Strategies for Implementing the MS&E Study's Recommendations

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A special session held by the Materials Research Society on the recently released Materials Science and Engineering (MS&E) Study gave a room filled with materials scientists and engineers an opportunity to ask questions and suggest strategies for implementing the Study's recommendations. As chair of that session, held November 30 during the 1989 MRS Fall Meeting in Boston, I'd like to take this opportunity to summarize the discussions and conclusions of the participants.

Prof. Merton Flemings of MIT, who co-chaired the Study with Praveen Chaudhari of IBM, presented an overview of the Study. A panel discussion, chaired by Bill R. Appleton, Oak Ridge National Laboratory, chairman of the National Research Council's (NRC) Solid State Sciences Committee (SSSC), followed Flemings' presentation.

Panelists in addition to Flemings were Rustum Roy, Pennsylvania State University, a member of the MS&E Committee; Don Shapero, staff director of the NRC's Board on Physics and Astronomy; Kathleen Taylor of General Motors, past president of MRS and a member of the MS&E Study's Panel on Education; and Lyle Schwartz, National Institute of Standards and Technology, who chaired the MS&E Study's Panel on International Competition and Cooperation in MS&E.

The MS&E Study, which drew on input from more than 400 scientists and engineers in materials-related areas, revealed serious weaknesses in materials science and engineering in the United States and made a variety of recommendations to address those weaknesses. Flemings noted that while the initial goal was not to address industrial competitiveness per se, as the Study progressed it became clear that this is a matter of ever increasing importance to the United States. As a result, the report is subtitled "Maintaining Competitiveness in the Age of Materials."

A recurring theme in the report is the need for increased cooperation between universities, industry and government laboratories. The Study report also stresses the need for increased emphasis on processing and synthesis of materials. Other critical areas identified in the Study are education, integration of materials science and engineering with other business operations, instrumentation and modeling, federal support for materials science and engineering, and the need for continued support for small-scale research carried out by a principal investigator.

Don Shapero outlined present actions under way and also those planned to implement the Study's recommendations. He reiterated Fleming's stress on the need for increased cooperation between university, industry and government laboratories. The President's Science Adviser, D. Allan Bromley, has been briefed on the report, and the report was presented to other policymakers at the SSSC Forum in Washington, DC, September 1989.** Regional meetings will allow all members of the materials science community to give input. Development of a national program with an industry focus and strong industry involvement is also being explored.

Lyle Schwartz commented that it is appropriate to think that we are engaged in a form of economic warfare. "One of the things our panel [on International Competition and Cooperation] noticed very clearly as we looked around the world," said Schwartz, "was the seriousness with which our economic competitors were engaging together in what we might call joint precompetitive efforts." Schwartz called for increased cooperation not only in developing new materials and technologies but also among societies of materials scientists and engineers. He also called for more individuals to accept rotator positions at the funding agencies which are in need of such help, and he encouraged all to enlist members of their congressional delegations to join the new Advanced Materials Caucus in Congress.

Several panelists, including Bill Appleton, suggested that MRS should play a role in helping to develop strategies and in implementing the Study's recommendations. As Appleton said, "I honestly can't imagine a society that is more appropriate for the contents of this report than the Materials Research Society, because it [MRS] is also very broad and multidisciplinary and deals with many of the same issues as the report does."

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A plea was made to address the pervasive weakness in science education in the primary and secondary school systems in the United States as evidenced by the performance of students in our high schools relative to the performance of students from other countries. Flemings explained that pre-college education is a large national issue which was beyond the scope of the Study. However, as he further explained, the Study did stress the importance of doing things quite differently than in the past, and also the importance of attracting more high quality students to the materials science field. Flemings additionally stressed the need for a greater emphasis on getting out into the lab and doing things. "American industry," he said, "needs people who can do things as well as study and analyze things."

In response to a related question, Flemings emphasized that "important things need to be done in education, and one of the things that needs to be done in universities is the development of new laboratories and laboratories that emphasize materials synthesis and processing. Very

**See the October 1989 *MRS BULLETIN* p. 27-32 for a summary of the MS&E Study and a report on the SSSC Forum during which it was introduced.

few universities have such laboratories today."

A member of the audience commented on losses to the United States due to company mergers that can eliminate entire research departments. This emphasized a problem noted in the report, and also mentioned by Dr. Robert Noyce, CEO of Sematech, in the Plenary Address† he delivered Monday, November 27 at the MRS Fall Meeting: U.S. industry is driven by short-term profits and suffers from lack of capital because of the nation's low savings rate.

The difficulty in cooperation imposed by antitrust laws and the way patents are handled was examined by the MS&E Study panel chaired by Lyle Schwartz. Although the attitude in Washington is changing, this area is still a problem. Schwartz said that his panel noted the problem but did not feel competent to make specific recommendations.

The materials research community must identify and prioritize important materials areas which can be implemented with funding. Bill Appleton reported that Representative Tim McCurdy (R-Oklahoma) raised this issue at a congressional committee hearing October 31, and that the planned regional meetings on the Study report will be influential to that activity. As Rustum Roy asserted, "There's no easy way to heaven; we must do some house cleaning and set priorities. We didn't set enough priorities and now we must start about that task." Roy was also of the opinion that "in a way, we allowed the people in particle physics and radio astronomy to steal science from us."

Maintaining that funding major projects such as the Superconducting Supercollider and the human genome at the present level will impact MS&E funding one-hundredfold more than funding in other areas, Roy urged the materials science community to tell their congressional representatives what they think about funding such projects. He further contended that we cannot sell materials science and engineering with words alone. We must educate government about what we can do for the nation and rely on "technology pull" in areas such as waste handling, rebuilding infrastructure, and launching next-generation integrated circuits to define the role of materials science and engineering. Roy complained that "the total energy we now put into writing proposals in response to an RFP is more than goes into the resulting funded research....each RFP is a step backward."

Noting that MRS had spent much time in its committee meetings during the week discussing the MS&E Study, Kathleen Taylor urged that MRS and other technical societies take an active role in implementing the MS&E Study. She recommended that "this role should be both individual and collective." Individual roles could encompass continuing education, including specialized instruction as done in the MRS education programs. Collectively, technical societies should join together to implement the recommendations. "MRS is eager to work with other societies to implement the massive changes required to put the recommendations of the Study in place," said Taylor. She saw this as significant in "providing a unified image and focal point for the field by interacting with policymakers, by promoting education in schools and universities and by representing the field as a profession."

A member of the audience, remarking that much of the information used to develop the report had been gathered more than two years ago, questioned how much the recommendations would change if the conclusions were developed today rather than a few years ago. The panel consensus was that the central theme and major recommendations would not change except in minor detail.

Flemings pointed out that the major change that occurred during the course of the Study was the increasing evidence of U.S. problems in the international competitiveness sphere. "I think we might have emphasized that more in the beginning had it been as apparent at the time, but I don't think the central conclusions or the central emphasis on synthesis and processing would have changed a bit," said Flemings. "The major external [development] since the Study has been the beginning of the breaking out of peace....had that happened earlier, there might have been some different thinking with respect to the industrial sector, but even there, I don't think the central conclusions would have been different, but simply reinforced."

The session concluded by emphasizing the need for increased cooperation among the various materials societies to enable the community to develop prioritized recommendations for policymakers and the funding agencies in Washington, DC. MRS is eager to help in such cooperative interactions. For example, MRS will cosponsor with other technical societies a symposium in conjunction with the SSSC Forum, in Washington, DC, February 27 to March 1, 1991. This coordinated activity will give scientists, engineers and federal policymakers the opportunity to meet together to discuss advances in materials science and engineering and also policy needs.

The MS&E Study report gives us an opportunity to influence the direction and funding of materials science and engineering, and it behooves us to take advantage of it in view of the major changes on the international and national scenes. These include changes in government attitudes which permit Sematech as well as the recently formed Consortium for Superconducting Electronics, both with participants from industry, university and government laboratories. Members of MRS are urged to participate in the regional meetings and to take an active role in helping to implement the MS&E Study's recommendations.

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†Robert Noyce's Plenary Address at the 1989 MRS Fall Meeting will be published in the April 1990 issue of the *MRS BULLETIN.*