March 15, 2010 Update
National Science Foundation
National Earthquake Hazards Reduction Program

Dr. Joy M. Pauschke
Directorate for Engineering
dpauschk@nsf.gov

Dr. Eva Zanzerkia
Directorate for Geosciences
ezanzerk@nsf.gov

National Science Foundation
4201 Wilson Boulevard
Arlington, VA 22230
NEHRP Activities Supported by NSF

• **Directorate for Geosciences**
  – Incorporated Research Institutions for Seismology (IRIS)
  – Southern California Earthquake Center (SCEC)
  – Fundamental Research on Earthquakes
  – EarthScope (Related non-NEHRP activity)

• **Directorate for Engineering**
  – George E. Brown, Jr. Network for Earthquake Engineering Simulation (NEES) Operations and Research
  – Unsolicited Proposal Research Programs
    • Hazard Mitigation and Structural Engineering
    • Geotechnical Engineering
    • Infrastructure Management and Extreme Events
  – **Post-earthquake reconnaissance**
  – National Hazards Center
**NEHRP (NSF) Success Stories Seismic Waves**

http://www.nehrp.gov/plans/index.htm#success

---

**Drilling Toward a New Level of Preparedness**

The Great Southern California ShakeOut

**Grounded in Science**

The Great Southern California ShakeOut was an unprecedented combination of events held in and around the week of November 19-23, 2009, in Los Angeles and other communities across the six counties of southern California. The objective was to mobilize existing resources, exercise, and events in a coordinated, innovative, and measurable manner so that, when they coalesce, they begin to transform the public’s understanding of preparedness.

**Innovative Features of a Multi-County Exercise**

The ShakeOut event, which provided a framework for testing the earthquake science, included a Southern California-wide mobilization drill, state and local crisis communication, and nearly 800,000 volunteers, the most comprehensive earthquake science ever conducted. In fact, each year since 2000, the Southern California Earthquake Center (SCEC) has conducted an exercise to test earthquake science but this year marked the first time that a major event of this type was staged.

**A Consequence of Interests**

Power company managers, particularly grid operators, were among the few pilots of buildings that will be eligible for the program. The NEHRP team, led by the Southern California Earthquake Center, includes the National Earthquake Science Laboratory, the Pacific Economic Development Corporation (PEDC), the Southern California Earthquake Center, and the Pacific Economic Development Corporation (PEDC), and the Southern California Earthquake Center.

---

**Seismically Benefiting the Precast Construction**

The Diesel Generator Safety Methodology Project

The Diesel Generator Safety Methodology Project was designed to provide a systematic approach to the safety of diesel generator operations. The project was a joint effort between the Southern California Earthquake Center, the National Earthquake Science Laboratory, and the Pacific Economic Development Corporation (PEDC).

**Integrated Construction**

The Diesel Generator Safety Methodology Project is an integrated system that provides a systematic approach to the safety of diesel generator operations. The project was a joint effort between the Southern California Earthquake Center, the National Earthquake Science Laboratory, and the Pacific Economic Development Corporation (PEDC).

---

**Can Wood Buildings Safely Grow Taller in Seismic Regions?**

The NEHRP Wood Project has developed a new methodology for assessing the seismic performance of wood structures. The methodology is based on the use of a comprehensive analysis of the seismic performance of wood structures and the development of guidelines for the design and construction of wood buildings.

**New Design Philosophy Needed**

In recent decades, large-scale wood buildings have been constructed in seismic regions and have performed well in earthquakes. However, the performance of wood buildings in seismic regions is not well documented and the design and construction of wood buildings in seismic regions is not well understood.

The methodology was developed by the Southern California Earthquake Center, the National Earthquake Science Laboratory, and the Pacific Economic Development Corporation (PEDC).

---

For more information, visit [http://www.nehrp.gov](http://www.nehrp.gov) or email np@nehrp.gov.

---

**The figures shown are provided by Cold Spring Harbor Laboratory.**

---

**Notes:**

1. The ShakeOut Earthquake Scenario is designed to help by J. A. Mabie (Pacific Oceanic & Atmospheric Administration, May 2009).
NEHRP Activities Supported by NSF

- Directorate for Geosciences
  - Fundamental Research on Earthquakes
  - Incorporated Research Institutions for Seismology
  - Southern California Earthquake Center
  - EarthScope (Related non-NEHRP activity)
Fundamental Research on Earthquakes

- GEO/EAR Programs fund fundamental earthquake-related science through general program solicitations
  - Geophysics, Tectonics, Continental Dynamics, Instrumentation and Facilities

- Areas of Current Research
  - Satellite radar information on surface deformation
  - Relationship of tremor, slow slip and other low frequency phenomena to large earthquakes
  - Fault zone modeling to understand earthquake dynamics
  - Study of material properties in fault zones

- Fundamental research is conducted and facilitated by centers such as SCEC, IRIS, UNAVCO, CIG and others

Satellite radar images are used to infer slippage on the Southern San Andreas Fault system. (Falko, UCSD)
NEHRP Activities Supported by NSF

• Directorate for Engineering
  – George E. Brown, Jr. Network for Earthquake Engineering Simulation (NEES) Operations and Research
  – Fundamental Research Programs (unsolicited)
    • Hazard Mitigation and Structural Engineering
    • Geotechnical Engineering
    • Infrastructure Management and Extreme Events
  – Post-earthquake reconnaissance
  – National Hazards Research Center
NEES for the Engineering Community

NEEShub Cyberinfrastructure
- Data repository
- Telepresence
- Simulation tools
- Hybrid simulation
- Collaborative tools
- Cybersecurity

NEES Headquarters at Purdue University

University of California, Davis
University of California, Berkeley
University of California, Santa Barbara
University of Nevada, Reno
University of Minnesota
University at Buffalo
Rensselaer Polytechnic Institute
Lehigh University
University of Illinois at Urbana-Champaign
University of Texas at Austin
University of California, San Diego
University of California, Los Angeles
Oregon State University
Cornell University
Post-Earthquake Reconnaissance Support

- Earthquake Engineering Research Institute (EERI) Learning from Earthquakes Program (CMMI-0758529) http://www.eeri.org/site/projects/learning-from-earthquakes

- Geo-Engineering Extreme Events Reconnaissance (CMMI-0825760, -0825734, -0825507) http://www.geerassociation.org/

- Natural Hazards Center (CMMI-0734304) http://www.colorado.edu/hazards/

- NSF RAPID (formerly SGER) awards
### NSF-supported “RAPID” Research Investigation Teams

<table>
<thead>
<tr>
<th>2010 Date</th>
<th>Team</th>
<th>Purpose</th>
</tr>
</thead>
</table>
| Jan 26-Feb 3       | USGS/EERI/NEES/GEER, with assistance from U.S. Military Southern Command (SOUTHCOM) | - Advance field reconnaissance and four portable seismographs installed  
| Jan 31-Feb 5       | GEER                                         | - Geological and geotechnical field observations  
| Feb 28-March 6     | EERI                                         | - Team of architects, engineers, planners, and social scientists for broader coverage/study of earthquake effects (e.g., hospitals, schools, port, lifelines) |
| Varies by project  | Individual Investigators Natural Hazards Center | - Several quick response studies for social scientists to capture perishable research data |
| March and beyond   | Teams to be supported through NSF RAPID awards | NSF 10-024: Engineering/International “Dear Colleague Letter”  
                      |                                               | In-depth field studies to gather perishable research data  
| Summer/Fall in DC area | Haiti Earthquake RAPID Awards Workshop | Dissemination of field observations and research findings |
# NSF-supported RAPID Research and Field Response Investigation Teams

<table>
<thead>
<tr>
<th>NSF Award Number</th>
<th>Directorate</th>
<th>Project Title, PI and Institution</th>
</tr>
</thead>
</table>
| 1030002          | CISE/IIS    | RAPID: Supporting Family Reunification for the Haiti Earthquake and Future Emergencies  
                  |             | PI: Chen Li, University of California-Irvine  
| 1028001          | GEO/OCE     | RAPID: Collaborative Research: Off-shore coseismic effects of the Port au Prince earthquake, Haiti  
                  |             | PI: Sean Gulick, University of Texas at Austin |
| 1028045          | GEO/OCE     | RAPID: Collaborative Research: Off-shore coseismic effects of the Port au Prince earthquake, Haiti  
                  |             | PI: Cecilia Gonzalez-McHugh, Columbia University |
| 1024990          | GEO/EAR     | Geodetic and Geologic Field Response to the January 12, 2010, Magnitude 7.0 Haiti Earthquake  
                  |             | PI: Eric Calais, Purdue University |
National Science Foundation – Directorate for Geosciences

Activities Supported to Study the January 12, 2010 Haiti Earthquake

RAPID Award to Dr. Eric Calais, Purdue University
- Research team from Purdue University, University of Texas, University of Arkansas, Haitian Bureau of Mines and Energy
- Mapping and precisely measuring the displacement on the fault
- Re-measuring existing network of 30 GPS benchmarks in Haiti and the Dominican Republic to determine co-seismic deformation
- Installing continuous GPS instruments in key locations to measure post-seismic deformation

OpenTopography Portal (UC San Diego/San Diego Supercomputer Center)
- Joint support from EAR-Instrumentation and Facilities and Office of Cyberinfrastructure
- Hosts EarthScope and other imagery data (www.opentopography.org)
- With NSF concurrence, hosts airborne imagery collected over Haiti by the U.S. National Geospatial Intelligence Agency

Checking GPS receiver on the roof of Jacmel's police station. Teaching about earthquakes to students at Mirebalais' high school.
### NSF-supported Research Investigation Teams to Date

<table>
<thead>
<tr>
<th>2010 Date</th>
<th>Team</th>
<th>Purpose</th>
</tr>
</thead>
</table>
| March 9 - 21 | EERI Learning from Earthquakes | Seismic performance of engineered structures, building components and interior furnishings, hospital and health care system; tsunami impact on structures; social impacts and recovery policy; instrumentation of selected structures.  
http://www.eqclearinghouse.org/20100227-chile/ |
| March     | GEER                          | Soil and geological investigations                                                                                                      |
Recent NSF-Supported Workshops

- **Workshop/Collaborative Research: Vision 2020 – An Open Space Technology Workshop on the Future of Earthquake Engineering**
  - St. Louis, MO, January 25-26, 2010
  - PIs: Shirley Dyke, Purdue University, and Bozidar Stojadinovic, University of California, Berkeley, CMMI-1004951/0957567
  - [https://www.nees.org/training/workshop_detail/eqv2020/](https://www.nees.org/training/workshop_detail/eqv2020/)

- **Coordinating Workshops for the NEES/E-Defense Collaborative Research Program in Earthquake Engineering (Phase 2; 2010 - 2013)**
  - Annual and topical meetings during 2010-2013
  - PI: Stephen Mahin, University of California, Berkeley, CMMI-0958774
  - Japan’s E-Defense to consider Payload Projects for NEESR Proposals

- **Earthquake Source Dynamics and Data-Constrained Numerical Modeling**
  - Smolenice Castle, Slovakia, June 27-July 1, 2010
  - PI: Ralph Archuleta, University of California-Santa Barbara, EAR-0944317
Earthquake Engineering Research Frontiers

• External factors
  – Hazard information/earthquake early warning
  – New materials (high performance, sustainable)
  – High performance computing capabilities
  – Advances in multi-scale, multi-physics modeling
  – Sensor technologies
  – IT/cyber advances
  – Others?

• Research frontiers, e.g., Vision 2020 Workshop
  – Real-time risk assessment
    • Smart sensors; networked sensor systems
    • Advanced analysis tools
  – New structural systems
  – Cost-effective rehabilitation strategies
  – Modular construction/deconstructibility
  – Advanced numerical simulation
  – Full-scale field testing

• Research frontier ideas from the NEHRP ACEHR?
National Science Foundation
http://www.nsf.gov