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COMING EVENTS

- March 5 - March 8, 2019
[EERI 2019 Annual Meeting](#)
Vancouver, British Columbia
Sponsor: [EERI](#)
- March 24 - March 27
[Geo-Congress 2019](#)
Philadelphia, Pennsylvania
Sponsor: [ASCE](#)
- April 22 - April 25
[2019 National Hurricane Conference](#)
New Orleans, Louisiana
Sponsor: [National Hurricane Conference](#)
- June 6 - June 7
[21st International Conference on Earthquake Engineering and Seismology \(ICEES 2019\)](#) San Francisco, California
Sponsor: [WASET](#)
- June 17 - June 20
[12th Canadian Conference on Earthquake Engineering](#)
Quebec City, Quebec
Sponsor: [CAEE](#)
- June 18 - June 21
[Engineering Mechanics Institute Conference 2019 \(EMI 2019\)](#)
Pasadena, California
Sponsor: [ASCE](#) and [Caltech](#)

FOLLOW US AND JOIN THE NATURAL HAZARDS ENGINEERING COMMUNITY!



NHERI RAPID Facility Deploys

University of Washington-based team supports disaster reconnaissance missions around the globe



After two years of gathering community input, acquiring and commissioning equipment, and developing protocols for natural hazards reconnaissance data collection, the Natural Hazards Reconnaissance Facility, headquartered at the University of Washington, was officially launched in September 2018. It's known simply as the RAPID facility.

The first of its kind in the world, the RAPID enables researchers to conduct next-generation rapid response investigations to collect, assess and archive high-resolution perishable data to characterize civil infrastructure performance and community response to natural hazards. It is funded by a five-year, \$4.9 million Natural Hazards Engineering Research Infrastructure (NHERI) grant from the National Science Foundation.

THE RAPID TEAM

Principal Investigator Joe Wartman, Professor of Civil and Environmental Engineering (CEE) at the University of Washington (UW), directs the facility; Jeff Berman, Professor of CEE at UW, serves as Operations Director; Michael Olsen, Associate Professor of Civil and Construction Engineering at Oregon State University, is Technical Director; and Troy Tanner, Principal Software Engineer at the UW's Applied Physics Laboratory, leads the software development and information technology for the facility.

The team also includes a number of natural hazards disciplinary experts including Kurt Gurley, Professor of Civil and Coastal Engineering at the University of Florida (Wind Hazards); Jennifer Irish, Professor of Coastal Engineering at Virginia Tech (Coastal Hazards); Scott Miles, Senior Principal Research Scientist in the Department of Human Centered

Design and Engineering at UW (Social Sciences); Ann Bostrom, Professor at the Evans School of Public Policy and Governance at UW (Social Sciences); and Laura Lowes, Professor and Chair of CEE at UW (Structural and Earthquake Engineering).

Facility staff includes Jake Dafni, Site Operations Manager, who frequently travels with the equipment to support reconnaissance team's data collection; J. Sean Yeung, technical assistant; Caitlin Bourassa, Program Coordinator; and Daniel Stromecki and Alex Dioso, IT specialists.

"Our facility is going to transform natural hazards reconnaissance research by making state-of-the-art data collection equipment available to a wide community of researchers across the country," Berman says.

The RAPID comes online when natural disaster-related losses continue to escalate. In the past 30 years, more than 2.5 million people and \$4 trillion has been lost in natural disasters, according to the World Bank.

TRANSFORMING DATA COLLECTION

Working with existing organizations, including the NSF-funded Geotechnical Extreme Events Reconnaissance Association (GEER) and Structural Engineering Extreme Events Reconnaissance Association (StEER), the facility's staff equips researchers with tools and equipment for gathering data, state-of-the-art workflows and data

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collection protocols that help ensure consistency and quality in the collected data, and software that promotes team collaboration, metadata collections, and integration of data across disciplines.

Additionally, the RAPID's expert field staff can accompany researchers who are not familiar with the equipment to assist in data collection and provide in-field training.

SHARING DAMAGE DATA

“One of the driving reasons to collect damage data is to validate models and design methods,” Berman says. “The better, higher resolution the data, the better the modeling methods will be.”

To enable systematic data collection, the RAPID facility developed a custom mobile application called the “RApp,” which guides researchers through standardized data collection methods. RApp manages multiple data types, from handwritten notes to photographs to 3D point clouds, automatically uploading everything to DesignSafe, NHERI's publicly accessible data repository.



Visiting researchers learn how to operate the BLK360, a lightweight, highly accurate close-range lidar scanner used to capture 3D point-cloud and imagery data.

THE TOOLS

To date, the NHERI RAPID center has procured more than 300 pieces of equipment worth over \$1.2 million. In addition to survey tools and seismic instruments for monitoring aftershocks, the equipment portfolio includes tools for collecting high-resolution 3D data on the state of structures, slopes and coastlines — items such as lidar scanners and

a fleet of drones outfitted with high-resolution cameras.

More specialized and experimental equipment includes the Z-Boat 1800, which uses sound waves to capture underwater topography information about the depth of lake or ocean floors for damage assessment; social science equipment such as EEG headsets to measure electrical brainwave activity and assess stress levels related to disasters; and an Applied StreetView camera to capture 360-degree imagery from a moving vehicle, enabling large-scale damage surveys.

Getting the equipment in the hands of researchers across the country has proven to be the biggest logistical hurdle. In addition to deployment destinations throughout the world, the equipment comes in various shapes and sizes. The small boat, for example, must currently be shipped in a crate.

“We’ve gone through several scenarios,” Berman says. “Sometimes the equipment will go to the researcher’s university and they will fly or drive with it to the field work site. Other times, we will ship it directly to the field site.”



RAPID's Jake Dafni, PhD, in OR validating data for the Spangler landslide. Supported by Chase Simpson, MSCE student at OSU, they flew the Phoenix miniRanger drone lidar system.

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2018 DEPLOYMENTS

Since the center became operational in September 2018, data gathering equipment has been deployed to disaster sites around the world. That data is now publicly available on the DesignSafe website, in the Recon Portal.

HURRICANE FLORENCE NORTH CAROLINA, U.S.

Following catastrophic freshwater flooding in September 2018, two reconnaissance teams were deployed to North Carolina to assess wind and water damage. Site Operations Manager Jake Dafni and Site Operations Engineer, Sean Yeung joined members of StEER using RAPID's Applied Streetview to capture continuous 360-degree imagery, as well as close range lidar scanners, drones (DJI Mavic Air and Matrice 210) and GPS units to build 3D models.

HOKKAIDO, JAPAN SEPTEMBER 2018

Following the magnitude 6.7 Eastern Uburu earthquake on September 6, GEER sent a reconnaissance team to Hokkaido, Japan to compile an inventory of landslides, liquefaction and lateral spreads. The team included Alex Grant of the United States Geological Survey, who had participated in RAPID's hand-on summer user training workshop. With his training, Alex was able to collect high-quality point-cloud data using RAPID's Leica BLK360 Scanner and its Maptek XR3 laser scanner.

HURRICANE MICHAEL NOVEMBER 2018

Researchers from Auburn University and the University of Washington traveled to the Florida panhandle in early November following Hurricane Michael, which made landfall in Mexico Beach, Florida, on October 10. An NSF-funded RAPID grant was awarded to assess the high failure rate of large-scale industrial buildings. The team utilized RAPID's extensive equipment portfolio, bringing along numerous cameras (DJI Osmo, Insta360, Canon DSLR, and Flir), DJI Phantom and Matrice 210 drones, the Leica TS16 and Maptek XR3 long-range scanner.



Captured by a RAPID drone, an aerial photograph shows wind damage on a large-scale industrial building following Hurricane Michael.

SULAWESI EARTHQUAKE, INDONESIA - NOVEMBER 2018

GEER supported a post earthquake and tsunami reconnaissance mission to Palu, Indonesia in November 2018.

The team spent time in Palu, Sulawesi, mapping and characterizing large ground failures using RAPID UAVs and GPS equipment.

USER TRAINING

RAPID will be hosting its second annual equipment training workshop this summer (July 23-26) at its University of Washington headquarters. The intensive, four-day training will equip researchers with the knowledge and skills to operate reconnaissance equipment and use it to collect high-quality data in the field.

For more information, contact the RAPID Facility at (206) 616-3318 or uwrapid@uw.edu.



Alex Grant, Research Civil Engineer with the U.S. Geological Survey, in Hokkaido, Japan pictured here with RAPID's Maptek XR3 laser scanner.

DesignSafe-CI Accelerates the “Resilience Curve”

Platform proves valuable for post-disaster data gathering

By Aaron Dubrow, Texas Advanced Computing Center

According to David Roueche, wind engineer and assistant professor of Civil Engineering at Auburn University, the 2017 and 2018 hurricane seasons put the NSF-funded DesignSafe platform to the test — and it shows great promise.

Roueche was on the front lines of the hurricane response during these particularly active seasons, participating in reconnaissance missions to coastal Texas, the Florida Keys, the Florida panhandle, coastal North Carolina, Puerto Rico and several Caribbean islands in the wake of Hurricanes Harvey, Irma and Maria in 2017 and Hurricanes Florence and Michael in 2018.

David Roueche’s team imported data directly from DesignSafe’s Data Depot into Hazmapper, a tool that facilitates data visualization, processing and analysis.

After Hurricane Harvey (2017), Roueche and his collaborators targeted clusters of single-family homes impacted by a range of wind speeds. They inspected more than 1,000 individual homes and logged more than 5,000 geotagged photographs captured by ground-based teams and unmanned aerial vehicles. They participated in similar efforts after Irma (2017) and Maria (2017). These efforts served as the foundation for the new Structural Extreme Events Reconnaissance (StEER) network, which was founded through an NSF EAGER grant (PI Tracy Kijewski-Correa at the University of Notre Dame) to build societal resilience by generating new knowledge on the performance of the built environment through impactful post-disaster reconnaissance disseminated to affected communities. StEER has relied upon the same tools and methods used in the 2017 hurricane season in responses to Hurricanes Florence (2018) and Michael (2018), and is expanding the approach to encompass structural impacts from all hazards.

DesignSafe helped researchers in a variety of ways. Researchers coordinated their deployments via virtual community channels on Slack (a cloud-based collaboration tool) established by DesignSafe; they used wind-map data developed by other researchers and shared on DesignSafe to determine where they would focus their efforts; and once they began capturing data in the field, they uploaded it immediately to DesignSafe and used mapping and visualization software like HazMapper and QGIS to generate maps that synthesized their and others’ data collections.

“We were interested in capturing data about structures before they’re destroyed, torn down and rebuilt,” Roueche said. “This is perishable data – that’s the purpose of the NSF RAPID program – to capture this perishable data before it’s lost.”



David Roueche is a wind engineer and assistant professor of Civil Engineering at Auburn University.

Roueche and his team found examples of houses side-by-side, built around the same time, where one was completely destroyed, and the other was intact. What factors influenced survival? And how could rebuilding efforts be improved by understanding what features led some structures to stand up to storms?

DesignSafe’s integrated workflow accelerates the “resilience curve” so recommendations from natural hazard engineers can be disseminated in months rather than years.

DesignSafe’s Reconnaissance Portal, which launched in 2017, provided both the computing capabilities Roueche needed for his analyses and a place to share more than 200 gigabytes of gathered data. The portal also allowed his team to immediately begin quality control and assessments on the data and rapidly generate reports that others going into the field later could use and contribute to.

Typically, it takes years for data gathered by researchers after a storm to be analyzed and reported on, which means rebuilding efforts cannot take advantage of engineers’ insights. With a system like DesignSafe, however, there is hope that the “resilience curve” can be accelerated and that recommendations can be disseminated in months.

“We want cities to be able to rebuild more resiliently,” Roueche said. “It can be one to five years before products from post-disaster data are out in literature. That doesn’t allow us to help communities in rebuilding. By having a more streamlined workflow, standardizing processes, and publishing data and data products sooner, it allows us to affect the reconstruction process and have a greater impact. That’s why I’m super excited about where this is going.”

Roueche’s collaborators included the following: Frank Lombardo from University of Illinois at Urbana-Champaign, Richard Krupar III from Berkshire Hathaway Specialty Insurance, Daniel Smith from the Cyclone Testing Station at James Cook University, and Tracy Kijewski-Correa from the University of Notre Dame.

Next Steps for NHERI Five-Year Science Plan

International Workshop Will Address Research Campaigns, Interdisciplinary Teams and Disruptive Technologies

On March 18-19, 2019, the NSF-funded NHERI network will host a workshop to advance its Five-Year Science Plan.

Contributing experts from traditional and transformative fields will help build a more sustainable civil and social infrastructure.

PLANNING FOR GRAND CHALLENGES

The workshop sessions will investigate and develop research campaigns, foster the formation of interdisciplinary teams, and plan for use of new materials and disruptive technologies in the transformation of traditional research approaches for mitigating the impact of natural hazards on civil infrastructure and society.

The focus will be within the scope of the NSF Natural Hazards Engineering Research Infrastructure, NHERI. The workshop will include a diverse range of researchers from geotechnical, structural, architectural, materials, coastal and construction engineering, as well as social science, bio-inspired design, advanced computation, data science, materials science, additive manufacturing, robotics and control theory.

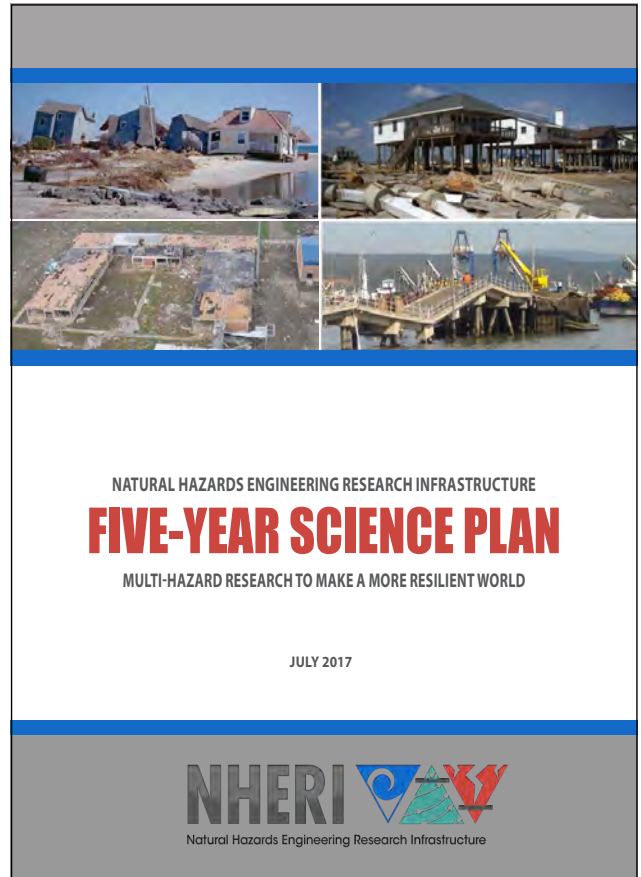
The workshop, which will take place at the Westin Alexandria near NSF headquarters, will provide an opportunity for 85 invited participants to interact with others from academia and practice. Participants include experts from the NHERI community, international researchers, non-traditional technology professionals and select young faculty.

PROGRAM HIGHLIGHTS

Opening the workshop, Dr. Timothy Persons, Chief Scientist of the Government Accountability Office, will present a talk entitled “Expanding the Vision of Science and Engineering for the Natural Hazards Community.” Then Dr. Edward T. Palazzolo of the Army Research Office, will give a presentation on the “Science of Team Science — Best Practices and Future Directions for Interdisciplinary Teams.”

A panel of young professionals will discuss their vision for future hazard mitigation, including disruptive technologies not addressed in the Science Plan. On the afternoon of the first day, six breakouts will feature interactive sessions on non-traditional technologies for hazard mitigation.

The second day will begin with three breakouts focusing on (1) earthquake and geotechnical related hazards, (2) windstorm hazards, and (3) storm surge or tsunami hazards in coastal areas.



The participants in the breakout groups will tackle research themes defined by the Workshop Organizing Committee and develop the elements of a research campaign for the assigned hazard.

The engineers, natural scientists and social scientists will work together to identify how traditional and disruptive technologies can work together to improve the resilience of civil and social infrastructure against natural disasters within the scope of NHERI.

The workshop will conclude with a discussion by Dr. Thomas Denis O'Rourke, NAE, the Thomas R. Briggs Professor at Cornell University, called “Frontiers of Hazard Risk Mitigation.”

Following the workshop, a final report will be published and used to advance the NHERI Five-Year Science Plan. Reports will be published on designsafe-ci.org.

More details on the workshop can be obtained by contacting either: Professor Julio Ramirez at ramirez@purdue.edu, or Professor Billy Edge at b-edge@tamu.edu.

On behalf of the entire Education and Community Outreach Committee, thank you for spreading the word about the NHERI Summer Institute for Early Career Faculty as well as the NHERI Research Experiences for Undergraduates program!

We are having great success recruiting highly-qualified applicants for both programs. This summer, we will welcome approximately 30 undergraduate researchers to the ten-week NHERI-REU program.

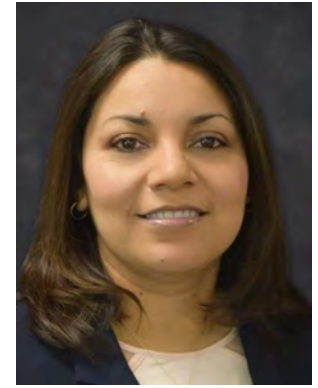
Students will be distributed across the country among the 10 NHERI sites. The research symposium, where students come together to exhibit their projects, will be held Aug. 1-2, 2019, at the University of Texas at Austin.

Also, the Summer Institute for Early Career Faculty will be held on June 5-7, 2019, at the University of Texas at San Antonio Downtown Campus.

We will support approximately 20 early career faculty, post-docs and senior-level graduate students to attend the three-day workshop.

All interested in conducting natural hazards engineering research and learning more about NHERI are invited to register and attend. Applications for travel awards to the Summer Institute are due Feb. 15, 2019.

Please continue spreading the word about the wonderful NSF-funded opportunities to learn more about NHERI and engage with our extraordinary community!



*Karina Vielma, EdD
NHERI Education and
Community Outreach*



2018 NHERI REU students took a break from the Hinsdale Wave Research Laboratory at Oregon State University and went on a field trip to Crater Lake. "The sights were amazing!" Pictured: Angela Del Rosario, Willie Moore, Zhongduo Zhang, and Yibin Liu. (Photo: Angela Del Rosario)



REU students Emma Donnelly-Bullington (left) and Salwa Badr tour the Ferguson Structural Engineering Laboratory at the University of Texas at Austin. (Photo: Patricia Clayton).

Greetings from the NHERI NCO

The last quarter of 2018 was highly productive!

On October 29, a group of U.S. researchers met with researchers from Italy at the Italian embassy in Washington, D.C. This activity was the first under the letter of agreement signed in 2018 between the EUCENTRE Foundation and NHERI.

Several topics for potential collaboration were discussed as well as mechanisms to realize this collaboration. The report from the workshop and the presentations will be made available this quarter on the collaboration page on DesignSafe-CI.

Also in the last quarter, the NCO made plans for the Feb. 7-8, 2019, trip to Japan's E-Defense facility. It is the second meeting of the research collaboration between NHERI and NIED/E-Defense.

In addition to discussing possible opportunities for collaboration under the Tokyo Metropolitan Resilience Project, ten participants from the U.S. observed two tests on the shake table to evaluate the performance of residential wood construction.

In other news, the Feb. 15 deadline for requesting a travel stipend to attend the NHERI Summer Institute is fast approaching. Click here to apply! And be sure to read article in this issue about the next revision of NHERI's Five-Year Science Plan.

In the latter part of 2018, the NHERI RAPID facility came into full swing, as you will read in this issue. We anticipate that, thanks to the RAPID Facility team's excellent support to the community, great strides will be made in natural hazards damage mitigation. Data from reconnaissance missions RAPID has enabled is already available in the DesignSafe Recon Portal.

In other happenings last quarter, three teams of NHERI-affiliated researchers presented at the American Geosciences Union. And the UC San Diego facility was awarded \$16.3 million for upgrades to its LHPOST shake table. Read more about the activities of NHERI faculty and staff in the DesignSafe newsroom.

Lastly, I am pleased to say that many more of the NHERI experimental facilities have joined social media and are using Facebook and Twitter for posting research updates to stakeholders and the public. Communications via social media is an NSF priority. Be sure to check out the social media roster below and follow our EFs!



*Julio Ramirez
Director, NHERI Network
Coordination Office,
Karl H. Kettelhut Professor
of Civil Engineering,
Purdue University*



The full-scale testing took place at Japan's E-Defense facility.



With support from the RAPID facility, Texas A&M professor Maria Koliou and her team collected data on two full-scale, three-story wood-frame buildings. Koliou is the PI on NSF project #1829433, which is funded under the NHERI-NIED/E-Defense research collaboration.



NHERI Grant Awards October–December 2018

RAPID: Assessing the Performance of Elevated Wood Buildings, including Manufactured Housing, in Florida during 2018 Hurricane Michael. Award Number:1903486; Principal Investigator: Elaina Sutley; Co-Principal Investigator: Thang Dao; Organization: University of Kansas Center for Research Inc; NSF Organization: CMMI; Start Date:12/01/2018; Award Amount: \$44,615.

RAPID/Collaborative Research: Performance of Low-Rise Large-Volume Buildings in Florida during 2018 Hurricane Michael. Award Number:1904327; Principal Investigator: Jeffrey Berman; Organization: University of Washington; NSF Organization: CMMI; Start Date: 11/15/2018; Award Amount: \$26,987.

RAPID/Collaborative Research: Performance of Low-Rise Large-Volume Buildings in Florida during 2018 Hurricane Michael. Award Number: 1904653; Principal Investigator: Justin Marshall; Co-Principal Investigator: David Roueche; Organization: Auburn University; NSF Organization: CMMI; Start Date: 11/15/2018; Award Amount: \$32,048.

RAPID: Field Survey of the 27 September 2018 Sulawesi Tsunami. Award Number:1906162; Principal Investigator: Costas Synolakis; Co-Principal Investigator: Hermann Fritz; Organization: University of Southern California; NSF Organization: CMMI Start Date:12/01/2018; Award Amount: \$101,261.

NHERI NETWORK SOCIAL MEDIA ROSTER

Our current list of social media accounts. More to come!

NHERI EF	FACEBOOK	TWITTER	OTHER
NHERI	@NaturalHazardsEngineeringResearchInfrastructure	@NHERIDesignSafe	
UT Austin	@NHERIatUTMobileShakers	@UTMobileShakers	
UC San Diego	@UCSD.NHERI	@NHERI_UCSD	
UC Davis			CGM Facebook group
Lehigh University	@NHERIlehighRTMD	@NHERIlehighRTMD	
Univ of Florida			#ufNHERI
Florida Intl University			
OSU		@NheriOsu	
SimCenter	@NHE.SimCenter	@NHE_SimCenter	
RAPID	@RAPIDNaturalHazardsRecon	@NHERI_RAPID	
NHERI NCO		@NHERI_NCO	
CONVERGE		@NHERI_CONVERGE	



NHERI programs are funded by the National Science Foundation (NSF). The NHERI Quarterly Newsletter is prepared by the NHERI Network Coordination Office (NSF award #1612144). All official online NHERI content including monthly and quarterly publication issues are hosted by DesignSafe-CL which is supported by a grant from the NSF (award #1520817).

