



Update on the National Science Foundation's Role in the National Earthquake Hazards Reduction Program

Presentation
to the
NEHRP Advisory Committee on Earthquake Hazard Reduction
December 17, 2008

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Directorate for Engineering

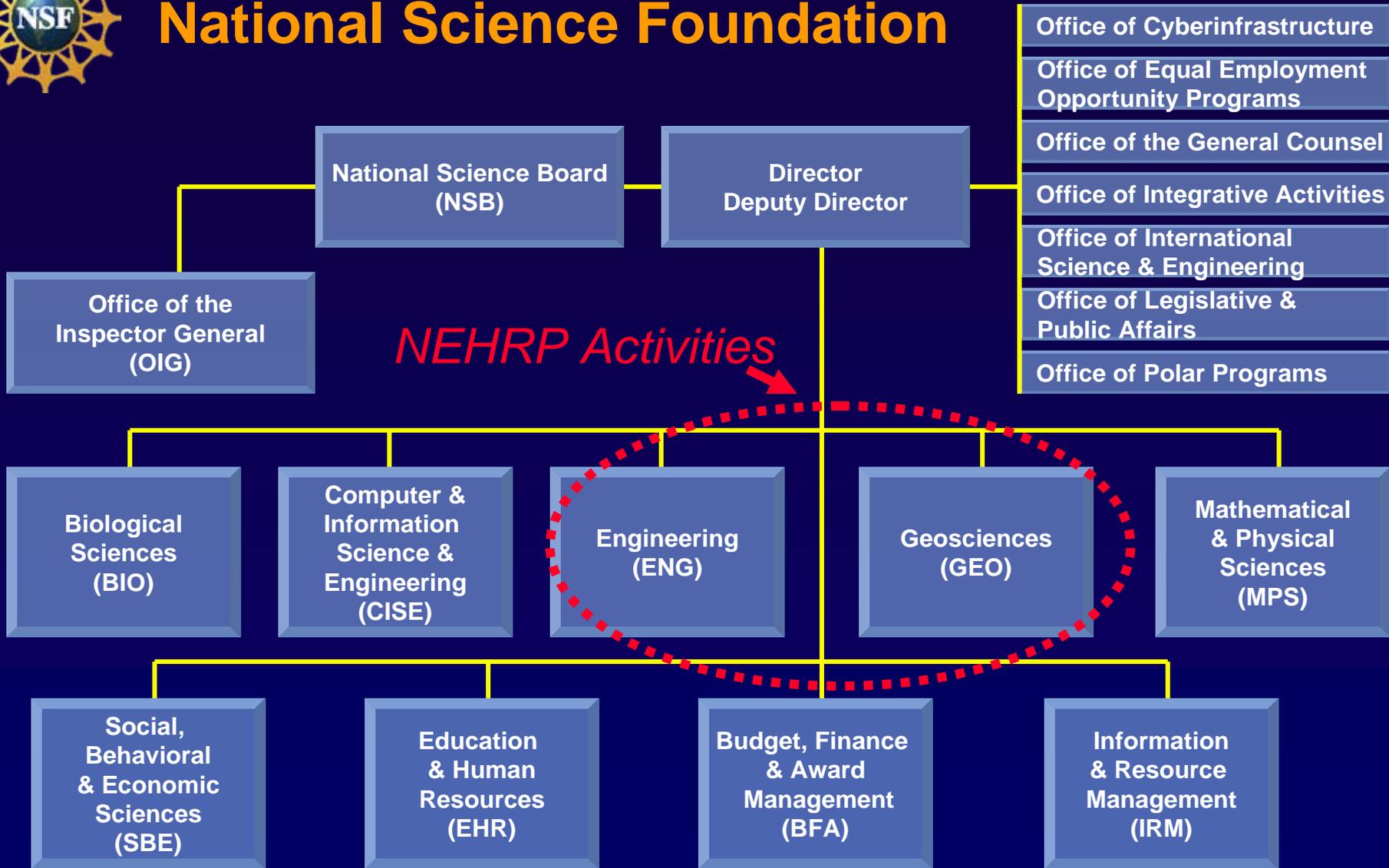
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NEHRP Activities Supported by NSF Directorate for Geosciences

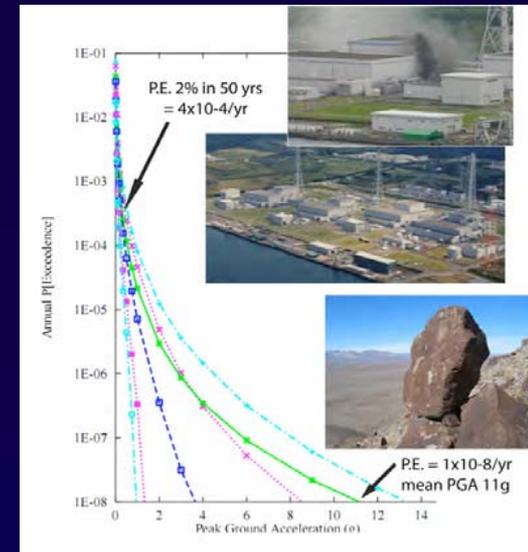
- Incorporated Research Institutions for Seismology
- Southern California Earthquake Center
- Fundamental Research on Earthquakes
- EarthScope (Related non-NEHRP activity)





Incorporated Research Institutions for Seismology (IRIS) Activities

- September 18-19, 2008 : Long Range Science Plan For Seismology
- November 19, 2008 Draft Report “Grand Challenges in Understanding Earth’s Dynamic Systems” available for comment <http://www.iris.edu/hq/lrsps/>
- 10 Grand Challenges:
 - How do faults slip?
 - What is the relationship between stress and strain in the lithosphere?
 - How do processes in the ocean and atmosphere couple to the solid Earth?
 - How does the near-surface environment affect resources and natural hazards?
 - Where are water and hydrocarbons hidden beneath the surface?
 - How do magmas ascend and erupt?
 - What is the lithosphere-asthenosphere boundary?
 - How do plate boundary systems evolve?
 - How do temperature and composition variations control mantle and core convection?
 - How are Earth’s internal boundaries affected by dynamics?



Probabilistic seismic hazard curve for Yucca Mountain, Nevada. Kashiwazaki-Kariwa Nuclear Power Plant in Japan. Photo of precarious rock. (Image courtesy of R. Allen, with graph from J. C. Stepp and I. Wong)

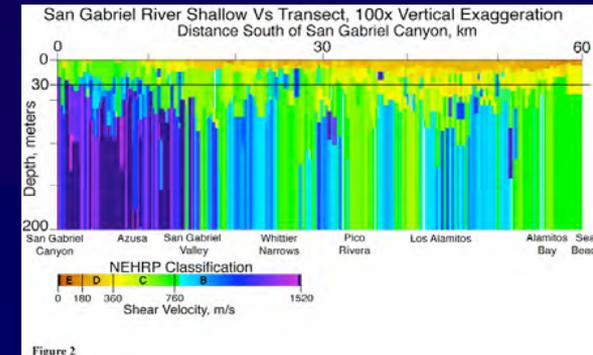


Figure 2. A 60-km long cross section of the upper 200 m of the Los Angeles basin, at 100X vertical exaggeration, showing shear-wave speed. The image was derived using seismic surface-wave background noise. (From W. Thelen et al., BSSA, 96, 1055, 2006)

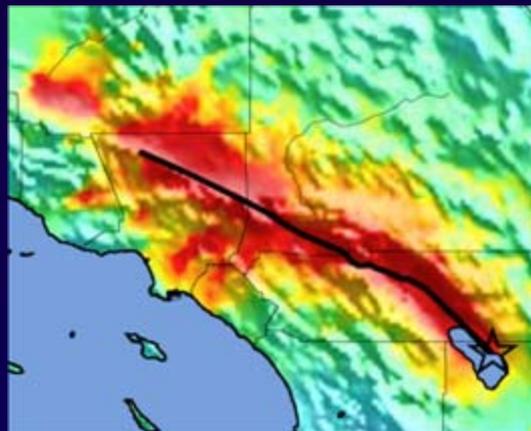




Examples of Geosciences Activities

Southern California Earthquake Center

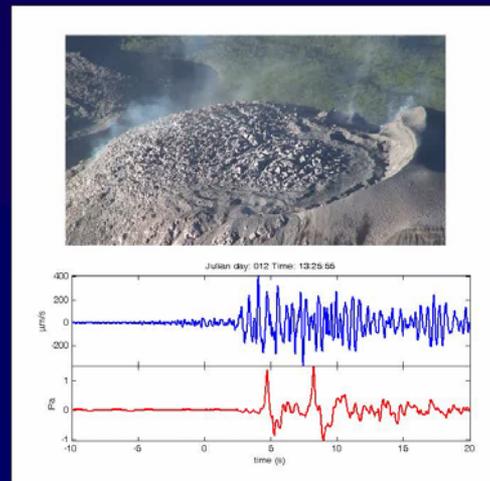
- Participation in the Great ShakeOut 11/13/08
 - Basis of ShakeOut: SCEC PetaSHA high-performance simulation (Graves et al.)



Ground shaking during the simulated Magnitude 7.8 southern San Andreas Fault Earthquake.

Seismo-acoustics View Volcanic Eruption

- Jeffrey Johnson (New Mexico Institute of Mining and Tech.) et al. Published in Nature, 11/20/2008: “Long-period earthquakes and co-eruptive dome inflation seen with particle image velocimetry”
 - Links volcanic activity with long-period earthquakes. May be a means of understanding seismic and volcanic hazards and monitoring explosive gas and ash venting



Santiagito explosion with seismo-acoustic recording





Related Non-NEHRP Activity

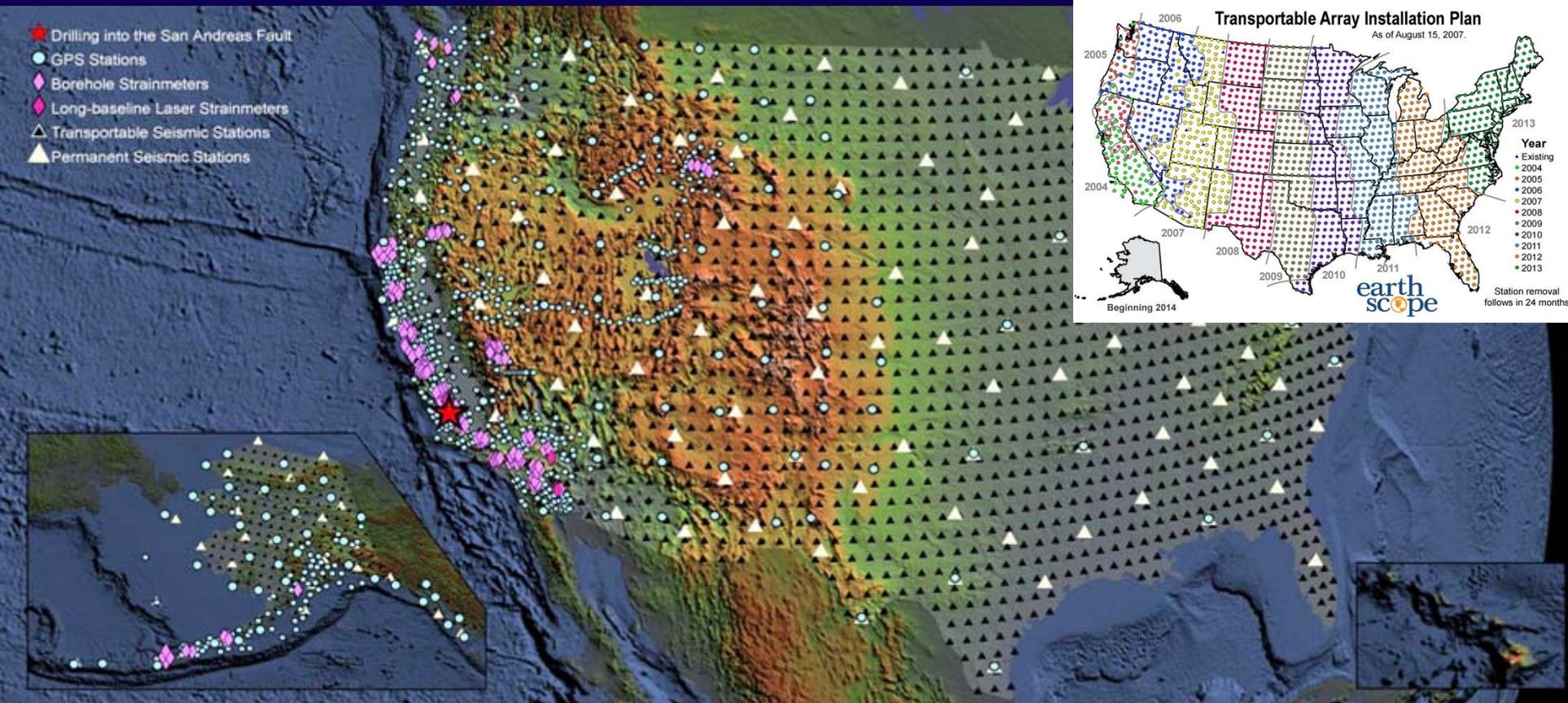


earthscope



EarthScope :

- Construction phase completed 09/30/2008
- Now entered five-year Operations and Maintenance of the facility
- Data Portal to all EarthScope data sources www.Earthscope.org
- USArray continues to rolling through the mid-continent (North Dakota-Texas)





NEHRP Activities Supported by NSF Directorate for Engineering

- Post-Earthquake Reconnaissance
- National Hazards Research Center
- Unsolicited Fundamental Research on Earthquake Engineering and Social Science and Public Policy Aspects of Disasters
- George E. Brown, Jr. Network for Earthquake Engineering Simulation (NEES)
 - Research
 - Operations





Post-Earthquake Reconnaissance

Awards 0758529 (LFE) and 0825734, 0825760, 0825507 (GEER)

- Purpose: Post-earthquake field investigations
 - Learning from Earthquakes (LFE) – EERI
 - Geo-Engineering Earthquake Reconnaissance - GEER
- Since 1973, over 180 investigations
- USGS Circular 1242–NEHRP Post-Earthquake Investigations
- Recent Reconnaissance Reports (LFE and GEER)
 - M 6.3 Greece (offshore) – June 8, 2008
 - M 7.9 Wenchuan, China – May 12, 2008
 - M 8.0 Near Central Coast, Peru – August 15, 2007
 - M 6.6 Honshu, Japan – July 16, 2007
- More information:
<http://www.eeri.org/site/content/section/6/229/>
<http://research.eerc.berkeley.edu/projects/GEER/>





Natural Hazards Center University of Colorado, Boulder



(Award 0408499)

- Purpose: To advance and communicate knowledge on hazard mitigation and disaster preparedness, response, and recovery
- Co-funding: NSF, USGS, FEMA, and other federal agencies
- Publications include
 - *Natural Hazards Observer (bimonthly)*
 - *Disaster Research (biweekly e-newsletter)*
 - *Natural Hazards Review Journal (joint w/ASCE)*
- Quick response program and reports (post-disaster studies)
- Annual Workshop: July 12-15, 2008
- More information and publications:
<http://www.colorado.edu/hazards/>





Fundamental Research - Unsolicited Proposals

Examples of Recent Awards

- **Hazard Mitigation and Structural Engineering**
 - Rapid Post-Earthquake Assessment on Building Condition and Chemical Hazard with a Temperature-Tolerant Monitoring System (Award 0825942)
 - Lateral Load Behavior and Modeling of Shear-Dominant Reinforced Concrete Walls for Performance-Based Design (Award 0825347)
- **Geotechnical Engineering**
 - Multiscale Meshfree Analysis of Failure in Geostuctures Founded on or Containing Liquefiable Soils (Award 0825483)
 - GOALI/Collaborative Research: The Integrity of Geosynthetic Elements of Waste Containment Barrier Systems Subject to Large Settlement and Seismic Loading (Awards 0800030 and 0800873)
- **Infrastructure Management and Extreme Events**
 - Enabling the Next Generation of Hazards and Disasters Researchers (Award 0758484)
 - New Methods for Measuring, Monitoring and Evaluating Post-Disaster Recovery (Award 0825747)





Infrastructure Management and Extreme Events Projects

- **Social Science and Multidisciplinary Research**
- **Currently over 50 active awards**
- **FEMA'S USAR Task force Deployments:
Implications for the management of emergency response**
- **Prevalence and Preparedness for Conjoint Natural and Technological Disasters**
- **Family Business Response to Federal Disaster Assistance**





Infrastructure Management and Extreme Events Projects (cont.)

- **Agency Within Disaster Preparedness and Response: The Role of Poverty and Disability**
- **Improvisation and Sensemaking in Sudden Crisis**
- **The October 2006 Federal disaster in Buffalo, NY: An Investigation of First and Second Responder Operations**
- **The Dynamics of Collaboration in Emergency Planning for America's Schools**
- **Responding to the Unexpected: Understanding Travelers' Behavioral Choices in the Wake of the Mississippi River Bridge Collapse**
- **Protective Action Decision Making in Wildfires**





Human and Social Dynamics

- **A NSF foundation wide five-year solicitation supporting multidisciplinary research in social science, physical science, natural science and engineering.**
- **Decision-making under Risk and Uncertainty focus area has supported about 55 social science proposals on hazards and disasters.**
- **Total support for research on hazards and disasters is in excess of \$36,000,000.**





Update on NEES

- NEES Research
 - Over 50 awards made as the result of five NEES research program solicitation competitions
 - 13 new research awards made in FY 2008, e.g.,
 - NEESR-SG: Seismic Performance Assessment in Dense Urban Environments (Award 0830331)
 - NEESR-SG: Understanding and Improving the Seismic Behavior of Pile Foundations in Soft Clays (Award 0830328)
 - Next NEESR program solicitation to emphasis ACEHR recommendation for curiosity-driven basic research
- NEES Operations FY 2005-FY 2009
 - Several sites (e.g., Berkeley, UIUC, Buffalo, Minnesota) at capacity usage
 - June 18-20, 2008 NEES Annual Meeting in Portland, OR
 - REU program summer 2008 and planned for 2009
 - Consortium participated in LA ShakeOut in November 2008
- NEES Operations FY 2010-FY 2014
 - June 2008 - NSF 08-574 NEES Operations FY 2010-FY 2014 Program Solicitation issued
 - February 13, 2009 – Invited Full Proposals due
- Meetings
 - January 12-13, 2009 at NSF: NEES/E-Defense Research Planning Meeting
 - June 22-25, 2009 in Honolulu, HI: Joint ENG/CMMI Grantees & NEES Annual Meeting





UCSD NEES Outdoor Shake Table: Precast Concrete Structure Test during 2008



Engineers at the University of California-San Diego's Englekirk Center tested the seismic response of precast concrete floor systems that are used in parking garages, college dormitories, hotels, stadiums, prisons and increasingly in office buildings. This three-story, one million pound structure is the largest structure ever tested on a shake table in the U.S. This project is supported by NSF, industry, and the Precast/Prestressed Concrete Institute and includes a collaboration among researchers at the University of Arizona, University of California-San Diego, and Lehigh University.

(Photo courtesy of Dr. Robert Fleischman, University of Arizona)

NSF Awards 0434522, 0402490, and 0623952





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<http://www.nsf.gov>



national **earthquake** hazards reduction program