

EXECUTIVE SUMMARY AND RECOMMENDATIONS

Makeup and management structure of IMW Region

The Intermountain West (IMW) Region of the Advanced National Seismic System (ANSS) encompasses a large part of the western U.S. and includes the following eight core-member states (from north to south): Montana (MT), Idaho (ID), Wyoming (WY), Nevada (NV), Utah (UT), Colorado (CO), Arizona (AZ), and New Mexico (NM). [A pending request by Idaho would change it to be an affiliate member of the IMW Region and a core member of the Pacific NW.] For the mutual benefit of seismic network operators in New Mexico and west Texas, and to encourage ANSS development in that subregion, Texas is welcomed as an affiliate member of the IMW Region.

The IMW Regional Working Group consists of 15 members, including representatives from each member state as well as the U.S. Bureau of Reclamation, Yellowstone Volcano Observatory, and the USGS National Strong Motion Program. The Regional Coordinator is Walter Arabasz of the University of Utah. The Regional Advisory Committee (RAC) currently consists of 15 members from throughout the U.S. (predominantly from the Intermountain West)—variously representing IMW State Geologists, IMW State Emergency Managers, the private sector, utility operators, Indian Nations, the engineering community, FEMA, USGS, DOE, the seismic hazard community, and the seismology research community.

The ANSS Management Plan recognized that, "The urban monitoring component of ANSS will likely require local or State-level advisory groups, linked to the Regional Advisory Committee, to guide implementation." Accordingly, a 12-member ANSS state advisory committee has been formed in Utah and a similar advisory committee is actively being formed in Nevada to guide new urban strong-motion networks in these states. One representative from each of these state-level advisory committees, as well as a representative from a 22-member earthquake subcommittee of the State of Colorado Natural Hazards Mitigation Council are also members of the IMW Regional Advisory Committee.

Regional issues

The IMW Region is large—both in area (nearly three times larger than California, Oregon, and Washington combined) and in the geographic extent of moderate to high hazard. Not counting west Texas, the region encompasses eight different state jurisdictions, four different FEMA regions, and eleven seismic networks; total population is 18 million, and the population distribution is highly heterogeneous.

The IMW Region is the fastest growing region in the nation, based on 2000 census figures. The five fastest growing states in the U.S. during the 1990s were in the IMW Region—and seven of the eight IMW states ranked in the top 20. Dramatic growth and development is profoundly affecting the entire region but is clearly increasing earthquake risk in major metropolitan areas such as: the Ogden-Salt Lake City-Provo urban corridor in Utah; Las

Vegas and the Reno-Carson City area in Nevada; Albuquerque, New Mexico; and Boise, Idaho. A recent FEMA report, *HAZUS99 Estimated Annualized Earthquake Losses for the United States* (FEMA 366, Sept. 2000) provides rankings of absolute and relative earthquake risk among states and major metropolitan areas in the IMW Region.

Federal ownership of more than half of the land in the West (e.g., 83% of Nevada, 65% of Utah, 62% of Idaho) contributes to the concentration of earthquake risk to population and economic wealth in scattered metropolitan areas in the IMW Region. Activities on federal land require not only local but regional seismic monitoring of seismicity caused, for example, by (1) underground and surface mining on federal lease lands, (2) deep fluid injection, (3) reservoir impoundment, and (4) military explosions on test ranges. Arguably, the Federal Government shoulders a major responsibility for ensuring earthquake data and information both for time-critical needs, such as the safety of millions of visitors to National Parks and other recreation areas on federal lands, and for long-term needs, such as the safe siting of high-hazard facilities (nuclear waste-storage facilities, dams, pipelines).

FY2002 instrumentation requests

Members of the IMW Working Group from each state were invited to submit a statement of their respective needs in order to complete a planning template provided by the USGS. The individual contributions are included as appendices in the report, and the inputs were aggregated to complete a generalized master template.

National backbone.—On a state-by-state basis, specific comments are offered on the proposed siting of more than 30 existing or proposed "national backbone" stations included in the IMW Region. In general, proposed backbone stations will go far toward meeting the region-wide need for significantly increasing broadband seismic coverage—especially in Montana, Idaho, Wyoming, Colorado, Arizona, New Mexico, and west Texas. IMW Working Group members offer many suggestions and are willing to collaborate with the USGS in finding high-quality station sites.

Regional broadband stations.—Ken Dueker of the University of Wyoming offers a proposal to cooperatively fund and install five new broadband stations throughout Wyoming using five new Guralp CMG 3-T seismometers and five REF TEK 72A-07 data loggers recently acquired by the University of Wyoming. Required ANSS funding to enable the five installations amounts to approximately \$43,000. Other states—notably Nevada, Utah, New Mexico, Montana, Idaho, and west Texas—are positioned to add broadband stations to existing seismic networks as funding becomes available. Colorado has stated a strong need for additional broadband stations beyond the national backbone stations. Bob Smith of the University of Utah proposes that six broadband seismographs be installed at existing sites in the Yellowstone seismic network (for monitoring the Yellowstone caldera and the Hebgen Lake fault zone), with some cost sharing, chiefly telemetry costs, to be provided by the USGS Volcano Hazards Program and the National Park Service.

Urban (ground and structures).—As part of continuing the development of urban strong-motion networks already started: Nevada proposes in FY2002 to (1) install 15 new strong-motion stations in Las Vegas and the Reno-Carson City areas, (2) instrument one multiple

span bridge, (3) upgrade seven existing strong-motion stations in Reno, Carson City, and Las Vegas to real-time telemetry, and (4) implement ShakeMap. To continue the development of a real-time urban network in the Wasatch Front area, Utah tentatively expects an allocation of 20 or fewer instruments; the Utah state advisory committee urges that some buildings (a minor fraction of the total instrument allocation) be instrumented in FY2002. Targeted ANSS urban networks in Albuquerque and Boise can be incrementally started. Elsewhere, Montana, Colorado, and west Texas have justifiable local needs for strong-motion instrumentation. Bob Smith requests 14 strong-motion instruments for the Yellowstone seismic network.

Pre-2002 ANSS equipment in the ANSS for which O&M support has to be provided includes 40 strong-motion stations in Utah and 12 strong-motion stations in Nevada. Small network operators in the IMW Region provide great value to a nascent ANSS, and any help than can be offered to them—aimed at specific ANSS performance goals—is strongly urged.

Information centers.—Various arguments suggest that state-level earthquake information centers are a desirable part of the structure of ANSS—at least in the Intermountain West. There inevitably must be some hierarchy in the size, resources, and responsibilities of the varied ANSS earthquake information centers, but the importance of having a state earthquake information center reporting to its own state is evident from the inputs of IMW states. Exceptions in the IMW Region are: (1) Colorado, which is served by the National Earthquake Information Center in Golden, Colorado; (2) west Texas, where the University of Texas El Paso serves as an earthquake information center for the western part of Texas as well as for northern Mexico (which is not well instrumented by Mexican seismograph networks); and (3) Yellowstone National Park, which falls under an agreement between the USGS, the National Park Service, and the University of Utah as part of the Yellowstone Volcanic Observatory.

Major earthquake information centers now operate in Nevada and Utah. Smaller information centers deserving of attention include Arizona, Idaho, Montana, New Mexico, west Texas, and Wyoming. The value of Earthworm hardware and software to help such information centers is widely recognized.

Recommendations

Important Notice!

- *The following recommendations were constructed from varied input I received from the IMW Regional Advisory Committee (RAC) and the IMW Working Group after circulation of a draft version of this implementation plan for FY2002.*
- *Twelve of fifteen members of the RAC either (a) participated directly in one or both of two telephone conferences on August 3 and August 9, (b) designated someone to represent them in the conference calls, and/or (c) provided review comments by e-mail.*
- *As voiced and agreed upon during one of the RAC telephone conferences, "**We all have to recognize that individual states [within the large IMW Region] have their self interests, and we have to be flexible in shaping a regional plan.**"*
- *Because no funding was available for a collective meeting of the RAC, selection of a chair was deferred until such a meeting occurs—so major responsibility fell back upon me to aggregate and articulate general recommendations for the IMW Region. The recommendations below were circulated to members of the RAC and the Working Group and have the consensus support of the RAC.*
- *Bottom line: The following recommendations fairly represent the majority—but not necessarily the unanimous—view of members of the IMW RAC and Working Group. In this first-of-its-kind document for the IMW Region, the identification of issues and needs has been just as valuable and important a goal as reaching consensus on short-term priorities. Ultimately, higher-level decision-makers will have to help set the priorities for FY2002.*

*— Walter Arabasz, Regional Coordinator
August 16, 2001*

1. In the IMW Region there needs to be good balance between new instrumentation for urban strong-motion monitoring and regional/national broadband seismic monitoring. There are compelling needs associated both with (a) dramatic population growth in metropolitan areas at moderate to high seismic risk and (b) large gaps in broadband coverage of extensive, seismically active areas within the IMW Region (compare Figures 2-1 and 2-3).
2. Consistent with USGS planning guidance, the justification for keeping momentum going in developing urban strong-motion networks in Nevada (Reno-Carson City and Las Vegas areas) and in Utah (Wasatch Front urban corridor) is well recognized. Specific requests for these two urban networks are summarized above under **FY2002 instrumentation requests—Urban (ground and structures)**, and more detail is provided in Appendices E and H. Among various deserving sites for strong-motion instruments in the IMW Region, the metropolitan areas of Albuquerque, New Mexico, and Boise, Idaho, should be considered for some start-up allocation in FY2002.

3. In terms of augmenting broadband seismographic coverage in the IMW Region in FY2002, adding new national backbone stations is of high-priority importance. One can argue that the plate boundary already has reasonable broadband coverage, elevating the large IMW Region in priority for new backbone stations because of the areal extent of its ambient, moderate-sized seismicity. For example, if a dozen new national stations were to be funded in FY2002, four to six in the IMW Region could readily be justified by the needs described in this report (e.g., for Montana, Idaho, Wyoming, Colorado, Arizona, New Mexico, and west Texas). Beyond many siting suggestions offered herein, a productive way for the USGS to prioritize and plan national stations (however many) in the IMW Region in FY2002 would be to schedule a conference call with the IMW Working Group.
4. We strongly urge the USGS to consider a cost-effective proposal made by Ken Dueker of the University of Wyoming to cooperatively fund and install five broadband stations throughout Wyoming at a cost to ANSS of approximately \$43,000—using five new Guralp CMG 3-T broadband sensors and REF TEK 72A-07 data loggers recently acquired by the University of Wyoming at a reported cost of approximately \$120,000. The availability of data from these stations to the ANSS (through involvement of the USGS in siting and telemetry routing to Golden, Colorado) would not only advance regional seismic monitoring in Wyoming but also enhance regional monitoring in Montana, Idaho, Utah, and Colorado.
5. We believe that the growth of ANSS in the IMW Region—both practically and politically—must be based on the involvement and varying degrees of modernization of existing regional seismic networks in the region. State by state, their operators have worked with great sacrifice and have a longstanding commitment to regional seismic monitoring (typically with severely strained resources), to providing authoritative earthquake information to their state and local populations, and to outreach and education. Small network operators in the IMW Region provide unquestionable value to a nascent ANSS—and even small amounts of help can make a great difference.
We emphatically urge the USGS to consider the following relatively low-cost ways to help small network operators with technical support:
 - Help make available the services of a traveling seismograph technician, both to improve data quality from existing analog instrumentation and to assist in planning digital upgrades and new telemetry.
 - Similarly, help make available the services of a traveling computer professional to assist in installing/upgrading hardware and software and to be available as a remote resource to answer questions.
 - Facilitate periodic meetings/workshops for seismic-network technicians in the IMW Region to exchange ideas, solve problems, and keep abreast with aspects of new instrumentation, telemetry, data acquisition, etc.

6. There is a clear consensus in the IMW Region that state-level earthquake information centers are a desirable part of the structure of ANSS in the region—recognizing that there must be some hierarchy in the size, resources, and responsibilities of such centers. To promote the modernization and effectiveness of existing earthquake information centers in the IMW Region, we recommend more assistance in implementing and upgrading Earthworm hardware/software—especially assistance to the small IMW seismic networks whose seismic monitoring contributes importantly to ANSS regional coverage.
7. The IMW Regional Advisory Committee argues against using present results of HAZUS (*FEMA 366*) as the only guide to prioritizing the distribution of ANSS resources in the IMW Region, and it encourages consideration of other information relevant to earthquake hazard and risk. While HAZUS can be a useful tool in estimating relative earthquake risk and expected losses, the Committee is apprehensive about (1) uncertainties in HAZUS inputs, (2) neglect of potentially large losses to economic resources (e.g., mineral, oil, and gas facilities in Wyoming), and (3) the possibility that earthquake risk in metropolitan areas in Colorado (e.g., Denver and Colorado Springs) has been underestimated.
8. For future planning of ANSS growth in the IMW Region, we urge that funding be made available in FY2002 for at least one collective meeting of the IMW Regional Advisory Committee. A similar collective meeting (either jointly with the RAC or separately) of the IMW Working Group is also highly desirable—particularly if a five-year plan has to be created and submitted.