Materials Slipping on the U.S. Critical Technologies List

For the third time in six years, the United States government has issued a national report card on technologies critical to the security and prosperity of that nation. As before, the United States still maintains a leading or comparable technological position relative to Europe and Japan in all the 27 critical areas, the National Critical Technologies Report states.

However, the report's authors also note that a technological lead does not necessarily translate into dominance of world markets. Also, the authors expressed concern about the static nature, and in some cases, the dwindling gap between the United States and other countries. They call for continued investment in technology development—something being hotly debated by U.S. lawmakers these days.

"This report documents the very tenuous lead we maintain," said John H. Gibbons, director of the Office of Science and Technology Policy, which issued the report. Yet at this crucial time, "the new congressional leadership proposes to gut the very core of our strategy to preserve American preeminence in these critical areas."

Materials is one of seven major categories of technology. Yet materials research and development often provide the basis for advances in the other six categories: energy, environmental quality, information and communication, living systems, manufacturing, and transportation. Key enabling technologies emerge from materials efforts and often those technologies prove important to multiple national goals, both civil and military, according to the report.

The overall marks for materials are good: The United States maintains a slight or substantial lead in both materials and structures in comparison to Japan and Europe. But the panel authoring the report warn that between 1990 and 1994, the lead over Japan shrank in both materials and structures, which refers to aircraft. This trend is worrisome, the authors said.

Furthermore, a look at specific types of materials did reveal weaknesses. "Indeed, the international position of the United States in materials is mixed," the report said. In no materials category is the United States improving its status. It continues to lag and lose ground relative to Japan in ceramics and superconductors and to slip in photonic and electronic materials and highway and infrastructure materials relative to both Japan and Europe. The U.S. lead in alloy technology is also diminishing.

Only in stealth materials and composites did U.S. technologies maintain a status ahead of Japan relative to Europe. Overall, the United States stayed the same in ceramics, composites, superconductors, and high energy density and stealth materials. The U.S. strength in composites stems primarily from development of polymer matrix composites.

The 27 technologies considered were selected based on the Joint Chiefs' of Staff list of "Top 5" Future Joint Warfighting Capabilities and recommendations of the National Science and Technology Council Committee on National Security and in the 1994 Defense Science Technology Strategy.

The Office of Science and Technology Policy prepared this report with the help of a federally funded unit within RAND. Then an independent panel of senior government officials and representatives from industry and academia reviewed the results. That panel was chaired by John Young, head of the President's Committee of Advisors in Science and Technology. It was issued in March 1995 and is available from RAND. For a copy of the report, contact Linda Tanner (202) 296-5000 ext. 5692.

ELIZABETH PENNISI

NRC Highlights

Call for Research Proposals

The Office for Central Europe and Eurasia of the National Research Council (NRC) is accepting proposals for collaborative research programs which link individual U.S. scientists with their counterparts in Belarus, Bulgaria, Kazakhstan, Moldova, Romania, and Ukraine, for the Twinning Program 1996–1997. As funding for the Twinning Program is provided by the National Science Foundation, only proposals in fields normally supported by NSF will be considered.

The Twinning Program requires a two-year commitment beginning in January 1996. Subject to the availability of funding, support will be provided for travel and living expenses for research visits by American grantees and junior scientists from the same institution to the countries listed and for visits by their foreign counterparts to the United States. Grants will generally be in the $12,000–$15,000 range, with requests for higher amounts considered on a case-by-case basis.

The application must be postmarked by September 1, 1995. Address inquiries to the Office for Central Europe and Eurasia (FO2014), National Research Council, 2101 Constitution Avenue, NW, Washington, DC 20418; phone 202-334-2644, fax 202-334-2614, or e-mail ocee@nas.edu.

Publications

The National Research Council (NRC) published two reports involving information technologies (IT) in regards to manufacturing *(Information Technology for Manufacturing)* and materials selection *(Computer-Aided Materials Selection During Structural Design).*

The basis for a computer-aided materials selection system (CAMSS) is to make available a range of possible materials and manufacturing methods to speed up the application of new materials and processing technologies. Currently, materials scientists have no standard by which to construct databases and knowledge bases. The report recommends a collaboration of materials users and suppliers, materials societies, and standards organizations to design and implement guidelines and maintenance so that the CAMSS may provide a continuously updated archive with links between various materials databases and knowledge bases while protecting proprietary sections of this information.

So that scientists are not relying merely on materials-properties databases, the report recommends that the CAMSS provide structural design modeling techniques. The designing project would involve materials scientists from industry and universities as they participate in research that establishes links between materials models at several scales such as atomic, molecular-crystal, cluster-grain size, and polycrystal-aggregate.

The report on necessary changes in manufacturing practices identifies IT as the key that will enable U.S. manufacturers to accelerate production. According to the report, to reduce the time lapse between product conceptualization and production, and present greater product customization and higher product quality and performance, manufacturers require the assistance of materials science. The fabrication of products will require IT to convert and transform material properties or shapes, to assemble systems or subsystems, and to verify process results. Among its recommendations, the report outlines a technology research agenda. In one area of the agenda, managing shop floor production, the process of quality control would be improved with sensors. IT relying on tactile and force sensors, temperature sensors, and pressure sensors would enable the tracing of potential problems through the manufacturing system.

Contact National Academy Press; 2101 Constitution Avenue, NW; Box 285; Washington, DC 20055; phone 800-624-6242 or, from the Washington Metropolitan Area, 202-334-3313, for copies of either report. □