

# National Earthquake Hazards Reduction Program

*... a research and implementation partnership*

## Program Update

2007 WSSPC - ICC Annual Conference

1 October 2007

**INTERNATIONAL CODE COUNCIL**

**RENO 2007**  
Annual Conference  
and Education Program

ICC '07  
ANNUAL CONFERENCE  
RENO  
WORKING TO BUILD A SAFER WORLD

Western States Seismic Policy Council

**WSSPC**

WESTERN STATES SEISMIC POLICY COUNCIL



**FEMA**

**NIST**  
National Institute of  
Standards and Technology

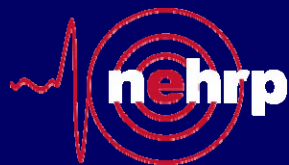


**USGS**  
science for a changing world

national **earthquake** hazards reduction program

# Presentation Outline

- Background
- P.L. 108-360 overview
  - Statutory Program Activities
  - Agency Roles
  - Ongoing Efforts Supporting Legislation
- Conclusion



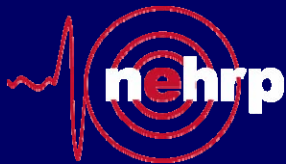
# Background

- NEHRP was established by Public Law (PL) 95-124, the *Earthquake Hazards Reduction Act of 1977*.
- Thru NEHRP, Congress authorizes appropriation levels for the four principal agencies (FEMA, NIST, NSF, USGS).
- Most recent reauthorization (PL 108-360) covered FY 2005 – FY 2009 at average annual totals for all 4 agencies of ~ \$180M, an increase of \$75M per year from previous levels.
- In PL 108-360, Congress observed that new mitigation technologies are being implemented slowly, while urban development has accelerated, resulting in significantly increased societal vulnerabilities.



# PL 108-360: Statutory “Program Activities”

- Improve understanding of earthquakes and their effects.
- Develop effective measures for earthquake hazards reduction.
- Promote adoption of earthquake hazards reduction measures.
- Develop, operate, and maintain Advanced National Seismic System; *George E. Brown, Jr.* Network for Earthquake Engineering Simulation; and Global Seismographic Network.



# NEHRP Partnership

## Typical FEMA Activities



### Next-Generation Performance-Based Seismic Design Guidelines

Program Plan for New and Existing Buildings

FEMA-445 / August 2006



### 2003 NEHRP Recommended Provisions

for Seismic Regulations for New Buildings and Other  
Structures and Accompanying Commentary and Maps

FEMA 450-CD – 2003 Edition / June 2004



FEMA



### Techniques for the Seismic Rehabilitation of Existing Buildings

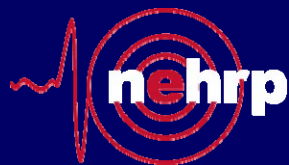
FEMA 547 / 2006 Edition



*Ongoing efforts involve all  
NEHRP agencies*

*Joint effort with USGS  
(seismic hazard mapping).*

*Cooperative effort with NIST.*



national **earthquake** hazards reduction program

# NEHRP Partnership

**NIST:** *Perform problem-focused research!*

- President's *American Competitiveness Initiative* re-energizes NIST earthquake research program:

FY 2007 budget started process (+ \$800K from FY 2006).

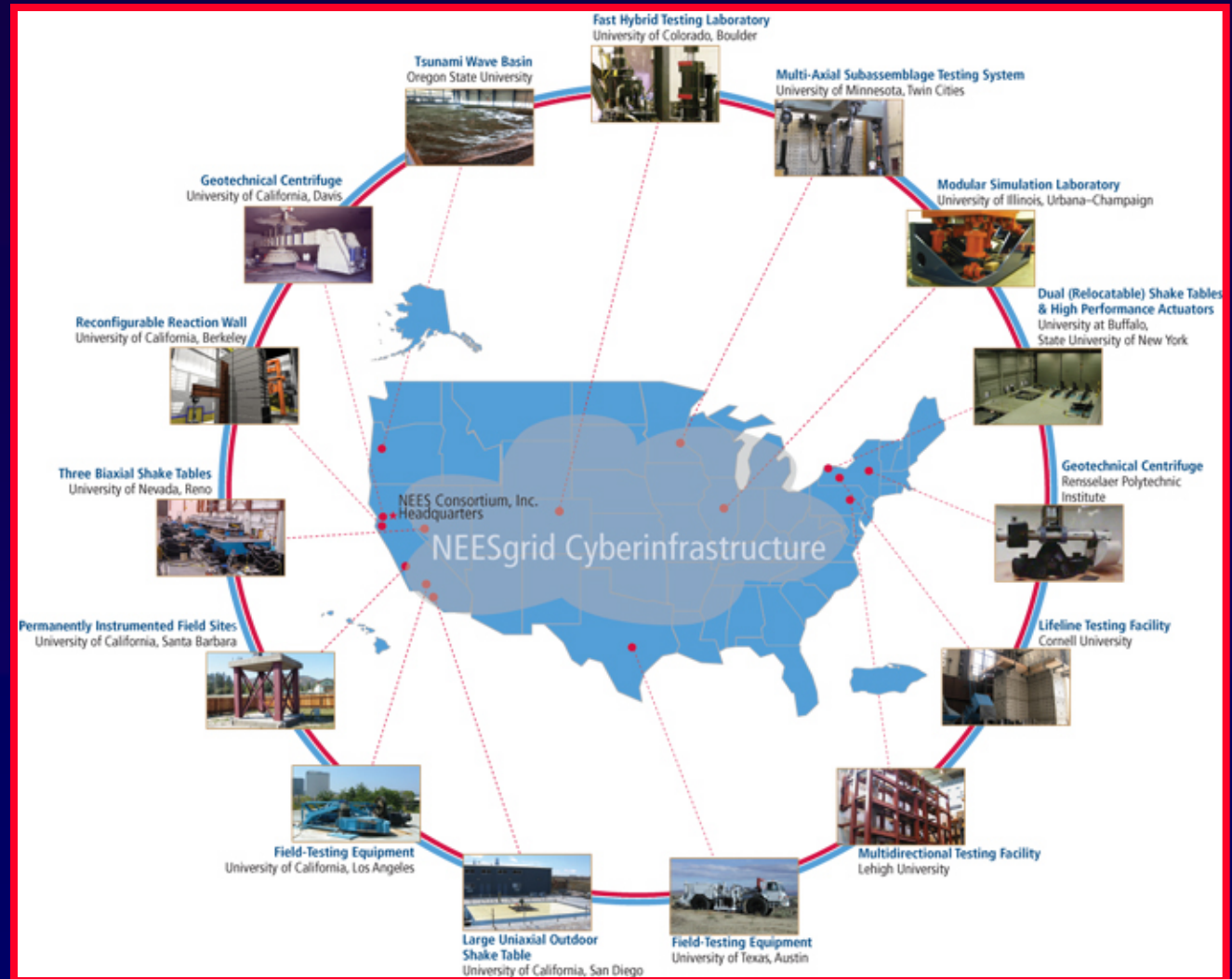
Requested FY 2008 budget strengthens commitment (+ \$5.5M from FY 2006).

- NIST will follow the “ATC Roadmap” approach with a program that combines in-house and extramural research efforts.
- Recently awarded major R&D contract to ATC-CUREE partnership.
- Currently planning to build new in-house research staff.



# NEHRP Partnership: NSF and NEES

## NEES Shared Use Infrastructure [Operated by NEES Consortium, Inc.]



# NEHRP Partnership: NSF and Centers



**Mid-America Earthquake Center**  
Assessment, Mitigation, Response & Recovery



**PEER**  
PACIFIC EARTHQUAKE ENGINEERING RESEARCH CENTER



*SCEC is jointly supported by NSF & USGS! SCEC has 50+ members & affiliates!*



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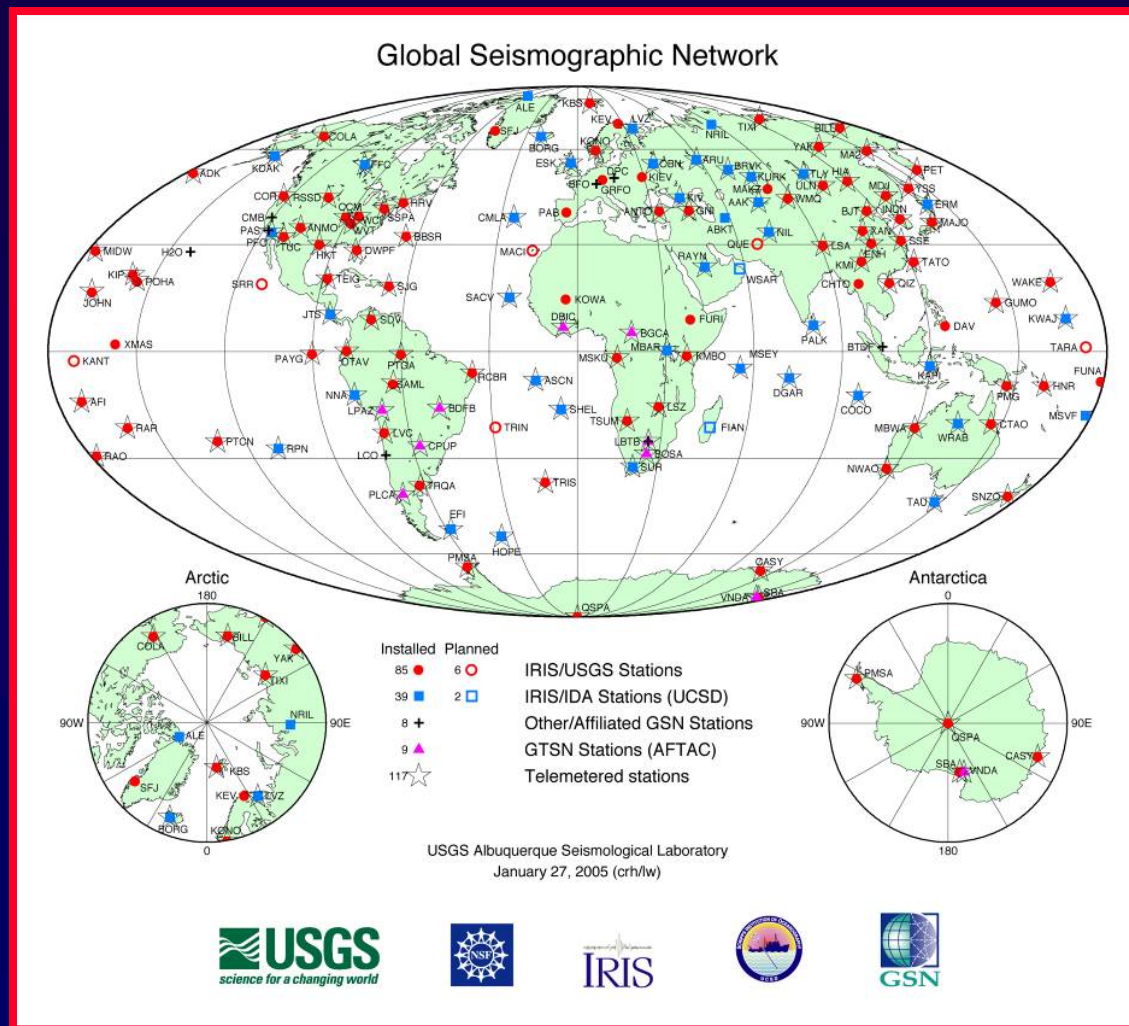


# NEHRP Partnership

## USGS

Unique Geoscience  
and Seismology  
Initiatives

*GSN is jointly supported by  
NSF & USGS, as well as  
the Incorporated Research  
Institutions for Seismology  
(IRIS)!*



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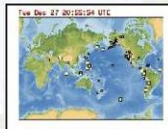
# NEHRP Partnership

## USGS

### Unique Geoscience & Seismology Initiatives

ANSS is jointly supported by NSF & USGS and will ultimately also be used by NIST & FEMA!

### ANSS Earthquake Information Products & Tools



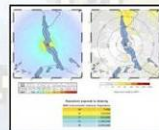
**Latest Earthquakes**  
Maps and information for U.S. and worldwide earthquakes within minutes after they occur.  
<http://earthquake.usgs.gov/eqcenter/>



**Earthquake Notification**  
Customizable earthquake information automatically sent to your wireless device or email account.  
<http://earthquake.usgs.gov/ens/>



**ShakeMaps**  
Distribution of shaking from an earthquake anywhere in the world within minutes.  
<http://earthquake.usgs.gov/shakemap/>



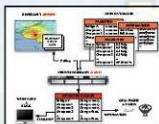
**PAGER**  
Estimates of population exposure to significant earthquake shaking anywhere in the world within minutes.  
<http://earthquake.usgs.gov/pager/>



**Realtime Feeds & Data**  
Real-time earthquake data in a variety of formats including RSS, CAP, CSV, and KML.  
[http://earthquake.usgs.gov/eqcenter/feeds\\_data.php](http://earthquake.usgs.gov/eqcenter/feeds_data.php)



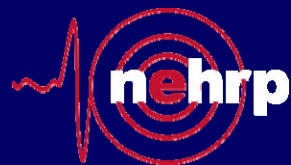
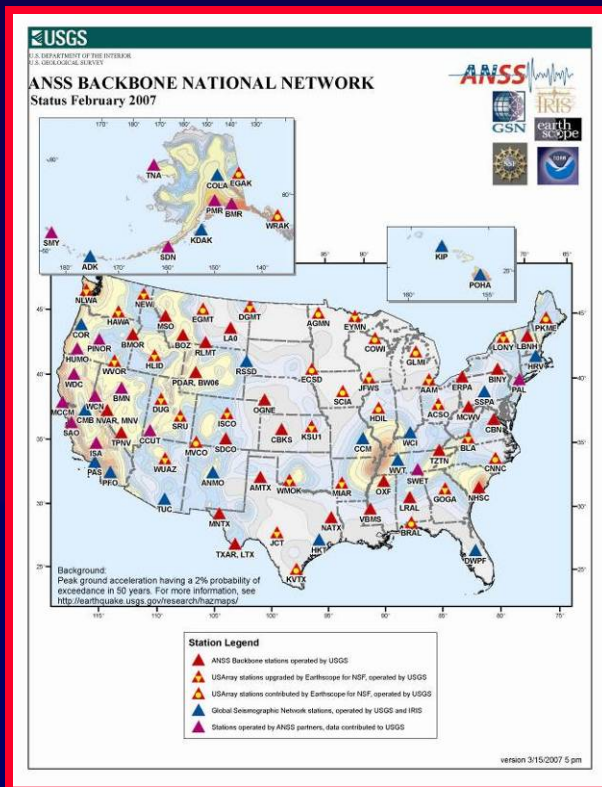
**Did You Feel It?**  
Citizen science webpage where shaking intensity maps are created by the people who felt the earthquake.  
<http://earthquake.usgs.gov/dyfi/>



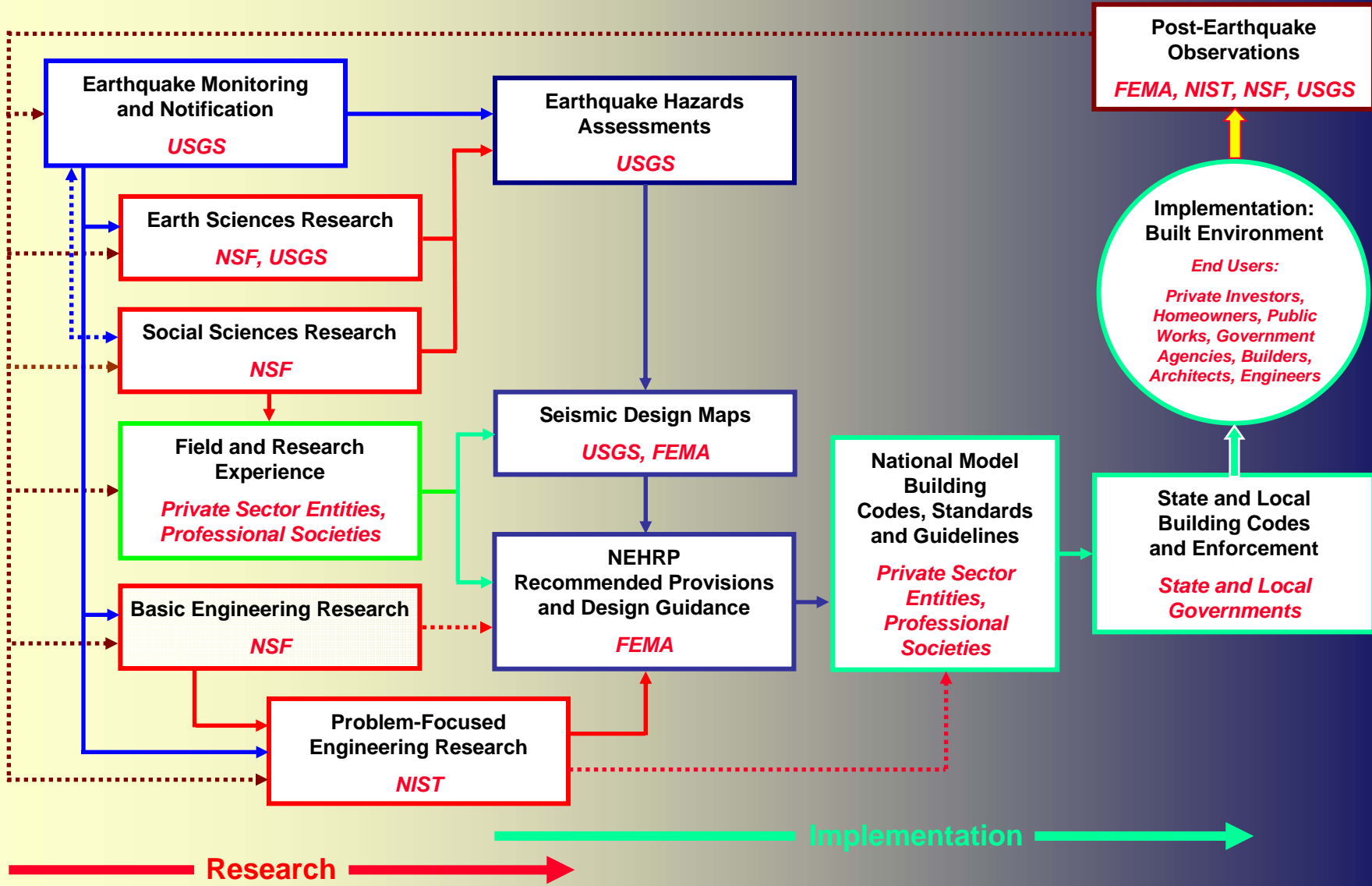
**ShakeCast**  
Automated ShakeMap delivery, damage assessment, and notification for critical lifeline operators.  
<http://earthquake.usgs.gov/resources/software/shakecast/>



**CISEN Display**  
Downloadable software to visualize and receive notifications for seismicity anywhere in the world on your computer.  
<http://www.cisn.org/software/cisndisplay.html>



national earthquake hazards reduction program



# NEHRP Impact on the Built Environment

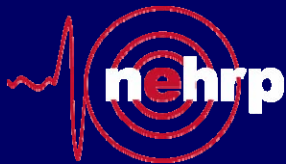


national earthquake hazards reduction program

# PL 108-360: Major Technical Priorities

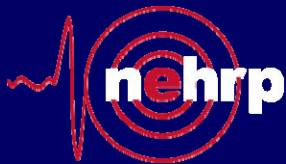
PL 108-360 endorsed priorities identified in 2001-2005 NEHRP Strategic Plan, which was developed in partnership with the stakeholder community:

- Development and commercial application of performance-based seismic engineering tools, codes, standards, and practices.
- Completion of Advanced National Seismic System (ANSS).
- Operation and maintenance of and conduct of research using NEES.
- Operation and maintenance of Global Seismographic Network (GSN) by USGS & NSF.



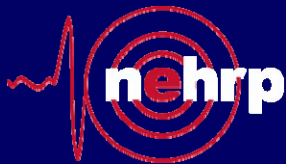
## PL 108-360: Leadership & Management Priorities

- Interagency Coordinating Committee (ICC).
- Advisory Committee on Earthquake Hazards Reduction (ACEHR).
- NIST to be Lead Agency.
- Updated **Strategic Plan**.
- Management Plan.
- Coordinated interagency budget.
- Annual Report to Congress.



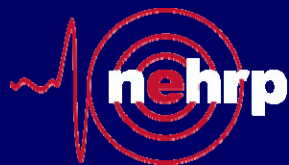
# Interagency Coordinating Committee (ICC)

- Directors of FEMA, NIST (**Chair**), NSF, & USGS, Office of Science & Technology Policy (OSTP), and Office of Management & Budget (OMB).
- Oversees planning, management, & coordination.
- Responsible for developing and updating strategic and management plans, coordinated interagency budgets, and annual program reports.
- Status:
  - Five meetings held thus far (April, July, October 2006; May, September 2007).
  - Very positive - strong leadership consensus and support.



# Advisory Committee on Earthquake Hazards Reduction (ACEHR)

- Reports to NIST Director (as Chair of ICC) to assess trends and developments in science and engineering; program effectiveness; need for program revision; and program management, coordination, and implementation activities.
- 16 qualified members representing research and academic institutions, industry standards development organizations, state & local governments, and financial communities (no Federal employees), & USGS SESAC Chair serving in *ex officio* capacity.
- First meeting held on 10-11 May 2007. Second meeting scheduled for 23-34 October 2007.
- Plans to provide annual reports that coincide with Federal budget preparation cycles.



# ACEHR Members

Walter Arabasz – Univ of Utah

Jonathan Bray – UC Berkeley

Lloyd Cluff – PG&E

Dave Cook – Boeing

Rich Eisner – CA OES (retired)

Ron Hamburger – SGH

Jim Harris – JR Harris & Co

Howard Kunreuther – Univ of PA

Tom O'Rourke - Cornell

Chris Poland – Degenkolb (**Chair**)

Paul Somerville - URS

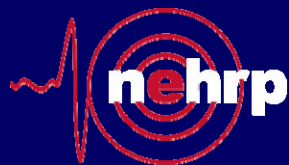
Kathleen Tierney – Univ of CO

Anne VonWeller – Murray, UT

Yumei Wang – OR Dept of Geology  
& Mineral Industries

Sharon Wood – Univ of TX

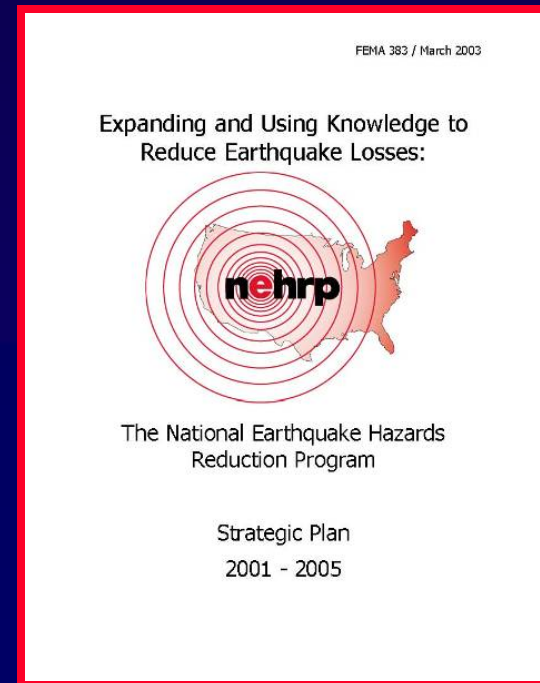
USGS SESAC Chair, Mark Zoback  
(*ex officio*)





# Strategic Plan

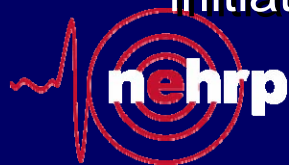
- NEHRP agencies using 2006 stakeholder inputs and internal review results to update 2001-2005 plan (FEMA 383), creating new Strategic Plan.
- Emphasis on interagency synergy and areas of increased emphasis resulting from stakeholder inputs and internal reviews.
- Plan to be forward-looking in anticipation of future program developments.
- Draft plan currently under development .
- Plan development approach endorsed by ICC at 31 May 2007 meeting.
- Plan outline currently under ICC review.
- Draft plan to be available for ACEHR and stakeholder review before finalization.



# Strategic Plan: New Thrust Areas

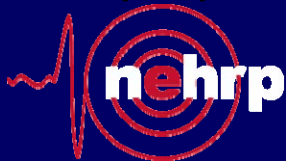
*Internal gap analyses of current Strategic Plan & stakeholder comments from Spring 2006 point to 8 areas of added emphasis that have been reviewed by ICC:*

- Develop & implement advanced risk mitigation technologies and practices.
- Facilitate improved earthquake mitigation at state and local levels.
- Fully implement Advanced National Seismic System.
- Refine techniques for evaluating and rehabilitating existing buildings.
- Further develop Performance-Based Seismic Design (PBSD).
- Develop & conduct earthquake scenarios for key urban areas.
- Develop a Post-Earthquake Information Management System.
- Incorporate socio-economic issues in developing risk mitigation initiatives.



# Coordinated Interagency Budgets

- Ensures:
  - Balance among “program activities.”
  - Consistency with Strategic Plan and Administration priorities, considering funding levels authorized by Congress; and,
  - Integrity of budget data with NEHRP goals and objectives.
- Coordinated budget to be submitted to OMB at time established by OMB for agencies to submit annual budgets.
- Budgets to be reported to Congress at “Program Activity” levels defined in PL 108-360.
- ICC endorsed approach proposed by PCWG at May 2007 ICC meeting - **unified NEHRP planning with coordinated budget requests** – to be implemented in full with FY 2010 budget preparation cycle.



# Program Budgets

Agency	\$M							
	FY 2005		FY 2006		FY 2007		FY 2008	
	Authorized <sup>1</sup>	Enacted <sup>2</sup>	Authorized <sup>1</sup>	Enacted <sup>2</sup>	Authorized <sup>1</sup>	Enacted <sup>2</sup>	Authorized <sup>1</sup>	Requested <sup>3</sup>
FEMA <sup>4</sup>	21.0	14.7	21.6	9.5	22.3	9.1	23.0	9.1
NIST	10.0	0.9	11.0	0.9	12.1	1.7	13.3	6.4
NSF <sup>5</sup>	58.0	53.1	59.5	53.8	61.2	54.8	62.9	55.7
USGS <sup>6</sup>	77.0	58.4	84.4	54.5	85.9	55.4	87.4	56.5
<b>Totals</b>	<b>166.0</b>	<b>127.1</b>	<b>176.5</b>	<b>118.7</b>	<b>181.5</b>	<b>121.0</b>	<b>186.6</b>	<b>127.7</b>

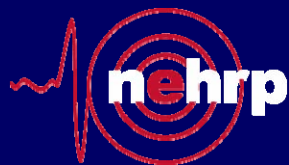
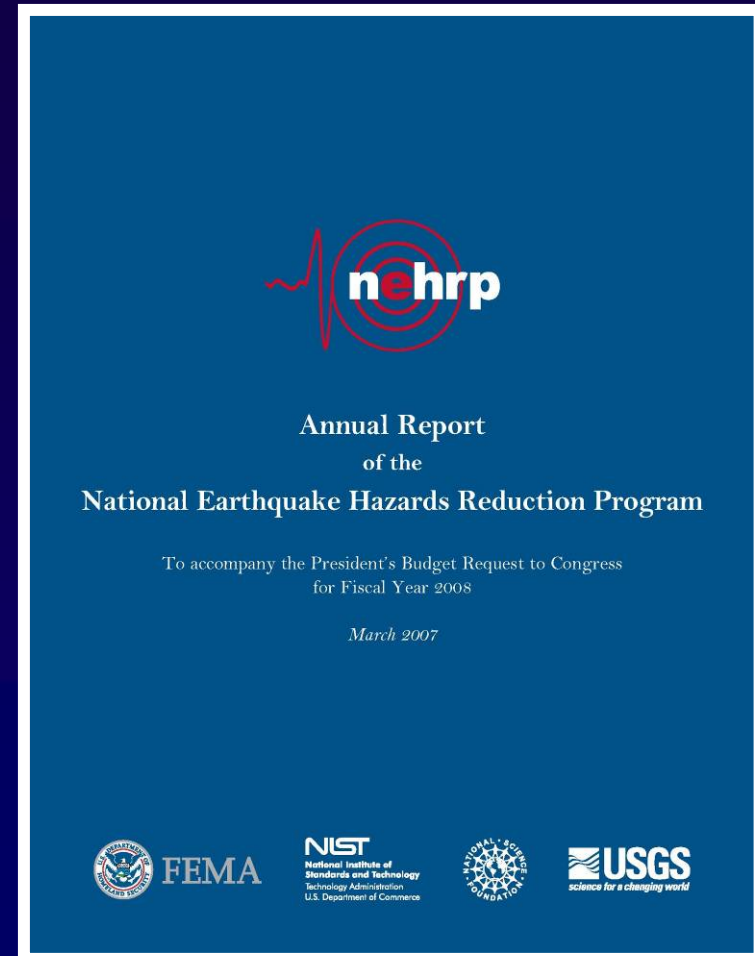
**Notes:**

- Budgets authorized by Congress in Public Law 108-360.
- Budgets reported by NEHRP agencies for FY 2005 – FY 2007.
- Budgets for NEHRP agencies in President’s FY 2008 budget Request in February 2007, except for FEMA.  
FEMA FY 2008 “requested” budget is estimated portion of President’s FY 2008 DHS budget request that will be allocated for FEMA NEHRP activities.
- FEMA FY 2005 actual budget covered program activities & S&E, but excluded state grants that are administered by DHS.  
FEMA FY06 & FY07 budgets cover program activities, but excludes S&E and state grants that are administered by DHS.
- NSF budgets include NEES O&M funds: FY 2005 - \$17.9M, FY 2006 - \$20.3M, FY 2007 - \$21.3M, FY 2008 - \$22.2M.
- USGS authorization includes for ANSS: FY 2005 - \$30M, FY2006 and beyond - \$36M per year.  
USGS FY 2005 actual budget includes funds for tsunami warning from emergency supplemental appropriation (\$3.95M for EHP, \$4.15M for GSN).  
USGS actual budgets include funds for GSN: FY 2005 - \$7.5M, FY 2006 - \$3.9M, FY 2007 - \$3.9M.



# Annual Report

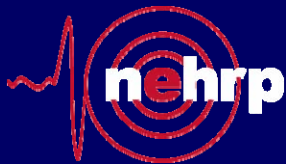
- Format follows statutory requirements:
  - Current FY budgets for agencies, listed by “program activities”
  - Proposed next FY budgets for agencies, listed by “program activities”
  - Description of program activities and results for previous FY
  - Description of extent program has incorporated ACEHR recommendations
  - Description of activities carried out by program agencies that are related and supportive but not included in the program
  - Description of activities related to FEMA grants
- Report has been released and is available in pdf form on NEHRP web site.
- FY 2007 edition now under preparation.



# Joint Agency Planning Activities

## Workshops

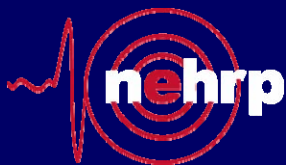
- Existing buildings workshop, mid-September 2007
- Scenario workshop – tentatively planned for 2008
- Performance-Based Seismic Engineering Workshop – planned for early 2008
- Post-earthquake Information Management System workshop – tentatively planned for 2008



# Conclusion

- Congress wants the whole of NEHRP to be more than the simple sum of its parts.
- NEHRP agencies are working hard to meet that expectation!
- Stakeholder interaction is a “must!”

[www.nehrp.gov](http://www.nehrp.gov)



**SeismicWaves** June 2007  
How NEHRP is Advancing Earthquake Safety

### The NEHRP “Recommended Provisions” and the National Model Building Codes:

How NEHRP interacts with the Code-Making Bodies

There is no single mandatory national building code or standard for designing and constructing buildings and other structures in the United States. Building codes are adopted and enforced by individual States, by local jurisdictions within the States, or by both State and local authorities. State or local building codes are usually based on a “model” building code or other voluntary consensus standards. State and local governments may either directly adopt the model code or adapt the code with amendments. Today, the model building code is a combination product developed by the International Code Council (ICC), which is promulgated by the International Code Council (ICC). The ICC also promulgates other model codes that impact the building process, such as the International Residential Code (IRC). In addition to the ICC and IBC, some localities have adopted the NFPA model Building Construction and Safety Code, which is promulgated by the National Fire Protection Association.

The ICC and its recognition ICC commissions form the basis of the building codes in 49 States and the District of Columbia. The remaining three States have chosen to adopt the IBC at a planned future date. Some States adopt the ICC fully, while others permit local government amendments. The widespread use of the IBC means that State and local building codes adopted throughout the United States share a common origin. Over time, as States and localities have based their codes upon the model code, the performance of buildings constructed in accordance with the current building code has improved.

The National Earthquake Hazards Reduction Program (NEHRP) works cooperatively with appropriate national building and standards organizations, such as the ICC and NFPA, to ensure that the most up-to-date and technically sound earthquake engineering design technology is available for use around the Nation. The NEHRP agencies view the building code development process as the best means to ensure that building and other standards in local communities are adequately protected against natural hazards.

Through the efforts of the Federal Emergency Management Agency (FEMA) and the US Geological Survey (USGS), NEHRP has been involved in the national model building code and consensus standards development processes for over 40 years. In addition, the National Science Foundation (NSF) and the National Institute of Standards and Technology (NIST) have also been instrumental in the development of the NEHRP Recommended Provisions and the National Model Building Codes.

**SeismicWaves** July 2007  
How the National Earthquake Hazards Reduction Program is Advancing Earthquake Safety

### ShakeMap and ShakeCast

Revisualizing Information for Earthquake Response

In the immediate aftermath of a damaging earthquake, lives and property may hang in the balance as emergency personnel search and respond to the disaster. The ShakeMap and ShakeCast systems can help responders where they are most likely to be needed, and tell them exactly—within minutes—of an earthquake.

ShakeMap and ShakeCast (also for ShakeMap Broadband) are complementary software systems developed by the United States Geological Survey (USGS), one of the agencies participating in NEHRP. ShakeMap originated in the late 1980s and expanded to a key product of the Advanced National Seismic System (ANSS), the nationwide network of monitoring stations that detect, measure, and record seismic events. ShakeMap systems receive and process ANSS data to produce high-resolution maps of ground shaking. The most popular of these products is the Instrumental Intensity ShakeMap, which uses real-time data to depict the severity of earthquake shaking.

USGS and its regional seismic network partners use separate ShakeMap systems in Alaska, Southern California, Northern California, Nevada, the Pacific Northwest, and Utah. Before these systems were established, responders typically received just two pieces of data from instrumenting networks following earthquakes: the magnitude and location (epicenter) of the quake. Although helpful, this information has limited utility for targeting and prioritizing response efforts. This is because the shaking at a particular location is influenced not just by how far it is from the epicenter or how strong the earthquake was, but also by the characteristics of the Earth's crust between the two events. As the ShakeMap system has been developed, shaking can be stronger in some locations than in areas closer to the epicenter.

By mapping ground motions in near real time, ShakeMap can help responders to quickly assess the scope of an event, determine which areas are likely to have sustained more or less damage, and mobilize and target appropriate resources. In addition to earthquake response, ShakeMap is also being used for structural engineering studies, including seismological research, and for developing earthquake insurance, which provide ShakeMap products—produced using real-time ground motions—to potential future earthquake victims. ShakeMap systems data are widely used in conjunction with earthquake loss estimation software, such as the Hazus US (HAZUS) software developed by the Federal Emergency Management Agency (FEMA), a NEHRP agency, for guiding disaster planning and associated recovery activities.

ShakeMap's central role, however, is in allowing situational awareness among responders, enabling them to better target, prioritize, and execute a range of activities from medical treatment, firefighting, and emergency building and shoring to damage and safety assessments, utility and lifeline restoration, loss estimation, and public information activities. The public agencies, utilities, and media organizations that carry out these activities are the critical ShakeMap users that ShakeCast was created to assist.

**SeismicWaves** August 2007  
How the National Earthquake Hazards Reduction Program is Advancing Earthquake Safety

### Bringing Cutting-Edge Science to Nonstructural Mitigation

What design comes to mind when you think of buildings damaged by earthquakes? Chances are, you see building exteriors with cracked or crumbled walls and collapsed floors or roofs. Perhaps because of the greater exposure to the public, and earthquake engineers' historical components—foundations, columns, beam-column, load-bearing walls—on, after all, the elements that can hold buildings up or bring them crashing down.

Change in other nonstructural parts of buildings, including their contents, has gone almost unnoticed. The University at Buffalo (UB), part of the State University of New York, has taken a significant step toward changing this, however. With funding from the National Science Foundation (NSF), a NEHRP agency, the university has developed a state-of-the-art seismic testing system, the Nonstructural Component Testbed (NCTB), to make available state-of-the-art testing capabilities for nonstructural components and equipment.

Structural versus Nonstructural Damage

The added attention to building nonstructural side is justified. Although structural damage may be less dramatic or threatening than structural failures, it nevertheless can be responsible even after a building collapses, and for loss of property damage and loss of use, can be even more costly than structural damage. A study partially funded by NSF through the Pacific Earthquake Engineering Research Center\* found that nonstructural components and systems account for most of the cost of reconstructing and restoring commercial buildings according to the results of present-day seismic codes. In hospitals, where contents include expensive medical and laboratory equipment, nonstructural components and systems account for 40 percent of total investments in health care infrastructure.

The recent growth of performance-based earthquake engineering has further emphasized the contribution of nonstructural building components, which previously were often overlooked.

**SeismicWaves** October 2007  
How the National Earthquake Hazards Reduction Program is Advancing Earthquake Safety

### FEMA Homebuilders' Guide to Earthquake-Resistant Design and Construction

Under the National Earthquake Hazards Reduction Program (NEHRP), the Federal Emergency Management Agency (FEMA) works to reduce the ever-increasing risks to people and property posed by earthquakes and related hazards in the United States. Preventing losses by designing and constructing buildings to withstand anticipated earthquake forces is one of the key components of mitigation and one of the most effective ways of reducing the impact of future disasters. In part of this mitigation, FEMA has published a new NEHRP FEMA design, publication, and dissemination technical guidance on the design and construction of earthquake-resistant structures.

One- and two-family dwellings have traditionally performed fairly well in earthquakes because of their relative lightness and regular shape, and, as a result, little technical guidance on the earthquake-resistant design and construction of these dwellings has been developed. While one- and two-family houses typically do not collapse in earthquakes, recent events have shown that they can sustain significant damage and be rendered uninhabitable. This is especially true when sufficient attention is not paid to construction details and when contemporary design practices the use of improvements of modern and regular techniques. Given the sheer number of these buildings in the United States, even minor earthquake damage to houses can result in significant aggregate loss and heavy demand for temporary housing.

FEMA's first guidance on earthquake-resistant housing was a manual for homebuilders published jointly by FEMA and the Department of Housing and Urban Development in 1995, based on data collected after the 1971 San Fernando earthquake. FEMA later updated and released the manual in 1995. This version has now been replaced by the current Homebuilders' Guide to Earthquake-Resistant Design and Construction (the Guide), which FEMA published in late 2006.

Two important developments provided the impetus for producing the 2006 edition. The first was the completion of the Construction of Universities for Research in Earthquake Engineering (CUREE) Colosseum, Multifamily Building Project. The project used FEMA's Homebuilders' Guide as a primary design reference after the first earthquake in Northridge, California, in 1994. The second important development was the release of a new FEMA manual on design to resist future residential structures increased in the event. The study combined academic research and actual full-scale testing of wood frame buildings and components with the development of engineering-based design guidance for future construction.

The second development was publication in 2006 of the first International Residential Code (IRC) by the International Code Council (ICC). This document, which the ICC adopted in 2003 and 2006, is the principal governing building code for residential construction in the United States. The IRC reflects the requirements found in the latest edition of the ASCE/SEI Recommended Provisions and Commentary for Seismic Regulations for New Buildings and Other Structures (FEMA 450) and addresses the earthquake risk to nonstructural residential construction—in other words, to one- and two-family houses built with brick or no direct assistance from architects or engineers.

Because of these developments, FEMA funded the National Institute of Building Sciences' Building Science Seismic Safety (BSSS) to update the 1995 version of the homebuilders' manual. The primary authors of the resulting Guide, who also authored one of FEMA's Colosseum project reports, are Edward Dolan of Washington State University, Edmund Washington, Kelly Colson of Colson and Associates Structural Engineering, Lafayette, California, and James Bensen, Building Code Consultant, Concord, California.

The Guide presents seismic design and construction guidance to a degree that can be utilized by homebuilders.