Motivation for NHERI: Earthquake and Wind Engineering Research


- NSF as part of legislated interagency natural hazards programs (NIST is lead agency)
  - National Earthquake Hazards Reduction Program (NEHRP)
  - National Windstorm Impact Reduction Program (NWIRP)

- Community planning, as referenced in NSF 14-605 and NSF 15-598, e.g.,
  - NIST GCR 14-973-13, Measurement Science R&D Roadmap for Windstorm and Coastal Inundation Impact Reduction. (This roadmap developmental effort was supported in part by NSF, through award CMMI-1235689, to obtain community input on related long-term fundamental research challenges in windstorm and coastal inundation impact reduction)
Description of NHERI

• Is a distributed, multi-user, national facility – part of NSF’s large facility portfolio.

• Provides the natural hazards community with access to research infrastructure (earthquake, tsunami and storm surge, and wind engineering experimental and post-disaster, rapid response research (RAPID) facilities, cyberinfrastructure, computational modeling and simulation tools, and research data), coupled with education and community outreach activities.

• Enables research and educational advances that can contribute knowledge and innovation for the nation's civil infrastructure and communities to prevent natural hazard events from becoming societal disasters.

NHERI Scope: Major Infrastructure Components (Notional Diagram)
NHERI Facilities

<table>
<thead>
<tr>
<th>Component</th>
<th>Institution</th>
<th>NSF Award</th>
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<tbody>
<tr>
<td>Network Coordination Office</td>
<td>Purdue University</td>
<td>1612144</td>
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<tr>
<td>Cyberinfrastructure</td>
<td>University of Texas at Austin</td>
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<td>Computational Modeling and Simulation Center</td>
<td>University of California, Berkeley</td>
<td>1612843</td>
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<td>Twelve-Fan Wall of Wind</td>
<td>Florida International University</td>
<td>1520853</td>
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<tr>
<td>Large-Scale, Multi-Directional, Hybrid Simulation Testing Capabilities</td>
<td>Lehigh University</td>
<td>1520765</td>
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<tr>
<td>Large Wave Flume and Directional Wave Basin</td>
<td>Oregon State University</td>
<td>1519679</td>
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<tr>
<td>Geotechnical Centrifuges</td>
<td>University of California, Davis</td>
<td>1520581</td>
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<td>Large, High-Performance Outdoor Shake Table</td>
<td>University of California, San Diego</td>
<td>1520904</td>
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<tr>
<td>Boundary Layer Wind Tunnel, Wind Load and Dynamic Flow Simulators, and Pressure Loading Actuators</td>
<td>University of Florida</td>
<td>1520843</td>
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<tr>
<td>Large, Mobile Dynamic Shakers for Field Testing</td>
<td>University of Texas at Austin</td>
<td>1520808</td>
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<tr>
<td>Post-Disaster, Rapid Response Research (RAPID) Facility</td>
<td>University of Washington</td>
<td>1611820</td>
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NSF History of RAPID Awards

- SGER/RAPID support (NSF Engineering) awarded, e.g.,
  - 2004 Great Sumatran Earthquake and Tsunami
  - 2005 Hurricane Katrina
  - 2010 Haiti and Chile Earthquakes
  - 2010/2011 and 2016 New Zealand Earthquakes
  - 2011 Tohoku, Japan Earthquake and Tsunami
  - 2011 Tuscaloosa, AL Tornado
  - 2012 Hurricane/Superstorm Sandy
  - 2013 Moore, OK Tornado
  - 2013 Super Typhoon Haiyan
  - 2016 Hurricane Matthew (Haiti)
  - 2017 Central Mexico Earthquake
  - 2017 Hurricanes Harvey, Irma and Maria (e.g., GEER and organized structural)
NHERI RAPID Facility – Role (NSF 15-598)

• Provides community resources (equipment, instrumentation, and data management infrastructure) for quick field deployment globally to support perishable research data collection following an earthquake or windstorm event.
• The primary users of the RAPID Facility resources will be researchers supported through separate NSF awards (RAPIDs) for post-disaster investigations, with assistance in the field from RAPID Facility staff, as required.
• While the primary focus of this facility must be for perishable data collection following earthquake and windstorm events, this does not preclude facility resources being deployed for perishable data collection following other natural hazard events or for testing at other facilities.
• All collected data must be curated and archived in NHERI DesignSafe Reconnaissance Integration Portal.
• RAPID Facility development and commissioning
  • Develops facility concepts and requirements in year one
  • Procures and commissions equipment in year two
  • Operational by end of year two, including user training conducted

GEER Model for Community-led RAPID Deployments

• Geotechnical Extreme Event Reconnaissance (GEER) Association
  • http://www.geerassociation.org
  • Supported by NSF since ~2003 formation
  • Community-organized and community-governed
  • Receives multi-year NSF support to enable “quick,” preliminary RAPID data collection (travel/lodging/per diem)
  • Selects RAPID field team and notifies NSF
  • Collects perishable data from a range of natural hazards, e.g., earthquakes, floods, hurricanes, landslides, tsunamis
  • Quickly shares findings and report on web
  • Observations and data enable follow-on NSF RAPID proposals

• A path forward? GEER as an “X”EER model, e.g.,
  • EAGER: Interdisciplinary and Social Science Extreme Events Reconnaissance (ISSEER) NSF Award 1745611, Lori Peek, University of Colorado, Boulder
  • “Structural engineering” EER??
Opportunity for “Collective” Community Expertise: Self-Organization for “Early” RAPID Deployments using NHERI RAPID Facility

Existing Organization

Geotechnical Extreme Events Reconnaissance (GEER)

Interdisciplinary Coordination/Reconnaissance

A New Organization?

Interdisciplinary and Social Sciences EER

Structural Engineering EER

A New Organization?

Going Forward – Working Together

• NHERI RAPID Facility becomes operational and trains users (by fall 2018)
• Unsolicited NSF/ECI proposals to establish “X” EER organizations
  • Talk with NSF Program Director before submission!
  • GEER is supported by ECI
  • Structural engineering field (new EER may be supported by ECI)
  • Social sciences field (new EER may be supported by HDBE)
  • “X” EER proposal might consider
    • PI with national & international NSF-supported RAPID experiences
    • Experienced core leadership and management team
    • Governance plans and team selection process
    • Plan to interface with NHERI RAPID Facility
    • Cross “X” EER coordination and interdisciplinarity
    • Mentoring early career faculty and graduate students
    • Avoid naming “cast of 1000s”
  • NSF support for “X” EERs and follow-on individual RAPIDs