National Windstorm Impact Reduction Program (NWIRP)
National Advisory Committee on Windstorm Impact Reduction (NACWIR)

Meeting Summary
August 23-24, 2017
National Institute of Standards and Technology (NIST)
Gaithersburg, Maryland

MEETING PARTICIPANTS

NACWIR Members:

Walker Ashley	Northern Illinois University
John Boudreaux	Assumption Parish Office of Homeland Security and Emergency Preparedness
Parthiv Dangodara	AIG Property Casualty
Wanda Edwards	RCI, Inc
Katherine Greig	New York City Mayor's Office of Recovery and Resiliency
Forrest Masters	University of Florida
Kishor Mehta	Texas Tech University
Walter Peacock	Texas A&M University
Tim Reinhold, *Chair*	Insurance Institute for Business and Home Safety
Donald Resio	University of North Florida
Donald Scott	PCS Structural Solutions
Kevin Simmons	Austin College
Thomas Smith	TLSmith Consulting, Inc.

Windstorm Working Group (WWG)

Dana Bres	Department of Housing and Urban Development
John Cortinas	National Oceanographic and Atmospheric Administration
Ed Laatsch	Federal Emergency Management Agency
Marc Levitan	National Institute of Standards and Technology
Chungu Lu*	National Science Foundation
Ted Mansell*	National Oceanographic and Atmospheric Administration
Shirley Murillo*	National Oceanographic and Atmospheric Administration
Robert O'Connor	National Science Foundation
Joy Pauschke*	National Science Foundation
Mike Uhart*	National Aeronautics and Space Administration
Jonathan Westcott	Federal Emergency Management Agency

**participated via teleconference*

Additional Federal Participants:

Elizabeth Cocke	Department of Housing and Urban Development
Rick Mendlen	Department of Housing and Urban Development
Wade Witmer	Federal Emergency Management Agency

NIST Staff:

Jason Averill	Division Chief, Materials and Structural Systems Division
Joannie Chin, *DFO*	Deputy Director, Engineering Laboratory
Tina Faecke	Program Analyst, National Earthquake Hazards Reduction Program
Judy Mitrani-Reiser	Director, Disaster and Failure Studies Program
Carmen Martinez	Engineering Laboratory Technical Support
Steve Potts	Program Analyst, NWIRP

Members of the Public:

JiQiu Yuan	National Institute of Building Sciences

SUMMARY OF DISCUSSIONS – Day 1 (August 23, 2017)

I. Opening Remarks

The meeting was called to order by Dr. Joannie Chin at 9:00 am. She thanked the Committee for their continued hard work and provided a safety briefing. She then turned the meeting over to Dr. Tim Reinhold, Committee Chair.

Reinhold reminded the Committee that there is one month left to get things done. He stated the purpose of this meeting is to pull together text, and reminded the Committee that an additional 3-hour phone call is set for Sept. 18, and further stated that the Committee will probably need another short call after that to finish up.

Reinhold asked the group which topics they want to work on in break out groups. He said we need 3 groups to deal with:

- Coordination
- Effectiveness
- Revisions to the Program.

Reinhold then asked for any additional comments on the meeting summaries sent out thus far. None were offered by the Committee.

II. Summaries of Presentations and Discussions on Program Activities, Accomplishments and Effectiveness

Representatives from each of the four Program agencies provided briefings on their agency's activities and accomplishments in support of NWIRP. The NACWIR members

asked questions of the presenters and discussed ideas and observations among themselves after each presentation.

A. Presentations

Presentations from the National Science Foundation (NSF) - Dr. Robert O'Connor / Dr. Chungu Lu/ Dr. Joy Pauschke

https://w3auth.nist.gov/sites/default/files/documents/2017/08/23/1-nsf_nacwir_meeting_august_2017_final_aug_21.pdf

- The NSF provided one single set of slides for all three of its speakers. Dr. O'Connor facilitated the presentations. The overarching themes of NSF presentations were that:
    - Windstorm-related research occurs in Engineering, Geosciences, and Social, Behavioral and Economic Sciences Directorates
    - Research includes how windstorms behave and impact the built environment, and reduction of impacts.
    - NSF awards are public – can be found online,
    - A recently added requirement is that publications resulting from NSF awards must to be made available online.
- Dr. Lu discussed NSF awards in the areas of:
    - Mesoscale Convective Systems (MCSs) – summer thunderstorms with damaging winds & flash flooding;
    - Tornadoes;
    - Hurricanes.
- Dr. O'Connor provided information on:
    - Description of new research – no specific calls for proposals for wind research have been issued in SBE, but in many competitions, they receive some proposals that are wind related;
    - Participation in competitions, such as CRISP;
    - RAPID – sometimes involves wind data;
    - Partnerships with other agencies- e.g. with the National Oceanographic and Atmospheric Administration (NOAA);
- Dr. Pauschke's presentation covered the following programs:
    - Engineering for Natural Hazards (ENH);
    - Infrastructure Management and Extreme Events (IMEE);
    - Natural Hazards Engineering Research Infrastructure (NHERI)
        - Updates to NHERI facilities.
        - Purdue 5-year science plan includes wind, as well as earthquake and coastal research.
    - Summary of windstorm impact reduction awards.

The Committee discussion included questions, observations, and recommendations about:

- Problems are not purely engineering, geo-science, economic or cultural – but all the above and we must integrate our methodologies. NSF leadership is on-board. Currently not much funding for research convergence, but NSF is moving forward with the "10 big ideas" (https://www.nsf.gov/about/congress/reports/nsf_big_ideas.pdf), and the Committee may want to comment on how to set up projects to get social scientists more involved.
- A Committee member noted that one of the difficulties is diversity of how locals handle disasters. There can't be a universal system. People at the national level want to develop something, but it won't be the same in different regions. There needs to be someone from local groups tied into these efforts to ensure they are linking into a specific area.
- NSF staff noted that it encourages the wind community to seek out partners from other fields, and figure out how to quickly put inter-disciplinary teams together following events.
- Committee members felt there is a need for more specific notifications of grants that fund pilot project on the ground.
- NSF staff noted it would like to get proposals on obstacles to getting the research results to people who use it.
- Committee members felt it would be useful for NSF to create some kind of permanent working group to determine what kind of inter-disciplinary research is a good investment, especially when budgets are tight and there is a tendency to protect independent fields.
- NSF staff responded that it must be a bottom-up process. Principle Investigators (PI's) must organize to send in proposals. NSF encourages PI's to start a grass-roots movement.
- For NEHRP and NWIRP – NSF has working groups for both of these programs that meet separately from time to time. The challenge has been that in order to do joint programs or solicitations, there's an expectation that both sides put up funding. If not, it's difficult to do joint research.
- There is also a workload issue, NSF is very under-staffed. There are two types of Workshops:
    - One where NSF generates a proposal based on wanting to know more about x.
    - Another type where a scholarly community wants to do a workshop to share thoughts on advancing a field, then NSF reviews the proposal. NSF expects them to bring people together who don't ordinarily meet. They need to communicate their results to a broader community.
- Committee members felt that funding should continue for professional meetings. NSF works with other agencies, and the most successful collaborations are built on personal relationships. Professional meetings are sometimes considered unnecessary, but some of the best ideas, and successful projects stem from relationships among different agencies or researchers that are developed based on

discussions and connections occurring at meetings such as the Annual Natural Hazards Research and Applications Workshop (https://hazards.colorado.edu/workshop/2017).

- Committee members felt that all federal agencies need to do a better job making data available. The National Institutes of Health (NIH) is a leader in this area, and some agencies are following. NHERI has taken a great first step. NSF data sharing practices vary by directorate. SBE requires data be shared within 2 years. The Committee acknowledged NSF's collaboration with Elsevier to make research reports available, and the development of the public access repository. NSF should continue to review procedures to ensure the best possible access to research results. Proposals should also have a clear plan which documents the process of sharing data and meta-data.
- Committee members suggested that successful proposals to NSF should include a dissemination plan.
- A Committee member suggested that one of the most valuable things this Committee can do is help the federal agencies break through the model-centric silo's they operate within. The Federal Emergency Management Agency's (FEMA's) models are 25-30 years old. They miss storms. If NIST wants to get into wind effects on surge – it's short sighted to not deal with the models which need to be improved. But even when validated for some things, they miss a lot of other things.
- A Committee member suggested that the Committee should recommend funding to update those models. There are things we know are wrong with the physics and other assumptions, and these cause expensive, bad decisions. Emergency managers, for example rely on products from NOAA. But some NOAA models show more extensive flooding than actually occurs, causing large segments of the population to evacuate, which costs a lot of money.

Presentation by Dr. John Cortinas Presentation: NOAA Update - National Advisory Committee on Windstorm Impact Reduction (NACWIR)

https://w3auth.nist.gov/sites/default/files/documents/2017/08/23/2-noaa_presentation_for_nacwir.pdf

- Dr. Cortinas' presentation covered:
  - National Weather Service (NWS) Weather Ready Nation
  - NWS Storm Surge Program
  - NWS Storm Ready Program
  - NWS Storm Data Events Database
  - NOAA Office of Atmospheric Research (OAR) Programs
    - Hurricane Research
    - Tornadoes, Thunderstorms, and Severe Weather Research

Reinhold asked the Committee if they had any questions or comments? The Committee discussion included questions, observations, and recommendations about:

- FEMA's and NOAA's need to be on same page with surges, wind, and waves, which they currently are not.
- NOAA sees value in the social sciences, but staffing is different among organizations. The National Ocean Service (NOS) does a good job integrating the social sciences and physical sciences into their programs. The Oceanic and Atmospheric Research (OAR) programs are intent on bringing social scientists on staff from the beginning of projects, through analysis. The NWS publicly acknowledges the value of the social sciences and is evaluating where to get the greatest benefits from integration. Sea Grant has shown increased emphasis, and each state will focus on different priorities, generated by different users.
- Local emergency managers (EM's) rely heavily on the High-Resolution Rapid Refresh model (HRRR) (https://rapidrefresh.noaa.gov/hrrr/). Funding that program, as well as research to give longer warning periods for tornadoes is very important to the EM community.
- There is a need for tornado research to characterize wind loading. NOAA, however, doesn't have mesonet capability to capture wind-speeds, which would be necessary to evaluate wind loading related to particular structures. Mobile networks are necessary to capture data on the characteristics and structure of windstorms.
- Engineers are only able to perform statistical analyses using tornado hazard data from the last 50 years, similar to what the insurance industry did to decide what premiums should be. NOAA's models are not refined enough yet to give people what they really want - trends in where tornadoes will be in 50 years. Science and high performance computing are two limitations right now. Movement from decadal & centennial scales to annual storm frequency predictions is ongoing.
- There is a huge cottage industry of modelers interested in surface winds. They sample differently, therefore data is inconsistent. Multi-doppler radar is a way to help close the gap. VORTEX (http://www.nssl.noaa.gov/projects/vortex/) relies heavily on mobile radar, however, managing such a fleet is costly. The solution is likely to be found in a systems of systems, which include aerial networks, drones, radar systems, and mesonets.
- NOAA is considering using mesonets to integrate and validate private information. Congress has directed NOAA to evaluate buying data from small commercial satellites instead of NWS having their own satellites.
- NOAA has not received specific NWIRP funding. If funding were available, it could be utilized to look at all aspects of problems such as surface wind speed of tornadoes,
- These are very complex issues, and the Committee might consider offering feedback to NOAA to help identify priorities.

Presentation by Dr. Long Phan: NIST Activities and Accomplishments in Support of NWIRP

https://w3auth.nist.gov/sites/default/files/documents/2017/08/23/3-nist_briefing_for_nacwir_meeting.pdf

- Dr. Phan's presentation covered:
  - NIST NWIRP-Related Projects
  - Support for NWIRP Strategic Priorities
  - Support for NWIRP Objectives
  - Disaster Resilience grant-funded projects

Reinhold asked the Committee if they had any questions or comments. The Committee discussion included questions, observations, and recommendations about:

- When technologies mature, NIST can provide products that nobody else can.
- The NIST engineering lab is beginning to work with 3-D printing of concrete. The intent is to answer the question "What do you do in the real world if somebody wants to use 3D printed buildings? Those kinds of structures might be useful for rapid reconstruction, or wind resistant construction. NIST is also considering what kinds of new materials and standards we need to help make building envelopes more resilient.
- NIST really needs to get civil engineering out of people's comfort zone. You can reshape ideas about using these technologies. The academic community is looking to this group to speak loudly and take positions on infrastructure and technology.
- An important aspect for NIST and the WWG to look at on a long-term basis is what will it be like 10-15 years from now? The WWG, HUD and FHWA should hold a limited workshop on current problems and what you expect in future.
- While technology is important, the Committee also needs to think about the current building environment. Ninety-five percent of existing buildings and other infrastructure will still be here 50 years from now.
- If another Hurricane Andrew came through the same area today, there would be similar devastation. We need to push new technologies to assess existing buildings.
- NIST has been a great supporter of performance based design. It is a great tool for assessing current buildings.
- NIST works with the American Society of Civil Engineers (ASCE) to ensure adoption of research into ASCE-7.
- The Joplin report is a first-class document. Few events need that, but some do. We learned so much from that study, particularly human behavioral aspects.
- NIST's commitment to following through on recommendations from the Joplin report is notable.

- NIST has separate authority under the National Construction Safety Team Act (https://www.nist.gov/director/nists-responsibilities-under-national-construction-safety-team-act) to do safety investigations. All of NIST's investigations have looked extensively at human behavior and why people that survived behaved in certain ways.
- All the codes and standards are only as good as the compliance – to the extent possible, NWIRP research on how to encourage increased compliance would be very important.
- Compliance is largely a local issue that is in part constitutionally driven – state's rights vs. the federal role.

Presentation by Ed Laatsch: NWIRP Activities and Accomplishments: FEMA

(https://w3auth.nist.gov/sites/default/files/documents/2017/08/23/4-fema_nwirp_overview_for_the_nacwir_aug_2017.pdf)

- Mr. Laatsch's presentation highlighted FEMA's windstorm impact reduction activities within the scope as specified by law, although he noted that FEMA does much more than just that, for example, emergency response. His presentation covered:
  - FEMA Overview
  - FEMA's Role in the NWIRP
  - NWIRP Goals and Objectives
  - NWIRP Strategic Priorities
  - Success Stories
  - Contributing Activities

The Committee discussion included questions, observations, and recommendations about:

- It would be useful if FEMA would create something that shows if there was any commonality among what happened in different storms – e.g. something that can be distilled into key findings. At some point, we need a history of this since people are retiring and a new generation is taking up the mantle. We need to look back and see historical trends.
- There are lots of similarities between NWIRP and NEHRP. They are organizationally similar, having progress reports to Congress, and Interagency Coordinating Committees. NOAA has a robust series of problems, which reasonably correlate to USGS. USGS has a line item resource for NEHRP while NOAA does not have one for NWIRP. NSF documents their work in both programs similarly. For the 4 NWIRP agencies, the budget is about $30M, of which NOAA's portion comprises almost 2/3. The total NWIRP budget is less than a quarter of the NEHRP budget.
- With NEHRP, there are a couple of overarching, dominating issues centering around the ability to exert influence over the direction of the program, or provide leverage with decision makers. There is an effort to get funding for the National

Research Council recommendation (http://www.nehrp.gov/pdf/nrc2011.pdf) of an earthquake program with a $300M annual budget.

- It's not clear when the recently funded Losses Avoided (Mitigation Saves update) study will be published, it has been delayed.

III. Discussion on Summaries of NACWIR Meetings 1 and 2

Reinhold led a discussion on the Meeting Summaries from NACWIR Meetings 1 and 2:

- Editorial changes to Meeting #1 Summary were adopted, and will be published on the NIST/NACWIR website (https://www.nist.gov/el/materials-and-structural-systems-division-73100/national-windstorm-impact-reduction-program-1).
- Editorial changes to Meeting # 2 Summary were adopted and will also be posted to the NIST/NACWIR website.

IV. Discussion on NACWIR Assessments and Recommendations Report

Reinhold noted that he received comments on the Social Vulnerability section and incorporated them into the draft report. He asked if the Committee wanted to use that or develop independent language? He thought the current draft covered the basis pretty well. The Committee discussion included questions, observations, and recommendations about:

- The NHERI Science Plan has a definition of Social Vulnerability. Smith committed to send it to the entire committee, so it can be revisited on day two of the meeting (8/24/17).
- A question was asked of Simmons how he reached his findings on the cost of building a new home to Florida building code. He explained that he used loss data from ISO (http://www.verisk.com/insurance/brands/iso/about.html) then ran a model that compared the cost using the cut-off date from implementation of the new code relative to the previous code. He found a 5-to-1 (which was a mid-point) benefit, using ten years of loss data from the whole state of Florida. There were seven land-falling hurricanes during that period - from 2001 to 2010.
- Reinhold committed to work on the report over-night, incorporating the comments made by the Committee (above) and said the group would revisit the report on day-two of the meeting.

V. Discussion of whether to do one big report or two separate reports.

Reinhold asked the group whether they preferred two separate reports (Comments on Strategic Plan, and Assessments and Recommendations reports), or one combined report?

- The Committee agreed to develop one report, with an Executive Summary by end of next month.

Reinhold raised the possibility of another phone call toward the end of September.

- He reminded them that a call is already scheduled on the 18th.
- He suggested the Committee May need a short call to review comments
- The Committee agreed to have a brief call on September 25th.

VI. Discussion on Program Effectiveness

Reinhold asked for feedback on the overall sense of Committee members based on what they heard today? The Committee discussion included questions, observations, and recommendations. Observations and comments expressed by various members are briefly summarized below:

- There is a lack of focus because of a lack of funding. All the agencies other than NIST are not focused on NWIRP. They do what they can, but there's no funding for it.
- It is really important that we have a good building code for coastal areas. There needs to be on a finer grid that is dependent on the hazard level. This is especially true for storm surge. If high hazard zones are better identified and development in those areas is required to build to higher requirements, then people will be less likely to build there. But if they do build there, it would have to be more robust. People need to be encouraged to move away from hazardous areas, because the tradeoff is the cost of building. If we had building codes and local enforcement that reinforced that, it would be a strong message.
- The Committee needs to define coastal areas. The risks to people living on the coast vs. 50 miles in-land are quite different. That's why the codes have to be hazard based.
- It may be necessary to put this back in the Strategic Plan, or the Effectiveness document. It's hard to be effective if people are building in these hazard-prone areas.
- The real issue is land use. A tremendous amount of time was spent today talking about codes and improving them. But what good is that if people are building in hazardous areas? Right now, it's all built so badly in the wrong places, we can't learn anything.
- We can mention land use but development is more important – we need to show the real cost involved including the insurance cost.
- If there is no way to enforce where people can build, how can the program be effective? It's imperative to get the location figured out! 50 miles inland can't be codified in terms of distance, it has to be codified in terms of hazard.
- The issue we face is density vs. affordability. Either way, cities are under pressure to build resilient structures. We have to consider what design guidelines say about infrastructure – is it in a flood zone, or if the hazards are precipitation or heat, need to consider informed guidelines. At a local level, we need to be more aggressive at not building in these areas, and we would be more successful if we could bring in the federal government.

- Another problem local officials deal with is that the new flood maps have areas that are sometimes incorrect. The flood elevations that FEMA developed don't always use the elevation data that flood managers provided.
- NIST met with NSF/SBE and engineering folks to explore the possibility of a joint solicitation. The minimum partnership was $2M on each side. NIST didn't have that level of funding at that time. As computational facilities and other NHERI funded facilities ramp up, NIST is slowly becoming involved with the whole range of NHERI facilities.
- These things just take time. Coordination is already taking place, and some positive things have occurred. Funding for one or two projects doesn't do it. We found out from NSF's presentation that proposals depend on PI's. PI's need to know what the strategic plan is. Somehow the WWG is the information pathway to the research community – we need to help them decide how to implement what they are working on. NOAA is doing great work but needs to combine it with NSF. The NSF/Geo doesn't always work with NSF/Engineering. The Committee should make some recommendations to make these collaborative efforts more effective after hearing more from NIST about program coordination on day two.

Meeting adjourned 5:00 p.m.

SUMMARY OF DISCUSSIONS – Day Two (August 24, 2017)

VII. Opening Remarks

Dr. Joannie Chin, DFO called the meeting to order at 9:00 a.m. She thanked the Committee for all the work and expertise that they have brought. She expressed appreciation for the rapid pace at which the Committee has operated, then turned the meeting over to Dr. Tim Reinhold, Chair of the Committee.

Reinhold stated that there would be additional presentations, and the Committee has a lot of work to get done.

VIII. Summaries of Presentations from Requested Presenters

At the end of the second NACWIR meeting on June 28, there was a request from NACWIR members for speakers from FEMA and HUD. In response, Dr. Levitan invited Mr. Wade Witmer, FEMA Continuity Communications Division, Deputy Director for Integrated Public Alert and Warning System(IPAWS), to discuss their public alert system. He also invited Mr. Rick Mendlen from the U.S. Department of Housing and Urban Development to discuss manufactured housing. Finally, Levitan described the coordination and accomplishments of the Program.

A. Presentations

<u>Presentation by Wade Witmer: Integrated Public Alert and Warning System Program</u>

(https://www.nist.gov/sites/default/files/documents/2017/08/24/5-ipaws_for_nacwir_mtg_24aug2017.pdf)

- Mr. Witmer's Presentation Covered:
  - Definition and Uses of IPAWS
  - IPAWS architecture and how that translates to use capabilities
  - Wireless Emergency Alerts (WEAs)
  - FEMA Emergency Alert System (EAS)
  - Proposed Rule Changes in the near future
  - IPAWS lab – offline testing and development

Reinhold asked the Committee if they had any comments or questions. The Committee discussion included questions, observations, and recommendations about:

- The more locally specific the sender and tag line, the more likely you'll get a response. Geo-targeting, however is not as precise as we thought it would be. The state of the art today is 90 characters, free-form text, using cellular broadcast technology. Cell carriers are sending out alerts from towers. They can talk to all phones in the area, and are not subject to congestion to get through, but there is no response capability.
- Several WEA changes are on the way:
  - Increase message length from 90 to 360 characters.
  - Add new alert category "Public Safety Messages" which is lower than the "Imminent Threat" category.
  - Allow URLs and phone numbers.
    - Text allowed at first, clickable in future.
      - Will allow access to a website with additional information.
  - Support for Spanish language messages.
    - Alert originator will translate, the message will follow the phone setting.
  - Enable a local WEA test code.
    - Will be disabled by default.
- In terms of search and rescue, the reverse ping of phones in a target area is a useful tool to locate people in an emergency. It would be useful if FEMA expanded the technology to give 1st responders the ability to locate cell phones to speed up the process, and increase the effectiveness of search and recovery.
- FEMA can provide the Committee with the Address to the FCC Advisory Committee to comment on the reverse ping. FEMA is discussing "many-to-one messaging." People get this emergency alert and they can reply, or send information back. Carriers know there are active phones, but they don't know if that's a person. It could be an ATM machine or security system or something like that.
- In terms of global comparison of systems, Canada is rolling out their version of wireless alerts in January. Until two years ago they had nothing. Now they are

partnering with us, and developing similar capabilities. Five nations have now adopted common learning protocols. Switzerland has the best system - a national call center system, and text-to-911 function which requests people send pictures of their location, and they will reply. Holland implemented self-broadcasting. Several nations wanted to buy IPAWS, but didn't understand it's not a one size fits all. It's really community specific. For example, NWS has a new extreme wind warning today they send to wireless alerts. Some people opt out because they don't consider a 40 mph wind an-issue. Truckers on I-80 or mid-western states concerned about high winds and potential truck roll-overs pay attention.

Presentation by Rick Mendlen: Windstorm Related Aspects of HUD's Manufactured Housing Program (MHP)

https://w3auth.nist.gov/sites/default/files/documents/2017/08/23/6-hud_manufactured_housing_presentation.pdf

- Mr. Mendlen's Presentation Covered:
  - MHP Mission and role with manufactured homes
  - Definition and description of manufactured homes
  - HUD rulemaking process for manufactured homes, and regulations (24 CFR Part 3280.305 and 3280.402)
  - Challenges faced by the program: Attached Carports

Reinhold asked the Committee if they had any comments or questions. The Committee discussion included questions, observations, and recommendations about:

- The table of design wind pressures shown in the presentation was proposed, but not adopted.
- The new code development cycle for ASCE 7 begins January 2018.
- HUD staff noted that anchoring standards are certified for soil conditions.
- A Committee member noted that installation requirements are controlled at the local level and in 1998, Florida decreased the maximum spacing between earth-screw anchors – resulting in twice as many anchors.
- HUD standards for construction of the units are preemptive, meaning no local jurisdiction can make a different standard for construction of the units themselves. Congress allowed states to control installation. Some State standards are different, LA for example, doesn't allow local jurisdiction to have tighter standards than the state.
- HUD staff noted that HUD went through a whole testing regime with some of the anchor manufacturers and compared HUD's test numbers to theirs.
- HUD staff also noted that it doesn't design against tornadoes. HUD collects data on failures and serious issues, there are assessments made by manufacturers to make corrections. HUD allows states to collect their own data; abut, there are 14 states where HUD doesn't have partners and consequently needs to collect its own data more rigorously. HUD has started to do that in the last couple of years.

- A Committee member noted that Florida requires home owners to either provide a second set of columns, or the manufacturer has to provide a separate attachment point that will carry the load of the attached structure. We'd like to see other states implement those.
- HUD staff noted that there is opportunity to submit code proposals to HUD's Consensus Committee for consideration. There could be an opportunity for this Committee to initiate changes for attached structures because HUD doesn't regulate car port attachments. There's also an opportunity to do investigations. Attached structure failures were some of the more serious sources of damage HUD identified after hurricane Charley.
- HUD went through a whole process to ensure design pressures in HUD Code relate to pressures in the 2010 ASCE 7. If the same size building is considered, the main wind-force loads haven't changed much.
- There are provisions for windborne debris that the manufacturer can make, but they are not mandatory.
- In ASCE 7-16 - the new pressure coefficients are based on research over the past 20 years using both full scale and wind tunnel test results have been adopted to correctly estimate component and cladding pressures.
- Major changes in wind-maps and coefficients have changed the component and cladding loads. But recommendations to adopt just the new maps were rejected based on costs. HUD provided a process in the presentation that can be used to propose changes to the Consensus Committee. Anyone can make proposals, not just organizations.
- A Committee member noted that when we see a death in a manufactured home (MH), we don't know how old it was.
- A Committee member also noted that there is some data showing that the post 1994 homes (when HUD changed their standards) did better than the pre-1994 homes in Hurricane Charley. In the Punta Gorda and port Charlotte areas, if homes were located west of Interstate 75 homes built after 1994 were required to be zone 3 rated homes, East of Interstate 75 they were required to be zone 2 rated homes. There was a very dramatic difference between the post 1994 HUD-code homes and the older pre-1994 HUD-code homes.

Presentation by Dr. Marc Levitan: NWIRP Coordination and Accomplishments

https://w3auth.nist.gov/sites/default/files/documents/2017/08/23/7-nacwir_meeting_4_-_nwirp_coordination.pdf

- Dr. Levitan's presentation covered:
  - Background and History of NWIRP
  - Components of the Program
  - Agency Roles
  - Key WWG activities

- Interagency Coordinating Committee
- Deliverables of the Program
- Coordination of Post-Windstorm Investigations
- Accomplishments Toward Strategic Goals and Implementation of the Strategic Plan

Reinhold asked the Committee if they had any comments or questions. The Committee discussion included questions, observations, and recommendations about:

- NWIRP was established in 2004. The 2015 Re-authorization changed the lead agency to NIST.
- Significant improvements underway for the Enhanced Fujita (EF) scale will include new damage indicators, based on wind-tunnel tests and field operations that have produced larger empirical data sets. The ASCE Standards committee is planning to include vehicles as a relatively universal Damage Indicator, because vehicles are the same across the U.S. and Canada.
- Communities will be adopting the ICC family of codes that contain reference to tornado shelter design (ICC 500).
- NFPA 1616 was published in Feb. The 1st edition addresses questions such as: How do you plan for mass evacuation, sheltering, and determining the best available refuge areas.
- Once the Committee submits the report, it will be reviewed by NIST and the WWG, and the WWG may make revisions to the Strategic Plan. Then it will go to the NWIRP ICC for review. After that, the NIST congressional affairs office sends it out across government agencies. The estimate for that review is 6 weeks, but it can take much longer. An optimistic estimate is that the Strategic Plan will be completed by the end of the year.
- The NSF/NHERI RAPID facility, where the University of Washington is lead – is developing a list of equipment they are purchasing that will be made available to teams that deploy. The list will be available this time next year, including drones. If a team is funded by NSF, they are a priority, but other gov't agencies can use the equipment if not being used by NSF funded teams. You could use the drone out of the RAPID facility, to conduct pre – or post-event surveys.
- Looking at what NIST presented, we are pleased to see accomplishments. The direction of the program looks good. Might consider the National Research Council (NRC) be a contact for the WWG, or form a committee looking into the future, 15 years from now. While NRC committees are expensive, it's worth considering asking them to recommend what NWIRP needs to be doing in the future.

At approximately 12:30 p.m. Jason Averill assumed the role of the Designated Federal Officer.

IX. Discussion: Effectiveness and Coordination

Reinhold stated the need to tackle the broader context of effectiveness and coordination of the Program. He suggested the Committee needs to go back and look at presentations we've been given, and ask how do they link with the strategic priorities? The Committee discussion included questions, observations, and recommendations about:

- Revisions to program – the Committee discussed including a look at land use planning. We heard that people would like to involve the Feds re: land use, but that's not likely to happen.
- Need to think about what stakeholders need. Very frustrating when we only think of decision makers as homeowners - but there is a whole ecology of decision makers out there. Having worked at the county level - if not for federal policy related to flood, many of the leverage points to introduce mitigation would be missing.
- Collectively we have made huge strides in reducing losses where codes are adopted. We are seeing commercial structures being engineered, and getting the right loads.
- The ICC consensus process is totally broken. What we do with ASCE 7, where experts discuss proposed changes and work together to produce code change language is much better. In the ICC process, technical people aren't there to weigh, discuss, and improve the language being proposed. Consequently, many good ideas get rejected because of last minute objections and no facility for meaningful compromise or improvement at the hearings. ICC has no stomach to tackle some of the issues that have been raised.
- The wind community is eons ahead of the coastal flooding community in terms of linking economic factors. The only tool used by Army Corps of Engineers (ACE) is a depth-damage curve. Give them a wave height and they calculate. They haven't tried to look at the entire flooding distribution. Flood maps and depth curves don't give much of an answer.
- Important for everybody to hone their economic tools. Where are you getting a gain on your investment? Great job on wind side, flood side hasn't started.
- Research is needed on enhancing the modeling for surge and flood hazards.
- There is a need for better tools to measure effectiveness. Effectiveness can't be only based on more houses survived, it has to also include cost.
- Regarding economics - we're not doing a good job of capturing all costs when buildings don't perform well.
- Need to do a better job educating and convincing building officials of needed changes. Resistance doesn't usually come from the public.
- Regarding land use –we need to convey the importance of not building in high risk, or heavily damaged areas. It's not a federal issue, but does have its place.
- There are innumerable policies we could implement re land use. They vary in effectiveness. We don't know when it works or why, or what kind of policy

regimes it works under. That's part of the research we need to employ in these complex state/policy environments.

- Emphasis on modeling may need to be expanded to the analysis of policies.
- NIST has an Applied Economics Office. As a companion to the Community Planning Guide – there is an economics component. It uses ASTM consensus economic analysis standards. We've used those in support of proposed code changes.
- Peacock committed to write up need for research on improving our understanding of these methods for promoting or supporting land use management - multiple policy approaches for assessing the portfolio of options available to promote windstorm risk reduction.

X. Feedback on Strategic Priorities

Reinhold asked for feedback on each of the 7 Strategic Priorities. The Committee discussion included questions, observations, and recommendations about:

Strategic Priority #1: Develop Baseline Estimates of Loss of Life and Property due to Windstorms

- The program is not effective in terms of reporting injuries and fatalities. This is a new objective that just started being addressed. Better fatalities/injuries reporting with CDC makes a lot of sense.
- There's very little data measuring surface winds or current/waves in storm surge in extreme storms. We don't see NOAA deviating from their plan to provide some of the detailed information. They've tried to harden some of the NWS automated surface observing system (ASOS) stations (http://www.nws.noaa.gov/asos/), but we don't know the status of those efforts. The Committee may want to recommend something similar to what the Digital Hurricane Consortium (http://ascelibrary.org/doi/abs/10.1061/41130%28369%29216) has done.

Strategic Priority #2 - Obtain Measurements of Surface Winds and Storm Surge Current and Waves in Severe Storms

- We need on-shore wave measurements, where people live.
- A good point was made about the Digital Hurricane Consortium. For the hurricane coming in (Harvey), John Christianson is already on his way. If funding is not a high priority, we need to put it in as a recommendation.
- University of Florida has an initial program there, but it's not well funded to the extent that we'd like to see it. We need a recommendation that some work is on point, but not enough.
- A lot of places don't have the instrumentation to take measurements – need to make better use of hardened structures like bridge piers that can have enough pressure differential so that you can get good waves and current measures.

Strategic Priority #3 - Develop Publicly Available Databases of Windstorm Hazards and Impacts

- In the NHERI RAPID facility, they will be collecting an ecosystem of data. The University of Texas (UT) is developing the system architecture.
- Does it include anything relative to investigations of buildings? Need to consider that.

Strategic Priority #4 - Develop Performance Based Windstorm Design for Wind Based Hazards

- We need to reach out to NSF to come up with a system reliability analysis. Could be through simulation, or a combination of simulation and experimental?
- The Committee could recommend using a NHERI facility, and bring in an experimental facility, like UF.
- Need a system reliability analysis to include simulation and testing programs at experimental facilities. The University of Michigan has primary data.

Strategic Priority #5 – Enhance Outreach and Partnerships to Improve Windstorm Preparedness and Hazard Mitigation

- Young people coming into emergency management positions struggle with making decisions. They are in the position of having to make decisions on the spot. That's where education can help.
- We have table-top simulations to help train younger EM's. For example, we need to evaluate facilities such as nursing homes; but, you have to know how to deal with the egos of elected officials. When you have experience, you've been through those battles. Newer folks struggle with putting available data into persuasive presentations during stressful situations.

Strategic Priority #6 - Enhance and Promote Effective Storm Sheltering Strategies

- FEMA published guidance on selection of best available refuge areas in existing buildings in 2003, and published a small editorial update in 2008 (FEMA 431 (Tornado Protection: Selecting Refuge Area in Buildings - https://www.fema.gov/media-library/assets/documents/2246).
- There is a critical need for FEMA to update 431 as soon as possible.
- One recommendation regarding the NIST Joplin Report (https://www.nist.gov/publications/final-report-national-institute-standards-and-technology-nist-technical-investigation) was to update FEMA 431 because it only focused on schools. FEMA began to update it, but it became more of an R&D project – FEMA doesn't do R&D, so the project was transferred to NIST. Levitan mentioned that the work is basically on hold, pending resources, although post-tornado data collection to support future validation of the new methodology for selection of best available refuge areas is included with the field data collection supporting the tornado hazard mapping project.

- The Committee should recommend that NIST and FEMA move forward with urgency on updating the best available refuge area document.

Strategic Priority #7 - Develop the Nation's Human Resource Base in Windstorm Hazard Mitigation Fields

- Need to specifically include the construction workforce.
- One Committee member commented that effectiveness of SP #7 is effectively 0. Nothing is being done.
- NHERI held the inaugural summer institute (https://www.designsafe-ci.org/community/news/2017/nheri-summer-institute/) in mid-July. It consisted of 5 days primarily for early career faculty, early practitioners, and graduate students. For 1-2 days, NHERI brought in K-12 teachers to give them exposure to natural hazards we are dealing with.
- FLASH is working with Home Depot to help educate the public on hurricane hazard mitigation.
- Those are good points, but compared to the need, it's very small, not enough.

XV. Discussion on Existing structures.

Reinhold asked the Committee for feedback on what's needed to address the topic of existing structures, which came up repeatedly during the Committees previous discussions. The Committee discussion included questions, observations, and recommendations about:

- Tornado hazard work - there is not any funding for condition assessment of existing buildings, or for retrofitting.
- Averill mentioned that in the FY17 appropriations language, NIST must assess what it would take in terms of code requirements, and to assess the cost impacts of those code requirements, for buildings to maintain functionality following natural hazard events. NIST will have a workshop in Nov/Dec/Jan to feed into that report which is due in 1 year.
- FEMA started developing a guideline to conduct vulnerability assessments of critical facilities. The document got to 90% completion, then was put on hold because of funding. It's worth mentioning in our report that FEMA should get that finished.
- The Committees focus seems to be on what needs to be done in the short term. There is an opportunity to do something on a long-term basis. If hurricane Harvey hits something that is critical, it may generate interest and funding may become available. Our report should address what can be done 10 years from now, and where are we going.
- Somebody should look at whether strategic priorities are being executed.

- We've had many working groups and agencies meeting on a regular basis. It helps to have some external group like NRC monitor and evaluate efforts. They can have a major impact, and this has been documented.

XVI. Discussion of Next Steps to Pull the Report Together.

Reinhold committed to put together a draft of the last few sections, and circulate by mid-week next week, with a 1 week turn-around. He reiterated some of the key points he has heard during the meeting:

- The Committee needs to support and re-emphasize the value of what's in the strategic priorities set up by NIST and contractors and WWG.
- Given the amount of resources available – the NWIRP agencies are doing an amazing job. The biggest push needs to be to get Congress to put resources behind the things that need to be done. We can also push on smaller things that Agencies are currently working on, or suggest changes.
- NSF could do more to coordinate efforts for program managers to plant seeds and support research that would mesh with Strategic Priorities.

Reinhold asked for additional key points that he needs to include in the draft report. The Committee discussion included questions, observations, and recommendations about:

- Suggest that proposals to NSF related to the Strategic Plan could get some prioritization.
- The NSF-NHERI science plan was intended to provide guidance for people putting in proposals. Lots of discussions at the task force level that it should be wide enough that it doesn't constrain good ideas. If you look at the Grand Challenges document (https://www.nsf.gov/pubs/2017/nsf17035/nsf17035.jsp) and get down to the appendices, there is some pretty specific guidance given, but also wide enough for good ideas.
- The NWIRP is doing well in terms of pushing the strategic plan forward. But many things need to get done, and they need to push those forward. The Committee needs to be thinking in those terms as you read through the draft.
- It would be important in the report to say that if we're going to significantly improve performance, it's going to take funding. We have people with capabilities, and advanced facilities, but there needs to be funding available.
- The Committee needs to address training and education needs of new engineers. New engineers need to understand things like the incorporation of performance based design in construction. There needs to be some curriculum development, at the course level that deals with design for hazards like floods, design for serviceability, and design of envelopes. We don't talk about envelope at all in current curriculums.
- We talk about performance based engineering, but almost no universities are teaching how to do it. Stanford teaches it in the upper level courses, but not undergraduate. Need to at least have the discussion on how to make it available.

- The National Institute of Building Science (NIBS) and ASTM International are working on ways to promote building science education in America. It's difficult finding people to do research – there are not enough trained researchers.
- It's hard to get a specialist in to university class-rooms. The Committee might recommend the development of a set of slides that can be provided to professors on a topic like building future resilience, including performance based design. If a professor has to develop it on their own, it may be too far out of their area of expertise. But it could be provided by a talented group. Start with the history of building science and build on that.
- ASCE is developing a series of Khan Academy type presentations on wind design.
- The report needs a statement saying the Strategic Plan is a living document – that it should continue to be updated as technology changes, and things get implemented, according to current trends at the time.
- We should skim back through the report and make sure we don't give the impression that good building codes alone solve the problem. We need to make sure we say enough about performance design.

XVII. Adjournment

Reinhold thanked the Committee for their hard work, and adjourned the meeting at 5:00 p.m.