

Network Independent Advisory Committee Annual Report

Fiscal year 2023

Committee Charge

The Natural Hazards Engineering Research Infrastructure (NHERI) Network Independent Advisory Committee (NIAC) charge is to provide independent guidance and advice to the NHERI Council on:

- Progress, plans, and performance of the NHERI Awardees and annual Council work plan;
- An assessment of the level of community engagement and user satisfaction across NHERI, with input from the User Forum survey results;
- An assessment of NHERI's continuing value added and impact on research and educational advancements; and
- An assessment of the transparency and efficiency of the Network Coordination Office (NCO) Facility Scheduling Protocol.

The NIAC is also charged with keeping the community informed on NHERI activities through producing an annual report. The purpose of this document is to present the NIAC's annual report for Fiscal Year 2023 (FY23).

Committee Members

The current membership of the NIAC is:

- William Hansmire (NIAC Chair FY23) - Geotechnical Engineering, WSP USA
- John van de Lindt (NIAC Vice-Chair, FY23) - Wood and Earthquake Engineering, Colorado State University
- Catherine Petroff (NIAC Chair, FY24) – Coastal Engineering, U.S. Army Corps of Engineers
- Glenn J. Rix (NIAC Vice-Chair, FY24) – Senior Principal, Geosyntec Consultants, Inc.
- Lesley Ewing - Coastal Engineering, Social Sciences and Policy
- Carol Shield - Earthquake Engineering, University of Minnesota, Emerita
- Peter Vickery - Wind Engineering, Applied Research Associates

Committee Meetings

The NIAC held one face to face meeting during FY23. The meeting was held in San Diego, California on May 22-23, 2023. This was the first in-person meeting since 2019. On May 22, the Committee toured the NHERI University of California San Diego (UCSD) shake table facility and witnessed shake table testing of the Full-Scale Resilient 10-Story Mass-Timber Building as part of the NHERI Tallwood project. This was followed by virtual meetings with several NHERI Principal Investigators (PIs). The meeting concluded on May 23 with an NCO briefing on the status of NHERI and a NIAC Executive Session to begin drafting the NIAC annual report. The meeting was held in a UCSD Structural Materials and Engineering Building (SME) conference room. The NIAC thanks Professor Joel Conte for hosting the group, providing a meeting space and for conducting an excellent demonstration and tour of the UCSD Large Outdoor

Earthquake Simulator. A follow-up virtual meeting was held on October 24, 2023. The meeting's agenda included developing plans to meet with additional NHERI PIs and finalize preparation of the annual report.

Meeting with PIs

On May 22, 2023, the NIAC met virtually with six NHERI facility PIs. The NIAC practice has been to review work of approximately half of the PIs at each meeting. The purpose of the meetings was to gain insight from the site perspective on the workings of the NHERI network. Each PI was given a few minutes to summarize the scope and activities of their site, then they were asked a similar series of questions by NIAC members.

The following site PIs participated virtually in the meeting:

- (1) Ken Stokoe, University of Texas at Austin
- (2) Arindam Chowdhury, Florida International University
- (3) Lori Peek, Converge- University of Colorado at Boulder
- (4) Jason Dejong, University of California at Davis (UC Davis)
- (5) Dan Cox, Oregon State University
- (6) Jim Ricles, Lehigh University

The following is the summary of interview questions. The questions were adapted as needed to the nature of each facility. Questions included:

- (1) Describe how the work done at your site has impacted the profession.
- (2) Are there any actions that the NCO can take that would improve the efficiency or effectiveness of your site?
- (3) Estimate the number of projects over approximately the last three years or so at your site that have had neither a PI nor Co-PI from your site.
- (4) How are you planning for the possible loss of National Science Foundation (NSF) funding in 2025?
- (5) What proportion of the work done at your site is funded by NSF?

The PIs were also given the opportunity to make any closing remarks if they chose. It was not the purpose of the interviews to document status or research specifics, but rather to provide the NIAC with a sense of how the site was functioning and identify issues that merited elevation and reporting by the NIAC.

The NIAC has organized its observations and recommendations into three main sections: Perceptions on the impact NHERI work has had on the profession, site operations and ways to help the research community develop higher impact proposals, and the future of NHERI beyond 2025.

Perceptions on Impact to the Profession

Technology and information application varies greatly amongst the facilities. For example, the University of Texas at Austin facility conducts almost entirely applied research, an extreme example being providing geotechnical information that enables substrate mapping to as deep as approximately 5,000

feet with non-invasive measurements. This work supports other studies or research, such as mapping Thwaites Glacier or the substrate of one of the Hawaiian Islands currently erupting.

Work at other facilities has factored directly into Codes and Standards, for such things as wind and debris loads, earthquake and tsunami design load development, and new criteria for materials testing. Some research has led to new designs for roofing material, improved understanding of the load capacity of gravelly alluvium, and offshore anchoring systems for wind turbines. Some facilities are helping test the efficacy of natural and nature-based shoreline projects in comparison to traditional man-made structure protection, paving the way for more resilient coastal areas. Several facilities are examining soil-water interactions to improve geotechnical understanding of changes in bearing capacity associated with anticipated rising sea level.

Overall, the facilities appear to have a good balance of fundamental engineering studies and applied or transferable research.

Site Operations

As part of the interview process, a few recurring themes were present among the site PIs in terms of site and network concerns and successes.

Site Concerns

Uncertainty of Future Funding and Retention of Key Staff: The most prevalent concern among the site PIs was the difficulty that the uncertainty in future funding presents in retaining their highly trained and qualified site staff. As the network moves toward the next decision point in 2025, the site PIs are hopeful that decisions for the network's future will come well before the end of the current funding. The NCO should work with the site Council to develop strategies to retain the site staff during this period of uncertainty and communicate closely with sites on any anticipated actions.

The broader issue of potential funding of NHERI beyond 2025 is discussed below.

Technology Upgrades and Aging Equipment: A second concern of some of the site PIs is the aging equipment at their sites. Many sites have equipment that is more than 20 years old. There is some hope among these sites that in addition to future operations and maintenance funding, there will also be a pool of funding for equipment upgrades. The NCO may wish to emphasize the importance of this issue to NSF and encourage NSF to fund equipment upgrades to protect the substantial equipment investment and assets at the various sites.

Site Success

Comprehensive Inclusion of all Natural Hazards. There was nearly unanimous comment from the site PIs on the added value of the improved paradigm of the network and the way it has transformed how natural hazards research is performed in the U.S. Specifically, this has come in the form of broadening of the scope of NHERI to all atmospheric and geophysical natural hazards. Further comment on this is provided below as relevant to NHERI beyond 2025.

Opportunities for Site Use Enhancement to the Network

Eliminate Barriers for External Use: While significant improvement has been made by the network in facilitating research projects without the need for site local PIs or Co-PIs, the NCO should continue to urge sites to remove any remaining barriers for external site use (i.e., no PI or co-PI from the site). Some sites are more successful than others at fully external projects. This process might be facilitated by ensuring alignment of site staff to include a technical project manager for all projects. It will likely also require significant input to the project from the site PI or other knowledgeable site staff. It is recognized that the sites typically have trained staff that know how to operate the equipment safely and properly, but the sites also need to make technical knowledge of how best to plan for experiments available to external PIs. It may be essential for sites to maintain some site personnel as support to all projects that are otherwise fully external.

Provide Training and Guidance to Proposal Writers: The NHERI Science Plan puts strong focus on interdisciplinary work to address the Grand Challenges. However, some researchers do not know how to find and develop interdisciplinary input and collaboration. Also, some researchers do not recognize benefits from such work. The NIAC suggests that NCO develop a white paper, or guidance report on both benefits of interdisciplinary research and ideas for how to find interdisciplinary contacts and expand research foci to incorporate broader backgrounds.

The Future of NHERI Beyond 2025

Continuity of Funding

All the site PIs interviewed in May 2023 are optimistic about the future of NHERI and the possibility of continuing funding from NSF. However, the level of contingency planning differs considerably among the sites that the NIAC interviewed. Some sites simply expressed the hope that funding would continue. Other sites have identified other sources of funding. For example, the CONVERGE site has a conventional NSF grant that can support at least some of their operations if there is a discontinuation in NHERI funding, and the UC Davis site indicated that temporary, bridge funding might be available from the university. The Oregon State site would likely switch to Department of Energy (DOE) projects focusing on marine renewables, but the site PI was clear to point out that the lack of future NSF funding would have “devastating” consequences for coastal engineering research related to the impacts of and adaptation to climate change. The Lehigh site PI mentioned that they have made efforts to diversify their clients without providing specific details.

Based on these interviews, the NIAC encourages the NCO and, more specifically, the individual sites to develop detailed contingency plans in the event there is a disruption or, in the worst case, an end to the NHERI program funding from NSF.

Broadening the Multi-Hazard Scope of NHERI

Broadening the scope of NHERI will address an essential societal need for continuation of natural hazards research. The broader scope has brought in the hazards of wildfire and flooding. Wildfire is a hazard with universal recognition as a major consequence of climate change. Catastrophic wildfires in California in recent years, and the ongoing (2023) wildfires in Canada that have had hazardous impacts to air quality in major US cities, demonstrate the seriousness of this hazard. The hazard of flooding is often an element of other hazards (tsunami, hurricane) and is needed to be accommodated in NHERI.

Flooding from excessive rainfall and inundation of cities and farmland has been the subject of study and intervention for many years by the Federal Emergency Management Agency (FEMA) and the U.S. Army Corps of Engineers. Flooding hazards already addressed by those agencies do not need to be (should not be) a part of NHERI equipment sites, but rather should be allowed, or encouraged, for broader research from those agencies to also use NHERI equipment sites.

Summary of Findings and Recommendations

Impact to the Profession:

The site interviews conducted by the NIAC confirm that

- NHERI facilities are conducting a good mix of both basic and applied research,
- Both internal and external research is carried out at most of the facilities and the facilities are fully invested in serving as national resources for large scale testing and research, and
- The interviewed sites are receiving good support from the NCO.

Site Operations and Ways to Help the Research Community:

Concerns: The primary challenge common to most of the sites is that of retaining key technical staff in an uncertain funding future. sites that originated prior to NHERI, and sometimes prior to the Network for Earthquake Engineers Simulation (NEES), are also concerned about finding a means to update their facilities to modern technologies and research standards.

Opportunities: The NIAC encourages the continued emphasis in NHERI on interdisciplinary work encompassing the full spectrum of natural hazards research. It is quite important that the NCO continue to assist researchers with ideas on how to establish meaningful and productive interdisciplinary research teams. Support for a good mix of internal and external use of NHERI sites may be enhanced by encouraging a site staff structure with enough technical guidance from the site that external researchers can write effective proposals and experiment plans. Some sites do this well already while others may not be able to staff such coordination.

Future NHERI Activity:

Consistent with a continued emphasis on interdisciplinary collaboration, the NIAC recommends that NHERI continue to expand its natural hazards focus and to specifically consider the effects of climate change on the natural hazards spectrum.

The NIAC also recommends that sites are encouraged and assisted to develop contingency plans regarding future funding of NHERI and that they receive clear communications as the future path evolves.