor) are accounted for during and immediately following a natural disaster. Our team is committed to providing solutions on or before agreed-to delivery dates so that JSC is better prepared in future.
- The IRD team is meeting to discuss internal lessons learned and best practices on a regular basis. Of significant importance to the organization is our timeline of systems shutdown and recovery. A key to our success is how well we are able to integrate our plans into the Center timeline for closure and reopening, while at the same time minimizing the impact to the JSC workforce. An IRD timeline that is in keeping with the Center timeline is currently being updated and will be incorporated into our Emergency Operations Handbook.

11. HEALTH AND MEDICAL

11.1. Lessons Learned

- The Disaster Plan, which was prepared at a division and branch level as a work instruction, was useful in preparing for the hurricane but slightly less useful in recovering after the hurricane. We greatly expanded our pool of medical and health resources by moving this effort to the division level and taking advantage of all division resources. There is an action to “take it to the next level” and write a recovery plan that is based on our experiences with Ike.
- The location of the “medical clinic” that backed up the HRT was not in the inner core of the EOC and was not supported by emergency power. When JSC lost power during the storm, the temporary clinic also lost power and was not as effective in meeting its intended purpose. No other space that was served by emergency power was available in which to locate a temporary clinic.
- The original JSC paradigm regarding the availability of medical resources near the Center was incorrect. Our assumption was that if the JSC Clinic was not inundated with water, local medical facilities would be open. In reality, however, although the JSC Clinic and other local medical facilities were not flooded, the Center had the only medical capabilities that were available in the area for several days.
- The use of WEB-EOC, which is a local Web-based EOC that is run by the City of Houston, was instrumental in determining the operating status of local hospitals.

- A Disaster Medical Assistance Team (DMAT) from Alabama was located several miles down the street. While not used by JSC, it is important to be informed of these mobile resources. National Disaster Medical System (NDMS)/DMAT personnel are required to maintain appropriate certifications and licensure within their discipline(s). When personnel are activated as federal employees, licensure and certification is recognized by all states. Additionally, DMAT personnel, who are paid while serving as part-time federal employees, have the protection of the Federal Tort Claims Act, in which the federal government becomes the defendant in the event of a malpractice claim.
- JSC received assistance from the Stennis Space Center (SSC) Clinic, the Chief Nurse, and the EAP. We greatly appreciated the support from SSC, which eased some of the personnel support needs in the Clinic and the EAP areas. This effort brought up a question regarding credentialing and privileging health care providers from other NASA centers. We need a process that allows rapid credentialing and privileging, and ensures that personnel and the affected center have medico-legal protection. A possible solution lies in Joint Commission Standard HR.4.35.
- Rideout and recovery teams need to be established by position first; only then should personnel be assigned “three deep” to those positions to ensure continuity of operations. Single points of failure can be addressed by cross-training personnel at the Center or identifying personnel from other NASA centers in times of disaster.
- Asbestos and other facility hazards imposed a major impact to Center recovery. While JSC management feels that they were well prepared (see the best practice below), there is a need to establish the capability for a mobile asbestos laboratory in which to analyze asbestos samples to support recovery in the event our environmental health laboratory is damaged by a storm.
- There was an assumption that if JSC remained dry and undamaged, so, too, would the nearby medical facilities. This was not the case. Due to wind and/or rain damage, not rising water, CHRISTUS St. John Hospital remained closed for several weeks, and Clear Lake Regional Medical Center was slow to repopulate. Other medical centers that were farther north sustained more damage than may have been anticipated; and to our south, the University of Texas Medical Branch (UTMB) in Galveston was devastated, which placed additional strain on nearby facilities. Many private practices sustained damage and were slow to reopen, which placed additional hardships on employees. The Center had the only medical capabilities that were available in the area for several days. The JSC Center Director and Life Sciences personnel considered offering medical care to the community until additional medical services became available. We should change our plans to account for this in future.



11.2. Best Practices

- JSC Clinical Services established a temporary Rideout Team clinic, complete with a doctor and a paramedic, in a conference room just off the EOC in B30A. Medical support was available to HRT members throughout the storm. This support was also available for initial recovery activities until Clinical Services moved medical operations back to the JSC Clinic in B8.
- We were fortunate that the JSC Clinic, Occupational Health, and Environmental Health laboratory were relatively undamaged and were available for occupancy. Prior to landfall, any portable equipment that was necessary for assessment and recovery operations was moved to sturdier buildings and higher ground. Clinic Services Team members were cross-trained on the operation of several industrial hygiene analyzers to perform disaster recovery operations until additional industrial hygiene and public health personnel could be brought back on site.
- Clinic Services Team members were cross-trained on the operation of several industrial hygiene analyzers to perform disaster recovery operations until additional industrial hygiene and public health personnel could be brought back on site.
- Deploying a large number of asbestos-trained industrial hygienist and environmental professionals allowed for quick assessment and evaluation of asbestos-impacted areas across the Center. The need for this support was considered during planning activities the previous year, and the resultant plans were very successfully put into place during the JSC Ike response.
- A dedicated laptop was purchased and maintained that contained hazardous material inventory lists, material safety data sheets, etc. that provided useful information while servers and internet connectivity were unavailable.
- A Recovery Team was established that allowed rideout personnel a recovery period after the hurricane and for the first couple of days of recovery. The Recovery Team was established based on personnel who were availability after the storm.
- The EAP was also available during recovery, with its personnel working to support JSC responders and the JSC team members that were using the Gilruth Center facilities. The need for engaged EAP support was learned from our support to SSC after Hurricane Katrina and was greatly valued.
- Daily Life Sciences telephone tags were very valuable in keeping all support and management personnel up-to-date with assessment and recovery activities. Recovery Team members were able to report the status of the Center, including health and medical support, and were able to update coverage schedules and keep up with requests for additional resources.
- The ability to use the JSC well water system for potable water when the municipal water system was unavailable was a major advantage to JSC.
- Colilert[®] was used to test and clear (as safe for consumption) well water and potable water systems within 18 hours of sampling. This testing system, which is used on the International Space Station, provides the most rapid turnaround to test for bacterial growth. It allowed JSC to sample many areas across the site, and to assure the quality of potable water at the Center.