

# John F. Kennedy Space Center, FL Hurricane Frances Damage Assessment Photos

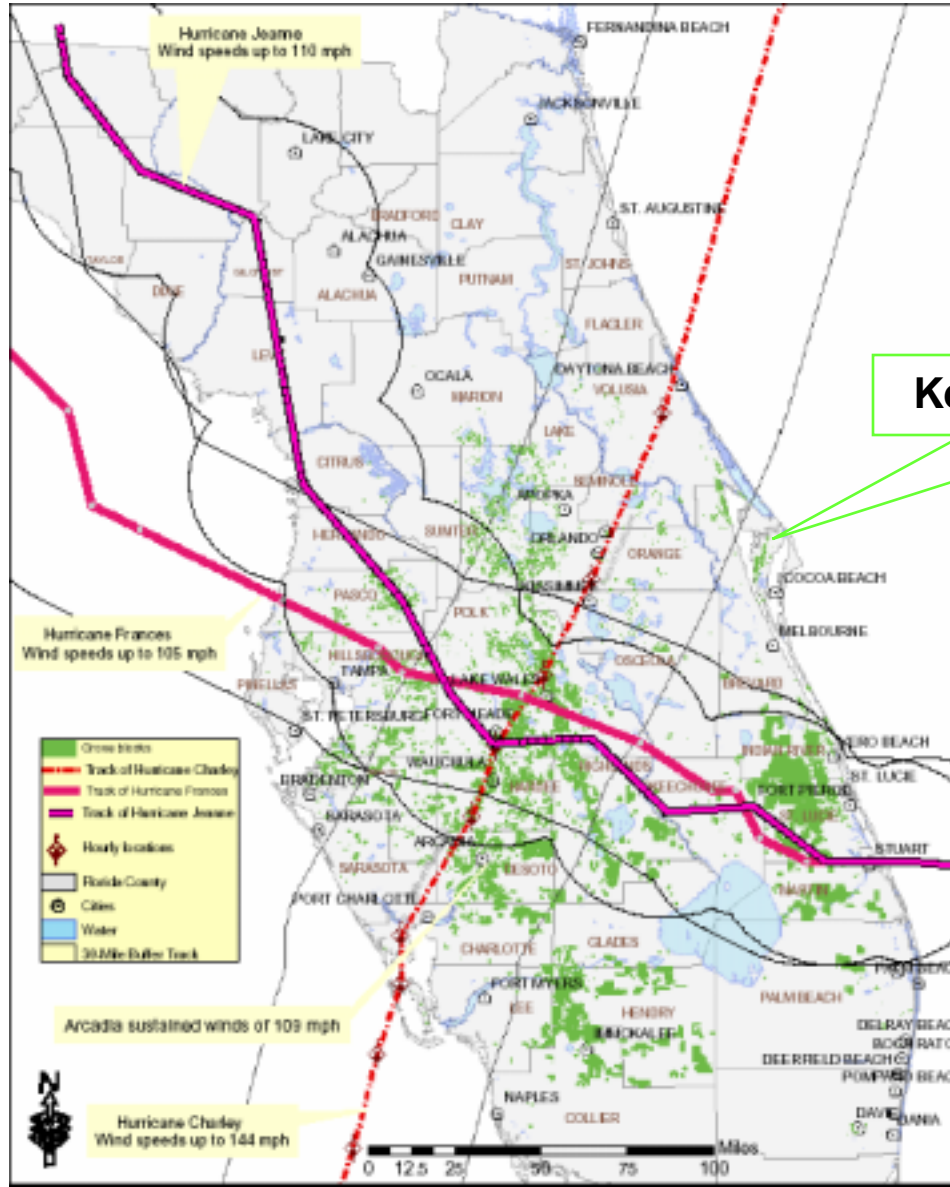
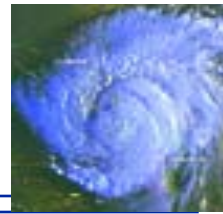
FLORIDA

Kennedy Space  
Center

Bahama Is.

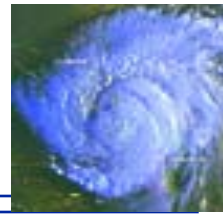


# John F. Kennedy Space Center Hurricane Frances Damage Assessment Photos





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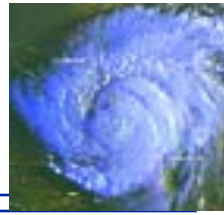


KSC  
Launch Complex 39 Area

KSC  
Industrial Area

KSC  
Visitor Complex

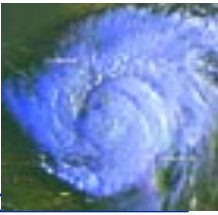
CCAFS  
Industrial  
Area and  
Fuel Storage  
Area



## KSC Wind Speeds

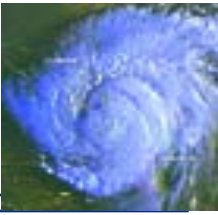
<b>Hurricane</b>	<b>&lt; 50' level sustained/gust</b>	<b>500' level sustained/gust</b>
Charlie	40/60 mph	60/80 mph
Frances*	69/94 mph	81/102 mph
Jeanne*	50/70 mph	82/93 mph

\* Both Francis and Jeanne were very large & slow moving storms I resulting in the maximum sustained winds persisting for 10 to 12 hours and high winds for 20 to 25 hours. Both had also been forecast and on track to directly strike CC and KSC but delayed their NW turns



## Saffir-Simpson Scale of Hurricane Intensity

Category	Wind Speed (mph)	Storm Surge	Damage
1	74-95	4-5 ft	minimal
2	96-110	6-8 ft	moderate
3	111-130	9-12 ft	extensive
4	131-155	13-18	extreme
5	> 155	>18	catastrophic

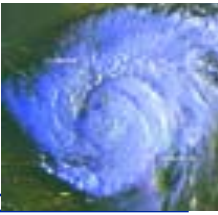


## Wind Speed Reference

- 25 - 31 mph
  - Large Branches in motion; whistling in telephone wires.
- 32 - 38 mph
  - Whole trees in motion.
- 39 - 54 mph
  - Twigs break off of trees; wind impedes walking.
- 55 - 72 mph
  - Damage to chimneys and TV antennas; pushes over shallow-rooted trees.
- 73 - 112 mph
  - Peels surface off roofs; windows broken; mobile homes overturned.
- 113 + mph
  - Roofs torn off homes; weak buildings and mobile homes destroyed; large trees uprooted.



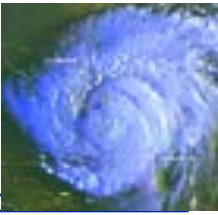
# John F. Kennedy Space Center Hurricane Frances Damage Assessment Photos



Vehicle Assembly Building (VAB) (K6-0848) – exterior panel damage (south side)



# John F. Kennedy Space Center Hurricane Frances Damage Assessment Photos



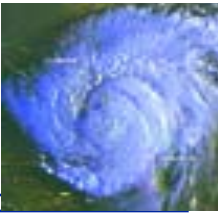
LC39 Area:

Vehicle Assembly Building (VAB) (K6-0848) – side panel damage above low bay south side





# John F. Kennedy Space Center Hurricane Frances Damage Assessment Photos

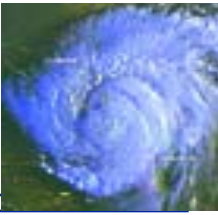


LC39 Area:

Vehicle Assembly Building (VAB) (K6-0848) – panels near east side doors damage



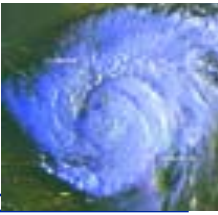
# John F. Kennedy Space Center Hurricane Frances Damage Assessment Photos



Vehicle Assembly Building (VAB) (K6-0848) – debris pile from exterior panels



# John F. Kennedy Space Center Hurricane Frances Damage Assessment Photos

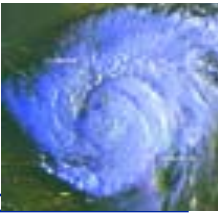


LC39 Area:

Vehicle Assembly Building (VAB) (K6-0848) – exterior roof damage



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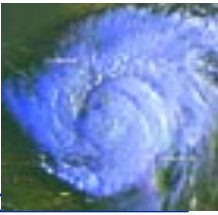


LC39 Area:

Vehicle Assembly Building (VAB) (K6-0848) – interior roof damage



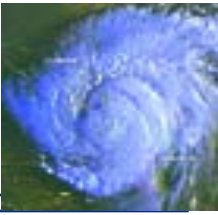
# John F. Kennedy Space Center Hurricane Frances Damage Assessment Photos



NASA facilities on Cape Canaveral Air Force Station  
Hangar AE (60680) – SE corner exterior



# John F. Kennedy Space Center Hurricane Frances Damage Assessment Photos

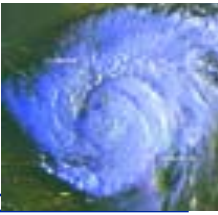


KSC Industrial Area

Vertical Processing Facility (VPF) (M7-1469) – Side panel damage south side



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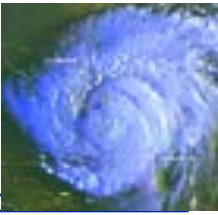


KSC Industrial Area

Vertical Processing Facility (M7-1469) – tarps cover panel damage



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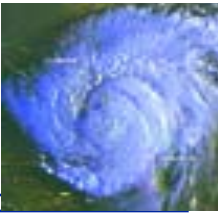


SWIFT payload  
prepared for  
hurricane.





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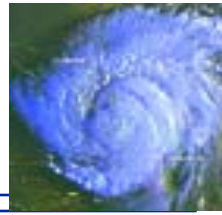


Launch Complex 39 Area

Thermal Protection System Facility (TPSF) (K6-0744) – extensive roof damage on 2<sup>nd</sup> floor east end of facility



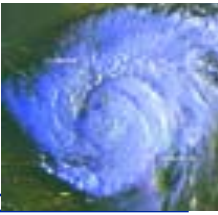
# John F. Kennedy Space Center Hurricane Frances Damage Assessment Photos



Launch Complex 39 Area  
Thermal Protection System Facility (TPSF) (K6-0744) – extensive  
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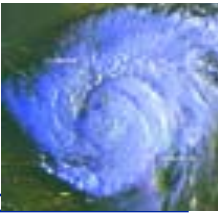


Launch Complex 39 Area

Thermal Protection System Facility (TPSF) (K6-0744) – interior damage  
– 2<sup>nd</sup> floor soft goods area



# John F. Kennedy Space Center Hurricane Frances Damage Assessment Photos

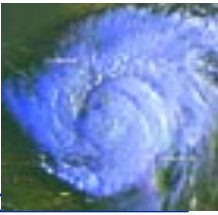


Launch Complex 39 Area

Thermal Protection System Facility (TPSF) (K6-0744) – interior damage



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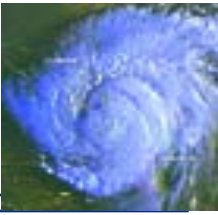


Launch Complex 39 Area

Thermal Protection System Facility (TPSF) (K6-0744) – damaged roof sections on north side of facility



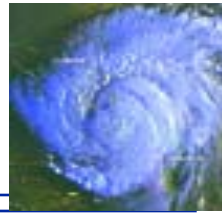
# John F. Kennedy Space Center Hurricane Frances Damage Assessment Photos



Trailers at various construction sites overturned



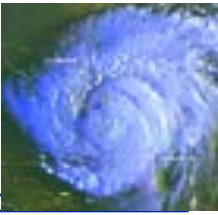
# John F. Kennedy Space Center Hurricane Frances Damage Assessment Photos



Launch Complex 39 Area  
Processing Control Center (PCC) (K6-1094) – exterior roof damage (roof  
on ground in left photo)



# John F. Kennedy Space Center Hurricane Frances Damage Assessment Photos



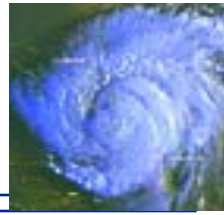
## KSC Industrial Area

Operations and Checkout (O&C) Building (M7-0355) – initial exterior roof damage east end high bay and 5<sup>th</sup> floor (covered with visqueen)





# John F. Kennedy Space Center Hurricane Frances Damage Assessment Photos



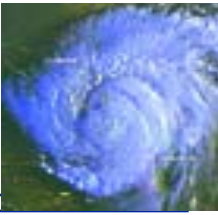
KSC Industrial Area

Operations and Checkout (O&C) Building (M7-0355)  
– tarps cover roof on east end





# John F. Kennedy Space Center Hurricane Frances Damage Assessment Photos



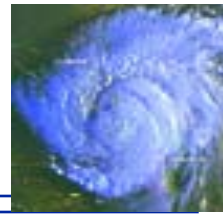
Launch Complex 39 Area

Shuttle Landing Facility

Landing Aids Control Building (J6-2313) – power/communications pole damage, exterior roof damage



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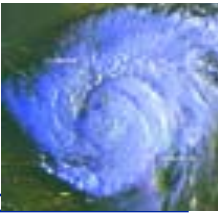


KSC Visitor Complex

Rocket Garden (M6-0409) – Rocket displays damaged, including Juno and Delta



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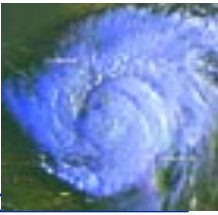


Pass and Identification Building #3 (M3-0002)

Redstone rocket display damage



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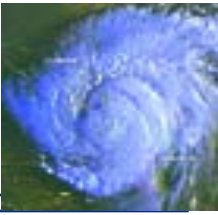


KSC Industrial Area

Prototype Shop (M7-0581) – roll up door damage and interior damage



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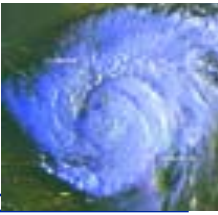


NASA Facilities on Cape Canaveral Air Force Station

Fuel Storage Area #1 (01037) – warehouse roof damage

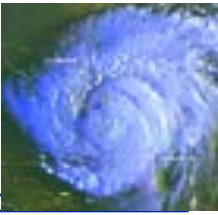


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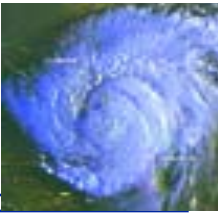
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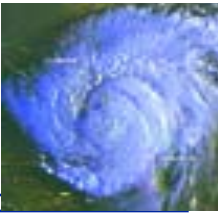


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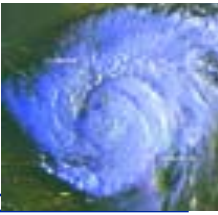


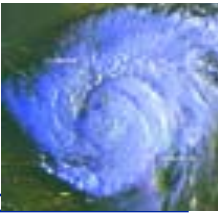
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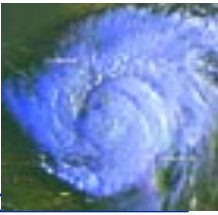


## The Good News

No report of significant personnel injury on Center during storm preparations, the actual storms, or securing after the hurricanes even though the unique activities, increased material handling activities, and added workplace stressors had significant potential to cause injury and/or illness.

There was no evidence of Flight Hardware damage as a result of either Hurricane Frances or Jeanne despite the storm damage to facilities housing shuttle, station and payloads

The Centers Emergency Management Processes and capabilities worked as expected and as planned/drilled



## The Good News

Center Managers did not hesitate to recognize the needs of the workforce

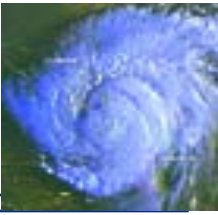
Time off to prepare family for evacuation and home for storm

Time for evacuees to get in front of the wave departing Florida

Time to return to Brevard County

Bulletin board/help line

Supervisory discretion for added excused leave if warranted

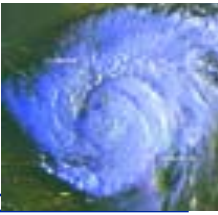


## The Good News

Daily and sometimes twice daily tag ups with the entire senior Management team worked extremely well to keep major departments and contract partners informed of the decision making process

- Weather predictions leading up to storms
- Team discussion relative to HURCON status
- Decisions relative to when to evacuate
- Tie in of Brevard County EP Manager
- Scope of damage - real time
- Return to work strategy

Establishment of message center for call in status



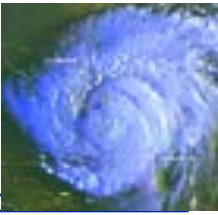
## The Good News

Hurricane Recovery Team took a very aggressive stance via removal of building materials with potential for mold growth. If in doubt rip it out.

Hot line for reporting wet building materials

IAQ/Mold scoring system developed to focus on worst first locations

Contracted IAQ consultants to augment existing environmental health staff



## The Good News

The hurricane season 2004 stimulated a comprehensive lessons learned Process and discussion which identified many valuable lessons learned

Leadership/supervision

Communications

Safety

Traffic

Facilities

Planning

Power

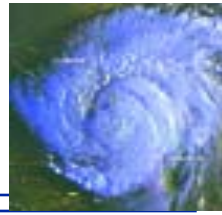
Logistics

Miscellaneous





# John F. Kennedy Space Center Hurricane Frances Damage Assessment Photos



- **HURRICANE CHARLEY**

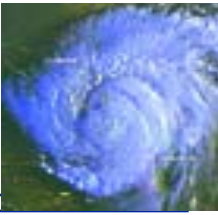
- Hurricane Charley made landfall on the west coast of Central Florida on the night of Friday, August 13, 2004, then passed over KSC during the morning of Saturday, August 14, 2004.
- Excused leave date was Friday, August 13, 2004.

- **HURRICANE FRANCES**

- Hurricane Frances hit KSC on Sunday, September 5, 2004.
- Excused leave dates were Thursday and Friday, September 2 & 3, 2004, and Tuesday through Friday, September 7-10, 2004, with Monday, September 6, 2004 being a federal holiday (Labor Day).

- **HURRICANE JEANNE**

- Hurricane Jeanne hit KSC on Saturday, September 25, 2004.
- Excused leave dates were Friday, September 24, 2004 and Monday, September 27, 2004.



## Workforce Impact

Work-hours Lost due to Center closings

Civil service	~ 125,000
Contractors	~ 700,000

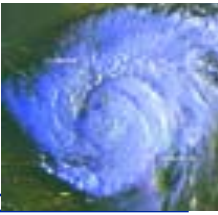
Hurricane Preparation and recovery (initial)

~ 90,000

Relocation of personnel and equipment (> 700 personnel moved to temporary work locations)

~ lost work hours not tracked

Total: > 450 work-year equivalents of lost time due to the 2004 Hurricane season



## Challenges

Personnel returning to Center in heavily damaged configuration

- Building panels vulnerable to continued high winds

- Water intrusion, mold, IAQ issues

- >700 personnel displaced from normal work locations

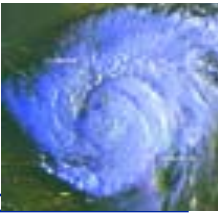
- High volume of contracted emergency construction activity

The next storm on the way

Heavy push to fully understand damage

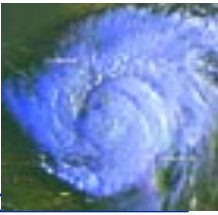
Major impacts of the home front for most of the workforce (trying to deal with FEMA, Insurance companies, home mitigations)

2 years worth of construction safety @ 5 times normal level



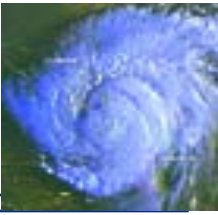
## KSC Hurricane Approach

The NASA Hurricane Executive Management Team (EMT) is chaired by the Center Director and the Air Force 45<sup>th</sup> SW Battle Staff is chaired by the 45<sup>th</sup> SW commander or designee. They will jointly establish the hurricane condition (HURCON) applicable to KSC/CCAFS and the Florida Annexes. Once a HURCON has been declared, the primary Emergency Operation Center (EOC) will be activated and will effect appropriate announcements and notifications.



## KSC Hurricane Approach

KSC utilizes the Incident Management System (IMS) structure which provides coordination and direction during emergencies. The Incident Commander (IC) is responsible for front-line management of the incident, for planning and execution, for determining whether internal and external assistance is needed, and for relaying requests for all support through either the 911 Center or the Emergency Operation Center (EOC) The IC for hurricanes is the Center's Emergency Preparedness Officer.



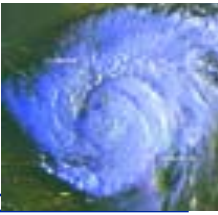
## Hurricane Preparation

**KSC uses a Phase approach in preparation for a forecasted storm strike based on preparation time.**

- Hurcon IV                      50-Knot/58-MPH winds within 72 hours
- Hurcon III                     50-Knot/58-MPH winds within 48 hours
- Hurcon II                      50-Knot/58-MPH winds within 24 hours
- Hurcon I                        50-Knot/58-MPH winds within 12 hours

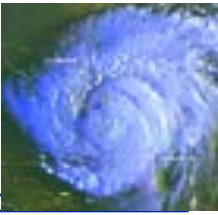
These are decision based points in determining adequate preparation activities such as:

- The securing and safing of high value flight hardware.
- The implementation of facility configuration for ride-out/center closure.
- The establishment of critical systems maintainability.
- The release of personnel based on organizational as well as personal needs.



# Hurricane Emergency Preparedness

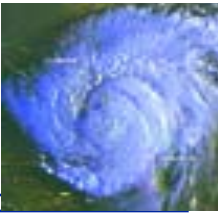
**Emergency Operations Center (EOC)** – This is the control center that is activated by the Center Director to manage the KSC Hurricane response starting with the preparation and continuing through the recovery process. This team is comprised of critical organizational representatives to manage and control efforts such as control of critical functions, assessment and analysis, offer recommendations to the Center Director such as return to work. It is the communications center for information to the work force, to the community, as well as to the Center Director.



## Hurricane Emergency Preparedness (Continued)

**Ride-out Team** – This Team is pre-selected and comprised of critical skills and personnel to assist in maintaining critical systems (such as electricity, environmental controls, temperature controls etc.) to protect critical flight hardware and facilities during the hurricane if possible. This team may not be utilized during Hurricanes of the magnitude of Category 3 or greater in strength on the Saffir/Simpson Scale due to the potential of extensive to catastrophic damage.





## **Hurricane Emergency Preparedness** **(Continued)**

**Damage Assessment Recovery Team (DART)** – These Teams are comprised of critical organizational representatives for the purpose of assessing damage to their affected areas/facilities. These DART Teams represent the Shuttle Program, ISS Program, ELV Program, Payloads Program, and Institutional areas. They work through the EOC in reporting damage assessment for senior management to act on relevant to protection of personnel, facilities, equipment, flight hardware and other high value items.