

# US Nanotech Program Strong, but International Race Is On

**A**fter five years of research and more than \$4 billion in federal spending, the National Nanotechnology Initiative (NNI) has given the US the global lead in the emerging field of nanoscience, but other countries are “aggressively chasing” US leadership with both broad and focused research programs. That assessment is from the President’s Council of Advisors on Science and Technology (PCAST) in the first in-depth review of the government’s effort to coordinate the many research disciplines and federal agencies involved in nanotechnology.

Annual federal spending on nanotechnology is about \$1 billion, with more than 20 different agencies receiving NNI money, according to the PCAST report. That \$1 billion represents about one-quarter of the current nanotechnology spending by governments in all nations.

When state and private nanotechnology spending are added to the federal number, total US R&D spending stands at \$3 billion annually, one-third of the global spending of about \$9 billion. “Nanotechnology today reminds me very much of the early days of the semiconductor industry,” E. Floyd Kvamme, cochair of PCAST and a founder of National Semiconductor in the 1960s, told the House science subcommittee on research in June. “The new interdisciplinary relationships being forged and the sense of excitement over future possibilities are very reminiscent of that earlier period.”

In his testimony and as lead author of the report, Kvamme was low-key about threats to US leadership in nanotechnology, calling the report’s two central concerns—growing international competition and problems with an inadequate technology workforce in the US—“cautionary notes and minor recommendations.” Others testifying at congressional nanotechnology hearings were not so sanguine.

“The relative lead [in nanotechnology] the US currently holds is in jeopardy because the rest of the world is catching up in a variety of measurements,” said Jim O’Connor, a vice president at Motorola Inc. Testifying before the science subcommittee, O’Connor said, “In government funding, for example, the rate of increase in the European Union and Asia is higher than that of the US. This should be a wake-up call for American

researchers and policymakers alike.”

He noted that China has more than twice as many engineers working in nanotechnology as the US has, and that countries spending less than the US are focusing their research to try to gain the lead in one or two fields. “Korea and Taiwan are investing heavily in nanoelectronics,” he said, “while Singapore and China are focusing on nanobiotechnology and nanomaterials, respectively.”

The “Where do we stand?” section of the PCAST report says, “Virtually every country that supports scientific and technology R&D has a nanotechnology initiative.” The “vast investments” by governments and private industry have spurred scientific progress, the report says, “yet most agree that nanotechnology is, by and large, still in a nascent stage and that its ultimate impact on the world economy remains to be seen. What all agree upon is that significant potential clearly exists.”

Regional, state, and local government spending in the US, often overlooked in nanotechnology studies, totaled more than \$400 million in 2004, the report says. State and local education and training programs are also playing a role in developing a technically skilled workforce. Some of the training is done through partnerships with universities or federal nanotechnology centers, and some is done through new state programs that provide “nanotechnology-relevant curriculum assistance to community colleges.”

The report, citing a recent study by Lux Research Inc, said that of the \$8.6 billion spent on nanotechnology R&D worldwide in 2004, \$3.8 billion was by corporations. Of that, 46%, or \$1.7 billion, was by North American (predominantly US) companies; 36%, or \$1.4 billion, was by Asian companies; 17%, or \$650 million, was by European firms; and about 1%, or \$40 million, was by businesses in other regions. Venture capital companies investing in nanotech startup companies spent another \$400 million worldwide.

In looking at peer-reviewed scientific articles on nanotechnology, the report found that although the US still leads in publications, its share has declined from 40% in the early 1990s to less than 30% in 2004. The total number of nanotechnology papers published in *Science*, *Nature*, and *Physical Review Letters* has doubled

since 1991, with US researchers responsible for more than 50% of the papers in those journals. The US percentage is beginning to decline, the PCAST report notes.

The PCAST recommendations for NNI primarily involve improving interactions with industry and with state nanotechnology programs. The report also urges the government to be “proactive” in ensuring that the environmental, health, and safety concerns of nanotechnology are addressed (see *PHYSICS TODAY*, June 2004, page 30). Finally, to make sure that nanotechnology becomes more than a “research project,” the PCAST report recommends that NNI officials work more closely with the Departments of Education and Labor to improve technical education programs related to nanotechnology.

**Jim Dawson**

## NIF Threatened with Closure

**A**fter battling technical challenges and cost overruns, the \$3.5 billion National Ignition Facility (NIF) at Lawrence Livermore National Laboratory in California is 80% complete. Three recent independent reviews of the US Department of Energy (DOE) facility say it is well managed and on schedule to meet a 2010 deadline to attempt fusion ignition. But political maneuverings in the Senate threaten to shut down the project.

On 30 June, in a late-night showdown, Senator Pete Domenici (R-NM), chair of the Water and Energy Appropriations Subcommittee, succeeded in cutting \$224 million from the \$337 million fiscal-year 2006 budget request for NIF. The proposed cut would cancel construction work on the project, on which \$2.8 billion has already been spent. Moreover, \$50 million is included in the proposed budget to close out NIF.

Matt Letourneau, Domenici’s



NIF technicians may soon be out of a job.