Update on Preliminary Reconnaissance of Hurricanes Harvey and Irma

February 20, 2018
NCST Advisory
Committee Meeting

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NIST
National Institute of Standards and Technology
U.S. Department of Commerce

Preliminary Reconnaissance Scoring Criteria

1.0 Event Consequence			
	Low	Medium	High
A. Mortality			
Facility context	0	1 to 2	>2
Community context[1]	0 to 3	4 to 9	>10
Regional context[2]	0 to 5	6 to 19	>20
B. Exposed Population			
Facility context	<100	100 to 499	≥500
Community context	<1 000	1 000 to 9 999	≥10 000
Regional context	<100 000	100 000 to 999 999	≥1 000 000
C. Hazard and/or Failure Intensity			
Earthquake	≤ MMI IV	MMI V to VII	≥MMI VIII
Hurricane at Landfall	≤Cat 3	Cat 4	Cat 5
Tornado	≤EF3	EF4	EF5
Coastal Inundation	< 3 ft	3 to 9 ft	≥ 10 ft
Fire Spread in Structures	Fire spread not beyond area of origin	Fire spread throughout a structure	Fire spread beyond structure of origin
Wildland Urban Interface Fire (WUI)	High Forest Service Fire Danger Rating	Very High Forest Service Fire Danger Rating	Extreme Forest Service Fire Danger Rating
Blast	< 99 lbs. TNT-equivalent	100 – 999 lbs. TNT-equivalent	> 1000 lbs. TNT-equivalent
Impact	$< 1 \times 10^6$ ft lb/sec	1×10^6 to 1×10^7 ft lb/sec	$> 1 \times 10^7$ ft lb/sec

Preliminary Reconnaissance Scoring Criteria

D. Physical Damage[1]			
Failure during Construction or in Service[2]	Minimal physical damage and/or loss of function	Moderate physical damage and/or loss of function	Severe physical damage and/or loss of function
Engineered Building Systems[3]	Minimal physical damage and/or loss of function	Moderate physical damage and/or loss of function	Severe physical damage and/or loss of function
Transportation & Utility Systems[4]	Minimal physical damage and/or loss of function	Moderate physical damage and/or loss of function	Severe physical damage and/or loss of function
Non-Engineered Building Systems	Minimal physical damage and/or loss of function	Moderate physical damage and/or loss of function	Severe physical damage and/or loss of function
Count x Weight:			
Event Consequence Score:			

2.0 Evacuation and Response[5]			
A. Evacuation	Normal evacuation	Moderate evacuation challenges	Severe evacuation challenges
B. Emergency Response	Normal operations	Moderate operational challenges	Severe operational challenges
Count x Weight:			
Evacuation and Response Score:			

engineering laboratory

Recent Disasters			
Date	Event	Event Consequence Score	Evacuation and Response Score
12/28/17	Bronx Apt. Fire (New York City, NY)	3.0/5.0	2.0/5.0
10/08/17	Tubbs Fire (Santa Rosa, CA)	4.7/5.0	5.0/5.0
09/20/17	Hurricane Maria (Puerto Rico)	4.7/5.0	5.0/5.0
09/19/17	Puebla Earthquake (Mexico)	3.9/5.0	3.6/5.0
09/10/17	Hurricane Irma (Florida)	3.7/5.0	4.0/5.0
09/06/17	Hurricane Irma (USVI)	4.7/5.0	5.0/5.0
09/06/17	Hurricane Irma (Puerto Rico)	2.3/5.0	4.0/5.0
08/25/17	Hurricane Harvey (Texas)	4.7/5.0	5.0/5.0
08/02/17	Central Oklahoma Earthquake	2.5/5.0	1.0/5.0
06/14/17	Grenfell Tower (London, UK)	4.0/5.0	3.6/5.0
04/24/17	Fuse-47 Apt. Fire (College Park, MD)	2.5/5.0	2.0/5.0
03/19/17	Sunshine Fire	2.0/5.0	1.0/5.0
03/16/17	Raleigh Apartment Fire	3.0/5.0	1.0/5.0
12/02/17	Ghost Ship Fire (Oakland, CA)	3.5/5.0	3.0/5.0
11/30/16	Gatlinburg WUI Fire (Tennessee)	2.5/5.0	3.0/5.0

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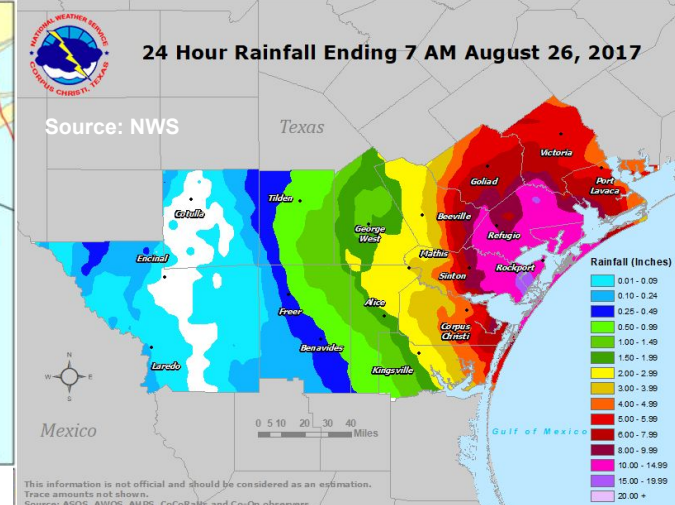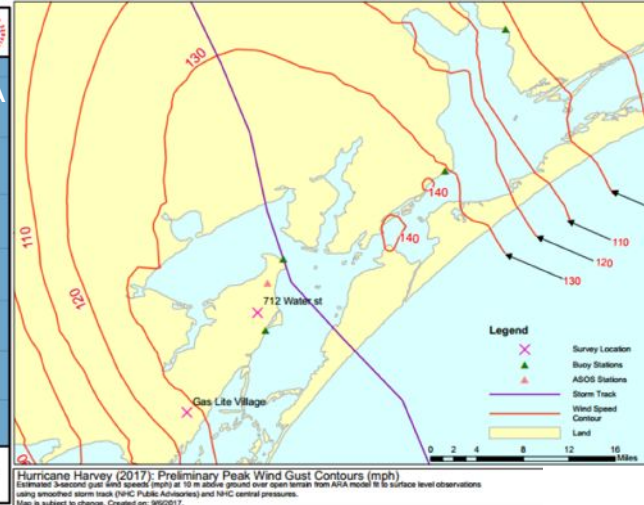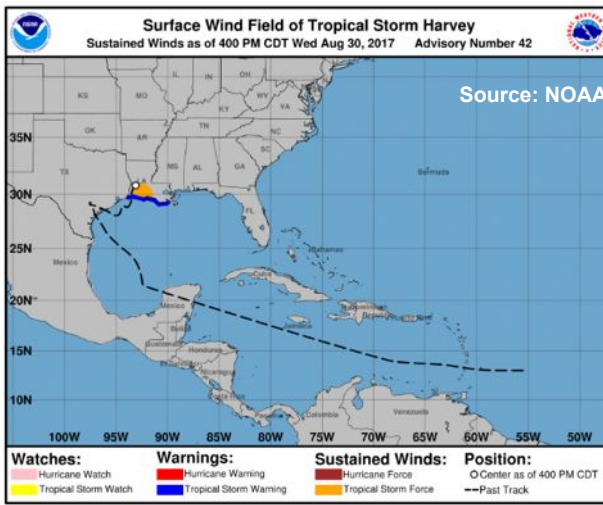| Recent Disasters			
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(1) **What is the unique new knowledge that would be potentially gained from this study?**

(2) **What is the anticipated potential impact on standards, codes and practices?**

(3) **Do we have sufficient resources (people and funding) to support a study? If there is an existing study in the same hazard area, what is the impact on the current study?**

(4) **What is a current assessment of how site conditions would affect safety for a field deployment? Would current site conditions affect the timing of the field deployment?**

(5) **Is there a request for NIST to conduct a study by others (local, state, Federal)? If so, would NIST provide complementary expertise or would NIST have primary expertise?**

(6) **Does NIST have primary authority? If so, would NIST collaborate with other agencies where NIST provides complementary expertise or would NIST have primary authority and/or expertise?**

Hurricane Harvey (Texas): Preliminary Reconnaissance Updates

Hurricane Harvey

Surface Wind Field of Tropical Storm Harvey
Sustained Winds as of 400 PM CDT Wed Aug 30, 2017   Advisory Number 42
Source: NOAA

Hurricane Harvey (2017): Preliminary Peak Wind Gust Contours (mph)

24 Hour Rainfall Ending 7 AM August 26, 2017
Source: NWS

Category 4 Hurricane   **Peak Wind Gusts of 140 mph**   **Record Rainfall (52" total[1])**

NIST deploys a preliminary reconnaissance team Sept 8-15, 2017

Team 1: Rock Port, Port Aransas, and Houston

- Joe Main – Lead
- Jonathan Weigand – Structural Engineering
- Andrew Mundy – Data Collection & IT Support

Partners: FEMA Pre-MAT

Team 2: West Houston

- Jason Averill – Lead
- Dave Butry – Applied Economics
- Maria Dillard – Social Sciences
- Ken Harrison – Infrastructure, Resilience
- Travis Thonstad – Structural Engineering

Partners: UT/GEER, Rice, TAMU, ARUP

[1]Fritz, Angela and Samenow, Jason. "Harvey unloaded 33 trillion gallons of water in the U.S." *The Washington Post* 2 Sept. 2017 Web

Hurricane Harvey

NIST Preliminary Reconnaissance Observations

(1) Damage from multiple sources (wind, wind-borne debris, wind-driven rain, and storm surge) in initial landfall

(2) Extensive wind-induced damage to metal buildings and wood-framed single-family homes

(3) Extensive damage from wind-borne debris

(4) Good performance of recent construction, even in hardest hit neighborhoods.

Hurricane Harvey

Credit: NOAA

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(2) Extensive wind-induced damage to metal buildings and wood-framed single-family homes

(3) Extensive damage from wind-borne debris

(4) Good performance of recent construction, even in hardest hit neighborhoods.

(5) Penetration of wind-driven rain caused extensive damage, sometimes due to inadequately anchored rooftop equipment

(6) Flooding from storm surge caused damage to schools and fire engines in the barrier island of Port Aransas, as well as residences in Port Aransas and Rockport

(7) Good performance of flood-proofing strategies of critical infrastructure.

Hurricane Harvey

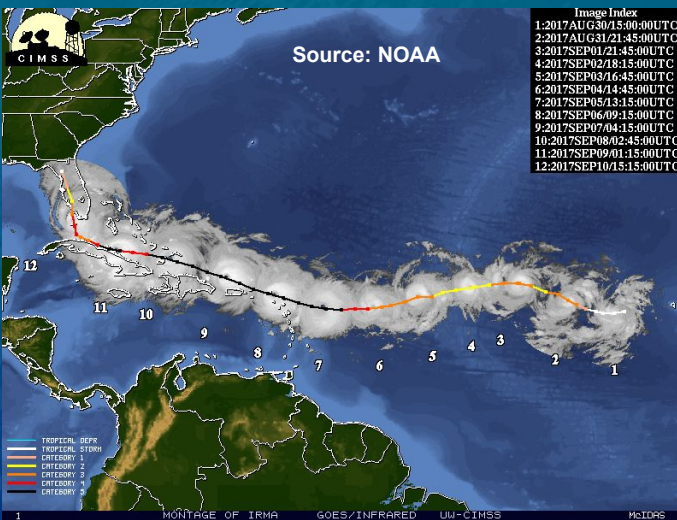## NIST Steps Following Preliminary Reconnaissance

- Have not recommended to the NIST Director to establish an NCST.

- NIST sent one team member back into the field with FEMA for a full MAT study.

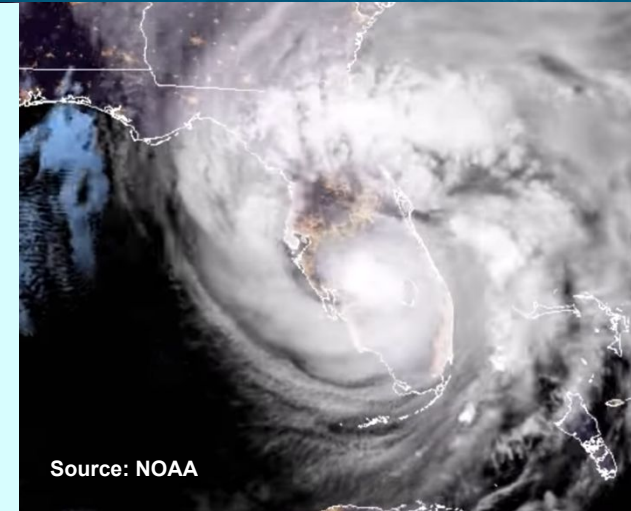# Hurricane Irma (Florida): Preliminary Reconnaissance Updates

Hurricane Irma

Source: NOAA

Source: NOAA

Category 4 Hurricane

Peak Wind Gusts of 124 mph

Record for accumulated cyclone energy (ACE)[2]

NIST deploys a preliminary reconnaissance team Sept 8-15, 2017

Team 1: The Florida Keys

- Long Phan – Lead
- Steve Cauffman – Community Resilience
- Erica Kuligowski – Sociology and Emergency Communication
- Carmen Martinez – Data Collection and IT Support

Team 2: South Florida

- Terri Mcallister – Lead
- Fahim Sadek – Structural Engineering
- Jazalyn Dukes – Structural Engineering
- Jen Helgeson – Applied Economics

[2]Cappucci, Mattew. "September is the most energetic month for hurricanes ever recorded in the Atlantic." *The Washington Post* 27 Sept. 2017 Web

Hurricane Irma

NIST Preliminary Reconnaissance Observations

(1) widespread electrical outage and physical damage to electric power distribution systems (failure of distribution poles & lines due to wind, tree fall)

(2) good performance of newer construction

(3) significant damage to older construction pronounced in the Florida Keys

(4) metal roofs performed better than shingle roofs

(5) old and new manufactured homes suffered significant damage,

Hurricane Irma

NIST Preliminary Reconnaissance Observations

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(5) old and new manufactured homes suffered significant damage

(6) long-term care facilities are not designed as critical buildings, not on FPL's list of critical facilities, and lots of fatalities in single complex

(7) challenges in evacuating people using limited routes and mixed communication strategies

(8) challenges in emergency communication due to extensive outages

(9) FL small business bridge program activated soon after storm

Hurricane Irma
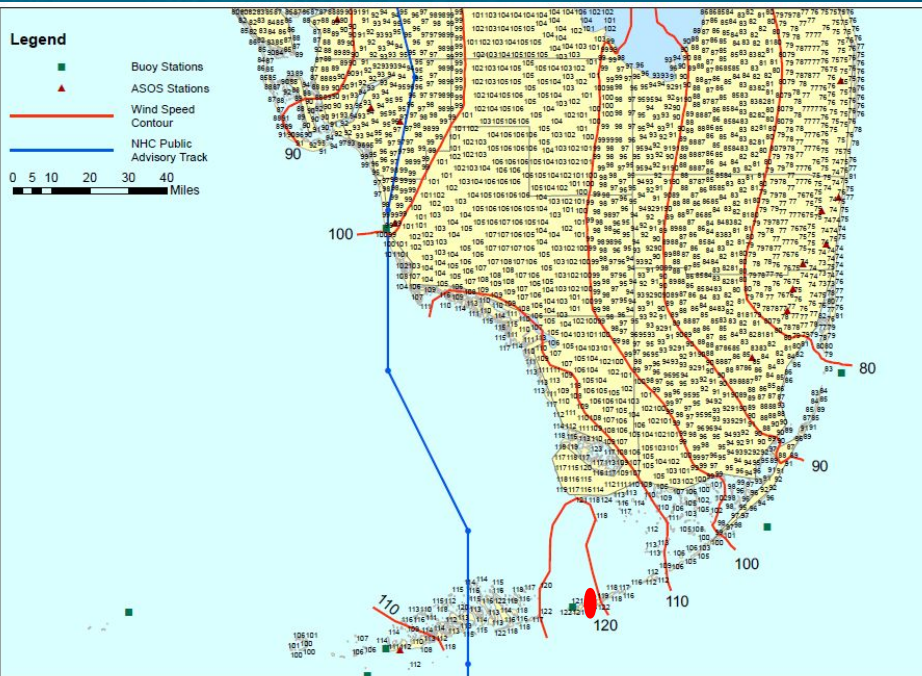
Hurricane Irma (2017): Preliminary Peak Wind Gust(mph)
Estimated 3-second gust wind speeds (mph) at 10 m above ground over open terrain from ARA model fit to surface level observations
using NHC storm track and central pressure data through Forecast/Advisory 52 at 0300UTC on 9/12/2017.
Map is subject to change. Created on: 9/18/2017.

Source: NOAA   Source: NOAA

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Questions?

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