An analysis of public policy issues and how they affect MRS members and the materials community...

Science and Technology: Enabling America's Future

The elements of rapid societal and institutional change are easily recognizable as we approach the twenty-first century. The end of the Cold War, the emergence of highly competitive economies in Europe and Asia, and the pervasive consequences of the information revolution have stimulated a significant ongoing reexamination of our national priorities and of the scope and scale of government needed to address them. While many of the drivers of change transcend national borders, the effects are seen with remarkable clarity not only in the complex shifting of global affairs, but also at the level of individual prosperity, security, health, and quality of life.

Science and technology have clearly been among the principal determinants of change and agents of progress. Of course, the benefits of these technology-based revolutions are far from evenly spread across the globe. Participation in the front ranks of the march of science and technological innovation generally has been an essential component of national capacity to capture the gains. So will it be for the information revolution and the unknown, yet certain, subsequent science and technology leaps. In the United States, half of our economic growth in the last half century is estimated to have arisen from technological advances.

Given this track record of impressive returns on our science and technology investments, the high amount of disagreement about the level of support for the federal research portfolio is surprising. A major part of the stress results from the uncertainties of federal research funding as we drive down the federal budget deficit. However, the bipartisan commitment to deficit reduction is important for sustaining a business environment that encourages substantial investment in commercial research and development (R&D). Another part stems from the attempt to reshape and expand the research portfolio to meet some of the major new societal realities of the decades hence.

We are obviously limited in our ability to predict the future accurately. Nevertheless, several elements of societal change are fairly clear and condition public policy, including that for science and technology. First, knowledge increasingly is identified as society's key resource. That places a tremendous premium on human capital development and on new ways of doing business. Second, global linkages are growing stronger, with the rapid movement of people, goods, and information permanently altering commerce, national security, demographics, and health. Third, physical and biological limits of the environment to absorb the impact of human activity must be faced. Already, the last decades have seen dramatic effects on the composition of atmospheric gases. An increase of world population to 10 billion by mid-century, coupled with standard of living increases in the developing world consistent with reasonable stability, raises the possibility of dramatically unpleasant outcomes. Furthermore, the environmental impacts are often global in nature, suggesting that difficult transnational solutions will be needed. Our science and technology research portfolio must evolve to address these emerging realities to enable a brighter future.

A continuing bipartisan commitment to the heart of our federally-sponsored science and technology enterprise is absolutely essential. That core encompasses basic and applied research to reveal Nature's secrets and to develop new enabling technologies. Research at universities, where education and research come together as two facets of learning, has special significance for underpinning American preeminence. Another traditional part of the core is R&D in technologies for which the government is the principal customer. Defense science and technologies are the leading example, and these are no less important now that external threats have diffused from the bipolar challenges of the Cold War period to a more complex set of security issues. The essential point is that leadership across the scientific frontiers has served the United States exceptionally well for many decades across numerous presidential administrations and Congresses. The intertwining of cutting-edge science and technology across many disciplines demands as much for the years ahead.

Materials research provides one of the best examples of the importance of broad investments in basic and applied research. Advanced materials are often at the focus of some of the most interesting fundamental research in the physical, biological, and engineering sciences. They also represent the enabling technologies needed for applications in areas as diverse as civil infrastructure, aeronautics, electronics, national security, and environmental stewardship. The material involved may be biological, ceramic, composite, electronic, magnetic, photonic, or superconductive. Clearly, widespread agreement concurs that materials research must remain a high priority.

The science portfolio has seen less agreement on the need to develop environmental research, particularly that focused on global aspects of the earth system. Despite growing consensus in the research community, disagreement on today's environmental impact of human activity has tended to draw attention away from key facts and has resulted in uncertain support. This makes no sense. Independent of the exact magnitude and timing of global environmental change, the magnitude of the potential consequences in several decades and the fact of observable human impact are more than sufficient to motivate strong environmental scientific research and technological innovation programs. These range from developing the computational and modeling tools for understanding complex global dynamics of the atmosphere and oceans to research investments in a long-term nonfossil energy portfolio. Materials research is obviously central to the environmental technology agenda (examples include biomaterials for cleanup and superconducting materials for energy storage). Bipartisan support will be important for sustaining the necessary long-term vision.

The information revolution and globalization have irreversibly affected the nature of industrial R&D. Dramatically shortened product cycles, competition for customers everywhere, and the increasing availability of knowledgeable workers in other countries have, among several factors, served to focus commercial R&D on the short term. At issue is the appropriate federal response to this fact, recognizing that a continuing position at the forefront of technological innovation is crucial for achieving national goals in the next century. The presidential administration's response includes both fiscal and regulatory initiatives and partnership programs aimed at supporting key enabling technologies identified by industry. Important materials research is supported through such mechanisms. The technology partnership programs, whose focus is mid- to long-term technology development in both the public and private interest, can now be reviewed meaningfully and refined for further increase in their effectiveness. Such a review may serve to restore bipartisan support to this element of an innovation paradigm suited to the twenty-first century marketplace realities.

The scientific and engineering communities have the opportunity and the responsibility to help forge consensus about the future's requirements on U.S. research investments. History suggests that the cost of not making key investments will be far greater than that of moving ahead.

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