The Federal Science and Technology Budget:

An Investment in Our Nation's Future

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As we benefit from the impact of the information technology and healthcare revolutions, only rarely do we reflect on the prescient investments of fifty years ago that spawned the science now yielding massive changes in our lives. It is not too soon to think about whether we are bequeathing a similar legacy for our children and grandchildren. The key is whether our naiton today is investing adequately in scientific research on a regular basis to yield life-enhancing technologies down the road.

The National Academies issued a report in 1995 entitled *Allocating Federal Funds for Science and Technology*, that attempted to address this question. The report recommended the use of an alternative to the federal R&D budget category, known as the Federal Science and Technology (FS&T) budget, designed to reflect the real federal investment in the creation of new knowledge and technologies and excluding activities such as the testing and evaluation of new weapons systems. In recent years, the administration has also chosen to present its budget recommendations using a similar concept, the 21st Century Research Fund, which reflects both investment in new knowledge as well as the administration's research priorities.

An Academy committee has just issued its latest update of the FS&T analysis of the President's FY 2001 budget, and the results are a mixture of good and bad news. The Administration's FY2001 budget proposes an increase in the FS&T budget of $674 million to $52.6 billion, amounting to a 1.3 % in constant dollars. Of particular note is the request for a major increase of 17.5% for the National Science Foundation,

clearly signaling the importance given basic research while taking an important step toward alleviating the disparity that has developed in recent years between federal funding in the health sciences and other scientific fields, since the National Institutes of Health are recommended for an increase of 3.7%. The administration's budget highlights a set of inter-agency initiatives, with focused efforts in nanotechnology ($485 million), information technology ($2.27 billion), clean energy ($283 million), and climate change ($1.4 billion.

Yet there are reasons for concern. The relatively small increase proposed for FY2001 FS&T is similar in magnitude to the 0.4% requested for FY2000, subsequently raised to 6.4% by Congress. The FY2001 budget proposes further major budget reductions for the Department of Defense in applied research (-9.6%) and development (-18.5%) that are included in the FS&T budget category. While the FY2001 budget does contain some modest but real growth in several other mission agencies (e.g., Department of Energy at 5.9%, National Aeronautics and Space Administration at 0.7%, and Department of Commerce at 4.9%), these are occurring within the context of several years of major erosion in the research budgets of mission agencies. Put another way, aside from the large proposed increases at NIH and NSF, proposed FS&T spending in the rest of the federal government would be down 1.4%.

Various federal agencies invest in quite different fields of science and engineering. For example, DOD is a major sponsor of academic research in the physical sciences and engineering, providing 60% of the support for computer science, 69% of spport for electrical and mechanical engineering, 38% for materials science, and 275 for mathematics. Hence the erosion of the FS&T budgets of mission agencies

raises concerns about adequacy of federal support for important fields of science and engineering with implications for other more generously funded areas. Harold Varmus, former Director of NIH, notes that discoveries in biology and medicine depend on progress in physics, chemistry, engineering and many allied fields, areas supported primarily by other federal agencies.

Swings in FS&T levels pose difficulties for those planning careers in science and engineering. Federal research funding directly and indirectly supports the training of the next generation of scientists and engineers. Only rarely do budget decisions take into account the effects on students of the various agencies funding research. A recent National Research Council review of major fields with substantial declines in federal research support (chemical engineering, mechanical engineering, and electrical engineering) in the 1990s shows a strong correlation with reduced graduate enrollments in those fields.

There is a wide consensus that U.S. scientific preeminence and economic growth depend on maintaining and possibly increasing the share of GDP devoted to R&D, with a target goal of 3% proposed by the administration. And, indeed, total R&D spending has been increasing over the past decade, rising to 2.8% in 1999. Yet since 1987, industry R&D has increased by 196% while the federal share of total R&D has dropped from 46% to 27%. In part this remarkable growth in private sector R&D has been stimulated by the importance of applied research and development in a technology-driven economy. But it also depends on the flow of basic research findings and the associated training of scientists and engineers, principally the concern of the federal government. Hence the growth of industry spending on R&D should not lull

observers into thinking that the federal FS&T budget can be reduced. In fact, one might well question whether the current federal investment is adequate to sustain the necessary private sector investment in these activities, so critical to our economic prosperity.

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