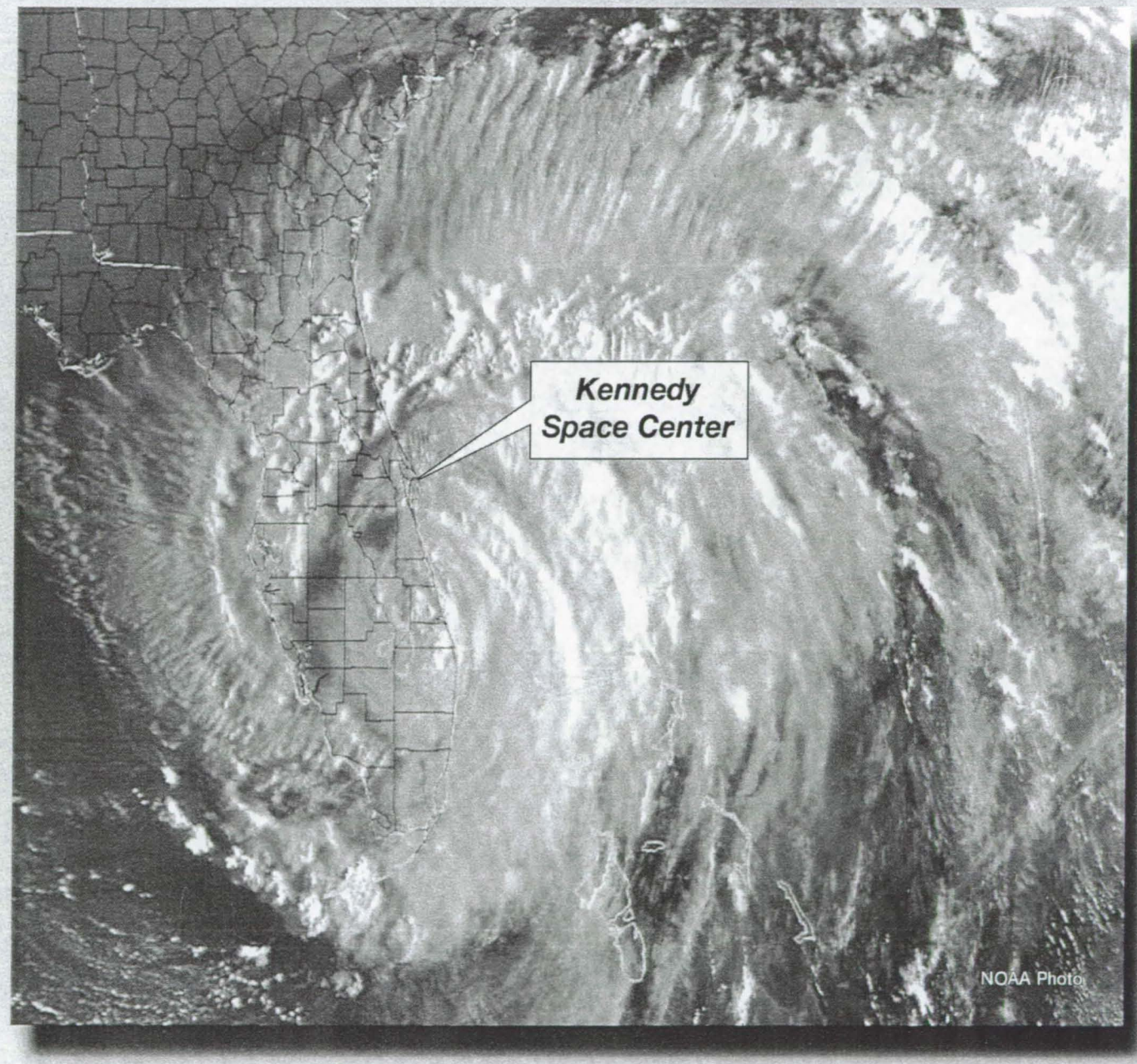
HURRICANE

Recovery Report 2004



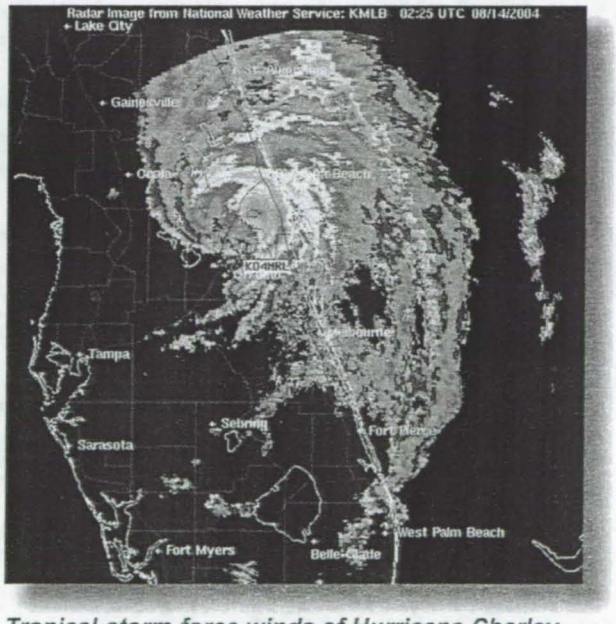
John F. Kennedy Space Center, Florida

NASA

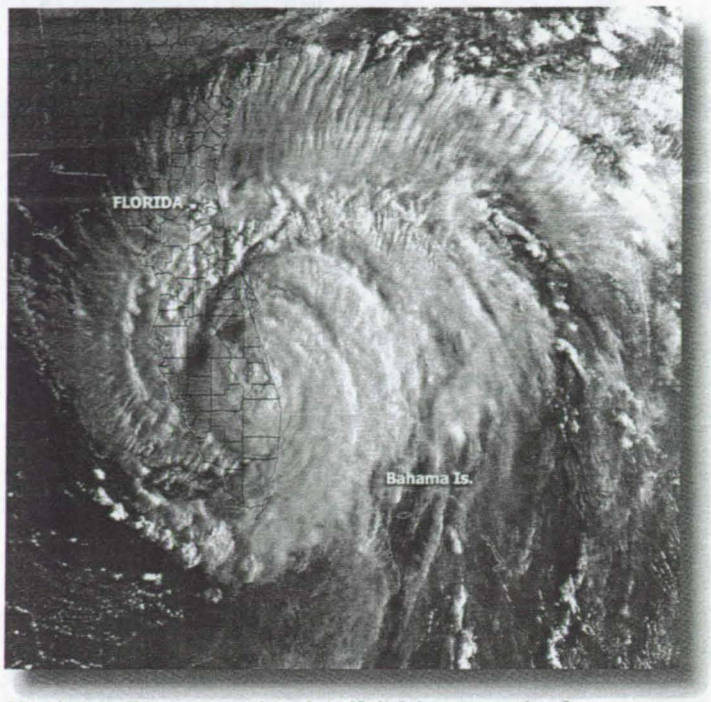
Executive Summary

During August and September 2004, four hurricanes tested the mettle of Space Coast residents and the Kennedy Space Center (KSC) leadership and workforce. These threats underscored two important points: the very real vulnerability of KSC and its valuable space program assets to the devastating power of a hurricane, and the planning required to effectively deal with such threats. The damage was significant even though KSC did not experience sustained hurricane-force winds. To better understand and appreciate these points, this report provides an overview of the meteorological history of the Space Coast and what is involved in the planning, preparation, and recovery activities, as well as addressing the impacts of the 2004 hurricane season.

The first hurricane to threaten KSC this season was Hurricane Charley. Although Charley was a Category 4 storm when it came ashore on the west coast of Florida, only tropical-storm-force winds brushed the Center the evening of August 13. At KSC, the sustained winds were 64 mph gusting to 86 mph, and the total rainfall was 2.58 inches. However, based on safety concerns for employees and their families, the Center was closed for normal business at noon, and all nonessential personnel were released from duty. An all-clear was declared the following morning. Minor damage was reported and the Center never lost utilities throughout the storm. However, many employees suffered damaged homes north and west of KSC, closer to Charley's path. KSC resumed normal operations on Monday, August 16.



Tropical-storm-force winds of Hurricane Charley brush KSC. (Photo courtesy of NOAA.)



Hurricane Frances makes landfall 84 nm south of KSC. (Photo courtesy of NOAA.)

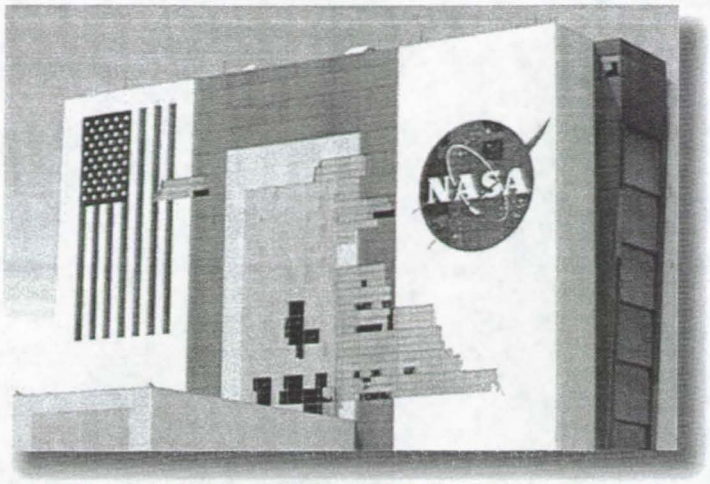
On August 31, Hurricane Frances, another Category 4 storm, was projected to hit KSC. All nonessential personnel were released on September 2. Because KSC was in the projected path, emergency preparedness personnel determined there would be no Rideout Team stationed at KSC. The Center was closed on Friday, September 3, and Frances made landfall on Sunday 84 nautical miles (nm) south of KSC. The Center experienced sustained winds of 68 mph and gusts of 94 mph. Rainfall was approximately 8 inches. From Frances, and later for Jeanne, employees living south of KSC and along the beaches suffered the greatest personal damages.

KSC reopened for damage assessment on Monday, September 6. The Emergency Operations Center (EOC) was reactivated and the Damage Assessment and Recovery Team (DART) began damage assessment and other recovery activities. These continued through September 13, when KSC reopened for normal business and nearly 14,000 employees returned to work following an 11-day closure of the Center. However, on September 11, Hurricane Ivan was forecast to strike south Florida as a Category 4 hurricane and move directly north over KSC by September 14, thus adding to the workload of the already highly taxed DART and EOC. Fortunately, Ivan's track eventually changed and KSC and its workforce were spared any impact. A KSC Recovery Team (KRT) was established on September 13 to continue management of recovery efforts after the EOC and DART were disbanded.

Unlike Charley, Frances inflicted significant damage to KSC. However, NASA's three Space Shuttle Orbiters—*Discovery, Atlantis,* and *Endeavour*—along with the Shuttle launch pads and all of the critical flight hardware for the Orbiters and the International Space Station (ISS), remained well protected and sustained no damage, as did the Swift spacecraft on the Cape Canaveral Air Force Station.

The Vehicle Assembly Building (VAB), the Thermal Protection System Facility (TPSF), and the Processing Control Center (PCC) felt the most effect from the hurricane and received significant damage. In addition, the Operations and Checkout Building (O&C), Vertical Processing Facility (VPF), Hangar AE, Hangar S, and Hangar AF Surface Preparation Facility (SPF) sustained substantial damage.

Of particular note was the damage to the VAB, where the Orbiter and its major elements are assembled and tested for launch. The facility lost approximately 30,000 sq ft of metal siding and translucent light panels, leaving the building interior open to the outside elements. The roof also saw considerable damage.

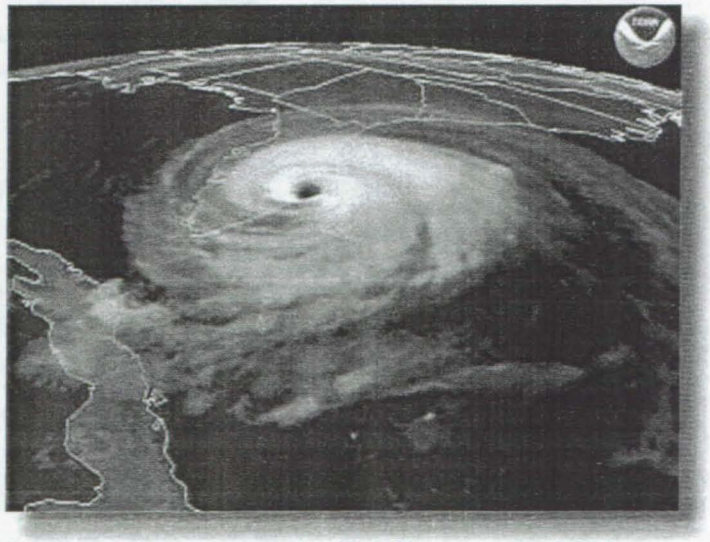


Loss of metal siding and translucent light panels on south face of VAB. (Photo courtesy of NOAA.)

On Thursday, September 23, KSC was responding to yet another threat—Hurricane Jeanne. For the second time in 3 weeks, the Center was closed for the safety of the workforce. Jeanne was expected to hit KSC late Saturday night or early Sunday morning. As with Frances, an evacuation order was issued for the residents of the barrier islands, including Merritt Island. However, unlike Frances, the Rideout Team remained on the Center. Also, the Center director, joined by 45th Space Wing Battle Staff, rode out the storm in the KSC EOC.

Jeanne made landfall 83 nm southeast of KSC. Maximum sustained winds at KSC were 62 mph with gusts of 87 mph. The all-clear was announced at 6:00 pm on Sunday, September 26. For the safety of personnel and to facilitate initial assessment and recovery actions, senior management kept the Center closed for normal business until Tuesday, September 28. Jeanne caused less damage than Frances, which was much more traumatic with sustained winds of 50 mph for more for 36 hours, compared to 21 hours during Jeanne.

Space Shuttles and ISS components, as well as Swift, remained undamaged. More important, there were no reports of injuries to any KSC employees. Initial assessment did show that the VAB lost additional panels. Other previously damaged buildings also sustained additional roof damage and significant water intrusion.



Hurricane Jeanne makes landfall 83 nm south of KSC.

One of the key activities in the recovery process is developing lessons learned. The primary purpose is to improve KSC's emergency response capability to reduce risks and better protect the safety of the Center's workforce and other valuable assets. In total, 86 lessons learned, ranging in scope and relative importance, were documented and categorized as Safety, Leadership, Communications, Planning and Preparation, Facilities, Traffic, Logistics, Power, or Miscellaneous. In the interest of brevity, this report addresses those of high import.

Immediately after Frances and after reviewing DART's damage assessment report, management convened the KRT to begin the process of initiating and tracking emergency repairs necessary to safe, patch, and secure damaged facilities and infrastructure. A key activity of the KRT was a hurricane damage assessment of the programs and Center/Government and Non-Government tenant assets. This assessment resulted in a Hurricane Estimated Recovery Baseline (HERB).

HERB is a detailed listing of projects and actions resulting from the damaging effects of the hurricanes on KSC facilities and real property. Since the requested supplemental funding would also address hurricane damage to other NASA Centers, this assessment also includes damage caused by Hurricane Ivan to the Stennis Space Center and Marshall Space Flight Center/Michoud Assembly Facility. To aid in analyzing costs, damages were categorized by equipment; facilities repair, recovery mitigation and restoration; and relocation of personnel and equipment. The cost estimates represent a very rough order of magnitude and will be refined as the listing matures. The total estimate was $122,868,801. However, this figure includes nonappropriated assets belonging to the KSC Visitor Complex, the National Park Service, the U.S. Fish and Wildlife Service, and the Florida Space Authority. These entities are resident on or adjacent to KSC, but costs for damage incurred should be covered by funding sources separate from NASA's supplemental funding.

Because of the significant damage inflicted by Frances, a request for $126M in emergency supplemental funding was coordinated with and submitted to NASA Headquarters. This became part of the Administration's second request to Congress for hurricane-related funding.

Due to the time required for approval of the emergency supplemental funding, the KSC Institutional finance and budget offices assessed unobligated KSC operational funding that could be redirected to fund emergency hurricane recovery efforts. This entailed agreements with NASA program and project managers for temporary use of their unobligated funds, with the agreement that once the emergency supplemental funds became available their funds would be reimbursed. In addition, agreements were reached with the major KSC contractors that their hurricane recovery costs would also be reimbursed.

On Wednesday, October 13, 2004, President Bush signed the bill that included the emergency funds to help hurricane victims in Florida and other areas. This package included the $126M requested by NASA. Because of the large scope of effort to ensure the most effective and efficient obligation and expenditure of the emergency supplemental funds, a senior project manager was designated and a team formed to plan, schedule, budget, and implement the repairs and emergency measures necessary to prepare for future storms. This team replaced the KRT, which was officially disbanded on October 22, 2004.