

NHERI GSC

**January General Meeting
with Ian Robertson**



2024



Agenda

11:00-11:05 Welcome & Announcements

11:08-11:38 Dr. Ian Robertson

11:40-11:58 Q & A

11:58-12:00 Wrap up



Welcome New Members



Khalilullah Zulai
Muhammed Yilmaz
Petros Lazaridis
Lissette Iturburu
Payam Gholamalipour
Farida Sehili
Armando
Ulises Santos Cruz
Hyunje Yang
Humayra Sultana
Hannah Friedrich
Mohammad Movahedi

*Reach out to [Daniel Yahya](#) and [Jenny Russell](#) to learn how to get involved!



FEB

25

NHERI Summer Institute

Apply Today!

- **February 25** - Apply for NSF Travel Award to attend NHERI Summer Institute
bit.ly/2024NHERI_SummerInstitute
- Learn more on NHERI Summer Institute website designsafe-ci.org/learning-center/summer-institute
- Funding is available for *20 early career faculty/post-docs* and *5 NHERI GSC members*



FEB

5

Natural Hazard Workshop

Apply Today!

- **July 14-17** - Natural Hazards Workshop (registration and submission see the webpage) <https://hazards.colorado.edu/workshop/2024>
- **February 5** - Sign-up to Volunteer at Natural Hazards Workshop <https://hazards.colorado.edu/workshop/2024/volunteer-application>
- **March 15** - Apply for funding for Natural Hazards Workshop from Natural Hazards Center & NHERI NCO bit.ly/2024fundingNHW.



Research Groups

- Join a research group to network with graduate students in your specific area of natural hazards research to discuss research ideas, methods, and resources

bit.ly/NHERIGSC_Research

Register Today!



JAN

26

Research Challenge

Register Today!

- **January 26** - Register to participate bit.ly/2024nheriGSCResearchChallenge
- Research topics based on NHERI Science Plan 3rd Edition.
- Learn more bit.ly/2024nheriGSCResearchChallengeInfo
- **May 31** – Research Challenge Groups will present research at the second annual NHERI GSC Mini-Conference



Speaker Introduction



Dr. Ian Robertson
Professor of Civil,
Environmental, and
Construction Engineering
at
University of Hawaii at
Manoa
ianrob@hawaii.edu





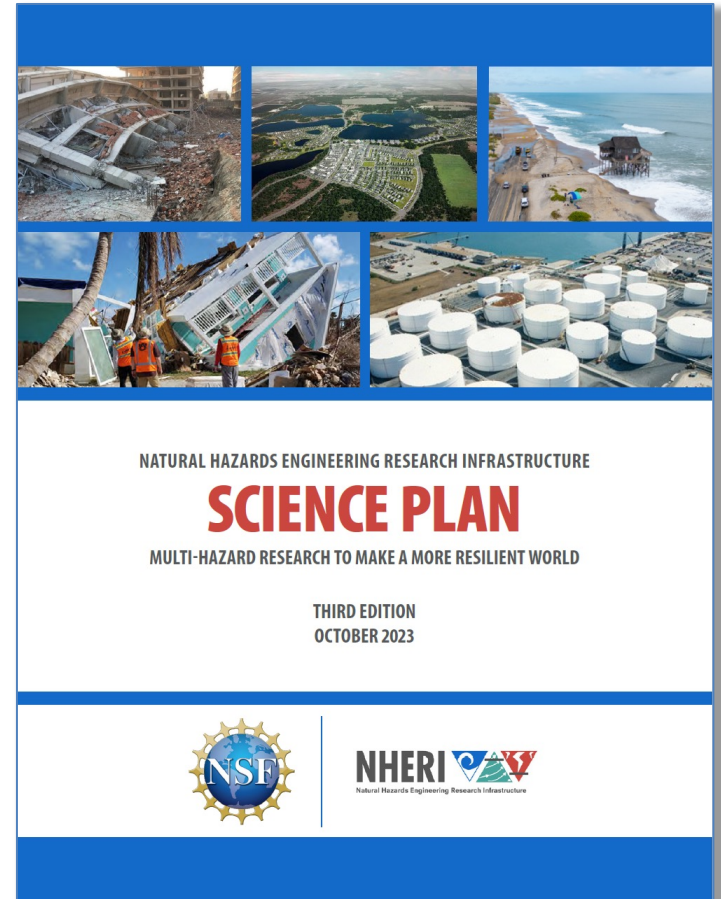
NHERI Science Plan 3rd Edition

Ian Robertson

NHERI Science Plan Lead

GSC Meeting

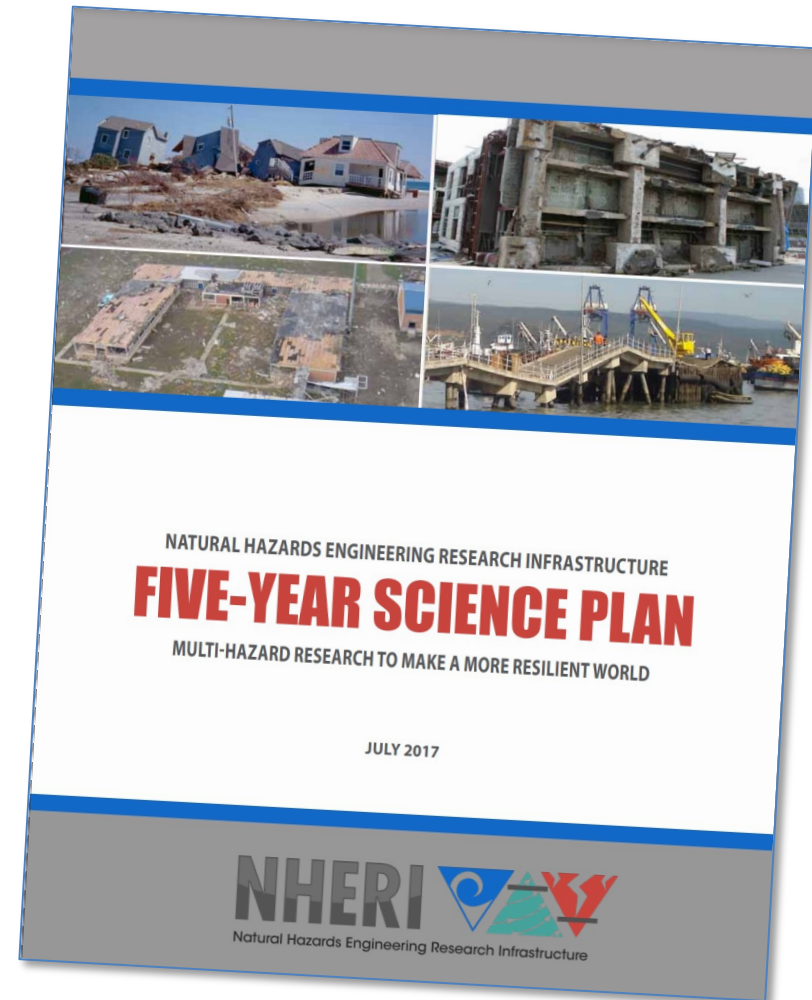
January 19, 2024



NHERI Science Plan – First Edition

NSF Contract Requirement:

- All experimental facilities, DesignSafe and SimCenter were required to develop a science plan
- Network Coordination Office, NCO, required to develop an overarching 5-year Science Plan for NHERI
- NCO Science Plan Task Group used the facility science plans and developed the first edition in 2017



Living document to be
updated as needed



NHERI Science Plan – Second Edition

- NCO received input from users, NHERI community and attendees at Summer Institutes
- NHERI International Workshop -- March 18-19, 2019 -- to incorporate Interdisciplinary Teams and Disruptive Technologies
- Developed 5 comprehensive Research Campaigns as appendices to the Science Plan
- 2nd Edition published January 2020



Impact of Science Plan

“I think the Science Plan is really helpful, particularly for newer, more junior researchers. It certainly helped me understand how my research ideas fit into the bigger picture of natural hazards engineering research, and what is seen as important from our research community.”

Elaina Sutley, Asso. Prof., University of Kansas

“Yes, we did cite the NHERI Science Plan as follows: Thus, the work plan considers the NHERI Science Plan’s objective to reduce reliance on experimental data through the development of more detailed numerical simulations and through the shake-table specimen re-use opportunity.”

Barbara Simpson, Asst. Prof., Stanford Univ.

“I cited the NHERI Science Plan in my recently successful proposal. I think it is important to continue emphasizing the need for novel computational simulations informed by physical testing.”

Petros Sideris, Assoc. Prof., Texas A&M University



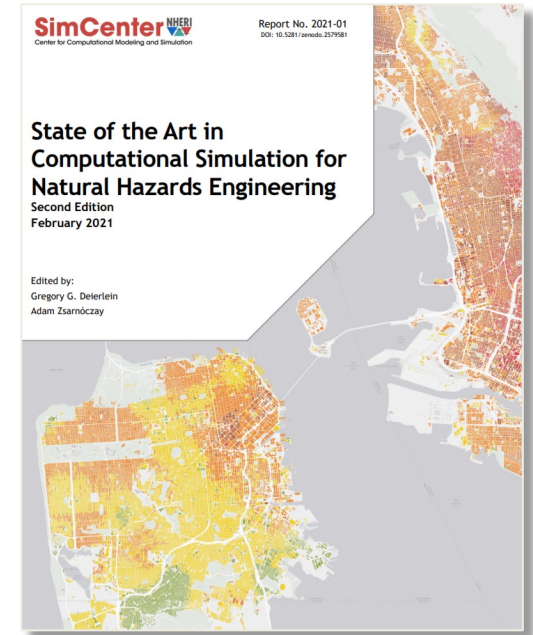
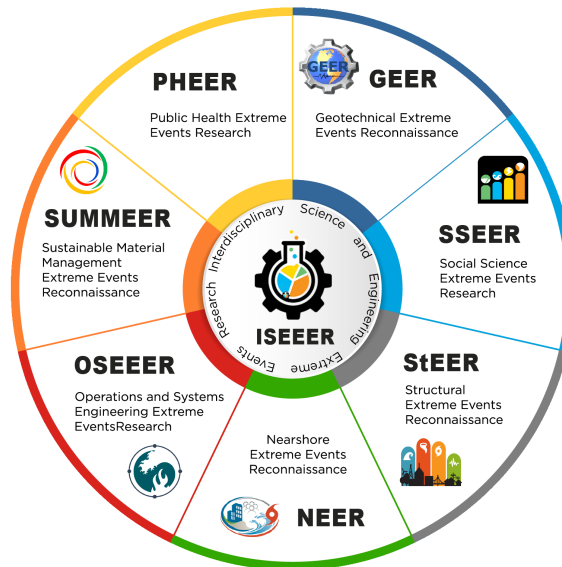
Medical Facility Seismic Performance
Large Outdoor Shake Table
University of California, San Diego



NHERI Science Plan – 3rd Edition

The new edition better synthesizes **social sciences, equity issues, climate change, field reconnaissance, laboratory research, simulation tools, and practitioner guidance** to address more holistically community resilience to future natural hazard events.

The NCO convened an enhanced Science Plan Task Group to develop the 3rd Edition of the Science Plan.



Science Plan Task Group



Rachel Adams
NHC - Boulder



Billy Edge
Texas A&M



Ann-Margaret
Esnard
Georgia State



David Johnson
Purdue



Andrew Kennedy
Notre Dame



Tracy Kijewski-
Correa
Notre Dame



Bret Lizundia
Rutherford and
Chekene



Lelio Mejia
Geosyntec
Consultants



Laura Lowes
U. of Washington



David Mendonca
Rensselaer Poly Inst



Science Plan Task Group



Eduardo Miranda
Stanford



Maryam Mooneghi
AECOM



Stephanie Patch
U. South Alabama



Lori Peek
U. Colorado



David Prevatt
U. of Florida



Julio Ramirez
Purdue U.



Dorothy Reed
U. of Washington



Ian Robertson
U. of Hawai'i



Jennifer Tobin
NHC Boulder



Gabrielle Wong-
Parodi
Stanford



NHERI Science Plan – Workshop

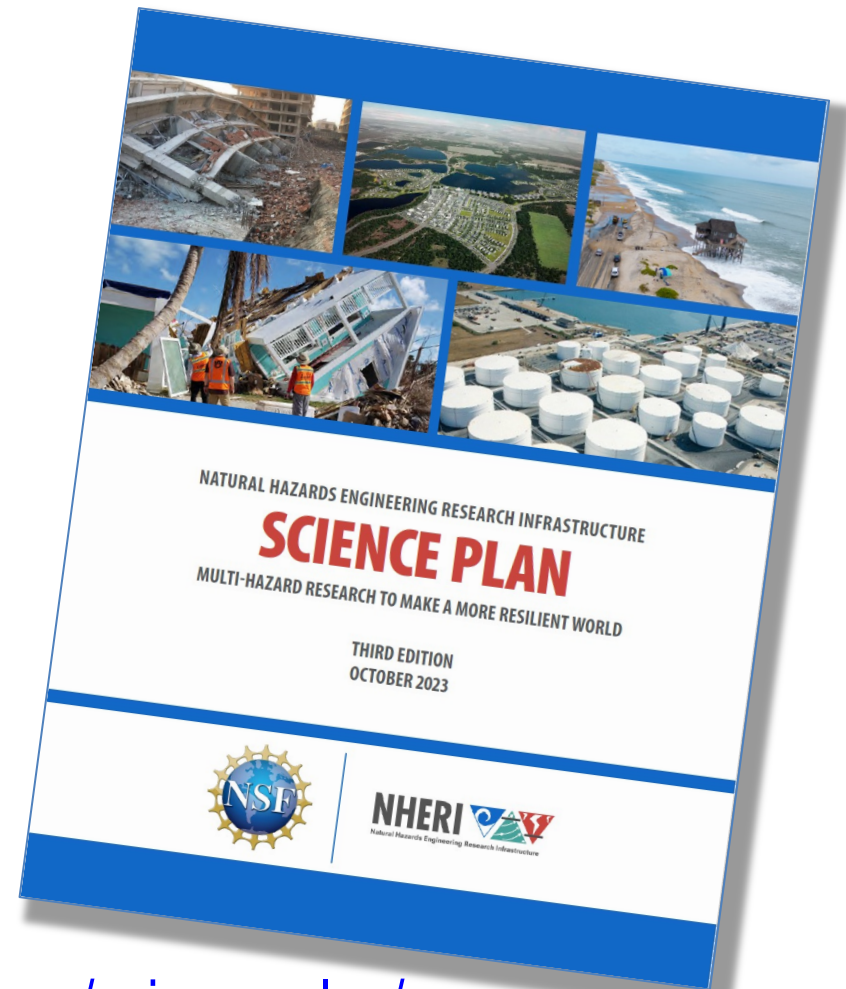
- The NHERI NCO organized a workshop held June 16-17, 2022 in Alexandria, VA
- 63 diverse attendees including, NHERI researchers, NSF and NIST, practitioners, early career faculty, and EF reps.
- Five excellent Keynote speakers to stimulate discussion and creativity
- Five break-out groups that developed a new set of seven Research Campaigns



NHERI Science Plan – Third Edition

- Published October 2023
- Wide dissemination
- Podcast introduction
- Video vignettes planned
- Presentations like this.

Science Plan
available at:



<https://www.designsafe-ci.org/facilities/nco/science-plan/>



Purpose

The NHERI Science Plan provides the natural hazards research communities (geophysical and atmospheric hazards), including NSF and other funding agencies, a roadmap for high-impact, high-reward, hazards engineering research at NHERI facilities.

The research community is encouraged to organize coordinated campaigns to fulfill the vision articulated by the hazards community in this plan.

The research results are intended to prevent loss of life, reduce damage and economic losses, and improve community resilience to these natural hazards.



Audience

- Researchers working on geophysical and atmospheric hazards
- Agencies funding hazards research
- Junior researchers and graduate students



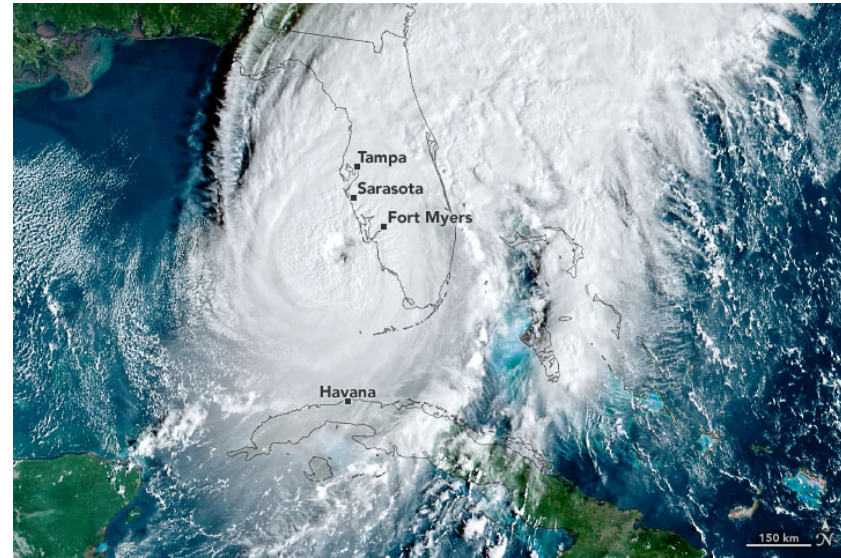
Summer Institute, 2022

- Provide the broader hazards community with a common vision for improving community resilience and sustainability of existing and future built environment

Three Grand Challenges

Hurricane Ian, 2022

- Identify and quantify the characteristics of single, co-occurring, and compounding natural hazards - whether of geophysical and/or atmospheric origin - that have the potential to harm people, damage civil infrastructure, and to disrupt communities.
- Assess the exposure, vulnerability, and adaptive capacity of civil infrastructure and social systems in areas threatened by natural hazards.
- Invest in a diverse hazards workforce and develop the technologies and tools to support the design, construction, retrofit, and operation of equitable, sustainable, and resilient civil infrastructure for the nation.



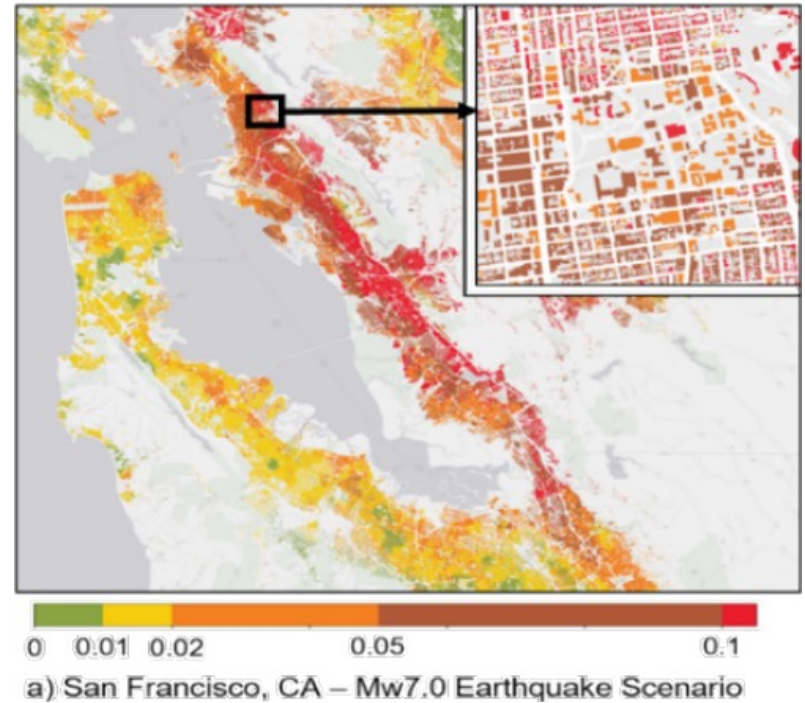
Six Key Research Questions

1. How can the scientific community more *effectively collect and share data* and information to enable and foster ethical, collaborative, and transformative research and outcomes?
2. What are *effective and potentially transformative mitigation* actions to achieve community resilience, especially when considering changes in hazard exposure and community characteristics, emerging technologies, and sustainability goals?
3. What are the *key physical, social, economic, and policy drivers* that influence the capacity for resistance, restoration and renewal both of infrastructure systems and of the services they provide to communities?



Six Key Research Questions

4. What *methodological innovations* are needed to support community resilience through integrated modeling, analysis, and experimental testing of constructed and societal systems under natural hazard stress?
5. What *barriers and opportunities* are shaping the development of *analytic- and simulation-based techniques* for understanding the behavior of civil infrastructure, communities, households, and individuals affected by single, co-occurring, and compounding hazards?
6. What methodological and empirical gaps must be closed to *characterize more accurately the transient and variable nature of the loading actions* imposed on the nation's civil infrastructure, the response of communities to those loading actions, and the implications for the design of future civil infrastructure for natural hazards?



Opportunities for Disruptive and Transformative Research

- DISRUPTIVE and TRANSFORMATIVE technologies are those that advance or optimize the design, operation, and construction of civil infrastructure in ways not previously imagined.
- Some technologies and developments that have shown great promise and will continue to expand creative research endeavors include:
 - Advanced Computing
 - Social sensing and modeling
 - Artificial intelligence and machine learning
 - Bio-inspired engineering solutions
 - Additive manufacturing
- NHERI researchers should seek to leverage emerging trends giving rise to these developments.



NEHRI Technology Transfer Committee, TTC

- TTC initiated by the NHERI NCO in Dec. 2017
- Consists of 15-20 volunteers – mostly practicing engineers knowledgeable of implementation paths of research, not only into building codes, but also directly into practice
- Expertise in all areas of natural hazards research
- Developed “Common Mechanisms for Implementation of NHERI Research Results” available from DesignSafe at this QR Code
- Reviewing all NHERI projects for potential implementation.



TTC White Paper

“NSF long has sought to accelerate the development of technology from fundamental research to move innovations into practice and create those partnerships that make it all happen”.

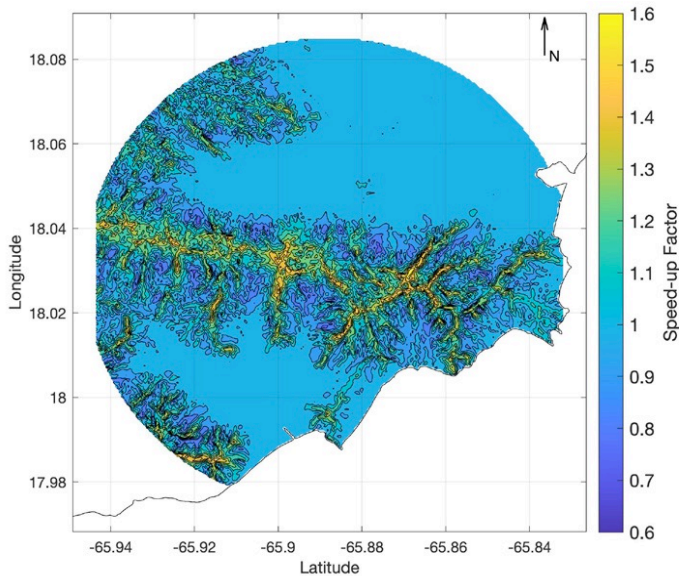
Susan Margulies – Asst. Director, NSF - Engineering Directorate



Five Technology Transfer Success Stories

Performance of Elevated Wood Buildings during Hurricane Michael – Elaina Sutley

1



2 Machine Learning and Atmospheric Simulation to study Topographic effects on extreme wind speeds – Forrest Masters

3 Modeling of above-ground storage tanks during storm events – Jamie Padgett



Five Technology Transfer Success Stories



4

A Resilience-based Seismic Design Methodology for Tall Wood Buildings, also known as NHERI Tallwood – Shiling Pei

Liquefaction Mitigation of Silts using Microbially Induced Desaturation (MID) and Field Testing with NHERI UTexas Large Mobile Shakers – Edward Kavazanjian and Arash Khosravifar

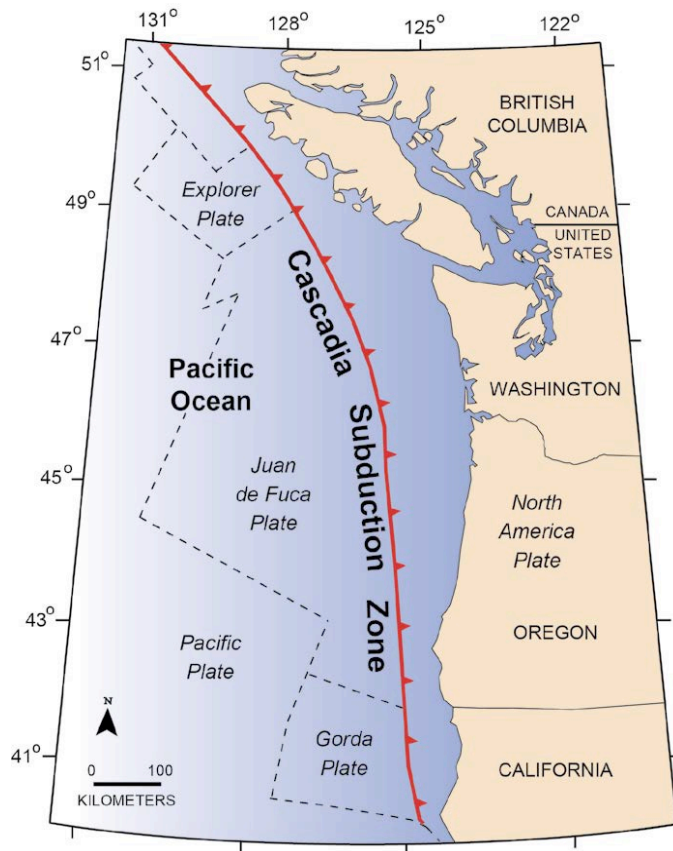
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Appendix A: Seven Research Campaigns

Understanding and Reducing Vulnerability of Low-Income Communities to Windstorms

1



2

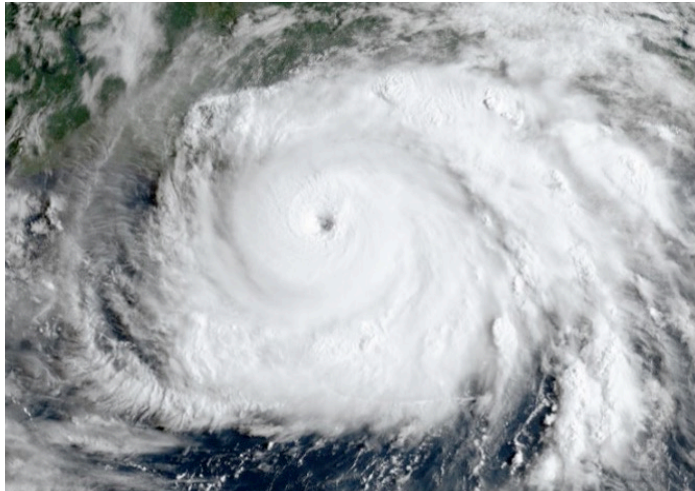
Increasing Regional Resilience to Mega Seismic Events: Cascadia Subduction Zone Earthquake and Tsunami



Appendix A: Seven Research Campaigns

Cascading and Compounding Impacts of Natural Hazards

3

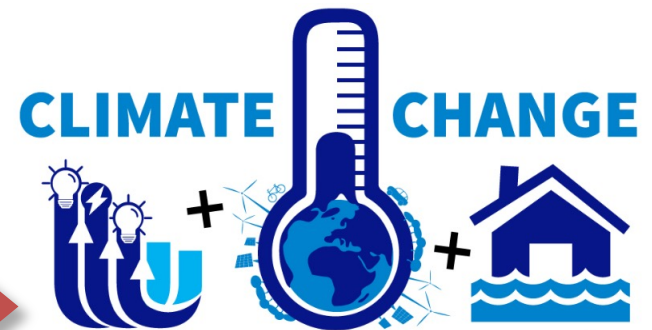


4

A Community-Driven Integrated Research Campaign for Hurricanes

Infrastructure Impacts of Climate Change-Induced Migration

5



Temperatures Rise + Property Losses Increase + Power Costs Rise + Crop Yields Decrease *



**If we continue on this path!*

Appendix A: Seven Research Campaigns

Net-Zero Building Materials and Construction

6



7

Securing our Nation through Communication and Education (SeNCE)

5 Additional Research Campaigns in the 2nd Edition of the NHERI Science Plan!



Keys to Success for NHERI Proposals

1. Develop credible research questions with *multi-hazard applications*
2. Include demographically and functionally *diverse research teams*
3. Include *social scientists*, such as an economist, urban planner, or policy analyst to evaluate cost effectiveness of societal impact of a new technology. Convergent research requires integration of inputs and outputs from different team members inextricable woven together.
4. *Build a credible team*: Convergence is one of NSF's Ten Big Ideas.
5. Contact any *NHERI facility* involved in the proposed research.
6. Get *letters of collaboration* from any supporting partners, but not simply recommendation letters.
7. If your research project involves testbed implementation in existing communities, it is imperative that you *involve representatives of those communities* in the proposal development process and throughout the project.



Keys to Success for NHERI Proposals

8. Where appropriate, include a team member experienced with *industry implementation* of the anticipated research findings. The NHERI Technology Transfer Committee (TTC) can assist with locating experienced practitioners willing to join research teams.
9. Plan from the outset how the research can be incorporated into *academic curricula and practice*, and what steps might be needed to accomplish the transfer.
10. Include a *time horizon* for potential implementation of the research findings in order to maximize societal impact.
11. “*Red team*” your draft proposal: Share your draft with trustworthy colleagues not involved in your team to get their feedback as a preliminary peer review of your proposal.



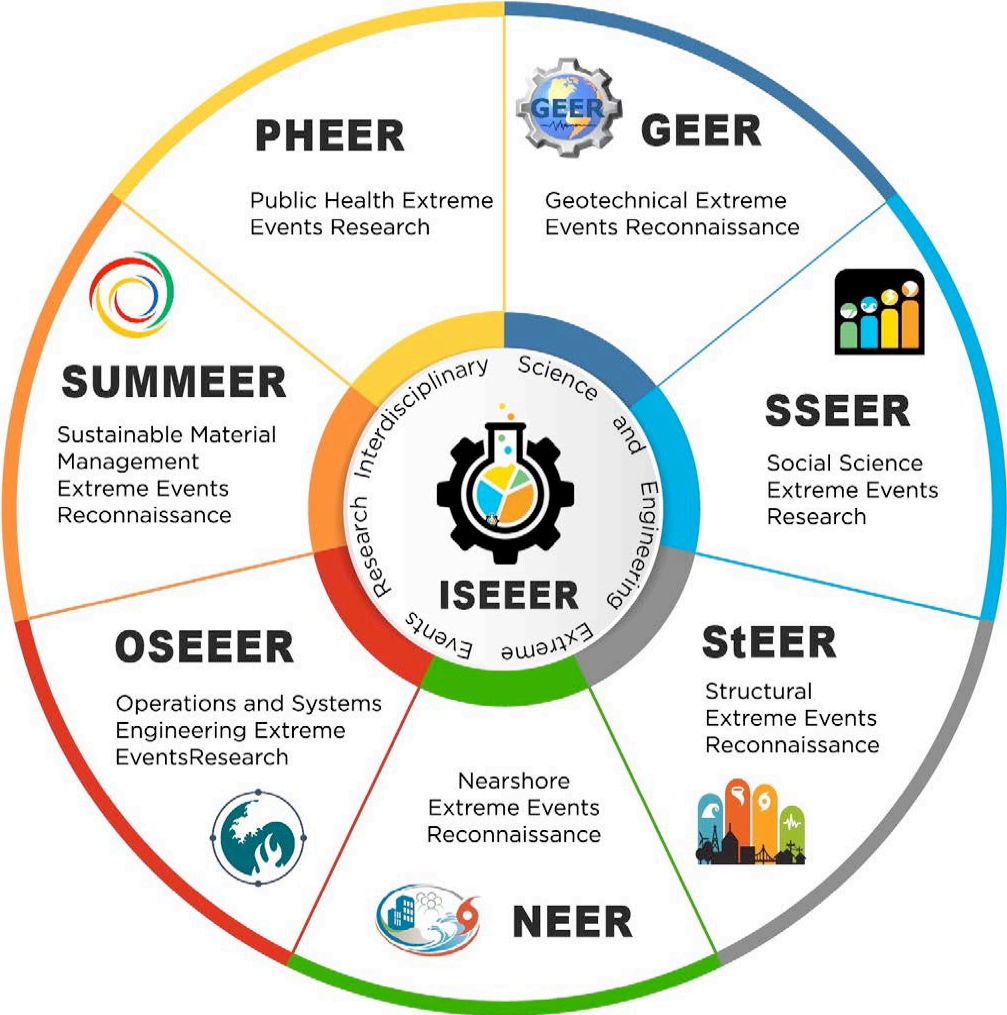
Appendix C: NHERI Experimental Facilities and Components



For more information, visit the
DesignSafe website: DesignSafe-ci.org



Appendix D: Extreme Event Reconnaissance and Research Networks (EERs)



NHERI Science Plan Version 3.0

This 3rd Edition will serve as a roadmap for NHERI researchers and others working on mitigating the effects of natural hazards on our communities.

“NHERI and other scientific networks are critical to move quickly, at speed and scale, to go from basic research, fundamental engineering research, to implementation by individuals, communities and other agencies.”
Susan Margulies – Asst. Director, NSF - Engineering Directorate





NATURAL HAZARDS ENGINEERING RESEARCH INFRASTRUCTURE (NHERI)



For more information, visit the NHERI DesignSafe website: DesignSafe-ci.org

Thank You – Any Questions?



Future Meeting Date

3rd Friday of
every month
at 11:00am
CST

