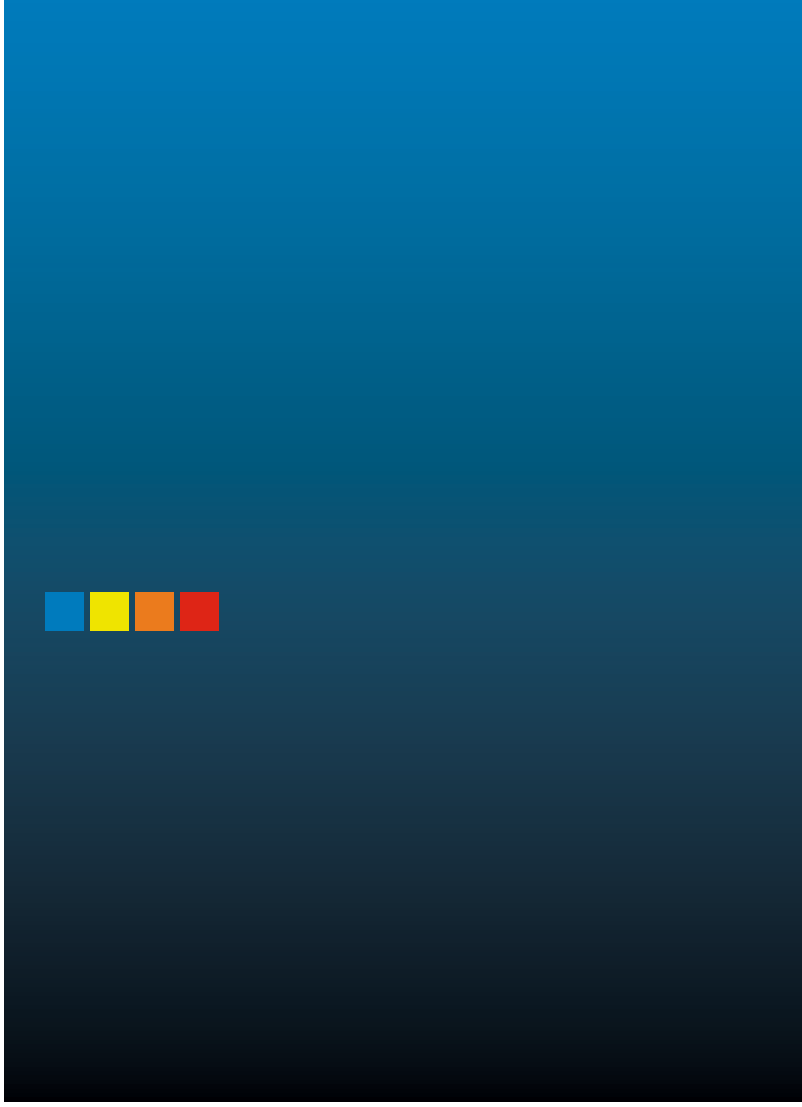
WEATHERING IKE

BY HALEY STEPHENSON

Operating the International Space Station under normal circumstances is challenging. Doing it during the third-costliest hurricane to hit the United States is another story.

Photo Credit: NASA

Hurricane Ike covers more than half of Cuba in this image, taken by the Expedition 17 crew aboard the International Space Station from a vantage point of 220 statute miles above Earth.



plans already in progress to support the current astronaut team on ISS and overall ISS system status and plans. "Once BAT is operational, then we just sit and wait until all MCC operations in Houston are handed over to BAT," said Rarick.

No, No! Don't Shut *That* One Down.

Hours before the storm struck, BAT set up their mobile mission control in a small hotel conference room. Two digital clocks, labeled "GMT" and "CST" with yellow Post-It notes, were at the front of the room. They were operational. Outside, parents, children, and pets lined the hotel halls, seeking refuge from the storm. None would have guessed what this team was doing.

The first half hour of every morning was rough. "At 8:00 a.m., the hotel guests would get up and check their e-mail, check the Internet, and then we'd drop off [lose the connection]," said Rarick, referring to the effects caused by the short surge in online traffic at the hotel. "We would have to reestablish our Internet link, and we'd be fine most of the day."

Although BAT had a backup—using the BCC team at Marshall—the international partners didn't. Computers in Houston were essential to providing command and control from the international partners to ISS. This was a major reason to keep Houston up and running for as long as possible. McMillan made constant calls to the hurricane Rideout team about the status of various computers and servers. Some had to be covered with plastic wrap; others had to be shut down entirely because of water leaks in the roof. Whenever Rideout delivered updates about equipment that had to be taken offline, McMillan recalled, "We'd think, 'No, no! Not *that* one.'"

Progress on a Schedule

As Ike approached Houston, BAT had gone west, the BCC team had gone east, and a Russian Progress vehicle had launched. Progress began its journey to the station on September 10. While the vehicle didn't dock until after the storm passed, Houston's MCC was still not operational when it did. Ike's timing was less than ideal.

Docking a Progress spacecraft to the ISS is a critical operation that involves conducting thermal analysis and reorienting the solar arrays, among other things. The ISS flies at an inclination of 51.6 degrees, which creates a tough thermal environment. Changes in temperature can cause structures like the solar-array longerons (the long, sturdy rods that support the arrays) and equipment positioned outside the ISS to expand or contract. "We go through larger hot and cold periods than we originally planned for some space station hardware," explained Rarick. "So when we have to configure for a docking, we have to do thermal analysis." This thermal analysis has to be done on a specific Houston computer.

To obtain the details needed, the thermal analysis team had to get creative. In order to communicate, the team had to relocate to an out-of-the-way coffee shop to get a Wi-Fi connection. "We had to send them the information needed to run the analysis back in a deserted office," said Rarick. "They would get the computer up and running, do all the analysis, and tell us if the plan was thermally acceptable."

Additionally, a Progress vehicle approaches the ISS in such a way that its thrusters can damage the solar arrays if they are not moved. But reorienting the solar arrays usually decreases the amount of energy they can acquire, which means instituting energy management procedures. Mission control powers down certain modules to conserve energy prior to an event. It is a complex maneuver, explained Rarick: "One loss of one computer and we can't put our solar arrays in the right position."