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Progress Developing the USGS Advanced National Seismic System

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The Advanced National Seismic System (ANSS) is a U.S. Geological Survey (USGS) initiative to improve the recording and reporting of earthquakes in the United States. ANSS is planned as a modern 7,100-station seismic network, including:

- a 100-station national "backbone" network (completed in 2006);
- 1,000 high-quality, broadband seismic stations in areas of moderate to high earthquake risk, designed to faithfully record data that can be used to develop complete fault models and time histories for large earthquake sources;
- 3,000 strong motion recording stations in 26 of the nation's highest-risk urban areas, for the purpose of recording damaging strong shaking and the generation of ShakeMaps, loss estimates, and related products for emergency response;
- 3,000 stations (9,000 sensors) in buildings, bridges and other "lifeline" structures, designed to collect data on how the nation's infrastructure performs during major earthquakes, data that are greatly lacking from historical earthquakes.

By the end of 2009, the USGS and its regional seismic network partners had installed 886 modern seismic instruments, about 12% of the ANSS requirement. With economic stimulus funding, USGS and partners will increase that total to about 1,450 —20% of the ANSS requirement— by the end of 2011. Also between 2009 and 2011, the Veterans Administration is contributing more than $5 million to add seismic instrumentation to 27 of its hospitals as part of the development of ANSS. This project will add an additional ~700 building sensors to the ANSS structural instrumentation component. With these developments, USGS projects that ANSS will be about 25% complete by the end of 2011.

This Fall, USGS will begin to distribute a new product, *LossPAGER*, which provides statistics-based estimates of fatalities and economic losses in an earthquake, typically within one hour of its occurrence. LossPAGER provides a rapid, color-coded alert indicating the likely impact of an earthquake. These alerts, which have been integrated into FEMA national response plans, will be made public in October. This effort builds on PAGER population impact estimates that have been distributed for several years.

A significant recent development is low-cost, internet-connected strong motion sensors. The USGS *Netquakes* instruments connect to a local network using WiFi and use existing broadband connections to transmit data after an earthquake. The seismographs were designed to be installed in private homes, businesses, public buildings and schools where there is an existing Broadband connection to the Internet. Current deployments and data can be viewed at: http://earthquake.usgs.gov/monitoring/netquakes/data/

USGS is also exploring use social network technologies to collect near-real-time, earthquake-related messages from anywhere around the globe. For earthquakes in sparsely instrumented regions, these "detections" could provide an early "heads up" that an earth-quake may have occurred. USGS has developed

a system that gathers real-time, earthquake-related *Twitter* messages and applies place, time, and key-word filtering to gather geo-located accounts of shaking. This approach provides rapid first-impression narratives, as well as a confirmation to analysts that station triggers are indeed from earthquakes.

An important result of our focus on quickly delivering earthquake information that provides situational awareness, is a sharp increase in the number of users of that information. Currently the system supports about 200,000 subscribers, and USGS earthquake web servers may post over 500,000 pageviews per day following a significant earthquake.

Currently, USGS has three priorities for the next phase of ANSS:

- expand structural instrumentation, increasing both the number of sensors deployed and the range of building types that are instrumented; also develop automated building damage assessment software for post-earthquake response needs;
- implement a prototype earthquake 'early warning' system in California (network improvements to support earthquake warning are currently being made using stimulus funds, and USGS is currently supporting a related R&D effort to develop a prototype);
- greatly expand earthquake recording networks in urban areas through the deployment of low-cost "Netquake" strong motion instrumentation.