

DRAFT REPORT OF CISN ADVISORY COMMITTEE  
July 12, 2002

PRESENT: *Advisory Committee members:* G. Beroza, E. Bortugno, B. Clark, P. Jacks, S. Nishenko, K. Paxton (for T. Gitlin), M. Powers, C. Roblee (with Tom Shantz), R. Tognazzini, S. Tubbesing, S. Ziolkowski, R. Garrott (for C. Perett)  
*Steering Committee members:* R. Clayton, J. Davis, R. Eisner, L. Gee, E. Hauksson, T. Shakal, W. Savage, D. Given,  
*Guests:* D. Jones, D. Helmberger, M. Huang, J. Anderson, J. Rowden, M.L. Zoback, J. Goltz

## INTRODUCTION

The regularly scheduled meeting of the CISN Advisory Committee was held July 12, 2002 at the OES Emergency Center in Sacramento. The purpose of the meeting was to brief the Advisory Committee on the progress the CISN team has made in the past year; to review the goals and objectives described in the CISN Strategic Plan; to explain the relationships among CISN, its member institutions, and ANSS; and to provide comments and recommendations on the individual products that have been developed by CISN, and the priorities that are being set for the coming year.

## GENERAL CONCLUSION

The entire CISN team is to be congratulated for the substantial progress they have made in the past year, despite limited funding and delays in the funding that did become available. It was a year of very meaningful accomplishments, a partial list of which includes:

- Installation of 45 new strong-motion instruments, primarily in northern California. There are now approximately 300 instruments in northern California, and approximately 600 instruments in southern California, that provide input to current ShakeMaps for the two areas;
- Permitting for 2 new or upgraded broadband seismometers, which will yield a total of approximately 180 broadband seismometers around the State that are in full operation;
- Completion of plans, and partial installation of a T1 ring connecting USGS Menlo Park, UCB, CGS, OES, USGS Pasadena, and Caltech. The circuit should be completed and on-line by 12/31/02;
- Expansion of the ShakeMap products, distribution to a broader audience (including push procedures for distributing products), and improvement of the production software on which northern California ShakeMaps are based.
- Development of new CISN web products, including the initial development phase of CISNDisplay, and preliminary planning of ShakeCast;

- Outreach through ATC-54 for potential users of ShakeMap, including a new draft publication and a well-attended workshop;
- Addition of ShakeMap generation facilities at UCB and CGS, to add redundancy to the generation capabilities;
- Continued development of the ShakeMap processing procedures including improved estimates for infill areas where recording density is sparse.

While many specific improvements have not been fully installed yet, the Advisory Committee concluded that the system is already much more robust than it was at this time last year, and that an earthquake tomorrow would be less likely to overwhelm the system's capacity to support the needs of the emergency response community.

All in all, CISN made major strides during 2001-2002 toward many of the goals it had set out in the Strategic Plan, despite having funding for less than half the year.

## COMMENTS AND RECOMMENDATIONS

The concerns and opportunities that were discussed at the meeting centered on observations that Advisory Committee members made during and after the presentations. Although the issues were raised, there was neither time nor enough knowledge within the room to make binding conclusions as to how the issues could best be solved. The Committee made some suggestions for solutions, but we intend for the CISN Steering Committee to visit these topics again in more depth, and decide on the importance of the topic, and the best solutions, as a part of their normal operating decision-making role.

1. As the number of ShakeMap products increases, there is a growing need for a 'my.cisn.com' approach to organizing the products for a diverse group of users. Searches through the various websites that contain recent earthquake results and data can result in confusion, especially on the part of unsophisticated public users. Yet the information is inherently valuable to those users, who have already demonstrated that they are interested, but don't quite know what to look for or how to use the information they find. As additional products become available, we strongly encourage CISN to put them on the web, but also to organize them so that users can go right to the products they understand and are looking for. We can expect widespread usage of the information after the next major earthquake, and we support the efforts to mirror the web pages and "push" data to specific users, including the emergency response community and the press.

2. We strongly encourage CISN to continue to develop derivative products from the basic ShakeMap information. Discussions of ShakeCast, HAZUS input products, and scenario ShakeMap products were well received. We concluded that opportunities for additional products were being identified, and that the basic ShakeMap information could be tailored for a wide variety of users with relatively little effort.
3. The CISN Steering Committee is strongly urged to continue to improve the robustness of the system, including communication links from field instruments to collection centers, and from one processing center to another. The physical paths of T1 communication links should be examined to assure that no two legs of the ring pass through the same fault hazard area. In light of the impact of earthquakes on both power and telephone systems, we remain concerned that key strong-motion data needed for a high quality ShakeMap might not be retrievable within minutes after the earthquake strikes. Since there appears to be growing reliance on these products in the emergency response community, there is a real need for the system to work, especially under very disruptive conditions (i.e., a major earthquake).
4. We encourage the CISN to determine the optimum density of, then complete the installation of, free-field strong-motion instrument sites for generating the ShakeMap output. At that point, installation of additional instruments should be directed toward addressing other critical ground shaking problems. For example, additional strong motion data are fundamental to understanding near-fault effects, directivity effects, and the impacts of unusual site geology, to name a few. At some point, the strong motion instrument deployment should address these problems, even if those instruments only contribute marginally to the geographic spread of stations needed for a high-quality ShakeMap.
5. The Advisory Committee was encouraged by the efforts of CISN to reach out to other potential alliance partners, including EERI, utilities, and public agencies. We believe it is appropriate to pursue cost-sharing and facility-sharing arrangements with these groups, particularly if it can bring additional instrumented sites into the Network, and create a new group of users who benefit from the products of CISN.
6. We concur with the Steering Committee that the level of effort and costs need to be apportioned between new installations and ongoing maintenance and operations, in a logical, pre-ordained way that is consistent with the CISN priorities and needs. The more stations that come on line, the greater will be the need for maintenance and operations to keep them on line.

## INSTRUMENTATION FOR BUILDINGS

This topic occupied a significant portion of the day's discussions. We were hampered by the absence of two key buildings experts from the meeting, Bill Holmes and Chris Poland. Bruce Clark tried to summarize his conversation earlier in the week with Chris, that this issue is vitally important to the engineering community, that the buildings chosen must be consistent with the data needs for verifying models of building performance, and that the number of instruments needed to instrument a building effectively would be at least an order of magnitude more per building than for a free-field site. Strategies for instrumenting buildings are considerably behind those for free-field sites, and they need to catch up. We recognized that there were a number of legitimate reasons for this, and that solving some of these problems would be a good 'next step' to take. The following areas were discussed by the Advisory Committee:

1. The critical role of ShakeMap in emergency response has generated a very high return for the initial expenditures of CISN funds on free-field sites. In the past decade, we have telescoped the time required for providing critical shaking intensity data to emergency responders from days to minutes. Today, they can target the areas of greatest need almost by the time the shaking has stopped. This emphasis on free-field sites for use in ShakeMap has had to be the greatest priority for siting of strong motion instruments.
2. ShakeMap has also needed an initial burst of funding just to bring it into operational mode, for such basics as software development and improving the communication pathways. As this product becomes more stable, some funds can be directed toward other important applications such as instrumenting buildings.
3. The needs of the structural engineering community, and the capabilities of new instruments, are evolving rapidly. Therefore, optimum long-term instrumentation strategies for buildings are not entirely clear. For example, in the past several years, engineers have been developing non-linear analytical models for predicting building performance. Traditional instrumentation may not be adequate to validate some of these models. Other users of structural instrumentation are primarily interested in developing methods of low cost alerts for rapid damage reporting. These types of installations may require a different strategy based on low-cost, lower fidelity sensors. In both cases, optimum strategies need to be developed if the instrumentation is to answer some fundamental questions in the next urban earthquake. Coordination with the NEES efforts in building performance testing in the coming years would make both programs more valuable to the engineering community.

4. The most effective instruments for buildings might not be classical accelerometers, but velocity, displacement (strain), or tilt instruments instead. CISN should have the capacity to incorporate whatever sensors are most useful, and to record and process time-history data from those sensors. We believe strongly that CISN is the right group to install and operate an instrumentation program for buildings, even if the instruments are not the traditional ones that have been available. The real strength of CISN is its growing capability to operate a data acquisition network over the long term.

## RECOMMENDATIONS FOR THE BUILDING INSTRUMENTATION PROGRAM

1. Allocate appropriate funds for instrumenting a select group of buildings, focusing at first on collecting conventional acceleration data that will answer fundamental building safety questions being posed by the research earthquake engineering community today.
2. In the selection of building sites, assure that as-built information, at least sufficient to develop a simple structural model, is compiled and made readily available to all users of the recordings. Consideration should only be given to sites for which owners provide permission to disseminate such information. This will assure that important lessons regarding building performance are not lost to the profession.
3. Follow the lead of the CGS SMIP program in using expert panels to identify classes of buildings (and other structures), and in using installation procedures that are time-tested for providing valid and meaningful strong motion data.
4. Given the diversity of potential objectives for a particular installation, site-specific objectives should be documented along with the instrumentation plan and as-built information (or structural model). Expert panels should be used to confirm the value of both the objectives and the instrumentation layouts.
5. Broaden the scope of CISN thinking to permit the installation and use of the most appropriate sensors to capture and record the most critical data on the fundamental performance of buildings in earthquakes. While this might challenge the status quo, CISN's proven capabilities in data acquisition, processing, archiving and distribution make CISN the most effective vehicle, by far, to lead this effort.

In summary, this has been a very rewarding first year of progress for CISN, and the Advisory Committee was impressed with both the quality and volume

of work accomplished. Much remains to be done, but CISN has indeed achieved 'take-off', and its products and impact will be appreciated by the State of California in the next earthquake, whenever and wherever it may strike.

Respectfully submitted,

CISN ADVISORY COMMITTEE

Bruce R. Clark, Chair