SCIENCE POLICY

Incorporating WASHINGTON NEWS and policy news from around the world.

NSB Draft Report Warns of Potential Shortfall in Future S&E Workforce

Echoing several other recent reports on future workforce trends, a draft report from the National Science Board (NSB), released for public comment in May, warned of an impending crisis for the science and engineering (S&E) enterprise in the United States. The findings were based on projections about job growth, current workforce retirement rates, the number of U.S. students pursuing S&E careers, and international competition for non-U.S. S&E workers. A final report is expected to be issued this year.

The NSB report identified two major trends threatening the U.S. S&E workforce. One is intensifying global competition for S&E talent, such that the United States may not be able to rely on the international S&E labor market as much as it has in the past to fill unmet skill needs. The other is that the number of U.S.-born S&E graduates entering the workforce is likely to continue to decline unless something is done to improve the success rate in educating S&E students from all demographic groups, especially those who have been traditionally underrepresented in S&E careers. To achieve this, the report called for a greater federal role—accompanied by increased federal resources—in preparing the future S&E workforce.

Complicating the issue is the post-9/11 climate, in which visa restrictions and other policies relating to non-U.S. scientists and students are being reexamined and tightened for national security. Julia Phillips, director of the Physical and Chemical Sciences Center at Sandia National Laboratories and chair of the National Materials Advisory Board (NMAB), said that visa and workforce issues are inextricably intertwined. Enrollments in materials S&E, and in related fields like physics, have been stagnant at best and more frequently in decline. The U.S. research enterprise has offset this decline for decades by relying on non-U.S. students and researchers.

"Historically, we've been training much of the world's workforce in materials S&E," Phillips said. "But now, with so much pressure from visa difficulties and increased national security, the question is, where will the next S&E workforce come from?"

The situation is further exacerbated by the fact that many companies are beginning to shift much of materials manufacturing, and even some materials research and development (R&D), overseas, particularly to China and other Pacific Rim countries like Korea and Malaysia, as well as to India, where the materials S&E workforce is cheaper and more plentiful (see the September 2003 issue of *MRS Bulletin*, p. 619).

"There are some very smart people overseas," said Julia Weertman, professor emeritus at Northwestern University and also an NMAB member. "Americans seem to believe we have expertise that nobody else can copy, but that's just not true. The foreign workforce is much better prepared."

Motorola's Darrel Frear, whose department relies heavily on skilled materials scientists, said, "I don't know if I'd call it a crisis, but over time there has definitely been a decrease in the number of high-quality engineers being produced who are U.S. citizens. There just aren't a large number of American graduates who

have the technology background and skills to come into the workforce. The competition is pretty high."

Smaller companies are having even more difficulty, according to T.S. Sudarshan, co-founder of Materials Modification (Washington, D.C.), a firm that performs materials R&D for the government. "With many government contracts, there's always a restriction on foreign nationals, but they are often the only ones available; I cannot find qualified American PhDs or master's-level workers very easily who are willing to accept a small-business environment," he said. "That is why small materials businesses cannot grow as fast as we would like to, because the workforce is not there to support the contracts we could get."

Ironically, Phillips reports the opposite situation at Sandia, which is in the midst of a hiring program in the wake of a stream of retirements. Sandia has been able to hire a number of well-qualified materials scientists and engineers from within the United States because of the country's poor economy, but she emphasizes that the situation is unlikely to continue. Sandia has struggled in the past with finding qualified U.S.-born computational materials scientists, for example, and once the economy picks up, she expects to revert to that situation.

"At Sandia, we are constrained to hiring U.S. citizens for national security reasons," she said. "You can count on one hand the number of non-U.S. citizens who are regular employees."

However, Merrilea Mayo, director of the Government–University–Industry Research Roundtable (GUIRR) at the National Academies and current president of the Materials Research Society, said that while the laboratory and government sectors are having problems because they can only hire U.S. citizens, the workplace at large is experiencing significant layoffs.

"If you are a U.S.-citizen materials scientist and your only desire is to work for the government, your job prospects are very good," she said. "If your desire is to work for industry or academia, your prospects are dismal," said Mayo. In industry, competition from non-U.S.-born scientists and engineers is stiff; the United States grants permanent immigration status to many more materials scientists each year than graduate domestically.

So what can be done to reverse these trends? The NSB report suggests increasing graduate student stipends, encouraging collaboration between schools of education and university science and math departments, and providing more scholarships to attract students to S&E careers. Many of these actions are already being implemented by the National Science Foundation and other agencies. The report also recommends more investment in research aimed at advancing the state of knowledge on international S&E workforce dynamics.

Sudarshan is a strong proponent of internships, which can provide practical work experience and convince budding young scientists to specialize in materials. Internships can also offset the sense of entitlement and unrealistic expectations he has sensed in many students who recently graduated and are entering the workforce for the first time. "They think it is still Wall Street five years ago," he said. In addition to expecting large annu-

al raises and generous benefits with share options, they have unrealistic expectations of work hours, he said.

Weertman said that physics salaries must be adjusted to become more competitive with those of other professions, pointing out that while lawyers' salaries have increased 30% in the past three years, those for physicists and materials scientists with PhD degrees have only risen about 8%. Furthermore, salaries for those with PhD degrees cap at around $90,000, while a new graduate with a master's degree in business administration (MBA) can expect to make around $300,000 within five years. Weertman has seen several students earn their PhD degrees, then opt to pursue MBAs and go into business because of the higher financial rewards.

But for most, it is a matter of increasing the awareness of the potential of a career in materials S&E. "We are heavily underadvertised," said Frear. "A materials degree gives you the breadth of experience to be able to synthesize diverse skills in industry, but materials doesn't necessarily come to the top of the list when companies are looking for a new hire."

Sudarshan agreed. "We have not promoted the profession strongly enough at the level at which people make a decision to go into materials science," he said, particularly among high school students, who are rarely aware of the field's existence. He believes scientific societies in particular could play a critical role in educating junior high and high school students about careers in materials S&E.

His thoughts were echoed by Phillips, who also believes more teachers who are qualified to teach hard sciences, like physics and chemistry, are needed. Above all, "We have to get them early. By the time kids go to college, they are already heading in a particular [career] direction," she said. "If they aren't heading toward the sciences to begin with, they don't tend to change their minds."

JENNIFER OUELLETTE

UK Releases Report on Nanotechnology

The Economic and Social Research Council of the United Kingdom has prepared a report, "The Social and Economic Challenges of Nanotechnology," as one of the first steps in a public debate on the subject. The report differentiates among current nanotechnology research and applications—predominantly limited to advances in well-established areas of applied science such as materials science and colloid technology; medium-term applications, with a focus on overcoming barriers to technological progress; and long-term applications, which are more difficult to predict and are the focus of most concerns. The report can be accessed on Web site www.esrc.ac.uk/esrccontent/downloaddocs/nanotechnology.pdf.

Australian Materials Technology Network Launched

The Australian Materials Technology Network (AMTN), aimed to give Australian industry access to a wide range of materials technology, information, and services that are available within Australia's research institutions, was launched on October 1 at the University of Technology, Sydney, during the Institute of Materials Engineering Australasia biennial materials conference. AMTN is designed to foster increased investment and involvement by industry in materials science and engineering, raise the profile of materials technology across the community, and assist with policy development at all levels of government. The network has been approved to receive $2.6 million (AUD) over three years from the Commonwealth Government's Innovation Access Program as part of Backing Australia's Ability, an initiative of the Department of Industry, Tourism, and Resources. Matching funds and in-kind support are to be provided by the consortium of partners behind the AMTN. Angus Robinson, chief executive of the Australian Electrical and Electronic Manufacturers' Association, is AMTN's inaugural chair.

At the core of the network are Technology Business Centers (TBCs), coordinated with the Institute of Materials Engineering Australasia and the Industry Capability Network. These TBCs will be based at the Australian National University, the University of New South Wales, the University of South Australia, Monash University, the University of Queensland, and the Advanced Manufacturing Technologies Centre at the Central TAFE, a college in Western Australia. Each center will focus on disseminating materials technology information, technology diffusion, and providing practical services to industry. The centers will interface directly with local industry, coordinate access to facilities and resources, and play a leading role in problem-solving and advice for industry. Initially, these service provider nodes will focus on materials characterization, testing, and evaluation as the most critical, immediate needs of industry. The network will subsequently be expanded to cover other aspects of materials such as production and processing.

Jim Williams, director of the Research School of Physical Sciences and Engineering and the driver behind the network, said, "It's hoped the AMTN will foster increased investment and involvement by industry in materials science and engineering. Such interactions and joint ventures between industry and academia will ultimately enhance the global competitiveness of manufacturing industries that rely on state-of-the-art materials technology in their products."

The Industry Capability Network, which has a national role as an information resource for over 33,000 companies, will incorporate a comprehensive record of service providers and professional bodies. The Institute of Materials Engineering Australasia, which is a national professional body serving the materials engineering community, will focus on improving industry's awareness of materials technology by assisting in the development of seminars and workshops and providing ongoing professional development in conjunction with other professional institutes.

Australian Research Information Infrastructure Committee Established

Brendan Nelson, Australian Government Minister for Education, Science, and Training, announced in September the formation of the Australian Research Information Infrastructure Committee (ARIIC). It will be chaired by Rory Hume, vice chancellor of the University of New South Wales, and will comprise representatives from the academic and research communities. The committee will act on recommendations from a recent report of the Higher Education Information Infrastructure Implementation Steering Committee for managing and using research information generated by Australia's universities and other research institutions. Funding of $22 million (AUD) for 2003–2004 has been allocated to allow the development of the technical framework and individual projects recommended in the report. The report can be accessed at Web site www.dest.gov.au/highered/otherpub/heiiisc03/default.htm#intro. □