Emergency Planning: Challenges & Lessons Learned

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Emergency Planning

Challenges and Lessons Learned
NASA Johnson Space Center and the Houston/Galveston Area

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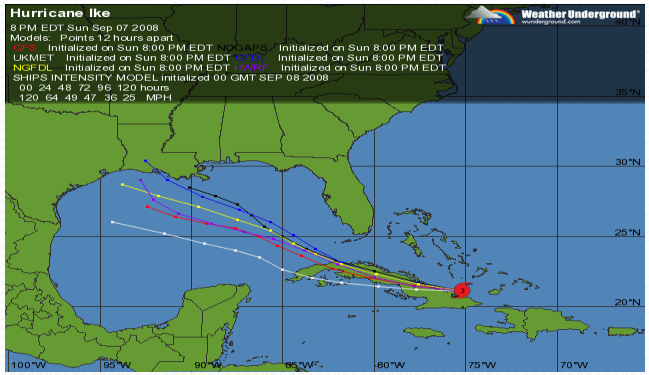
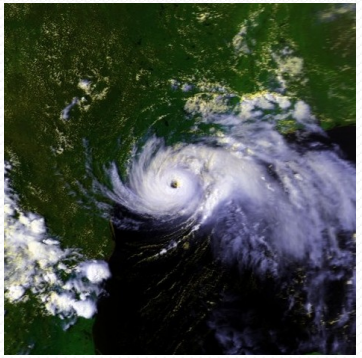
Hurricane Ike and Other Texas Storms

Texas Coast is subject to a Hurricane or Tropical storm once / 2 years

Tropical Storm Danielle- 1980
Hurricane Jeanne 1980
Hurricane Alicia 1983 Cat 3…
Tropical Storm Allison 1989 caused torrential rainfall and flooding
Hurricane Chantel 1989
Hurricane Jerry 1989…
Tropical Storm Allison 2001 flooded the medical center.
Hurricane Rita evacuation caused mass evacuation and deaths
Hurricane Ike 2008





Hurricane Ike September 2008

Landed as a CAT 2 storm for wind– but the 20 foot storm surge that inundated barrier Islands off Texas cost was similar to what a CAT 5 storm would generate. Storm surge came before the storm- Galveston flooded prior to storm/ water on JSC property prior to storm.

Heavy rains peaked at 18.9 inches. Power out to 2.6 M people. $19.3 B Damage. 84 people died.

JSC was closed for two weeks. The majority of work force was under mandatory evacuation notice.

Lessons Learned

Challenges associated with managing through a disaster and post-disaster recovery

- Preparation
  - Better Center closure coordination with local jurisdictions and school districts
  - Improvements in Internal Communication
    - Cell phones often did not work
  - Logistical preparation -Park vehicles indoors--windows were blown out

Lessons Learned

Challenges associated with managing through a disaster and post-disaster recovery

- Ride Out
  - Ride out team consisted of ~65 members and Precinct 8 Constables Office Members
    - Team membership should include a Facility Manager representative and additional High Voltage Utilities personnel
  - Supplies and Equipment need to be evaluated
    - Roof blew off part of Mission Control where ride out team was located
    - MRE's should be self heating /Flashlights did not always work Bed materials inadequate
    - Stores and restaurants were closed 3 to 5 days post storm- made it hard to get materials and meals

Lessons Learned

Challenges associated with managing through a disaster and post-disaster recovery

- Recovery
  - Preparation was focused on Preparation and Ride Out- not on Recovery
  - Recovery Teams
    - Teams had access issues
      - Roads were blocked /gas not available
      - Instruct employees to leave office doors unlocked and lock up sensitive materials.
    - Recovery teams should include procurement and budget support to finalize task orders for quick response construction work.
  - Ensure materials are on hand for recovery efforts
    - i.e. transportation, ceiling tiles, carpet tiles, plywood, tarp, water, etc.
    - Pre-stage materials – caution tape, etc.
    - Consider having a standby subcontract with an asbestos consulting firm for sample turnaround.
    - Meals provided for ride out team- but not recovery. Grocery stores were closed due to power loss

Lessons Learned

Challenges associated with managing through a disaster and post-disaster recovery

- Recovery
  - Sharing of resources: Stennis Space Center sent supplies and 1500 gallons of fuel
  - Large volumes of debris to clean up (Ike generated an estimated 25M cubic yards – 5,000 football fields a yard high- and cost >$80M to clean up)
  - Hidden “costs” of Power loss
    - Central plant went down due to power failure
    - Data center lost cooling and power
      - No back up generator
      - NOMAD email system went down along with multi center systems
    - Power loss caused pressure loss to potable water system
      - System had to be re-pressurized and then retested
      - Created unplanned need for drinking water for recovery team

Lessons Learned

Challenges associated with managing through a disaster and post-disaster recovery

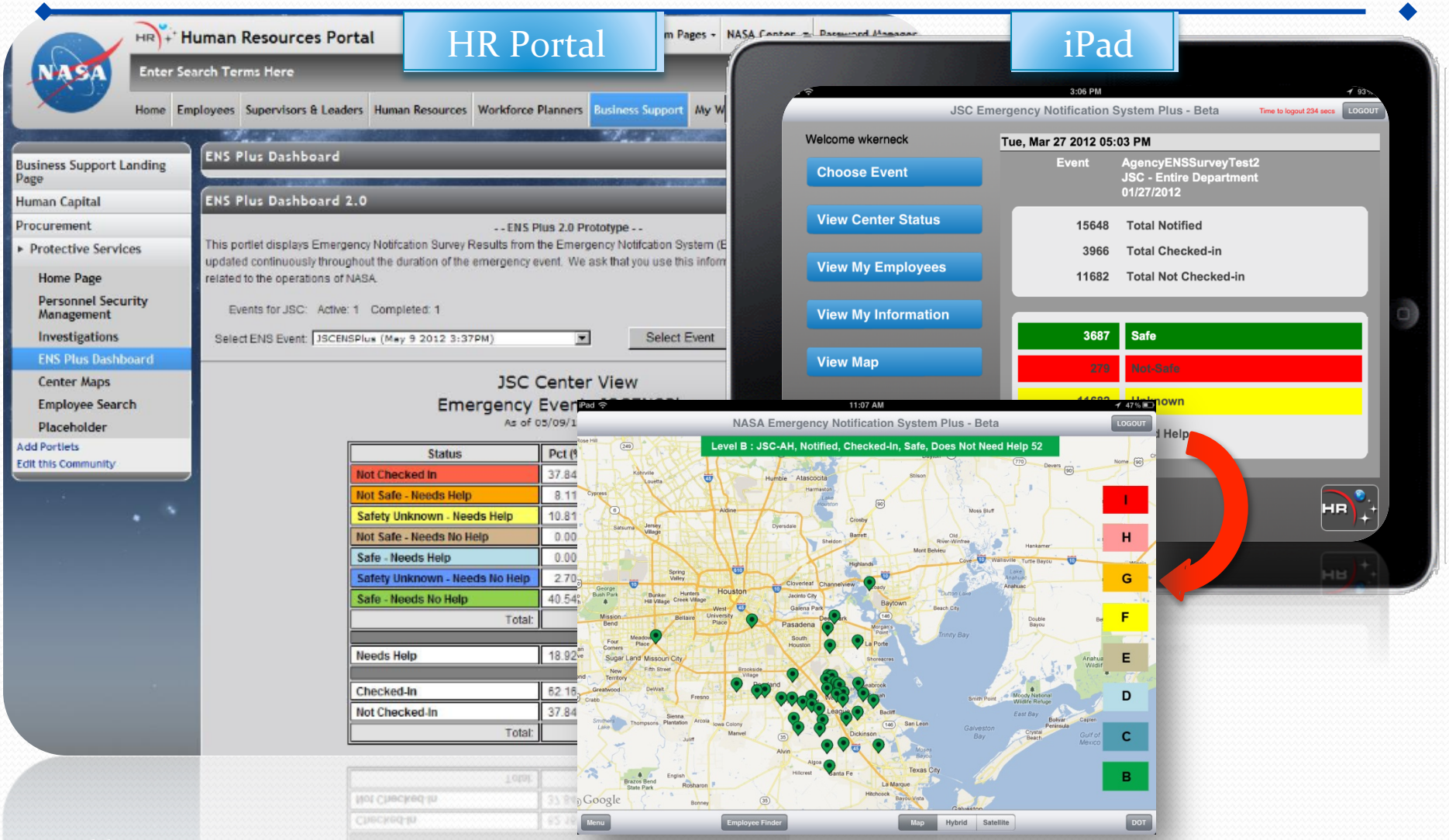
- Damage Assessment
  - Segregate Recovery and Damage Assessment
  - Training for damage assessment
  - Updated equipment to record damage (cameras, etc)
  - Rewrote Damage Assessment Annex to include Facility Manager support
  - Pre-stage Facility Housing Plans, GIS data, and other documentation tools to help in the damage assessment.
  - Need administrative help to manage damage assessment data

Lessons Learned

Challenges associated with managing through a disaster and post-disaster recovery

- Biggest issues deal with managing people
  - Hard to determine what resources were available for recovery.
  - Difficult to keep everyone organized through a very fluid process.
  - Ride out vs. Recovery
    - Roles got blurred and employees did not get adequate rest
  - Teams comprised of an aging workforce
    - Health concerns when forced to use stairs and endure heat
  - Accounting for workforce during emergencies
    - Led to development of Emergency Notification System (ENS) Plus to help supervisors account for personnel

ENS +
View ENS Plus Reports (HR Portal & iPad)



Changes Made After Ike

Preparation for future climate risks

- Mobile Command Post
  - Plans modified to include Management Away team who utilizes command post to bridge communications between ride out team and Senior management
- Thinking ahead for dual use items
  - Increased number of security cameras across site can aid in damage assessment
- NIMS/Incident Command System (ICS) training and implementation
  - Structured approach defines ride out and recovery teams separately and imposes shifts with mandatory rest time
- ENS Plus developed to help supervisors account for personnel

Changes Made After Ike

Preparation for future climate risks / disasters

- Space Act Agreements with local agencies to provide coordinated responses to a wide spectrum of emergencies affecting JSC and the surrounding communities
  - Reciprocal use of Emergency Operations Centers
  - US Coast Guard Marine Safety and Security Team from Galveston can bring their heavy rescue vehicles on site to avoid flooding during hurricanes (Cat 1 or 2)
  - Bay Area First Responders will be provided space to park emergency vehicles at Ellington Field to allow them to return to their communities more quickly. During Ike they were on the north side of Houston and were unable to return to their communities. In reciprocation, JSC Emergency Ops can utilize their facilities in cases of emergencies.

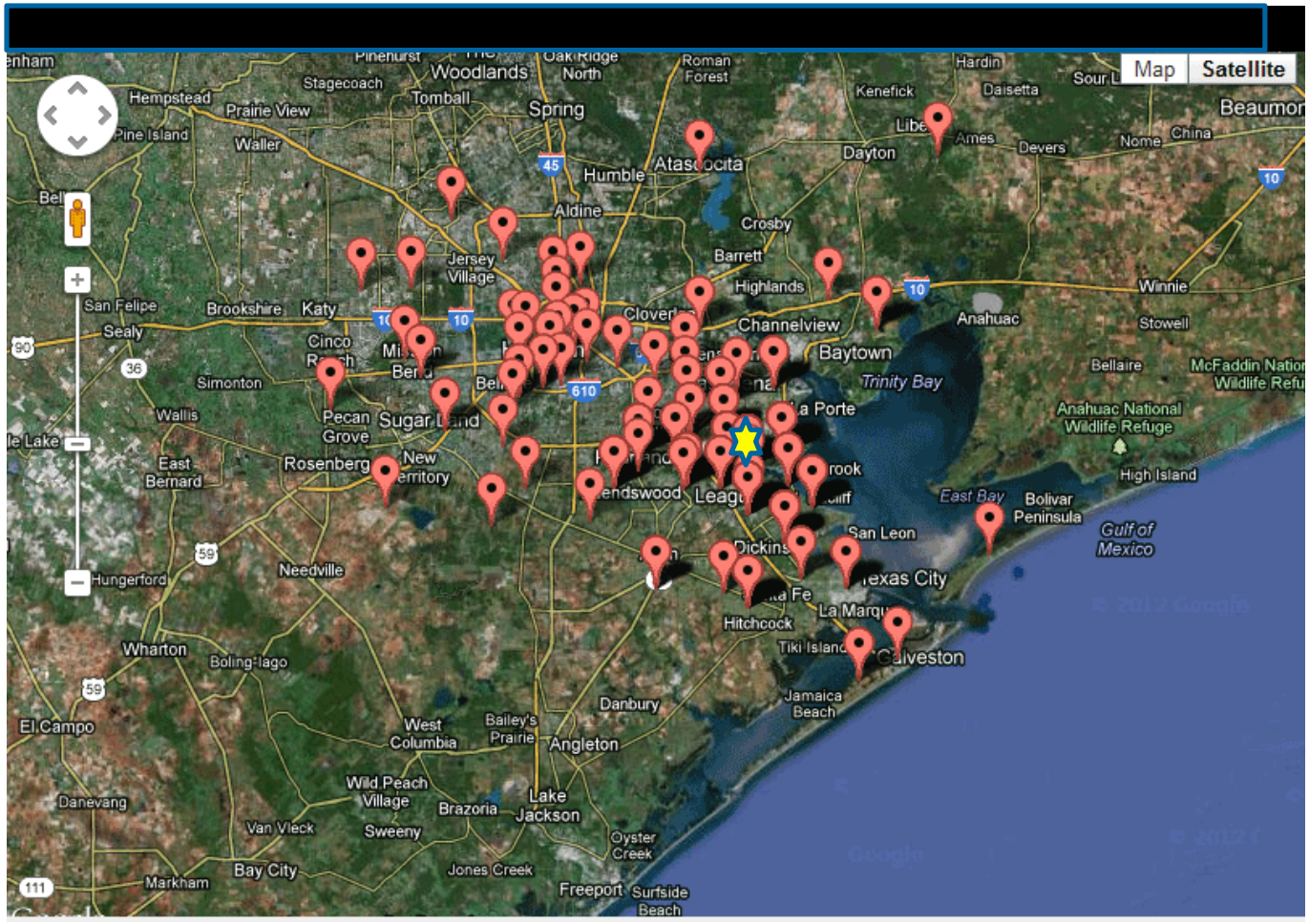
Regional Lessons Learned

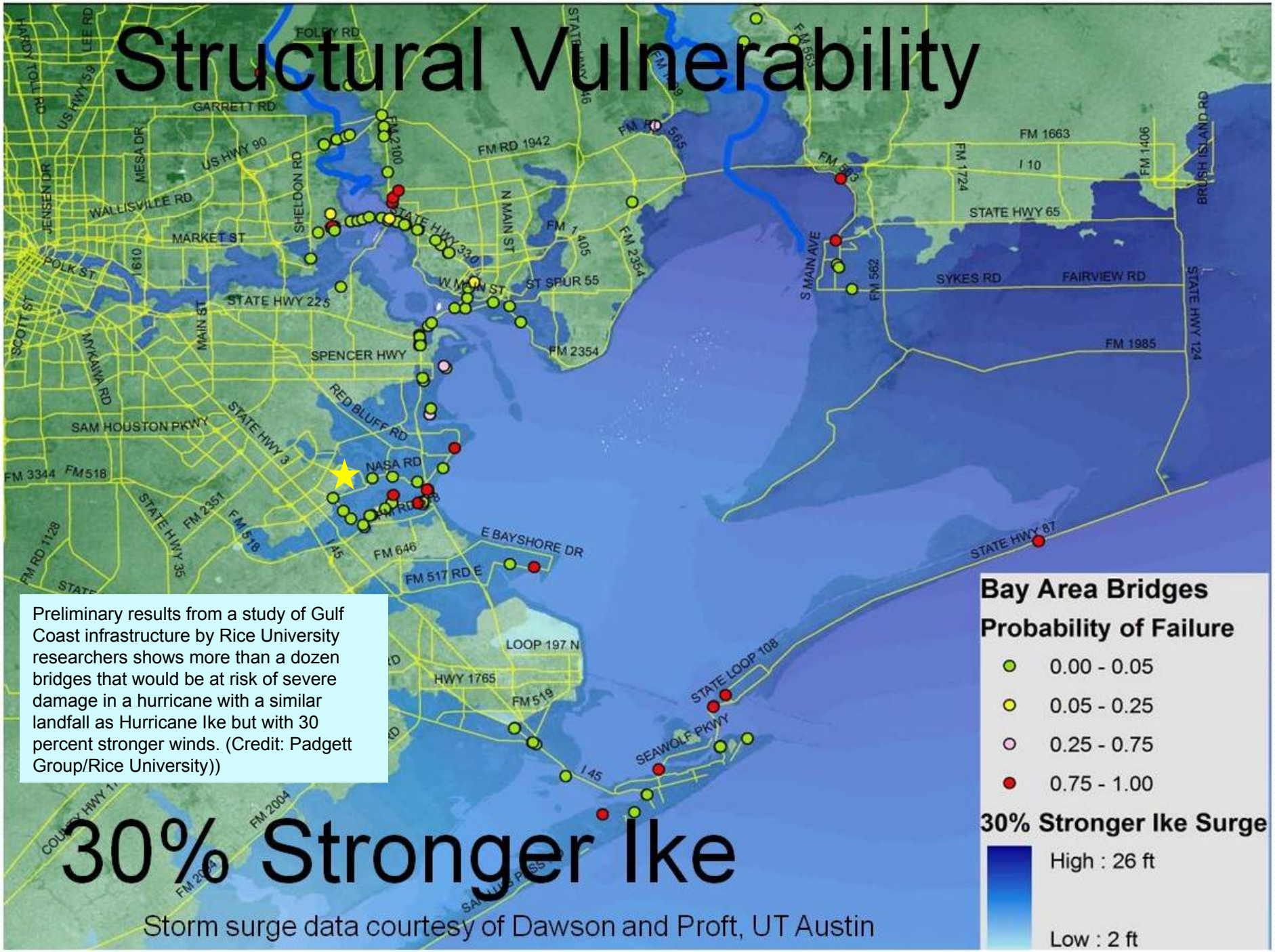
Workforce Availability depends on regional conditions:

- Power outages
- Gas not available /Roads not open
- Schools and daycares closed
- Employees dealing with personal loss
  - Posted websites for news and insurance information
  - Safety tips for cleaning water damaged homes- mold issues
  - Set up voluntary contribution fund for impacted employees
  - Organized work groups to help affected employees
- The Gilruth Center was opened to the public to provide showers, recharging stations, and air conditioning

People/Community System

Greater Houston/Galveston Area

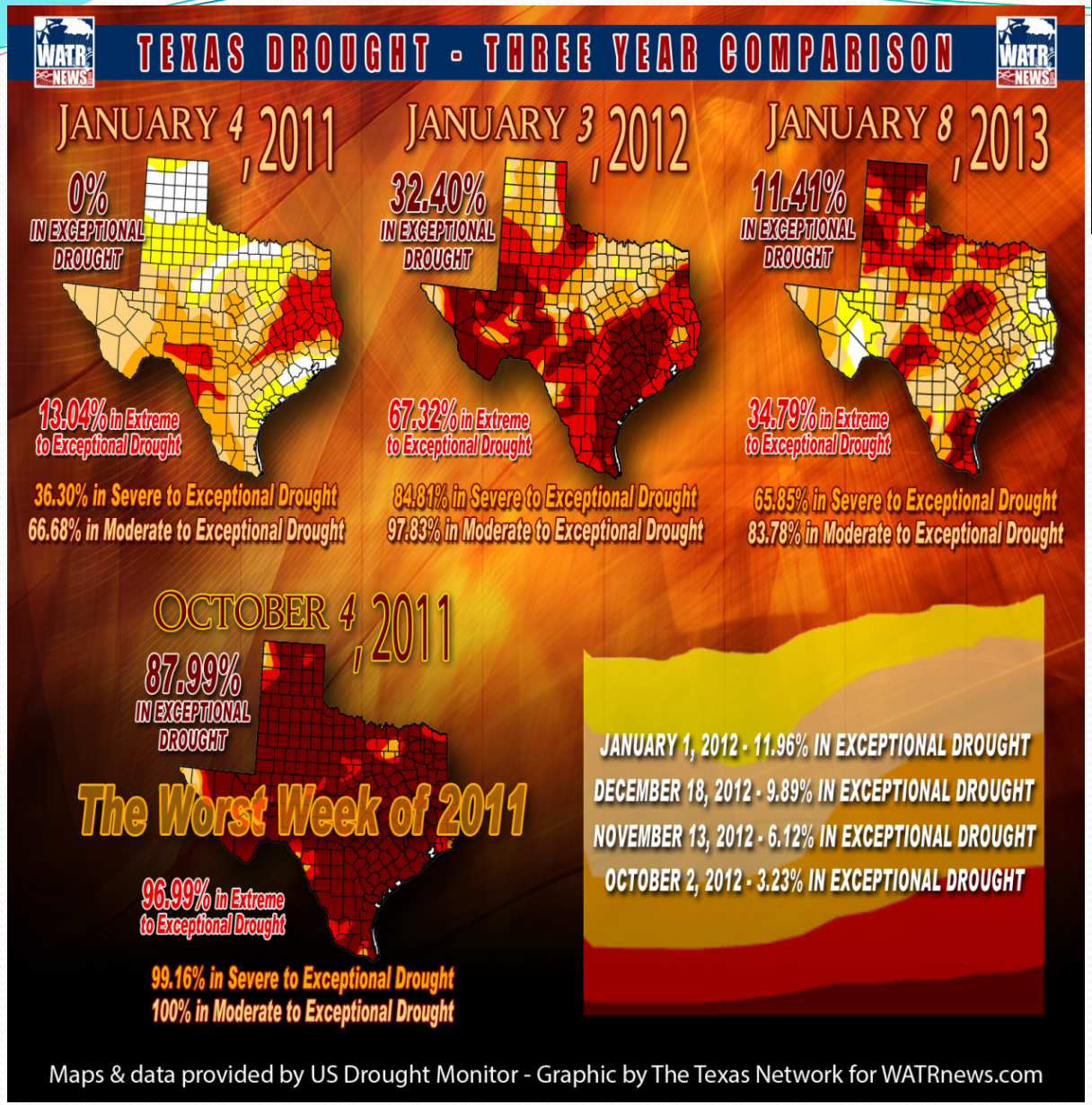




Preliminary results from a study of Gulf Coast infrastructure by Rice University researchers shows more than a dozen bridges that would be at risk of severe damage in a hurricane with a similar landfall as Hurricane Ike but with 30 percent stronger winds. (Credit: Padgett Group/Rice University))

Drought in Texas

- Disaster proclamation established by the governor July 5, 2011 was renewed April 18, 2013
  - WHEREAS, record high temperatures, preceded by significantly low rainfall, have resulted in declining reservoir and aquifer levels, threatening water supplies and delivery systems in many parts of the state; and
  - WHEREAS, prolonged dry conditions continue to increase the threat of wildfire across many portions of the state; and
  - WHEREAS, these drought conditions have reached historic levels and continue to pose an imminent threat to public health, property and the economy
- "the drought that has gripped much of Texas since the fall of 2010 shows few signs of abating soon. …parched West and South Texas will remain dry…above average temperatures…increasing evaporation from strained reservoirs…could lead to severe water restrictions."


TEXAS DROUGHT - THREE YEAR COMPARISON
JANUARY 4, 2011
0%
IN EXCEPTIONAL DROUGHT
13.04% in Extreme to Exceptional Drought
36.30% in Severe to Exceptional Drought
66.68% in Moderate to Exceptional Drought
JANUARY 3, 2012
32.40%
IN EXCEPTIONAL DROUGHT
67.32% in Extreme to Exceptional Drought
84.81% in Severe to Exceptional Drought
97.83% in Moderate to Exceptional Drought
JANUARY 8, 2013
11.41%
IN EXCEPTIONAL DROUGHT
34.79% in Extreme to Exceptional Drought
65.85% in Severe to Exceptional Drought
83.78% in Moderate to Exceptional Drought
OCTOBER 4, 2011
87.99%
IN EXCEPTIONAL DROUGHT
The Worst Week of 2011
96.99% in Extreme to Exceptional Drought
99.16% in Severe to Exceptional Drought
100% in Moderate to Exceptional Drought
JANUARY 1, 2012 - 11.96% IN EXCEPTIONAL DROUGHT
DECEMBER 18, 2012 - 9.89% IN EXCEPTIONAL DROUGHT
NOVEMBER 13, 2012 - 6.12% IN EXCEPTIONAL DROUGHT
OCTOBER 2, 2012 - 3.23% IN EXCEPTIONAL DROUGHT
Maps & data provided by US Drought Monitor - Graphic by The Texas Network for WATRnews.com

CRAWFORD
PHARMACY
PRAY
FOR
RAIN

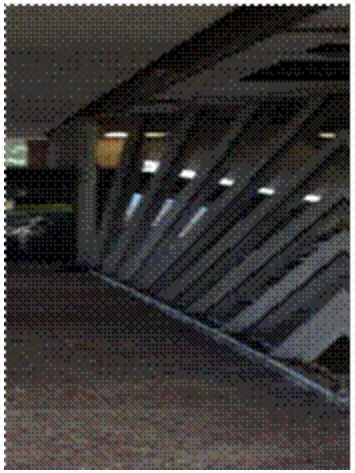
Drought in Texas

- Texas Forest Service estimates drought has killed more than 5.6 million trees statewide… hardest hit area is Houston and other urban areas where watering was restricted.

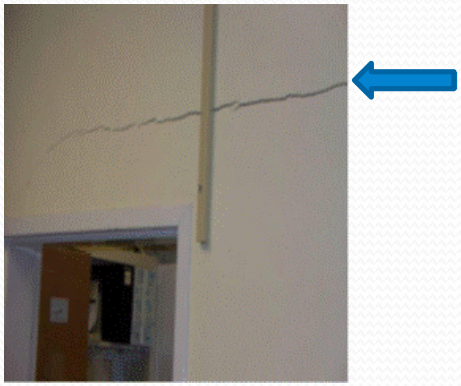
Houston Memorial Park 2010 and 2011

Lessons Learned

Challenges associated with managing through a disaster and post-disaster recovery



- Droughts are a long term “disaster”
- Fire prevention and preparedness
- Water rationing and conservation
  - Consider reuse of gray water
- Salvaging trees and replanting
- Infrastructure damage to foundations / window walls resulting from extended drought.



Recommendations to help design facilities for natural disasters: Mitigation through Construction

- **Buildings should be built to withstand a CAT 3 storm for wind:** Example: B46 data center designed for 95MPH winds and a mod CAT 2 storm (102MPH) could cause structural damage /mod CAT 3 storm (120MPH) could cause complete structural failure to the building frame
- **Buildings should be built at higher elevations-les less expensive than flood gates.** Example: Finished floor elevation of B46 is 21.08' above sea level. Storm surge elevation from CAT 3 is 20.9 ft. and a moderate CAT 4 is 23.7 feet.
- **Phone systems should be on Reliable generators.** Generator for the EOC and generator for backup network systems and phone system did not function during Ike. JSC emergency personnel were affected by lack of services . Cell phone service was unreliable /not working.
- **Tunnel project:** Raised height of tunnel vents and sealed hatches across site and installed floodgates to mitigate risk of flood impact to tunnel
- **Roof repair:** Gravel from roof ballasts damaged vehicles during Ike. Roof repair utilized different construction to remove gravel.
- **Security Camera Installation**: Dual purpose use: cameras can be used for damage assessment
- **New Facility Construction:** New Facilities are planned so that locations and features add resiliency

Climate Change Risks for Emergency Management

How climate change risks to infrastructure and availability of climate information impacts emergency planning

- Having information in advance increases the awareness to potential threats
- Sea level rise combined with subsidence
  - Greater Houston area affected by subsidence more than any other metropolitan area
    - JSC elevation lowered 5-6 feet of subsidence before changing to surface water
- Impact to roads and bridges/access for responders
- Increased temperatures result in heat stress
- Extended Drought Conditions
  - Water rationing and fire response
  - Infrastructure damage