

3 Ushering in a New Century of Progress Through Discovery

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In my remarks to this colloquium in May 1998, I spoke about the global imperative to make the fruits of science and engineering research available to all people, and I quoted Einstein's admonition: "From discord, find harmony. In the middle of difficulty lies opportunity." Personally, I have found these to be words to live by during my transition from National Science Foundation (NSF) to the Office of Science and Technology Policy over the past year. I like it when a speech has a take-away message, even if I'm the only one who takes it away!

This year, I would like to comment on some of the remarkable lessons I have learned in the White House about research and development (R&D) budgets. But I would also like to continue exploring the opportunities presented by the new millennium to unite the pursuit of world-class research with the pursuit of societal needs.

As we draw ever closer to the next millennium, I'm sure many of you have noticed the recent news stories offering various rankings of historic events. One such story reported on the results of a survey of leading journalists voting for the "biggest news stories" of the past 100 years. It was no surprise to those of us in the science and technology community that more than one-third of the top 100 stories concerned breakthroughs in science and technology. In fact, three of the top four were clearly science and technology news: the number one story was the United States' use of atomic bombs at the end of World War II; the number two story, astronaut Neil Armstrong's first steps on the moon in

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1969; and the number four story was the flight of Wilbur and Orville Wright's powered airplane in 1903. In these examples, science and technology made headlines because they shaped—significantly and tangibly shaped—the daily lives of people all across the globe.

The decisions we make—in the Administration, in Congress, in the science and technology community—about future investments in science and technology will influence the headlines of the 21st century in ways both predictable and serendipitous. More importantly, they will affect the lives of our children, our grandchildren, and all of those who follow. Our political leaders' vision of where science and technology can take us is vital, then, to the success of the nation. President Clinton and Vice President Gore have used their time in office to promote a compelling vision of the future of science and technology. Many of you may have heard the President's address in 1998, at the AAAS sesquicentennial meeting, in which he presented the following view:

Your bicentennial meeting can convene in a world where climatic disruption has been halted; where wars on cancer and AIDS have long since been won; where humanity is safe from the destructive force of chemical and biological weapons, wielded by rogue states or conscienceless terrorists and drug runners; where our noble career of science is pursued and then advanced by children of every race and background; and where the benefits of science are broadly shared in countries both rich and poor.

That is what I pray it will be like 50 years from now, when my successors stand here before your successors and assess how well we did with our time.

In each budget cycle, this Administration has made steady improvements in the science and technology investment portfolio to move us closer to the President's vision. This year is no exception. After this review of the FY 2000 budget, I want to open a dialogue with you—indeed, with the whole science and technology community—about how we can effect more than incremental change in the prospects for science and technology, and therefore for society as a whole in the 21st century.

I think you all know that this has been a tough year to put a budget together, but there are some notable high points. First among them is the fact that the President led us from a \$290 billion deficit in 1993 to surpluses as far into the future as the eye can see. The Administration successfully combined fiscal restraint with continued investments in the future, including investments in technology.

21st Century Research Fund

The FY 2000 budget includes \$38 billion for the 21st Century Research Fund. That's a three percent increase over FY 1999. The Research Fund provides a way to focus on balance, budget stability, and appropriate growth in the highest-priority research programs. This year, the Research Fund includes Department of Defense basic and applied research programs (6.1 and 6.2)—further evidence of the Administration's commitment to effective integration of the nation's university-based research portfolio. The Research Fund also helps ensure that research areas that cut across several agencies can flourish in the competitive budget environment. Let me mention a prominent example: information technology research.

Information Technology

This year's budget proposes a bold new initiative: Information Technology for the 21st Century (IT2). The initiative corresponds to an increment of \$366 million, a 28 percent increase in overall spending on information technology research, bringing the total to about \$1.8 billion in FY 2000. No one knows better than you the value of information technology in our national economy or the value of information technology to progress in science and engineering. Information technology now accounts for one-third of U.S. economic growth. Information technology offers the greatest return on investment of R&D dollars, producing not only more jobs, but also jobs that are more desirable because they pay more and can drive local economies.

Information technology also gave us the confidence to move from nuclear testing to science-based stockpile stewardship, through the Department of Energy's Accelerated Strategic Capacity Initiative (ASCI). And the new initiative will help move those hard-won advances into critical civilian uses, such as climate-change modeling and other applications. This initiative is what Thomas Jefferson would have described, if Gerald Holton is to be believed, as a research program by which science serves both the search for truth and the interest of society. I will return to Jefferson's views on science later in my remarks.

IT2 has three central goals:

- to carry out basic research to advance information technology;
- to use the most advanced information technology—for example, computer simulation—to enhance research across all areas of science and engineering and hasten the pace of discovery;
- to address the legal, ethical, economic and workforce questions that information technology raises.

The IT2 initiative is a team effort involving the White House and several federal agencies, and it's a high priority with the President and with the Vice President. IT2 will help contribute to advances in other cross-cutting areas, including, for example, the environment and national security.

Budget Summary

In summary, R&D fared well in the FY 2000 request. Non-defense discretionary spending was, essentially, flat compared to FY 1999, but non-defense R&D was up three percent. Among all the non-defense discretionary accounts, only education fared better.

I know that some of you are concerned with the National Institutes of Health (NIH) funding level, but it is important to remember that the \$320 million increase in FY 2000 maintains the rate of growth the President set out in the FY 1999 budget request. And R&D spending is up at NSF, USDA, Commerce, Interior, and Transportation. Importantly, R&D is up at Education to support large-scale, interdisciplinary research in three key areas: school readiness for learning reading and mathematics; K-3 learning in reading and mathematics; and education of pre-K-12 teachers in mathematics, reading, and science.

The Clinton-Gore Administration has a solid six-year record in science and technology funding:

- Civilian R&D has increased seven years in a row. At almost \$40 billion—a 31 percent rise since 1993—it now constitutes 51 percent of the federal R&D budget, fulfilling a Clinton-Gore campaign pledge.

- The FY 2000 budget boosts funding for basic research by 4.2 percent over FY 1999. The total is up 36 percent since 1993.
- R&D support to universities is up by two percent in FY 2000—a \$353 million increase. That’s up 33 percent since 1993.
- Finally, the President’s budget presents a balanced R&D portfolio, which recognizes the interdependence of all fields of science and engineering.

This last point is extremely important. The President’s request reflects his appreciation that diverse fields of research are intricately connected, with each breakthrough stimulating a chain reaction of advances in seemingly unrelated fields. The Senate budget resolution, which provides only for increases at NIH, stands in stark contrast to the President’s vision for science and technology. Certainly, increases for NIH are important—but it is essential that we also see increases in the budgets of NSF and the science and technology programs in all the agencies. We want to work cooperatively in a bipartisan fashion with Congress to support R&D. But it is crucial that the support be comprehensive to ensure continued vitality and leadership across the broad frontiers of science so that we don’t miss the next breakthroughs—in whatever field they may occur.

As leaders in the science community, you have strong voices that are heard and heeded. I urge you to speak out to all those involved in budget decisions—not only in the U.S. Capitol, but also back home in your own state capitals and across your regions. We hope you will join us in a concentrated effort now to sustain a balanced, comprehensive national science and technology enterprise.

In these years when two millennia converge, it is important to keep our perspective even as we engage in perennial political brushfires. We are plotting a course not just for the near-term future of the federal budget, but ultimately for the long-term future of our planet and its people.

We might take a lesson from an old budget debate among the faculty at an Oxford college. The dons were debating what to do with all of their college’s money. Most seemed to agree that buying land would be the best use for the money, since, as one faculty member observed, “for the past thousand years, land has proven to be a very wise investment for the college.” At this point, the college’s whiskered old patriarch stood and said, “True, but the past thousand years have been atypical.”

The past 50 years have been exceptional times for science and technology. But will they prove to be atypical, or will we successfully forge a new post-Cold-War partnership between science and society that secures benefits for all parties?

The Vice President has called on us—the scientific community—to look for new opportunities in the new millennium. He has called for the development of a “New Compact” between our scientific community and our government—one based on rigorous support for fundamental science, and also a shared responsibility to shape our breakthroughs into a powerful force for progress. He spelled out three prerequisites for a New Compact.

First, as we continue to probe the most fundamental questions of nature, we must do more to ensure the best use of science and technology to sustain our prosperity, create jobs, and grow the economy for the 21st century. To illustrate this need, he unveiled the IT2 initiative and announced the Administration’s plan to request a renewal of the R&D tax credit.

Second, the Vice President said we must “make sure that we not only generate the fruits of discovery, but also share them.” That means working to ensure that more of our people have access to technology and to rewarding careers in science and technology, and also that we give our students the best education available in the world.

We put top priority on addressing the needs of the science and technology workforce of the 21st century. The National Science and Technology Council (NSTC) will soon recommend actions to revamp the roles community colleges play in preparing our technical workforce and the ways in which graduate students are supported in our research universities. We are also committed to strong policies that encourage international scientific exchange. Researchers from other countries enliven academia and industry and help keep this country strong. *Time* magazine recently featured scientists who number among the great minds of this century, noting that behind each great idea, great discovery, and great invention is one extraordinary human mind. We intend to create an environment in which those minds can work their wonders for the long-term benefit of this nation.

Finally, the Vice President urged us to do more to make sure our newest technology helps advance our oldest and most cherished values. One example of our ongoing effort in this area is the work of the National Bioethics Advisory Commission, which is providing crucial guidance on the complex issues raised by biomedical research. IT2 also emphasizes

technology and values, with its allocation of \$15 million to examine the social and economic effects of the information revolution.

Science and technology community leaders have also recognized the need to refocus our efforts. For example, a new study by economists Michael Porter of Harvard Business School and Scott Stern of MIT, published last month by the Council on Competitiveness, warns that the United States is failing to invest in the fundamentals—basic research and advanced degrees in physical sciences and engineering. It suggests that we are eating our seed corn while other countries are increasing their stores for the future.

In a recent opinion column, representatives of Genentech, Netscape, and TechNet—a bipartisan organization—echoed the same concern that the once-reliable flow of federal funds into basic research is now in doubt. To help reverse this trend, the authors advocate doubling federal appropriations for basic research over the next ten years and enacting a permanent R&D tax credit for corporations.

The National Academy of Sciences has also entered this debate with its recent report on capitalizing on investments in science and technology, *The Pervasive Role of Science, Technology, and Health in Foreign Policy: Imperatives for the Department of State*. The report asserts that there is a consensus that the context for U.S. science and technology policies has changed fundamentally, and that the framework that brought success in the past needs to be rethought for the future.

Congress, too, has expressed concern about the future of science and technology. The Frist-Rockefeller bill and Vern Ehlers' report for the Science Committee, *Unlocking Our Future: Toward a New National Science Policy*, try to point us in new directions. During my recent appropriations hearings, Senator Barbara Mikulski (D-MD) urged me to do more to communicate the rationale for broad federal investments in science and technology to her congressional colleagues.

In many ways, all of this ferment of opinion is encouraging—for if we agree strongly enough that the outlook for R&D funding is threatened, perhaps we can find common cause for unifying and concentrating our efforts to answer the threat. There is some urgency to this task associated with one of the Clinton Administration's proudest accomplishments: we have a surplus in the federal budget—not just for this fiscal year, but for as far ahead as we can see. The figures being quoted are as high as \$2.8 trillion over the next decade. Yes, the President is committed to fixing Social Security and Medicare. Still, that leaves possibly hundreds of billions of dollars to make decisions about.

Many constituencies, armed with thorough documentation for their funding needs, will have their eyes on the surplus. We must be ready. One thing is certain—only political support for R&D ensures adequate attention in the final budget. And political support flows toward investments with real payoffs for real people who speak loudly, in unison—or at least in close harmony.

We have extremely compelling arguments at our command. The immense payoffs from long-term basic and applied research funding are evident throughout our economy—from laser surgery, to global positioning technology, to the microchip in your coffee maker. The contributions of science and technology are so woven into the fabric of our lives that it is easy to forget the effort that made them possible. Let us help people remember.

We already know the public believes in the value of science and technology, and especially R&D funding. According to the NSF's Science and Engineering Indicators 1998, a solid 80 percent of American adults agree that the federal government should support basic scientific research that advances the frontiers of knowledge, even when it does not provide any immediate benefits. Even more encouraging, this percentage has remained relatively constant throughout the last decade. The real question today is how we can translate this strong public confidence in our enterprise into a similar confidence among the federal budget decision-makers—who are elected by a public that strongly supports science.

We must pass along our own excitement to everyone who does not already sense it. The President's Committee of Advisors on Science and Technology (PCAST) is documenting the contributions of S&T to our daily lives. The NSTC will produce a document that describes the role of science and technology's contributions to the federal agencies' missions. I will be working closely with PCAST and the agencies in the NSTC over the coming months to help shape proposals to address the Vice President's call for a "New Compact." We will be reaching out to individuals and organizations like AAAS to get broad community input.

The "Cold War," the "Space Race," and the "Cure for Cancer" have been almost unassailable rationales for increased investment in science and technology. We revved up spending in this Administration with the "Engine for Economic Growth." Are there other ways to characterize a broad investment portfolio that can compete with other important discretionary programs when push comes to shove? I was thinking recently how appropriate it is that the year 2000—in the midst of the current revolution in science and technology—will not only mark the turn

of a century and of a new millennium, but will also mark the 200th anniversary of Thomas Jefferson's election as President of the United States. I have a feeling that President Jefferson—who was passionate about science—would be proud of what we are accomplishing today, both scientifically and politically.

Jefferson knew that science investment could be risky, but could also have enormous payoffs. That knowledge guided his decision to commission Lewis and Clark to explore the vast Louisiana Purchase. Except for the tall tales and legends of a few mountain men and trappers, Americans at that time had no clear knowledge of what kinds of lands and waters lay west of the Mississippi. But Jefferson did know that it was essential to investigate this huge tract—not just in the sense of taking an inventory of goods, but also in the fundamental spirit of scientific inquiry. The expedition he commissioned, of course, did pay off. As surely as Lewis and Clark dramatically increased our knowledge of the geography, the geology, and the peoples of the Western United States, that new knowledge opened the Western United States to economic expansion that still drives this nation forward.

And so, almost 200 years later, we find ourselves at another important crossroads of policy development, when similar levels of vision and courage are needed. I believe the Administration has an impressive record and an exciting vision for the future. And I look forward to working with you to translate this vision into a well-defined agenda and “compact” for the new century.

