



NHERI SCIENCE PLAN 3RD EDITION

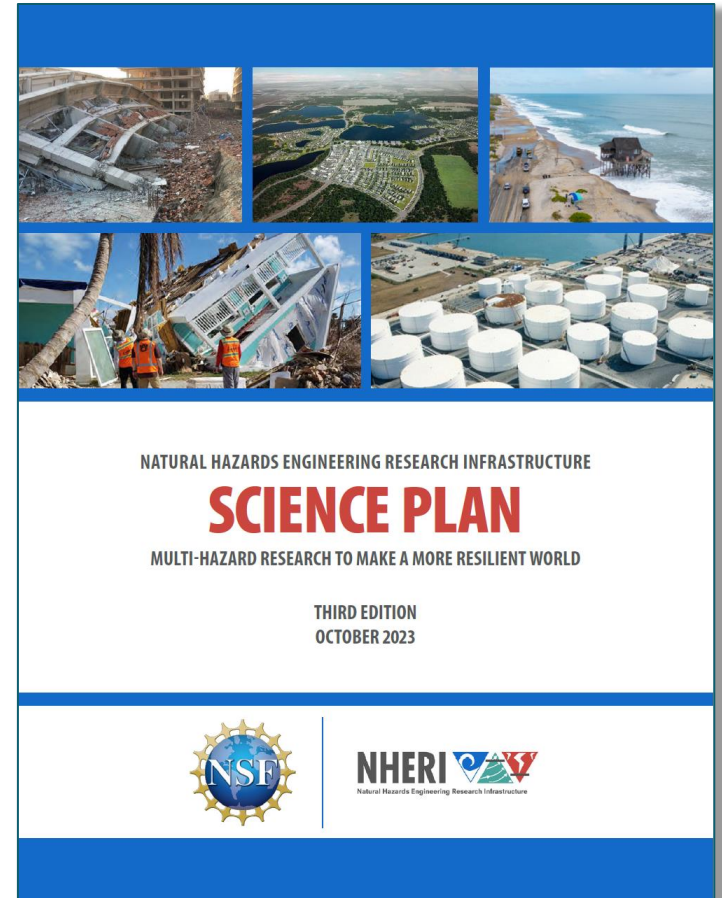
Ian Robertson

NHERI Science Plan Lead

CONVERGE Webinar

March 21, 2024

1



NHERI Experimental Facilities and Components

Appendix C



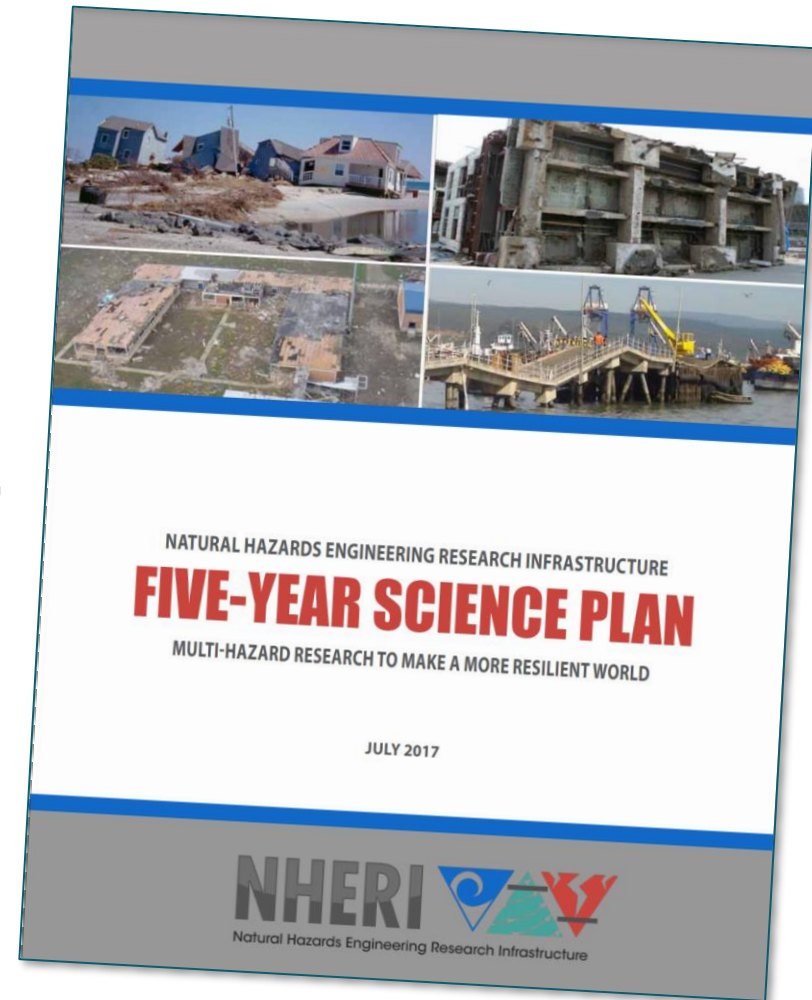
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NHERI Science Plan – First Edition

NSF Contract Requirement:

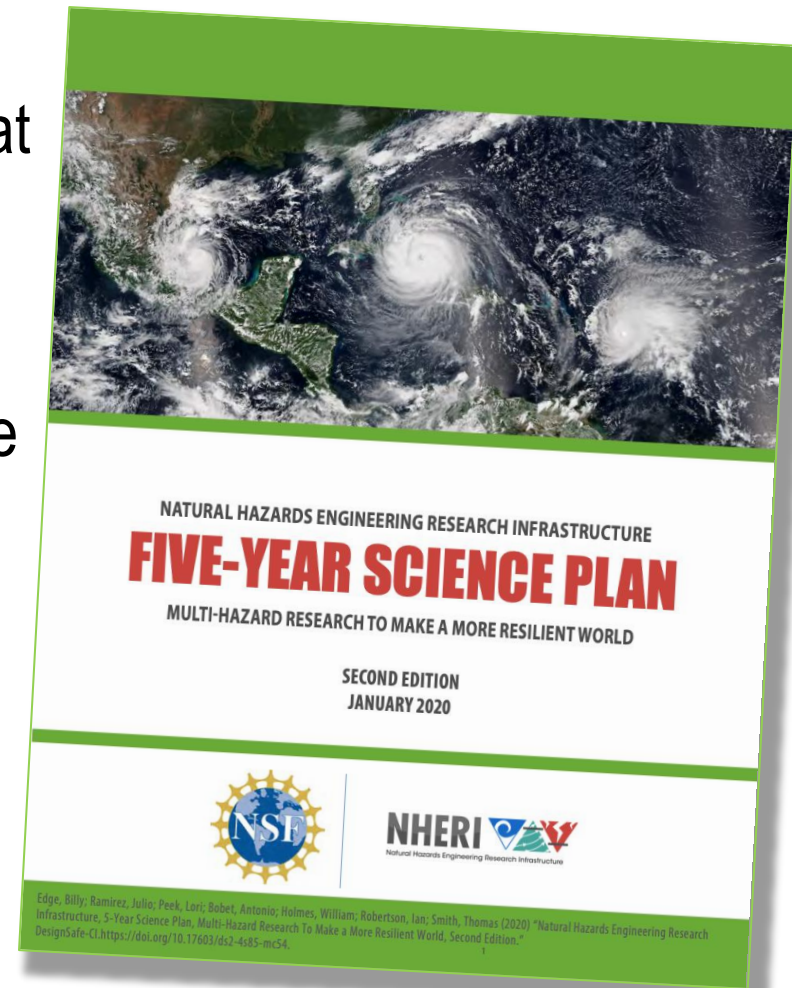
- All experimental facilities, DesignSafe and SimCenter were required to develop a science plan
- Network Coordination Office, NCO, required to develop an overarching 5-year Science Plan for NHERI
- NCO Science Plan Task Group used the facility science plans and developed the first edition in 2017



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



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.



Recent Hazard Events – Social Science Aspects



Hurricane Ian – Fort Myers Beach
150 deaths, many ignoring evacuation
orders

Maui Wildfires – Lahaina
101 deaths, many in vehicles trying
to escape



Science Plan Task Group (1/2)



Rachel Adams
NHC - Boulder



Billy Edge
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**Ann-Margaret
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Georgia State



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**Tracy Kijewski-
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Social Scientists

Science Plan Task Group (2/2)



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AECOM



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Social Scientists

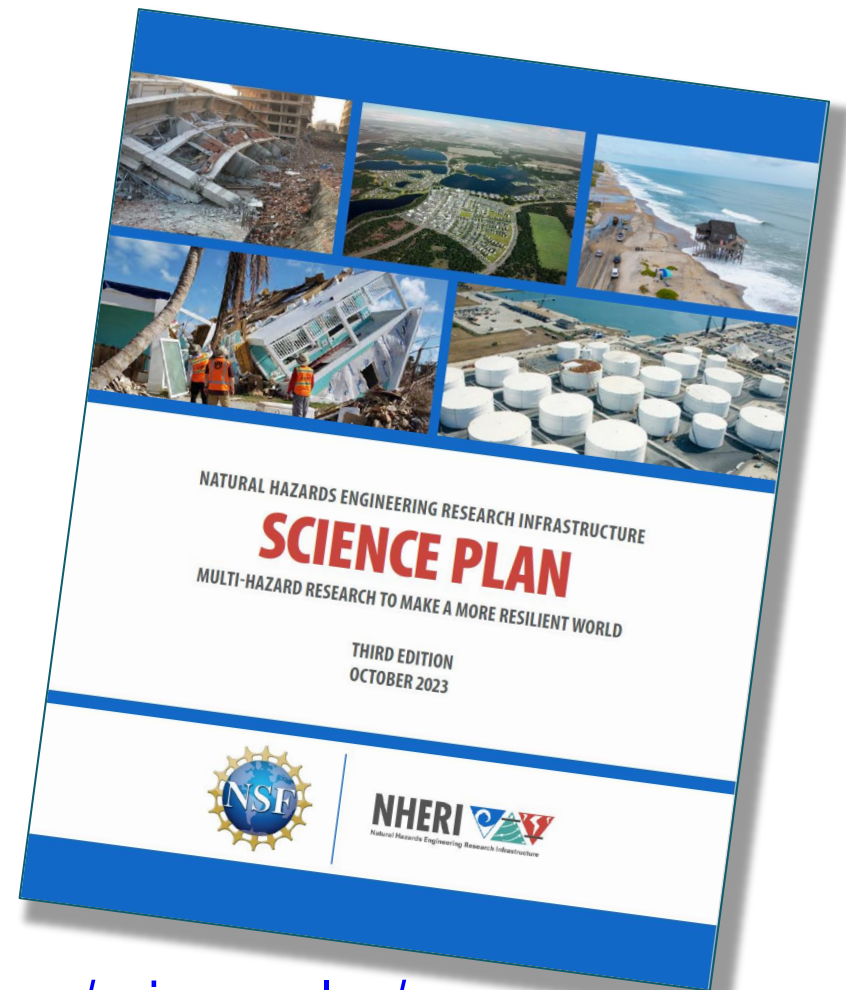
NHERI Science Plan – Third Edition

- NHERI workshop in 2022
- 63 Diverse attendees
- 7 New Research Campaigns
- Published October 2023
- Wide dissemination

Science Plan
available at:



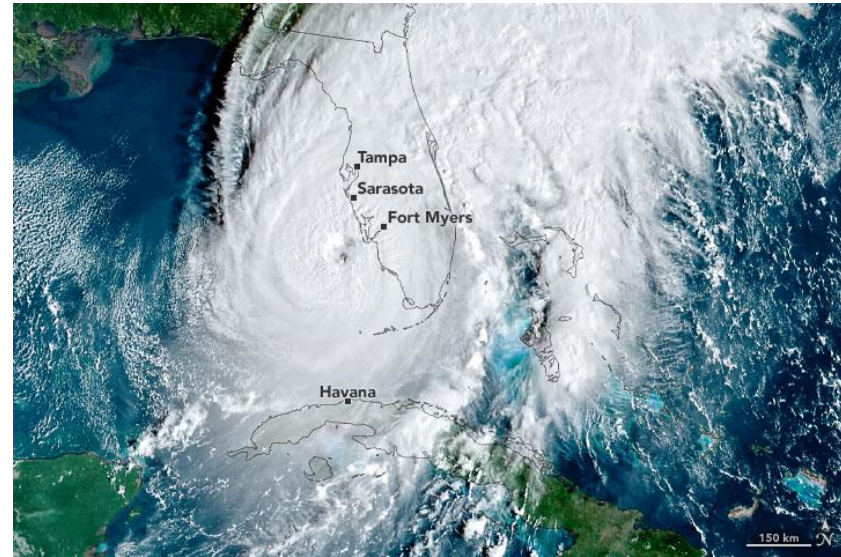
<https://www.designsafe-ci.org/facilities/nco/science-plan/>



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.**



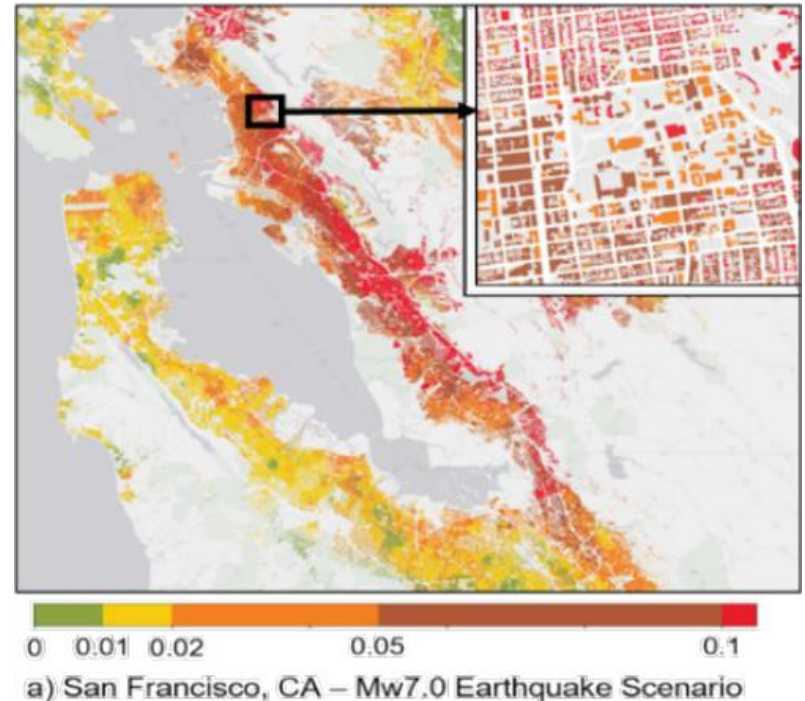
Six Key Research Questions

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

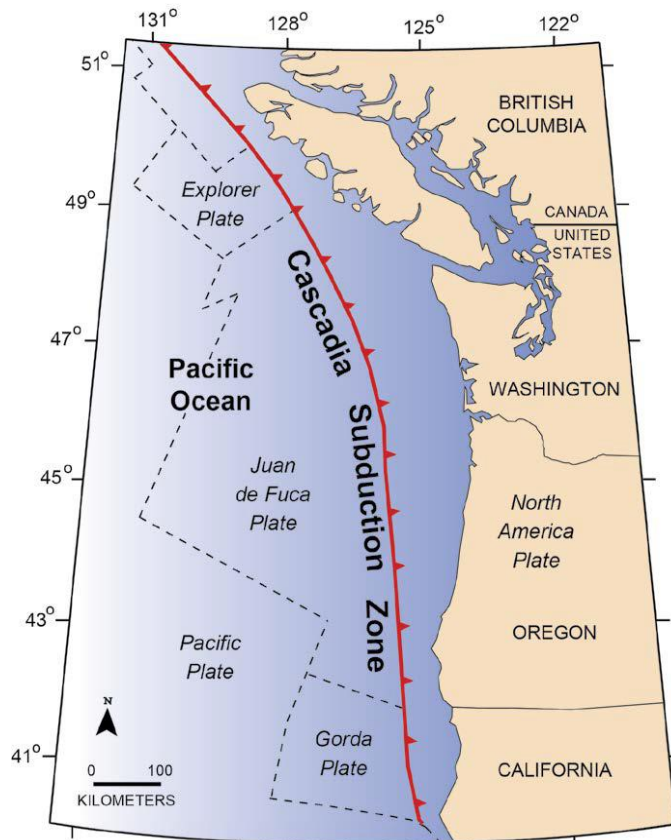
4. What *methodological innovations are needed* to support community resilience through integrated modeling, analysis, and experimental testing of **constructed and societal systems under natural hazard stress**?
5. What *barriers and opportunities are shaping the development of analytic- and simulation-based 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?



Appendix A: Seven Research Campaigns

Understanding and Reducing Vulnerability of Low-Income Communities to Windstorms

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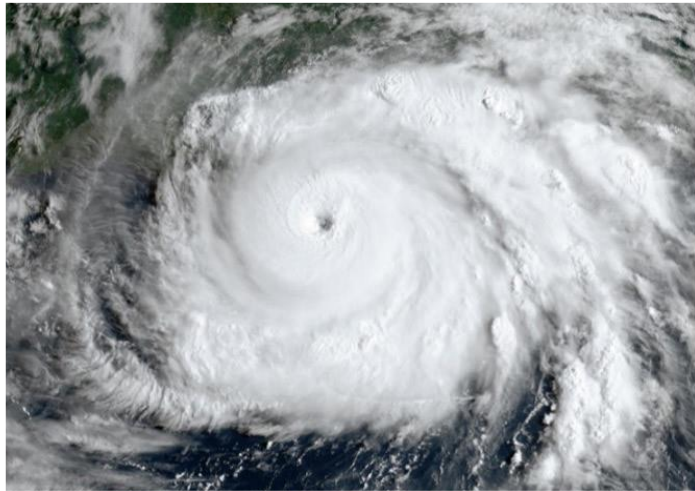
Increasing Regional Resilience to Mega Seismic Events: Cascadia Subduction Zone Earthquake and Tsunami



Appendix A: Seven Research Campaigns

Cascading and Compounding Impacts of Natural Hazards

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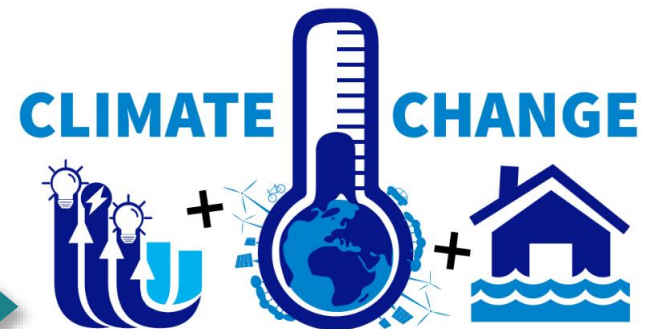


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A Community-Driven Integrated Research Campaign for Hurricanes

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!



Appendix B: Keys to Success for NHERI Proposals

1. Develop credible research questions with *multi-hazard applications*
2. Include demographically and **functionally diverse research team**
3. **Include social scientists, such as a sociologist, economist, urban planner, policy analyst** to evaluate societal impact or cost effectiveness 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.



Appendix B: 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.



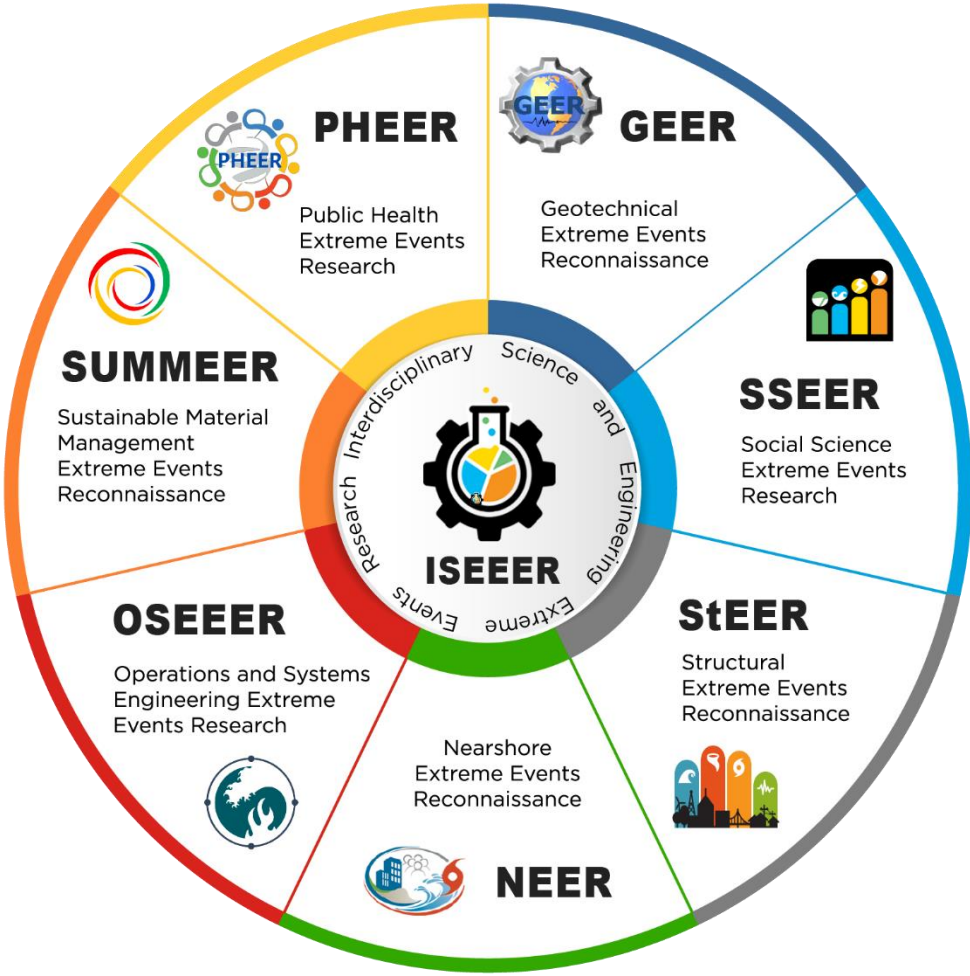
Appendix C: NHERI Experimental Facilities and Components



For more information, visit the
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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

Science Plan
available at:





NATURAL HAZARDS ENGINEERING RESEARCH INFRASTRUCTURE (NHERI)



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

Thank You – Any Questions?



National Science Foundation

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