

**National Construction Safety Team  
Advisory Committee (NCST AC) Meeting Summary**

**National Institute of Standards and Technology (NIST)  
Gaithersburg, Maryland**

**February 20, 2018**

**Advisory Committee Members:**

James Harris, Acting Chair	JR Harris and Company
Reginald DesRoches	Rice University
William Holmes	Rutherford & Chekene
Gary Klein	WJE Associates, Inc.
Jeannette Sutton	University of Kentucky
Ross Corotis	University of Colorado, Boulder

**NIST Representatives:**

Designated Federal Officer:

Howard Harary            Director, Engineering Laboratory (EL)

Attendees (in alphabetical order):

Alexander Maranghides	Fire Protection Engineer, Wildland-Urban Interface (WUI) Fire Group, EL
Benjamin Davis	Management and Program Analyst, Community Resilience Group, EL
Christopher Currens	Senior Advisor, Materials and Structural Systems Division, EL
Dorianna Andrade	General Attorney, Office of the Chief Counsel
Erica Kuligowski	Group Leader, Wildland-Urban Interface (WUI) Fire Group, EL
Jason Averill	Chief, Materials and Structural Systems Division, EL
Joseph Main	Research Structural Engineer, Structures Group, EL
Judy Mitrani-Reiser	Director, Disaster and Failure Studies (DFS) Program, EL
Long Phan	Group Leader, Structures Group, EL
Marc Levitan	Acting Director, National Windstorm Impact Reduction Program, EL
Melissa Lieberman	Deputy Chief Counsel, Office of the Chief Counsel
Nelson Bryner	Chief, Fire Research Division, EL
Rajesh Nair	General Attorney, Office of the Chief Counsel
Stephen Potts	Management and Program Analyst, Windstorm Impact Reduction Program, EL
Therese McCallister	Group Leader, Community Resilience Group, EL

## **I. Opening Remarks**

Dr. Howard Harary, the Designated Federal Officer, and Engineering Lab Director opened the meeting at 1:00 p.m., welcoming new members and attendees. He thanked the Committee for their report and said NIST looks forward to presenting their progress over the last five months, and to receiving the Committee's feedback. Harary emphasized that NIST values Federal Advisory Committees because their advice help NIST plan and conduct an effective program. The Committee's feedback is taken with significant consideration. He noted that NIST's report to Congress should be available next month and that NIST continues to work on implementing the Committee's recommendations.

Harary reiterated that since the last Committee meeting, the Disaster and Failure Studies (DFS) program completed two preliminary deployments: one to California and one to Puerto Rico, using information gathered and applied against NCST criteria to determine next steps. DFS's statutory responsibilities include advising the NIST Director on implementing and carrying out the Act. Harary then turned the meeting over to Dr. James Harris, Acting Chair of the Committee.

Harris welcomed the new members. He noted there is a remarkable change in the Committee because three previous NCSTAC members term limits expired. He stated that he looks forward to the upcoming face-to-face meeting with everyone. Harris said that this meeting will be an opportunity to get some idea of the ongoing work being done by NIST and will help the Committee understand what kind of advice can be provided. Harris emphasized that there will not be an emphasis on recommendations from the previous investigations and that the Committee will hold that discussion at the next face-to-face meeting. Harris asked Dr. Judith Mitrani-Reiser, the Director of the Disasters and Failure Studies Program to introduce Alexander Maranghides, a Fire Protection Engineer, who led a team to northern California in response to the Tubbs wildland-urban fires.

## **II. Update on Preliminary Reconnaissance of Northern California Wildfires (Tubbs Fire) - Alexander Maranghides**

[https://www.nist.gov/sites/default/files/documents/2018/02/26/01\\_maranghides\\_tubbs\\_fire\\_wui\\_ncst\\_final.pdf](https://www.nist.gov/sites/default/files/documents/2018/02/26/01_maranghides_tubbs_fire_wui_ncst_final.pdf)

### **Presentation Highlights:**

Factors contributing to the team's success included:

- Prior planning before departure
- Check-in protocols and daily safety briefings
- Multi-agency coordination across local, state and federal agencies

Factors contributing to the fire's behavior included:

- 50-year fuel buildup
- 5-year drought
- Strong winds carried large embers, 8-9 inches in diameter, that probably resulted from structures coming apart and oriented strand board (OSB) pieces being carried by the wind

#### Key observations:

- There were a large number of ignitions but the specifics about the ignitions are unknown.
- The fire spread rapidly from structure-to-structure through continuous horizontal flames.
- Very high local winds in Coffey Park community contributed to the rapid spread of the fire.
- There were large embers bouncing on pavement.
- There were a large number of fatalities (22).
- Loss of water pressure from leaking sprinklers in destroyed residences resulted in difficulty extinguishing the fire. Residential sprinklers are designed to protect the structure from internal fires, a sprinkler system is not designed to protect the home from the outside. This WUI fire burned homes with sprinklers down to the foundation. The water from the sprinkler system continued to flow into the foundation reducing the water pressure available to the fire fighters, and reducing their ability to extinguish fires.
- Night-time evacuations presented unique challenges due to low visibility. An evening WUI event obscures visibility due to the night-time darkness and the heavy smoke. The fire ignitions occurred close to some residents, creating low visibility in the evacuation areas that were also without power.

#### Q&A

Dr. Jeannette Sutton asked, “Is anyone looking at communications and warnings in terms of the evacuations?” Maranghides replied that the deployment was limited to three days, so they prioritized physical data over interviews, but discussed the evacuation notification before leaving when the NIST team met first responders and others in the field.

Mitrani-Reiser added that NIST has institutionalized a virtual team as part of the DFS team. The virtual team, modeled after those implemented by Earthquake Engineering Research Institute’s (EERI) “Learning From Earthquakes” program, supports and augments the work being done in the field to answer legal, technical and other questions. That allows DFS to have a more significant presence even though there is a limited number of individuals in the field.

Gary Klein asked, “What significance does NIST attach to the 1964 Hanley fire?” Maranghides replied that the information on the Hanley fire is incomplete. It is not possible to say with confidence how perimeter information or metadata on that fire was collected. Both fires may have behaved similarly. Looking at historical information on other fires, and across other states, there is a hypothesis that topographical characteristics create a fire-shed, similar to a watershed. In this scenario, the fire makes certain runs tied to the topography, and the topography is tied to the weather. The Diablo winds in that part of the country have very well-defined directions in the valleys, so it is likely not a coincidence.

Harris asked, “Were problems resulting from loss of water pressure from sprinkler systems, and whether they were fire suppression or irrigation systems?” Maranghides replied that there were fire suppression systems. Harris asked, “Were the neighborhoods new enough to have this equipment?” Maranghides could not say that was true across all areas.

William Holmes said that requirements to put sprinklers in all new houses are controversial, especially for those who live far from urban areas, and are without a water supply. He stated that sprinklers are intended to suppress interior fires, although they are sold to Californians as though they are for forest

fires. He asked if NIST had an opinion. Maranghides could not speak to that. One of the structures the team saw was developed in 2007, and it was saved by the sprinkler system; he said there's a range of issues that have to be examined.

## **II. Update on Preliminary Reconnaissance of Hurricanes Harvey and Irma – Dr. Judith Mitrani-Reiser**

[https://www.nist.gov/sites/default/files/documents/2018/02/20/02\\_update\\_on\\_preliminary\\_reconnaissance\\_of\\_hurricane\\_harvey\\_and\\_irma\\_presentation.pdf](https://www.nist.gov/sites/default/files/documents/2018/02/20/02_update_on_preliminary_reconnaissance_of_hurricane_harvey_and_irma_presentation.pdf)

### **Overview of the Disaster and Failure Studies Program's Activities**

Mitrani-Reiser described the NCST deployment scoring criteria and associated decision flow. She indicated that the information available to NIST to score events evolves. Therefore, as NIST receives new information on the event (e.g., intensity updates or number of deaths), the evaluation sheets are updated and are time stamped.

Dr. Reginald DesRoches asked if NIST has always used the Modified Mercalli Intensity (MMI) scale for the deployment scoring criteria. Mitrani-Reiser responded that NIST would like to update scoring methodology (including consideration of other hazard intensity measures), but for consistency, NIST has used the same methodology since the scoring criteria were developed. She suggested the Committee could help NIST with those updates, and continued with the following points:

- The criteria use a weighted average of scores to help NIST prioritize field deployments. Many engineers and scientists at NIST have used the scoring criteria for different hazard types, and NIST has been documenting their experiences to inform potential future changes to the criteria.
- Four of the five events that NIST deployed to last year met the quantitative threshold for deploying, except the Fuse-47 fire.
- The fire that took place in the Fuse-47 apartment complex occurred in an unoccupied building that was under construction (one month away from opening to occupants). The fire did not kill anyone but did cause evacuations of nearby buildings. There may be a recurring event pattern associated with sizeable wood-frame apartment buildings catching fire. Although this event did not have deaths associated with it, a trend of unfinished apartment buildings catching fire over the past year convinced NIST to investigate further. After a preliminary reconnaissance, NIST decided to do a research project under its Organic Act to better understand fire protection systems during the construction phase of buildings.
- NIST did not send teams for preliminary reconnaissance for the Puebla earthquake in Mexico or the Gatlinburg, Tennessee WUI fire, but are exploring research areas in both events.
- NIST is developing a survey instrument for use in Gatlinburg and focused on communication and evacuation decision making. The results of the survey will help NIST understand the communication and evacuation challenges that may have led to fatalities in the Gatlinburg, TN WUI fire. The survey instruments developed for this event can be used as tools in future investigations.
- NIST funded 12 awards under the Disaster Resilience Federal Funding Opportunity. One of those grants was awarded to the University of California, San Diego, which is focused on testing new technologies and algorithms to do damage assessments in the field after events. NIST talked to

awardees under this grant, and one did go to Mexico to study the impacts of using drones. NIST will be evaluating these new tools for use in future NCST investigations.

- The U.S. Virgin Islands (USVI) Hurricane Irma and Maria events scored high on the NIST deployment criteria, but NIST did not deploy due to issues with safety in traveling to areas still heavily impacted by the storm. Instead, NIST invited a delegation from the USVI to discuss potential projects for collaboration.
- NIST deployed two teams to Texas after Hurricane Harvey. The teams were exchanging as much information in the field as possible to maximize time in the field. The Engineering Laboratory has not recommended that NIST invoke the NCST Act for an investigation in Texas, but did embed one team member in the Federal Emergency Management Agency's (FEMA) full Mitigation Assessment Team (MAT) deployment and study.
- NIST deployed two teams to Florida after Hurricane Irma. All field teams were supported by a team back at NIST by the virtual team. The Engineering Laboratory has not recommended that the NIST Director invoke the NCST Act for an investigation in Florida.

### **III. Update on Preliminary Reconnaissance of Hurricane Maria (Puerto Rico) - Dr. Erica Kuligowski**

[https://www.nist.gov/sites/default/files/documents/2018/02/20/03\\_update\\_on\\_preliminary\\_reconnaissance\\_of\\_hurricane\\_maria\\_puerto\\_rico.pdf](https://www.nist.gov/sites/default/files/documents/2018/02/20/03_update_on_preliminary_reconnaissance_of_hurricane_maria_puerto_rico.pdf)

#### **Presentation Highlights**

- Wood structures, unpermitted construction, and rooftop equipment were most vulnerable to wind; rainwater also caused extensive damage.
- Utility system damage included complete electrical outage and almost total loss of communications, especially digital communications.
- While the emergency information was provided via multiple channels and multiple sources (NWS, local governments, media), the perceived credibility of the source is key to response.
- Lack of communications during and after the hurricane hampered response.

#### **Q&A**

- Dr. DesRoches asked if either Hurricanes Harvey or Maria's reconnaissance efforts looked at water contamination. Kuligowski responded that none of our team members collected any data on water contamination. DesRoches said he had many people looking at that, but not sure if it is beyond the scope of what NIST is doing, but he has a lot of data available. Averill stated that NIST was aware of superfund sites that involve water contamination and avoided their location during deployment.
- Klein was interested in the damage to rooftop equipment and asked if the responsibility for resistance to wind is an area for follow-up. Levitan responded that the American Society for Civil Engineers (ASCE) 7 Standard has little information on how to determine loads on rooftop equipment and there is room for additional research in this area.
- Harris asked which issue was bigger - damage to power distribution lines or damage to power facilities. Kuligowski responded that during the field reconnaissance, the teams did not get to

see any traditional power generation sites. They saw significant damage to power network systems of all types, utility lines, and transformer equipment, all the way across traditional power systems. FEMA reported that some solar panels were providing power, but had no battery storage. A hospital had panels still in place, but the cable array was lost so that they could not use them.

- Levitan stated that Tesla did come to provide a solar array and PowerWall batteries for a hospital in Puerto Rico, but there were few systems where a solar energy system was connected and ready to be used.
- Mitrani-Reiser added that NIST teams had several meetings with people with firsthand knowledge of the issues. About eighty percent of power generation is concentrated in the southernmost part of the island (which was severely damaged) and then traverses through a mountainous region to reach customers in more densely populated areas of the north. Both power generation and transmission were severely damaged in Puerto Rico.
- Sutton referenced an earlier statement about source and channel credibility and asked if NIST found evidence that people felt the sources or channels were not credible. Kuligowski responded that the general understanding was that the media is considered credible. Further examination is needed to determine if the National Weather Service or different news outlets have different levels of perceived credibility.

#### **IV. Update on Implementation of Recommendations from the Joplin Tornado Investigation - Dr. Long Phan, Dr. Marc Levitan, Dr. Erica Kuligowski**

[https://www.nist.gov/sites/default/files/documents/2018/02/20/04\\_update\\_on\\_implementation\\_of\\_recommendations\\_from\\_the\\_joplin\\_investigation.pdf](https://www.nist.gov/sites/default/files/documents/2018/02/20/04_update_on_implementation_of_recommendations_from_the_joplin_investigation.pdf)

Levitan presented updates on five of the recommendations from the Joplin Report:

- NIST is developing methods to estimate tornado occurrence more accurately for the tornado hazard maps.
- NIST is working with ASCE to develop criteria for wind performance-based design (PBD), and chairing the ASCE 7-22 Wind Load Subcommittee's new Tornado Task Committee, charged with the development of tornado load provisions for the standard.
- NIST is working on improving tornado shelter standards. The International Code Council (ICC) has agreed to expand the scope of the existing ICC 500, Standard for the Design and Construction of Storm Shelters, to incorporate retrofits of tornado shelters in existing buildings. NIST and FEMA collaborated on the submission of 10 proposals in December 2017 for ICC 500-2020.
- NIST developed all of the building safety-related content in the new National Fire Protection Association (NFPA) 1616 Standard on Mass Evacuation, Sheltering, and Re-entry Programs, providing guidance on selection of buildings for use as shelters for different hazards, including tornadoes.

Kuligowski discussed progress in emergency communications, noting that one of the recommendations from the Joplin report is to develop national codes, standards, and guidance for emergency

communications. NIST held a workshop with super-users (emergency managers, weather service, etc.). The outcomes of the workshop included the following:

- Obtained insights on NIST's interim guidance on short message alerts
- Received feedback on how to create and disseminate short message alerts

Additionally, NIST developed a technical note on short message alerting and will present study findings at the March 2018 NFPA committee meeting.

## **V. Overview of the Joplin Tornado Repository - Dr. Marc Levitan**

[https://www.nist.gov/sites/default/files/documents/2018/02/20/05\\_overview\\_of\\_the\\_joplin\\_tornado\\_repository\\_presentation.pdf](https://www.nist.gov/sites/default/files/documents/2018/02/20/05_overview_of_the_joplin_tornado_repository_presentation.pdf)

Levitan described the repository, and emphasized the following points:

- The repository contains a compilation of images, videos, and documents collected during and after disaster and failure events studied by NIST, as well as data generated from research on those events. The materials in the repository will serve as a historical archive.
- A repository is also a tool for research, and analysis of disaster data and information related to the performance of the built environment, emergency response procedure, and other technical, social, and economic factors.
- Next steps: completing updates, as well as legal and IT reviews for Joplin and Newcastle-Moore Repositories. Also, NIST will make the data publicly available once the reviews are complete.

## **VI. Discussion**

Mitrani-Reiser suggested that NIST could collaborate with academics involved with the National Hazards Engineering Research Infrastructure (NHERI) Centers. This could be helpful to the Centers headquartered at UT Austin (DesignSafe) and University of Washington (Rapid Center), which are developing a national repository for disasters and creating tools for disaster reconnaissance, respectively.

Harris asked if NIST has an estimate for the amount of time it takes to organize information after a reconnaissance effort. Levitan responded that the NIST HUB platform was not in place when previous NCST events occurred. Right now, if a tornado occurred and NIST decided to use the HUB platform, data could potentially be available in a few months. The initial focus would be on getting data processed for internal NIST work. Whether it is made available to the public, would be dictated by permissions granted to NIST to share the data publicly. Mitrani-Reiser added that all team members are trained before going into the field about what kind of data can be shared widely.

Holmes asked about permissions. Lieberman responded that NIST needs permission for anything that anyone else owns the copyright. For example, during the World Trade Center investigations, NIST had to determine who owned the building drawings. Additionally, NIST received documents or photos under non-disclosure agreements. If a picture is taken that has children in it, parent/guardian permission is needed to make those images widely available. Inside homes, NIST needs to get permission from the homeowner. For any investigation where there are volumes of information, it takes a long time to go

back to owners and get that permission. On the street, if a NIST employee takes a photo, NIST owns the right to the image and can share it publicly. DFS is working with the NIST legal team to develop tools to streamline the process.

Harris asked what NIST's expectations for the Puerto Rico study are. Mitrani-Reiser responded that there is a big difference between preliminary reconnaissance (deployments) and a full study of any type. Preliminary reconnaissance is quick and meant to collect data about what the team saw firsthand. After analysis, the Engineering Lab can recommend a full investigation to the NIST Director if the data suggest it is warranted. After the investigations are complete, NIST issues recommendations to influence codes and standards. The recommendations result from thorough data gathering, assessment, and analysis and never come out of a preliminary reconnaissance. The recommendations have incredible strength and power because of the participation of Committees like this one.

Corotis commented that it would be useful to know how NIST has relationships with the different regulatory bodies. Averill responded that for the World Trade Center (WTC) NIST had 30 recommendations that led to 40 code changes. The ICC stood up the Terrorism Resistant Buildings Committee for post-9/11 code change proposals. NIST also worked with the National Institute of Building Sciences (NIBS) to bring together a large group of stakeholders to get perspectives on operationalizing recommendations into code change proposals before they went through the formal process; this helped improve proposals before they went to the full ICC committees. Dr. Long Phan added that regarding Joplin, NIST identified the lead agencies and organizations responsible for implementing each recommendation before publishing the report. After the draft report was released for public comment, NIST met with the ICC and NFPA to discuss the proposed changes to be implemented. NIST is working with ASCE now on Joplin's recommendation #5. Harary commented that NIST keeps a scorecard on the progress of implementation of each of the recommendations and would be happy to share it with the Committee, but cautioned that it is important to approach the scorecard with an open mind. The Committee suggested NIST be mindful of implementation considerations, such as economic feasibility, of specific recommendations moving forward; the Committee recalled that some WTC recommendations were challenging to implement as originally defined in the report.

Harris commented that using the DFS website provides an excellent source of reference. It includes meeting presentations and summaries from more than ten years ago. He agreed that keeping a scorecard of recommendations is great. Harris also agreed that there were recommendations that came as a result of the WTC investigation that he felt had a minimal chance of being fully implemented.

Sutton asked if NIST is working to develop some survey items for field communication, which will be available to people outside of NIST. Mitrani-Reiser responded that we do not, yet, have a good system for collecting data on communication, across disasters. NIST is developing survey instruments and is working to make them public, to be used by others in their studies. When NIST co-deployed with its Center of Excellence on Risk-Based Community Resilience Planning, it helped develop structured and unstructured surveys on housing dislocation, business recovery, and school closures. The ultimate goal is to create a library of DFS tools and publish them in peer-reviewed journals or other mechanisms (e.g., DFS website, DesignSafe, etc.) and make them publicly available.

Kuligowski referred to protocols related to the Gatlinburg event. She stated it is a more structured survey for the public, but NIST is working on a less-structured protocol for decision makers on when messages should go out. NIST is reaching out to see what surveys have been developed for different

disasters, and what messages went out, to create more flexible tools that can be used for multiple events and multiple hazards.

The group discussed meeting preferences, and Mitrani-Reiser agreed to send out a poll to identify future meeting dates/times. Harary noted that NIST will not wait until a Committee meeting to provide an update to the Committee regarding an NCST investigation. As developments occur, NIST will inform the Committee.

#### **VII. Adjournment.**

Harary adjourned the meeting at 4:00 pm.