Meeting the Grand Challenges for Disaster Reduction

David Applegate
Chair, NSTC Subcommittee on Disaster Reduction
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The U.S. Subcommittee on Disaster Reduction (SDR) is an element of the President’s National Science & Technology Council charged with:

- Establishing clear national goals for Federal science and technology investments in disaster reduction.
- Promoting interagency cooperation for natural and technological hazards and disaster planning.
- Facilitating interagency approaches to identifying and assessing risk, and to disaster reduction.
- Advising the Administration about relevant resources and the work of SDR member agencies.
National Science & Technology Council Subcommitteee on Disaster Reduction

- Centers for Disease Control and Prevention
- Department of Defense
- Department of Energy
- Department of Homeland Security
- Department of Housing & Urban Development
- Department of the Interior
- Department of State
- Department of Transportation
- Environmental Protection Agency
- FEMA
- NASA
- National Geospatial-Information Agency
- National Guard Bureau
- National Institute of Standards and Technology
- National Oceanic & Atmospheric Administration
- National Science Foundation
- U.S. Agency for International Development
- U.S. Army Corps of Engineers
- U.S. Coast Guard
- U.S. Department of Agriculture
- U.S. Forest Service
- U.S. Geological Survey
- U.S. Public Health Commissioned Corps
Framing the Grand Challenges for Disaster Reduction

- Objective: To enhance disaster resilience by composing a ten-year agenda for science and technology activities that will produce a dramatic reduction in the loss of life and property from natural and technological disasters.
1. Provide hazard and disaster information where and when it is needed.
2. Understand the natural processes that produce hazards.
3. Develop hazard mitigation strategies and technologies.
4. Recognize and reduce vulnerability of interdependent critical infrastructure.
5. Assess disaster resilience using standard methods.
Implementation plans released March 2008

Available at www.sdr.gov
Implementing the Grand Challenges

**Priority interagency actions identified**

**Key: □ Short Term Action (1-2 years) ▶ Medium Term Action (2-5 years) ▼ Long Term Effort (5+ years)**
Grand Challenge 1. Provide hazard and disaster information where and when it is needed.

“To identify and anticipate the hazards that threaten communities, a mechanism for real-time data collection and interpretation must be readily available to and usable by scientists, emergency managers, first responders, citizens, and policy makers. Developing and improving observation tools is essential to provide pertinent, comprehensive, and timely information for planning and response.”

Warn the right people in the right place at the right time.
For tsunamis, seismic is the start

The beach is the finish

Credit: Washington Emergency Management
M 7.8, eastern Sichuan, China

Date:  Monday, May 12, 2008 06:28:00 UTC
Monday, May 12, 2008 02:28:00 AM at epicenter
Depth:  10.00 km (6.21 mi)

Details from USGS web site

- View ShakeMap
- Real-time earthquakes (M 4+, animated)
- Historic earthquakes since 1575 (M 3+)

Places:
- China
- Sichuan
- Chengdu
Prompt Assessment of Global Earthquakes for Response

http://earthquake.usgs.gov/pager/

M 7.9, EASTERN SICHUAN, CHINA
Origin Time: Mon 2008-05-12 06:28:01 UTC
Location: 31.02°N 103.37°E Depth: 19 km

Estimated Population Exposed to Earthquake Shaking

<table>
<thead>
<tr>
<th>ESTIMATED POPULATION EXPOSURE (k x 1000)</th>
<th>I</th>
<th>II-III</th>
<th>IV</th>
<th>V</th>
<th>VI</th>
<th>VII</th>
<th>VIII</th>
<th>IX</th>
<th>X+</th>
</tr>
</thead>
<tbody>
<tr>
<td>89,143k</td>
<td>15,400k</td>
<td>12,673k</td>
<td>3,897k</td>
<td>707k</td>
<td>610k</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Estimated Modified Mercalli Intensity

<table>
<thead>
<tr>
<th>PERCEIVED SHAKING</th>
</tr>
</thead>
<tbody>
<tr>
<td>Not felt</td>
</tr>
<tr>
<td>Weak</td>
</tr>
<tr>
<td>Light</td>
</tr>
<tr>
<td>Moderate</td>
</tr>
<tr>
<td>Strong</td>
</tr>
<tr>
<td>Very strong</td>
</tr>
<tr>
<td>Severe</td>
</tr>
<tr>
<td>Violent</td>
</tr>
<tr>
<td>Extreme</td>
</tr>
</tbody>
</table>

Estimated exposure only includes population within the map area.

Population Exposure population per ~1 sq. km from Landslide 2005

Selected City Exposure

<table>
<thead>
<tr>
<th>MMI City</th>
<th>Population</th>
</tr>
</thead>
<tbody>
<tr>
<td>VIII Jiangyou</td>
<td>127k</td>
</tr>
<tr>
<td>VIII Tianpeng</td>
<td>60k</td>
</tr>
<tr>
<td>VII Deyang</td>
<td>162k</td>
</tr>
<tr>
<td>VII Linqiong</td>
<td>65k</td>
</tr>
<tr>
<td>VII Chengdu</td>
<td>3,960k</td>
</tr>
<tr>
<td>VII Mianyang</td>
<td>264k</td>
</tr>
<tr>
<td>VII Guanyuan</td>
<td>213k</td>
</tr>
<tr>
<td>V Nanchong</td>
<td>7,150k</td>
</tr>
<tr>
<td>V Chongqing</td>
<td>3,967k</td>
</tr>
<tr>
<td>V Lanzhou</td>
<td>3,200k</td>
</tr>
<tr>
<td>IV Shiyian</td>
<td>3,480k</td>
</tr>
</tbody>
</table>

Shaking Intensity

Overall, structures in this region are vulnerable to earthquake shaking, though some resistant structures exist. A magnitude 6.4 earthquake struck the Sichuan, China region on August 23, 1976 (UTC), with estimated population exposures of 1,500 at intensity IX or greater and 5,700 at intensity VIII, resulting in 41 deaths. Additionally, a magnitude 7.3 struck this region in 1933 killing 6,800 people. Recent earthquakes in this area have also triggered landslide hazards that have contributed to losses. Users should consider the preliminary nature of this information and check for updates as additional data becomes available.
Grand Challenge 2. Understand the natural processes that produce hazards.

“To improve forecasting and predictions, scientists and engineers must continue to pursue basic research on the natural processes that produce hazards and understand how and when natural processes become hazardous.

New data must be collected and incorporated into advanced and validated models that support an improved understanding of underlying natural system processes and enhance assessment of the impacts.”
A new model for earthquake probabilities in California

More than 99% probability in the next 30 years for one or more magnitude 6.7 or greater quake capable of causing extensive damage and loss of life. The map shows the distribution throughout the State of the likelihood of having a nearby earthquake rupture (within 3 or 4 miles).

Funded in part by the California Earthquake Authority

Released April 14th
http://pubs.usgs.gov/fs/2008/3027/
Grand Challenge 3. Develop hazard mitigation strategies and technologies.

“To prevent or reduce damage from natural hazards, scientists must invent – and communities must implement – affordable and effective hazard mitigation strategies, including land-use planning and zoning laws that recognize the risks of natural hazards. In addition, technologies such as disaster-resilient design and materials and smart structures that respond to changing conditions must be used for development in hazardous areas.”

“By designing and building structures and infrastructures that are inherently hazard resilient, communities can greatly reduce their vulnerability.”
Grand Challenge 4. Recognize and reduce vulnerability of interdependent critical infrastructure.

“Protecting critical infrastructure systems, or lifelines, is essential to developing disaster-resilient communities.

To be successful, scientists and communities must identify and address the interdependencies of these lifelines at a systems level (e.g., communications, electricity, financial, gas, sewage, transportation, and water).”

“Protecting critical infrastructure provides a solid foundation from which the community can respond to hazards rapidly and effectively.”
The Trans-Alaska Pipeline and the 2002 Denali earthquake: An infrastructure success story

The Trans-Alaska Pipeline survived the 2002 mag-7.9 Denali earthquake because of stringent earthquake design specifications based on geologic studies done by the USGS & others when the pipeline was constructed.
San Andreas ShakeOut Scenario

- Top request of emergency managers
- Rallying point for community

- San Andreas ‘Big One’ simulated earthquake; multi-hazard scenario
- Initiation near Bombay Beach, rupturing to the northwest
- Disruption of critical lifeline infrastructure (freeway, internet, power and gas lines) along surface rupture
- Strong shaking throughout region, including urban areas
All railroads and freeways into Los Angeles cross the San Andreas fault
“Federal agencies must work with universities, local governments, and the private sector to identify effective standards and metrics for assessing disaster resilience. With consistent factors and regularly updated metrics, communities will be able to maintain report cards that accurately assess the community’s level of disaster resilience.”

“Learn from each hazard event...to support ongoing hazard research and future mitigation plans.”
Grand Challenge 6: Promote risk-wise behavior

“Develop and apply principles of economics and human behavior to enhance communications, trust, and understanding within the community to promote ‘risk-wise’ behavior.

To be effective, hazard information (e.g., forecasts and warnings) must be communicated to a population that understands and trusts messages. The at-risk population must then respond appropriately to the information.”

“This is an ongoing challenge that can only be met by effectively leveraging the findings from social science research.”
The Great Southern California ShakeOut

• November 13, 2008
• Golden Guardian DHS exercise
• Public drills
  – Schools earthquake drills
  – Business emergency drills
  – Faith-based communities
• City of Los Angeles Earthquake Safety conference
• Art Center Earthquake Spectacle
In a more disaster-resilient world...

- Relevant hazards are recognized and understood.
- Communities at risk know when a hazard event is imminent.
- Property losses and lives at risk in future natural hazard events are minimized.
- Disaster-resilient communities experience minimum disruption to life and economy after a hazard event has passed.
More Information

http://www.sdr.gov