

Report to OSTP Cites SNS, Instrument Upgrades as "Top Priorities" in Neutron Scattering

An interagency working group (IWG), appointed by the White House Office of Science and Technology Policy (OSTP) to assess the state of neutron-scattering facilities in the United States, released its final report in June, calling for the timely completion of the Spallation Neutron Source (SNS) as a top priority and for continued investment in instrument replacement and upgrades at existing source facilities. Comprising representatives from various federal agencies involved in the use of the major U.S. neutron facilities, the IWG was charged with conducting an in-depth review of the status of existing facilities and recommending ways to maximize their use for U.S. science programs.

Neutron scattering in the United States is widely recognized as an essential measurement tool for researchers in a variety of scientific disciplines—including physics, chemistry, biology, materials science, earth science, and engineering—but the IWG found that Europe and Japan have eclipsed this country's once-strong leadership role in developing the technology.

George Wignall, who heads the small-angle scattering programs at Oak Ridge National Laboratory (ORNL), agrees. He said, "The U.S. neutron-scattering facilities have lost their earlier lead over the past couple of decades. Thus, U.S. scientists have had less access to world-class facilities than their colleagues in, say, Europe, which now holds the lead in both reactor-based and pulsed (spallation) instrumentation."

Yet there are strong signs that neutron scattering is poised for potential rebirth. The SNS now under construction at ORNL will provide the highest-performance neutron-source capability available worldwide when it is completed in June 2006. Also, major upgrades are under way at the ORNL High Flux Isotope Reactor. The project includes 14 new or improved neutron-scattering instruments, especially for cold neutrons. In addition, the development of a new major cold-neutron capability at the National Institute of Standards and Technology (NIST) has resulted in substantial growth in the number of users. It is now the most widely used neutron facility in the United States and the only source recognized by the IWG as providing a broad range of world-class capabilities—

an achievement Mike Rowe, director of the NIST's neutron research facilities, attributes in part to the agency's commitment to users and to ongoing investments in new and improved instrumentation.

Despite these bright spots, the field has suffered major setbacks in the last decade. The Advanced Neutron Source (ANS) project was canceled in 1995 before construction began. While several proposals were made to add cold-neutron capability to Brookhaven's High Flux Beam Reactor source, they were never acted upon, and the facility was closed permanently in 1999 following a two-year shutdown after the discovery of a tritium leak from the fuel-storage pool. The IWG also concluded that the Los Alamos Neutron Science Center at Los Alamos National Laboratory has failed to meet expectations of reliability and capability, although recently, early signs point to improvements.

The result is a critical dearth of available beamlines: The overall number of neutron-scattering instruments in the United States has declined by 15% since 1998.

"Beamlines are so scarce that even if we fully instrument all the beamlines in the U.S. at all the facilities—including the SNS—we'll still have substantially less than the European scientific community," said Thom Mason, associate laboratory director for the SNS. "But we know the demand is there, and people will come to do their experiments if the appropriate tools are in place."

The largest untapped user community is academic researchers, according to Patricia Dehmer, who heads the Department of Energy's (DOE) Office of Basic Energy Sciences and was a member of the IWG. "The academic community has been somewhat reticent to use neutron scattering because of the unreliability of the sources and lack of world-class instruments," she said. While the number of U.S. neutron-scattering users has nearly doubled over the past decade, all of that growth has occurred at the NIST facility, which now supports nearly twice the number of users as all of the other facilities combined.

Foremost among the IWG's recommendations is the timely completion of the SNS facility, described as "the most significant new opportunity to provide world-leading neutron-scattering capability in the U.S." However, the SNS alone will not be sufficient to provide all of the required capability. Thus, "[i]t is vital to take steps

to improve both the number and quality of neutron-scattering instruments at existing source facilities and to broaden access to those facilities by the U.S. research community," according to the report. While the four operating U.S. sources are at capacity in terms of instrumentation, a large fraction of those instruments need upgrades or replacement to be considered world-class. Most facilities have major upgrade or replacement efforts under way, and the report urged that these efforts be successfully completed.

The largest unmet instrumentation need is currently for the SNS. While the facility has capacity for up to 24 neutron instruments at the target station, at present only eight have committed funding, and a suite of 15 instruments is needed to provide the basic broad range of measurement capability. "Given the large investments being made to develop the SNS source, the most cost-effective approach is to completely instrument the source so that it can realize its full potential," according to the report.

The IWG also called for the establishment of a framework for using interagency partnerships to develop neutron instrumentation that ensures balanced use and access. This is expected to help improve the coordination among the various stakeholders in the U.S. neutron facilities, which include not only the facilities themselves and the user community, but also DOE, the Department of Commerce, the National Institutes of Health, and the National Science Foundation. Representatives from these agencies attended the inaugural American Conference on Neutron Scattering at ORNL in late June, which Rowe interprets as a positive sign that the need for interagency coordination is broadly recognized.

Of course, "The real test will be to see what concrete policies and programs emerge [from the report]," said Mason. "Certainly all the conclusions and recommendations are very good ones, but the extent to which they can be implemented will largely be a question of budget priorities."

According to Dehmer, presidential science advisor Jack Marburger and the OSTP have responded favorably to the IWG's findings and recognize the importance of regaining U.S. leadership in neutron scattering. "I believe our message was heard by the administration, and one hopes this will positively impact future funding decisions," she said. "So, I think everything is in readiness for neutron scattering to blossom in this country, and to see significant growth in academic usage."

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