Post-Disaster, Rapid Response Research (RAPID) Facility

Natural Hazards Engineering Research Infrastructure (NHERI) Program of the National Science Foundation (NSF), Award No: CMMI 1611820

Christchurch NZ Earthquakes

Hurricane Katrina

Universities: University of Washington, NJIT, OSU, VT, UF
RAPID Facility Team

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Troy Tanner, Sr. Per., (UW; APL), IT and Data Director
Joseph Wartman, PI, (UW), Director

Coming Soon: Site Operations Specialist, IT Specialist

Steering Committee
Rachel Davidson, University of Delaware
Robert Kayen, USGS
Pat Lynett, University of Southern California
Chris Massey, GNS Science, New Zealand
Lori Peek, Colorado State University
Mark Pierpercarz, MRP Engineering
John van de Lindt, Colorado State University
RAPID Facility

The RAPID facility will provide *infrastructure* and *services* to enable the next generation of global reconnaissance-based natural hazards research

- Portfolio of state-of-the-art field data collection tools
- Software tools
  - *mobile field data collection app*
  - *citizen science app*
  - *Designsafe-CI reconnaissance portal*
- Visualization facility/tools
- Advisory and field services to support reconnaissance
- Training workshops and activities
RAPID Facility: *Broader Impacts*

- Enhancing the nation's shared use research infrastructure; help U.S. remain a leader in natural hazards research

- Providing open data products

- Supporting fundamental discoveries and major advancements in natural hazards; humanitarian and societal benefits

- Promoting public engagement with engineering/science

- Providing education and training opportunities

- Developing new and strengthen existing international research partnerships
RAPID Facility: *Transformative Aspects*

- Enabling systematic, high-resolution data collection (reduces biases and increase certainty)

- Unprecedented amount of high-quality, open-source disaster data
  - Shift from 2D to 3D, leading to new analysis and scientific approaches that consider the 3D nature of hazards and the systems affected by them

- Collection and integration of engineering, and natural and social science data sets

- Expanded community of reconnaissance investigators
RAPID Facility: Science Plan

Principal scientific goal: to inform natural hazards computational simulation models, infrastructure performance assessment, and economic impact analysis by supporting the collection, development, and assessment of high quality disaster data sets.
RAPID Facility: *Science Plan*

Grand Challenges for Natural Hazards Engineering (modified from NRC, 2011)

- **Community Resilience Framework:** Measure, monitor, and evaluate community-level resilience.

- **Hazard and Impact Simulation and Decision Making:** Computational simulation/forecasting of hazard and its physical and social impacts.

- **Mitigation:** Renewal and retrofit strategies are essential to mitigate hazards; development of effective strategies requires models, design methods, and construction standards are capable of identifying critical vulnerabilities and quantifying the impacts of risk reduction measures.

- **Design Tools:** Improved certainty in the predictive capability of design tools is essential to better exploit more sustainable and resilient building materials.
RAPID EF: Strategic Plan for Operations

Evaluate, Support, and Service a Wide Range of User Needs: Diverse needs of a user base that is broad in terms of discipline, natural hazards interest, data requirements, and reconnaissance experience.

Focus on Excellence of Operation: The RAPID facility will meet the operational and logistical challenges associated with serving as a shared-use research facility that must rapidly respond to unpredictable natural hazard events.

Contribute to the Broader Mission of NHERI. The RAPID facility will have impact within and beyond the natural hazards engineering community as aligned with the goals of the NHERI organization

Maintain Safety and Manage Risk. Safety is a major priority for the site. Consistent with NSF and UW requirements, the RAPID EF will maintain the safety of staff and users and manage the risk to facility equipment.
Facility Resources

- Advanced Geomatics Technologies
- Seismic Instrumentation
- Wind and Storm Surge Instrumentation
- Social Science Reconnaissance Equipment
- Ground Investigation
- Imaging Equipment
- Software tools
- Visualization facility

- Mobile Field App
- Total Station/High Res. GPS
- Geophones
- Anemometer
- Lidar
- Imaging
- Virtual Reality (GeoMAT Mini-CAVE)
- Drones (imaging and lidar)
GeoMAT Mini-CAVE

- Data Quality Control
- Data Extraction
- Immersive, interactive experience
- Observations in context
- Unlimited measurement extraction
- Perform visual assessments
- Geometric modeling & Analysis
Training

• **One-week immersive workshops held each summer**
  - Hands-on instruction on instrumentation fundamentals/use/data processing
  - Human subject research protocols
  - Strategic planning of field missions
  - Preparation of health-and-safety plans
  - Working with other teams and local and national governments/agencies
  - NHERI data archiving policy
  - Legal and professional ethics
  - Preparation of RAPID proposals
  - An outdoor field reconnaissance for a hypothetical natural hazard event

• **One-day traveling seminar**
  - Familiarize the natural hazards research community with capabilities
  - Inspire research ideas involving use of the facility.
  - Galvanize the community around field-data gathering opportunities identified in the science plan.
Our overall strategies:

• Support and actively participate in NHERI network-wide outreach programs

• Take advantage of opportunities unique to the RAPID EF
  - Capitalize on public interest in natural disasters by broadly disseminating RAPID EF activities and findings via widely read media sources.
  - Make officials at all levels of government aware of the RAPID EF and the policy lessons/implications

• Build on existing successful programs at host institution UW
Schedule and Work Plan

Year 1 Highlights

- Specification development
- Operations plans and facility policies
- Coordination with Designsafe
- Community engagement (e.g. workshops)
- Headquarters setup
- Financial operating plan
- Software development
Joe Wartman, Director
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RAPID Facility Web Site
https://rapid.designsafe-ci.org/

Overview articles published in mainstream media venues

UW will host global center for disaster reconnaissance, research

http://www.seattletimes.com/seattle-news/science/uw-will-host-global-center-for-disaster-reconnaissance-research/

$4M grant funds new UW RAPID Facility to investigate natural disasters worldwide