

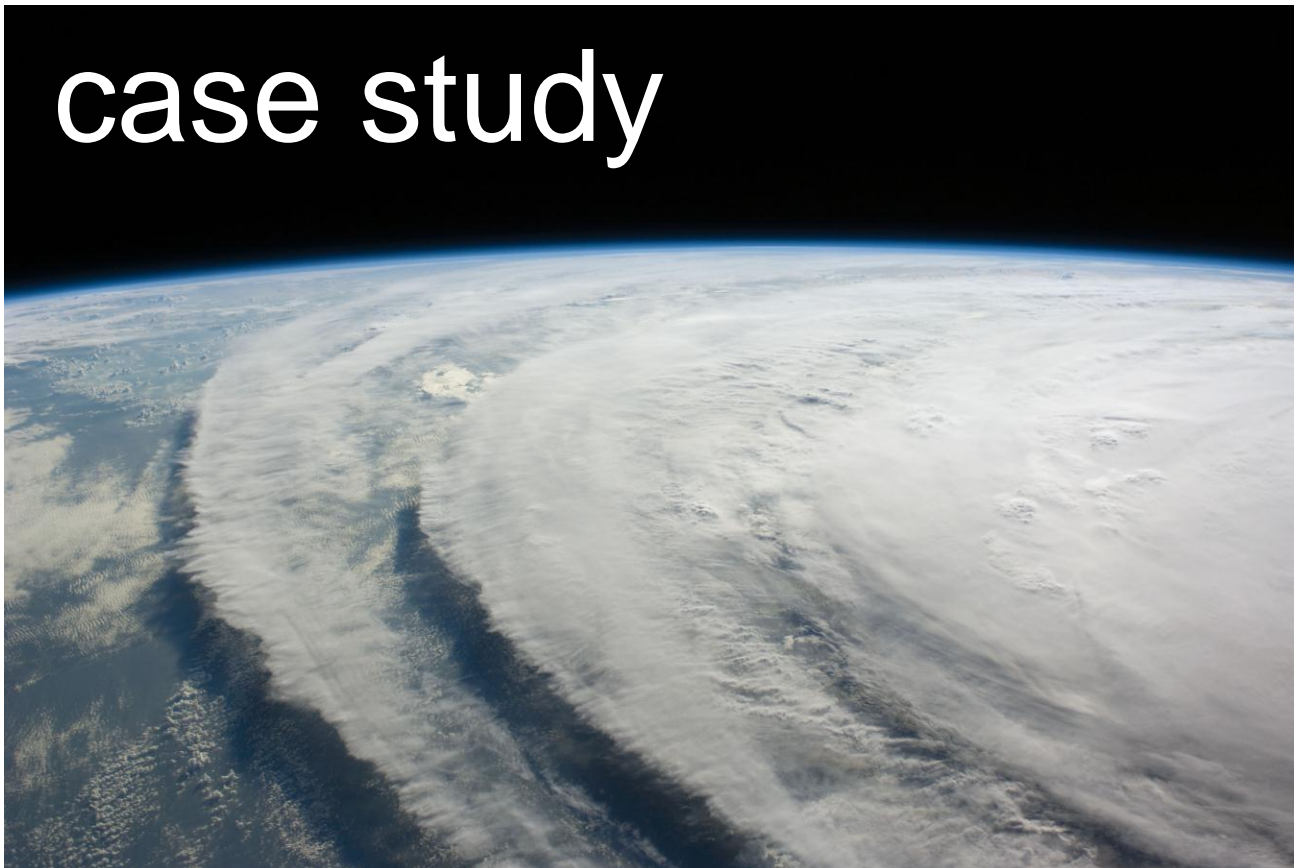


National Aeronautics and Space Administration

**Academy of Program/Project & Engineering Leadership**

**Weathering the Storm: Lessons from Hurricane Ike**

**case study**



In the event of an emergency, have a plan. NASA's ten centers operate together supporting missions in space through engineering, management, safety, operations, and research. When a center's performance is hindered, mission success is jeopardized. Natural occurrences usually are not the first performance-threatening obstacles that come to mind at NASA—budgets and technical problems are more frequent show-stoppers. As Kennedy Space Center Emergency Manager Wayne Kee said at the 2010 PM Challenge, “When you're dealing with emergency management, if the winds are not howling, and the rains are not blowing, and the earth's not shaking, it's out of sight, out of mind.”

Every center at NASA faces some threat of natural disturbance or disaster. Any number of natural disasters can shut down a center, threaten the well-being of NASA employees, and put missions behind schedule. Each center has emergency response plans in place, but the chance to execute and learn from these plans are far and few between—which can be both a blessing and a curse.

In August 2008, NASA astronaut Greg Chamitoff occupied the International Space Station (ISS) with two cosmonauts from the Russian Federal Space Agency. A series of Progress and Soyuz spacecraft were set to dock and undock from the ISS between September and October. STS-125 was slated to launch October 8, 2008 for the final servicing mission of the Hubble Space Telescope. Mission Control at Johnson Space Center (JSC) was busy with operations and preparations for ongoing and future missions. From August to October, JSC would also weather three tropical storms—one of which would devastate the Gulf Coast of Texas and earn the title of third costliest hurricane to hit the United States.

### **JSC Emergency Management Response**

Emergency response teams regularly rehearse their roles and keep employees up to date on necessary information. Hurricane season begins June 1 and ends November 30. In 2008, JSC's hurricane emergency response plan consisted of five countdown levels, which fit into three phases: preparation, ride-out, and recovery. On May 1, 2008 JSC initiated Level 5: readiness verification of all equipment, supply stocks, and supply needs, and cleaning up the center. From that point on, the center stood by in “wait-and-see mode.”

When a storm is predicted to be on track for the center, the center initiates Level 4. Practice runs typically occur as though a real hurricane were on its way: moving equipment, filling water tanks, moving sandbags, sampling water levels and chemistry, cleaning up building exteriors, asking contractors to clean up their areas, and getting rid of potential projectiles. It takes between 24 and 32 hours to finish all preparedness activities for this level.

The operations tempo accelerates when a storm threat is 48 hours away from the center. Tough decisions have to be made. This phase takes about 24 to 32 hours to prepare and includes activities such as shutting down utilities, sealing tunnel and manhole entries, and transferring critical equipment. Rideout Team members, who man the center during the

storm, go home to get their families in order before returning to the center for Level 2, the Rideout phase.

The goal of Rideout is to get the center up and running as quickly as possible after the hurricane passes. During the final stage, Recovery, the Recovery Team replaces the Rideout Team and initiates assessment and recovery tasks.

### **Ike Precursors: Edouard and Gustav**

Edouard, the first tropical storm of the 2008 hurricane season, hit the coast of Texas near Galveston early on August 5, bringing with it heavy rains, strong winds, and temporary electrical outages. While wind speeds were well below a Category 1 hurricane, JSC still initiated emergency management activities. In the end, Edouard caused little damage.

Ten days later on August 25, tropical storm Gustav appeared near the Dominican Republic. Over the next few days Gustav intensified into a Category 4 hurricane when it reached Cuba. By September 1, Gustav made landfall in Louisiana as a Category 3 hurricane. Warnings were in effect for High Island, Texas, eastward to the Mississippi-Alabama border.

Both Edouard and Gustav triggered emergency management response activities at JSC. By the time Hurricane Ike surfaced twelve days after Gustav on a path straight for Houston, the JSC team was experiencing “hurricane fatigue.”

### **Ike Preparation**

“In all of the hurricane war stories that I’ve ever heard,” said Sheila Powell, Division Chief for the Facilities Management and Operations Division at JSC, “nobody ever talks about why they board up their house or how they do it.” When Hurricane Ike swept through the Gulf, Powell managed the facility and utility preparations. “Preparedness is not very interesting from the standpoint of what you do,” she added, “but it becomes pretty critical to what you return to and how well you’re going to recover.”

By Tuesday, September 9, Hurricane Ike was moving through the southeastern Gulf of Mexico. Ike was projected to make landfall at Corpus Christi with winds of 200 miles per hour. That morning Powell made the transition from Level 5 to Level 4 to get a jump on the preparations for the impending storm. Even after starting early, though, Powell and her team still found themselves 10 hours behind. By coincidence, all of Johnson’s senior staff happened to be in Washington, D.C. for Congressional briefings. Anxiety levels rose significantly.

Powell and her team finished most of the Level 4 preparations by Wednesday morning and initiated Level 3 activities. The Rideout Team was asked to go home and rest up for their shift.

## Riding Out Ike

On Thursday at noon, Powell passed the baton to Rick Hewitt, Hurricane Incident Commander in charge of the Rideout Team. That afternoon, Hewitt looked to see what the local Emergency Operations Centers were doing. He noticed that Harrison County was evacuating and Galveston was not. Hewitt's primary concern was ensuring the safety of the crew still onsite and the people supporting him. "I could not have prepared for this hurricane were it not for Sheila and her folks getting everything set up to that point."

Friday was warm and sunny. This was going to be a typical hurricane, Hewitt recalled thinking. He had lived through Hurricane Rita three years before. The Rideout crew was calm, but ready for the worst if it came to pass. "We knew that we were prepared," said Hewitt, "but we were still anticipating that big storm."

With just over 24 hours to go before Ike reached the center, Hewitt faced some tough decisions. Either he shut down the center utilities, the storm missed them, and it would take a day or two to recover, or he didn't shut down the utilities, the storm didn't miss them, and they would have a hard outage, from which it would take two or three days to recover. Faced with this "no-win scenario" Hewitt called for the utilities to be left intact and operational.

Ike made landfall in Galveston at 2:00 AM on Saturday, September 13, hitting JSC shortly thereafter with winds of 92 miles per hour. After the front part of the storm had passed and the Rideout Team ran outside during the eerie calm in the eye of the storm, they realized that Ike had saved the worst for last. As the back half of the hurricane swept over the center, it took with it the roof of Building 30 (Mission Control Center), scattering pieces of peat over car windows. Ike shattered a window in the Central Heating & Cooling Plant (Building 24), cutting an individual who was inside. Hewitt had to act fast. Building 24 can't run without staff. Hewitt's choices were either to shut down the building partially or bring someone else inside. He chose to partially shut down the building. In addition to the building shrapnel stirred up by the storm, JSC also experienced high waters, which crept up above the fence on one side of the center.

By Sunday morning, Ike grumbled away to the northern part of Texas, marking the start of hurricane recovery, arguably the most difficult part of the hurricane emergency response plan. Hewitt's team had been up for over 24 hours.

## Recovery

Steve Campbell, Hurricane Ike Recovery Incident Commander, got the call to report to JSC while propping up a fence at his home on Sunday morning. Campbell showed up at the JSC Emergency Operations Center for a briefing from Hewitt to begin the recovery phase. When he arrived, all of the phone banks were covered in plastic. Now in charge, Campbell had to assemble his workforce and determine the priorities necessary to get the center back up and running.

First, Campbell found that he was short on people to do the assessment that the Recovery phase calls for. He used the Systematic Recall and Emergency Notification (SyREN) system, a mass notification and alert system, to contact extra workers, but then Campbell realized he couldn't let his Recovery Team into all the buildings to make their assessments. Some buildings contained asbestos. He also lacked a systematic way to track his team's recovery progress. They had maps on the walls to check off buildings that were cleared, and they developed a workable process: note damage on floor plans of each building, hand assessments back to Campbell, and then give the data to the estimators.

The top priorities were the Space Mock-up Facility (Building 9) and the Mission Control Center (Building 30). Both were in need of repair and roof work. Mission Control was without utilities, and the power had been down for nine hours. The Mission Operations Directorate needed to maintain communications with the ISS program. At Ellington Field, two hangars had lost their roofs and were taking on water. The canopy shelters were devastated. Getting these facilities up and running was critical for training astronauts for the upcoming shuttle mission in October.

In addition to recovering the astronaut facilities, his team focused on restoring phone service, restoring the Center Telecommunications System (CTS) closets, and getting the servers operational in Building 46, the onsite data center. There was more in store for him than he expected. "When you think of facilities, you think of the brick, mortar, and air systems, but they have a lot of equipment in there that needs to be checked out." A closet in Building 15 had wet equipment no one knew existed, Building 3 had asbestos covering the walls, Building 12 was producing mold, and Building 8 had a dead skunk in it.

"When you looked at the damage," said Campbell, "you really had an appreciation of the efforts that the Recovery Team was making." A best practice the team developed was holding standing 9:00 AM and 3:00 PM meetings. Everyone from environmental, safety, occupational health, planning office facility managers, budget and procurement all met to declare what they would do for the day, what they had accomplished by the end of it, and what the following day's goals would be.

By Monday, September 21, 2008, JSC reopened running at full speed.

### **In Hindsight**

In the weeks following Ike, the JSC hosted facilitated discussions between response team members and leadership to evaluate all three phases of the center's response to the emergency. The center operated a Web-based discussion forum that captured over 200 comments, best practices, and lessons learned, and identified action and mitigation plans that went on to shape future emergency response procedures.

Despite the havoc Ike wreaked, JSC received praised for its response. "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,” wrote Mike Coats, center director of JSC, in a [lessons learned report](#) on Ike.

The report identified lessons from a broad range of areas and functions. One of the biggest lessons Ike brought to light was orchestrating **center preparedness**. A center-wide integrated timeline detailing the organizational tasks and their resulting impacts due to the storm was essential. While preparedness levels have predetermined schedules to them, hurricanes don’t.

For instance, the Mission Control Center (MCC) has a large stack of evacuation checklists. “Everyone pulls out the procedure, we walk through them, and we track when they are done,” explained Heather Rarick, ISS Flight Director. They are systematic and vigilant with these checklists, she added. A problem arises when the predetermined level says it takes 24 to 38 hours to complete, but the storm changed pace, leaving only four hours. “You have an expectation and you go into work one day and you think ‘OK, we’re on Level 4. How do we get to a Level 3 late today or tomorrow?’ Suddenly, it’s late afternoon and JSC is at Level 3, but MCC isn’t,” said Rarick.

In another instance, shutting down one computer or cutting power in one building may affect multiple organizations. The team also learned the criticality of IT infrastructure to recovery operations. For example, getting Building 46, the JSC Data Center, running was necessary to communicate, organize, and prioritize recovery efforts, rather than having to resort to manual efforts to accomplish all recovery tasks. The Recovery Team had to get chilled water to the building to allow the IT systems to come back online. In the future, the emergency response team plans to keep this building active for as long as possible.

Another important lesson concerned **procurement**. While procedures for center shutdown are practiced annually, aftermath recovery was not as well developed. Tracking down the right personnel to access specific systems for contracts, funding, and procurement needed for center recovery and rehabilitation was a challenge. Funds were not readily available and personnel had to scramble in order to carry out the assessment and recovery efforts.

Good **communication** and updated **employee contact information** were also key lessons. The hurricane response team found that employees were calling into several established systems. For instance, employees reported to and received information from the Marshall Space Flight Center Emergency Operations Center, their supervisors, and SyREN. The lesson learned was to identify a single system and process to account for center employees in the future. The lessons learned report identified a best practice in assigning an emergency recovery advocate from each directorate to track employees and contractors to evaluate and distribute assistance. Additionally, dispensing a brief information pamphlet about hurricane safety was extremely valuable. Updated annually, the guide provided employees with important telephone numbers for people and services.

## Teaching Notes

This case study has been designed for use in a classroom setting. Please read the full case prior to in-class discussion to allow ample time for analysis and reflection.

Consider the following questions:

- What role did adaptability play throughout Hurricane Ike emergency preparedness, rideout, and recovery activities?
- What are the lessons to be learned from having the right personnel available when you need them?

Ask participants to discuss in small groups, encouraging them to draw analogies to their own experience and develop as many interpretations as possible. The small groups will then reconvene as a large group and share their conclusions.

## Additional Resources

[Read the \*ASK the Academy\* story about Hurricane Ike from the perspective of two International Space Station flight controllers.](#)