Major Materials Facilities Ranked

An unusually tight-lipped committee of the National Research Council has released a report calling for the expenditure of up to $900 million for new and upgraded materials research facilities, including instrumentation, over the next 12 years.* One reason for the secrecy: the committee headed by Frederick Seitz of Rockefeller University and Dean Eastman of IBM's Yorktown Heights Laboratory listed its recommendations in order of priority; that is, which should be funded first.

The rankings are for "major" facilities, defined in the committee's charge as those costing $5 million or more. The biggest ticket items are new sources for synchrotron radiation and neutron scattering research, whose price tags in the report range from $160 million to $330 million. All told, eight of the nine recommendations deal in one way or another with these two areas of research. The ninth is for a $5-million upgrade of the National Magnet Laboratory, a center for the production and use of ultrahigh magnetic fields at the Massachusetts Institute of Technology.

Presidential science adviser George A. Keyworth, II, asked for the study last fall and requested that findings be ready in time to serve as input for the fiscal 1986 budget preparations. One other function of the materials facilities study is the repair of the various lines of communication that were damaged or ruptured during the NCAM (National Center for Advanced Materials) affair (*Science*, 21 October 1983, p. 308).

To be established at the Lawrence Berkeley Laboratory with a synchrotron radiation source as its centerpiece, NCAM was inserted in the fiscal 1984 budget at Keyworth's insistance with little of the customary peer review. Some in the materials research community were particularly outraged and said so. Congress funded only a reduced CAM (without the National), and the synchrotron light source is in abeyance.

Although Keyworth specifically asked that the major materials facilities committee not wrestle with the highly charged issue of *big* versus *little* science, there were a number of advocates of the latter viewpoint in the group. Ideally, the report will therefore be read as a statement of what the materials community will come together and support. "It was a big accomplishment to get them all to walk out of the room together," noted one observer.

Prior to its recommendations, the committee listed two prerequisites to any new facilities: that "they are accompanied by expanded support of smaller materials research programs, including related instrumentation," and that "resources must be provided to operate existing user facilities productively." The latter proviso has already been violated as congressional action on DOE's fiscal 1985 funding will negatively affect the availability of both synchrotron radiation and neutron scattering beam time.

The committee then divided its attention between "new large facilities" and "new capabilities" at existing facilities. Priorities were established separately in each category. Synchrotron radiation and neutron scattering compete with one another for funding, and the recommendations give the impression that the committee paired off a new facility for one with an upgrade for the other. However, the recommendations do parallel closely those of two recent reports, one on each of the two fields.†

For example, among the large new facilities, the highest priority went to a $160-million synchrotron x-ray source based on a 6 billion electron volt (GeV) electron storage ring. Exceptionally bright beams of "hard" (short wavelength) x-rays would be produced by wigglers and undulators, special magnets inserted into the storage ring that bend the electrons into a sinusoidal trajectory and thereby greatly enhance the emission of synchrotron radiation. The committee urged an immediate start on design, so that operations could begin by 1992. The Europeans are close to approving a similar machine (*Science*, 27 July, p. 391).

On the new capabilities side of the ledger, the committee gave its highest ranking to guide halls and new instruments for the existing reactors at Brookhaven National Laboratory and the National Bureau of Standards, which have "cold" neutron sources. Cold or very low energy neutrons are especially valuable for certain types of experiments, and the United States woefully trails Europe in their availability. Guide halls use the neutron equivalent of light guides and thereby maximize the sparse neutron flux. Since it will be 12 or more years before a new steady-state source could be ready, upgrades such as this are essential to keeping U.S. neutron researchers within sight of the competition overseas. Cost is $30 million at each laboratory.

Similarly, the second new facilities ranking was given to a $260-million advanced steady-state neutron source, while the second new capabilities priority went to additional insertion devices for existing synchrotron radiation sources at a total cost of $20 million. The neutron source would provide at least five and possibly ten times the neutron flux as the best existing U.S. reactors. In particular, it would cover the entire range from thermal to cold neutrons.

Continuing the pattern, the committee gave a lower energy (1 to 2 GeV) synchrotron radiation source of the type proposed for NCAM the third priority. The $70-million machine would generate vacuum ultraviolet light and "soft" (long wavelength) x-rays. Meanwhile, an experimental hall and instrumentation for a pulsed neutron source now under development at the Los Alamos National Laboratory, at $15 million, came in third on the new capabilities list.

The pattern broke down for the final selections. The last new facilities recommendation was a $330-million high-intensity pulsed neutron source. Pulsed sources are based on proton accelerators. This one would generate ten times the flux of the Los Alamos source and the go-ahead on the advanced machine would await results from there.

Rounding out the new capabilities, the magnet lab upgrade was fourth. And new targets to increase neutron fluxes from the pulsed sources at Los Alamos and Argonne National Laboratory were fifth on the list.

The committee concluded the entire set of recommendations minus the pulsed neutron source could be financed for $50 million per year over the next decade.

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Major Facilities for Materials Research and Related Disciplines, available from Commission on Physical Sciences, Mathematics, and Resources, National Research Council, Washington, D.C. 20418.

†*Planning Study for Advanced National Synchrotron Radiation Facilities* (Office of Basic Energy Sciences, U.S. Department of Energy, Washington, D.C., 1984); *Current Status of Neutron Scattering Research and Facilities in United States* (National Academy Press, Washington, D.C., 1984).