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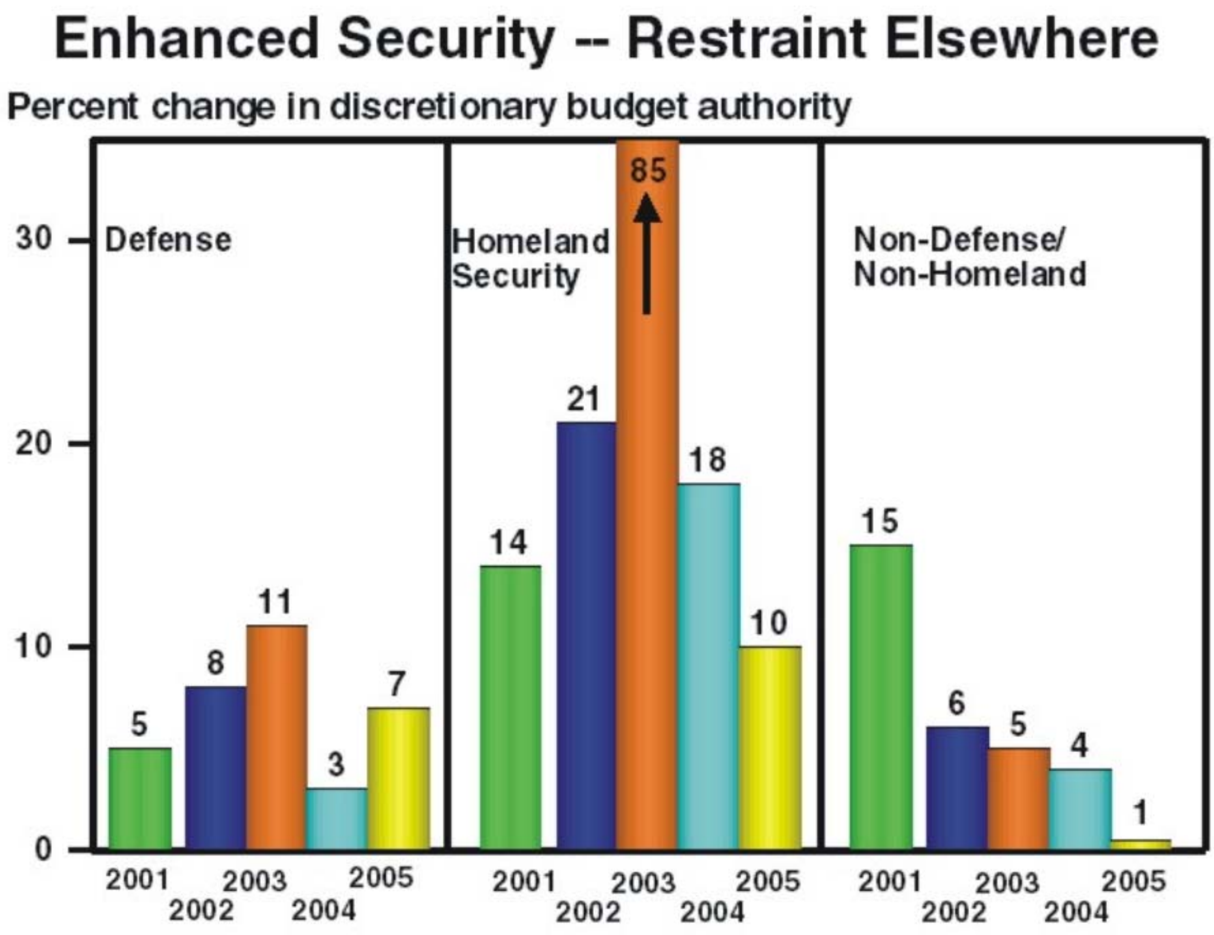
Thank you President Jackson. This is my third appearance as Presidential Science Advisor in this annual forum on Science and Technology Policy, and the last in the current Presidential term. When this forum took place in 2001, I was (in retrospect) blissfully engaged with a diminishing menu of management and environmental issues at Brookhaven National Laboratory, and enjoying an outpouring of excellent science from Brookhaven's facilities and their users. I came to Washington on September 15, 2001 and participated in the AAAS Symposium on terrorism in December. At the 2002 Policy Forum, I presented my thoughts on future priorities in science and technology funding, and related them to intrinsic opportunities in science and to current deep movements in society. In 2003 I addressed the single most serious issue facing science in the aftermath of the terrorist attacks of September 11, 2001 – the backlog of visas for students and scientists, and related problems. Now in 2004 the main external factors driving policy in this Administration are well established – particularly in the areas of national and homeland security and the economy – and it is a good time to assess current status and look ahead to future policy in view of past experience.

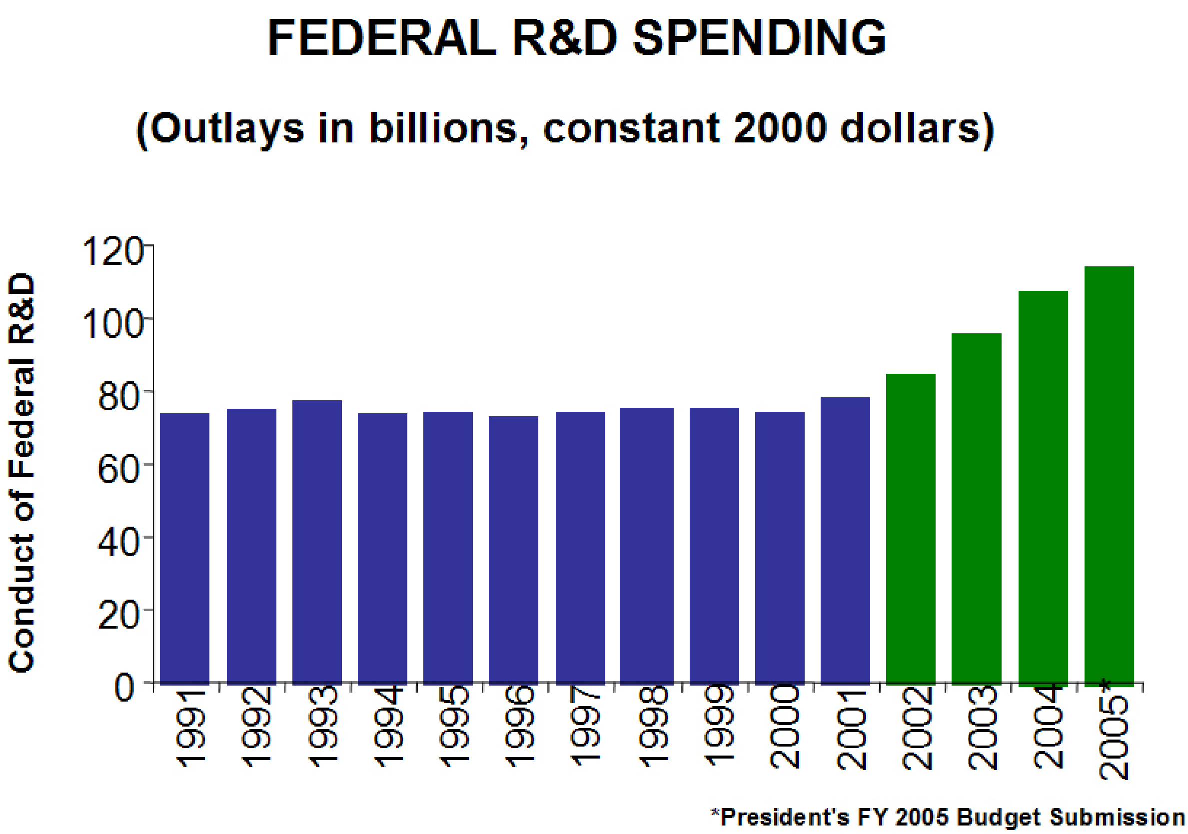
Administration Priorities and R&D Budgets

President Bush has made it abundantly clear that his budget priorities have been to protect the nation, secure the homeland, and revitalize the economy. His budget proposals to Congress are in line with vigorous actions in each category. Increases in expenditures for homeland security, in particular have dominated changes in the discretionary budget during this Administration (Figure 1),



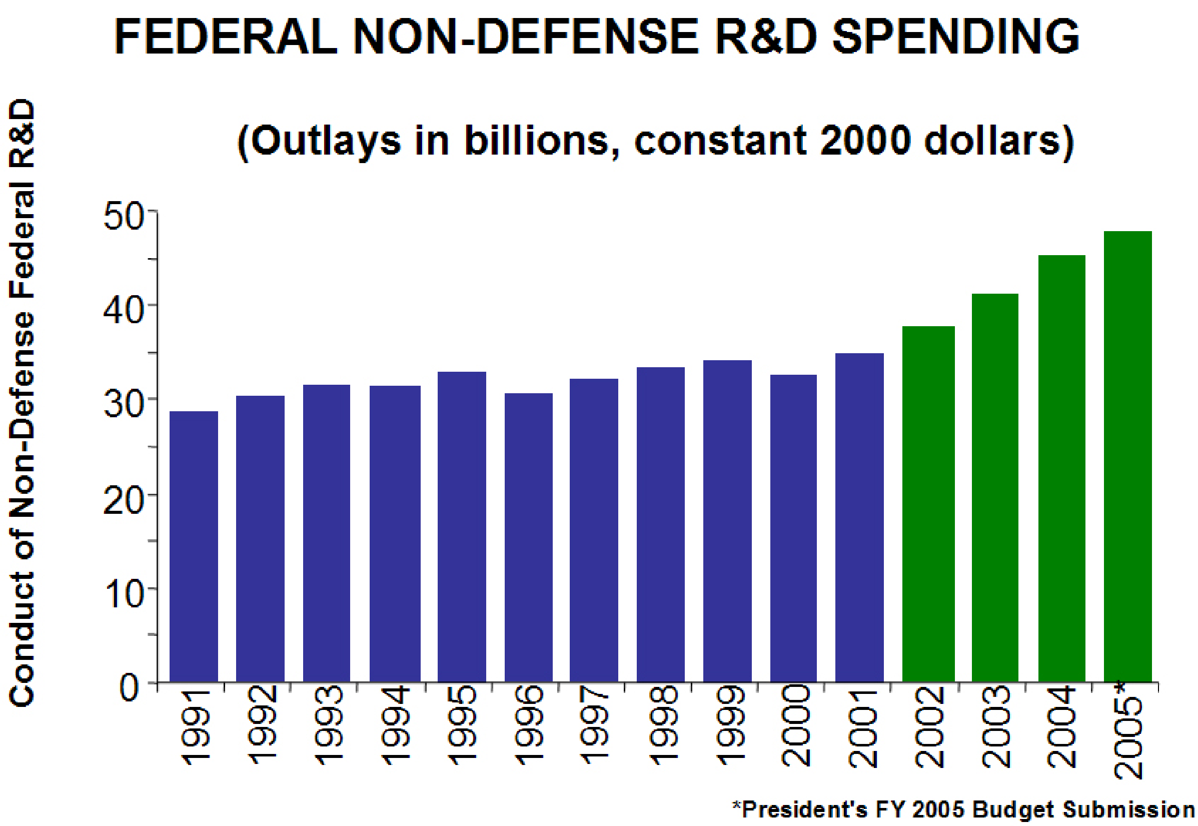
and we have seen the emergence of a significant new science and technology agency within the Department of Homeland Security (DHS). The current budget proposal for the DHS Science and Technology function is $1.2 billion, with an estimated total of $3.6 billion in homeland security related R&D in all agencies. The science and engineering communities exerted a significant influence on the structure of the new department, particularly through the National Research Council report "*Making the Nation Safer*."

Each of the three overarching Presidential priorities has strong science and technology components. The President has sought, and Congress has appropriated, substantial increases in Research and Development budgets not only for homeland security, but also for defense and for key areas of science and technology related to long term economic strength. Figure 2 shows the growth in total R&D expenditures in constant dollars during the past decade. (Figure 2)



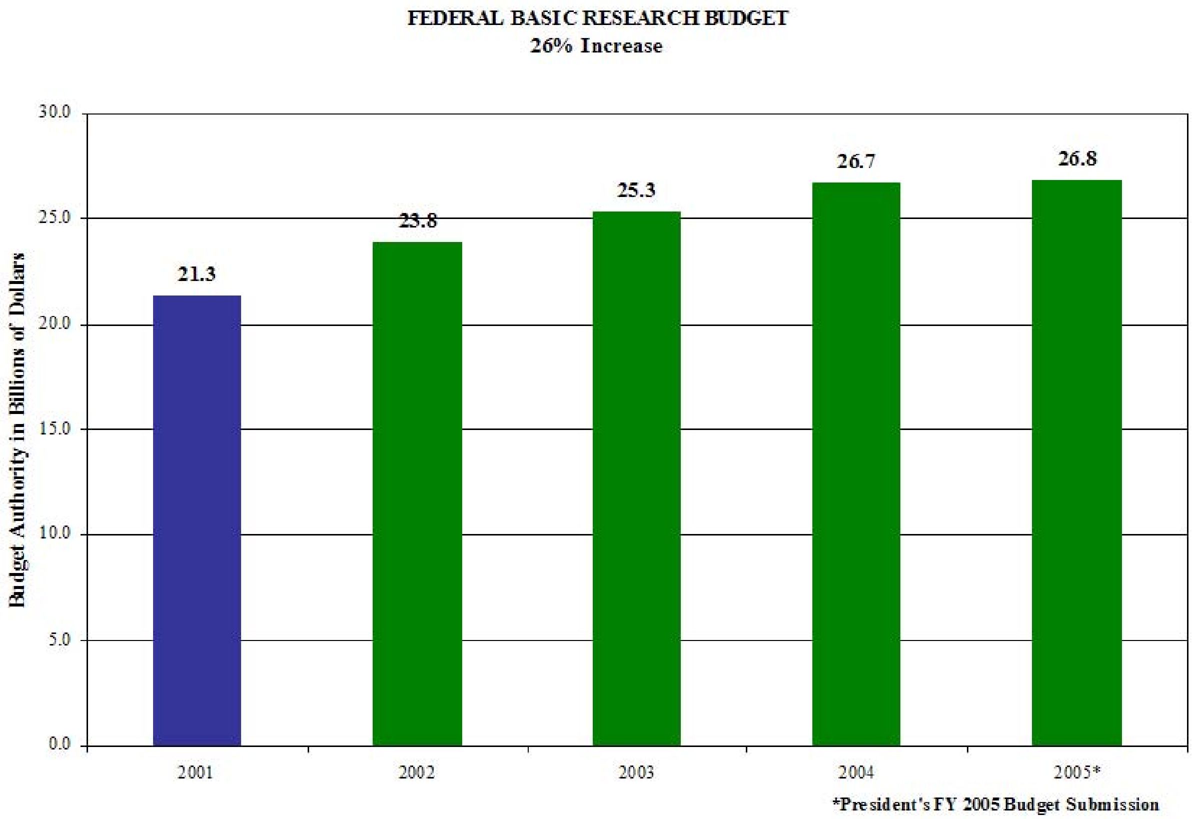
R&D expenditures in this Administration are up 44% over the past four years to a record $132 billion proposed for 2005 compared to $91 billion in FY 2001, and the non-defense share is up 26%. The President's FY2005 Federal R&D budget request is the greatest share of GDP in over 10 years, and its share of the domestic discretionary budget, at 13.5% is the highest level in 37 years. Non-defense R&D funding is the highest percentage of GDP since 1982. Total U.S. R&D expenditures, including the private sector was at 2.65% of GDP in 2002, the most recent year for which I have data. I suspect it is above that today. Its historical high was 2.87% in 1964 as NASA was ramping up for the Apollo program.

Figure 3 shows non-defense R&D spending. The FY 2005 request commits 5.7% of total discretionary outlays to non-defense R&D, the third highest level in the past 25 years.



While the President has proposed to reduce the overall growth in non-defense, non-homeland security spending to 0.5% this year to address overall budget pressures, his budget expresses a commitment to "non-security" science with a considerably higher growth rate at 2.5%. (Figure 3)

Figure 4 shows the "basic research" category tracked by OMB. During the current Administration, funding for basic research has increased 26% to an all-time high of $26.8 billion in the FY 2005 budget request. (Figure 4.)



What Congress will do with the Presidential requests for science, shown as the final bar in each of these charts, is at this point an open question. I do want to acknowledge that Congress has treated science well in its appropriations, and the good figures for science during this Administration represent a strong consensus between the Legislative and Executive branches that science is important to our nation's future.

As I emphasized in 2002, priorities for these large expenditures respond to two important phenomena that have shaped the course of society and are affecting the relationship of society to science, namely the rapid growth of technology, particularly information technology, as the basis for a global economy, and the emergence of terrorism as a destabilizing movement of global consequence.

Science and Security

I have been speaking of these phenomena ever since I arrived in Washington more than 30 months ago. The good news is that the accelerating pace of technology and its obvious economic impacts have captured the attention of governments at every level, creating an awareness that science is the source of technology, and a consensus that economic vitality is a strong rationale for public support of science. The bad news is that the new technology-intensive infrastructure of society makes it vulnerable to terrorism, and sensible responses to terrorism can have negative consequences for the conduct of science.

Balancing science and security has become a major theme of science policy during my tenure in Washington. I believe it will remain an important theme for years, not only in the United States, but in every nation that aspires to participate in the world economy. The inherent dual-use nature of the most significant new technologies – the so-called convergent bio-, info-, and nano technologies – guarantees that the development of these fields and their underlying science will be accompanied by increasing concern for misuse. Concern for the misuse of specific substances that might be employed by terrorists took concrete form in a provision of the Public Health Security and Bioterrorism Preparedness and Response Act of 2002 (PL 107-188) – the so-called Select Agent Rule – that requires registrations for institutions and clearances for individuals handling a list of pathogens and toxins. I believe the need for this kind of specific and restrictive legislation is infrequent, and will be rare in the future.

The issue of how to respond to threats of bioterrorism, has been an object of increased attention within the science and security communities since the deliberate contamination of U.S. mail with anthrax in October 2001. Well before that incident, the National Academies of Science had convened a committee, known as the "Fink Committee", to consider responsible measures that might be taken to reduce the risk that advances in bioscience might be exploited for terrorism. The recent establishment by the Department of Health and Human Services of a "National Science Advisory Board for Biosecurity" (NSABB) completes a highly successful policy-making cycle that began with the report of this committee. This process is a model for future productive dialogue between science and government, and I appreciate the spirit of cooperation that all parties have exhibited during this period.

The visa issues to which I devoted last year's talk to this Forum are still with us, and they are still serious. Fears that the newly introduced foreign student tracking system SEVIS would seriously impede the Fall 2003 enrollment process did not materialize thanks to concerted efforts by the Department of Homeland Security and the educational institutions. But reports from key institutions indicate that foreign graduate student applications are showing weakness, and serious obstacles remain for foreign scientists attending conferences and research activities in the U.S. These issues are receiving attention at the highest levels of government because it is well understood that a healthy scientific enterprise is a global one. The United States has benefited substantially from a steady influx of talent and ideas from around the world, and we desire to continue that enrichment consistent with responsible security. Progress on visas must be deliberate, because it must not come at the expense of security. I expect this to be a continuing issue for several years.

Societal Impacts of Science and Technology

Concern about environmental and health effects of the technologies we employ in daily life is another important theme affecting the interaction of science and government. These are more familiar themes than terrorism, and despite the sharpness of public debate surrounding them, our system of societal communication and response is well-equipped to manage the issues they present. The rapidly expanding capabilities of the Internet and wireless communications provide many opportunities for the public to learn about issues, form interest groups, and act to support their views. In our era, emerging societal concerns are unusually well aired and highly visible to policy makers and elected officials.

An example OSTP is following closely is the societal impact of nanotechnology. We worked with Congress to clarify concerns prior to the passage of the 21st Century Nanotechnology Research and Development Act that President Bush signed last December, and are working with agencies to ensure coordinated action. Research in nanotechnology is a priority in this Administration, and agency programs in this area are coordinated through an office reporting to OSTP. The Nanotechnology Act includes a number of provisions related to societal concerns including 1) that a research program be established on these issues, 2) that societal and ethical issues be integrated into all centers established by the program, and 3) that public input and outreach be integrated into the program. The bill further requires two studies by the National Research Council, one of which is on the responsible development of nanotechnology. Finally, the bill requires a center focused on societal and ethical issues of nanotechnology. PCAST is preparing itself to serve as the Presidentially designated group required by the Act to ensure these issues receive attention. This may seem heavy machinery for a problem that many scientists feel does not yet exist. The point is to act quickly to establish credible approaches to identifying and dealing with potential impacts of nanotechnology to preserve public credibility for this important emerging field.

Other environmental and health issues are even more visible, and more controversial, and many have ethical, economic and international dimensions that go far beyond science. Global change, reproductive technology, and health impacts of chemicals in the environment fall in this category. These are exceptionally important issues and how they are dealt with now will have long-term consequences for our Nation and for the world. I take very seriously the recent statement signed by more than five dozen eminent scientists expressing concern that – to put it in my own words – science in these controversial areas might be undermined by politically motivated actions. This should always be a concern of government as well as of scientists, and throughout history special arrangements have been made to protect the integrity of the scientific process. Not least of these arrangement was the establishment nearly a century and a half ago, of the National Academies of Science, which provides the "gold standard" for technical advice. The National Academies and the panels they form through the National Research Council, have been employed frequently by this Administration.

This is a good occasion for me to state clearly that President Bush believes policy should be made with the best and most complete information possible, and expects his Administration to conduct its business with integrity and in a way that fulfills that belief. As Director of the Office of Science and Technology Policy, I accept the responsibility to hear and respond to issues affecting the integrity of technical advice within this Administration.

Some of the issues raised by the eminent scientists, and in other documents, media reports, and websites, have themselves become subjects of a controversy which I think it is in the best interest of science to get behind us. I cannot guarantee that each of the multitude of daily decisions upon which science policy depends will be made wisely or efficiently, but I can assure you that there is no intention by this Administration to undermine or distort the products of that machinery. My office works with many organizations in science, engineering, higher education, and industry to identify and resolve problems that affect the science and technology enterprise. We are most effective when we have an opportunity to bring parties together to resolve mutual differences and devise corrective measures. I will continue to use my office to fulfill the President's expectations for scientific integrity to the best of my ability.

Meanwhile, some perspective is needed here. We have important work to do, serious challenges to meet, great opportunities to exploit. The intricate machinery of American science is the envy of the world because it works exceptionally well. It does so because the interface between government and the scientific community is broad and robust and remarkably apolitical. It is important to keep it that way.

Priority Highlights

Science policy entails more than setting budgets, but that is a major bottom line of the policy process. I do not have time to review the status of every priority that I have mentioned above, but some highlights are important to capture the flavor of science in this Administration.

Health Sciences Funding during these four years to NIH has increased more than 40%, to $28.6 billion. In response to this unprecedented National commitment, NIH as a whole has adopted an important new roadmap for transforming new knowledge from its research programs into tangible benefits for society. Emerging interdisciplinary issues such as nutrition and aging together with revolutionary capabilities for understanding the molecular origins of disease, health, and biological function will continue to drive change within NIH.

National Science Foundation In four years the NSF budget has increased 30% over FY 2001 to $5.7 billion. Much of this funding has gone to enhance the physical sciences and mathematics programs, where advances often provide the foundation for achievements in other areas, as well as increases to the social sciences and to the NSF education programs.

NASA has increased 13%, largely for exploration science that will spur new discoveries, enhance technology development, and excite the next generation of scientists and engineers. I will say more about the President's new vision for space exploration in a moment.

DOE Science and technology programs have increased 10%, in such important areas as basic physical science and advanced computing. As the agency sponsoring the largest share of physical science, DOE's Office of Science is increasingly viewed as a high leverage area for investment. DOE has engaged in years of intense planning, culminating recently in a multi-year facilities roadmap that assigns specific priorities to a spectrum of new projects.

Energy and Environment This Administration is investing heavily in technologies for producing and using energy in environmentally friendly ways, from shorter term demonstration projects for carbon-free power plants, to the very long term promise of nuclear fusion for clean, scalable power generation. In the intermediate term, technologies associated with the use of hydrogen as a medium for energy transport and storage are receiving a great deal of attention, not only in the U.S. but internationally. The President’s Hydrogen Fuel initiative is a $1.2 billion, five-year program aimed at developing the fuel cell and hydrogen infrastructure technologies needed to make pollution-free hydrogen fuel cell cars widely available by 2020.

Economic Vitality This Administration has also, of course, launched initiatives directly related to the President's priority for economic vitality. The President's tax relief plan includes making the Research and Experimentation tax credit permanent, thereby spurring the sustained, long-term investment in R&D. The President has also signed an Executive Order making manufacturing-related R&D a priority in two complementary Federal grant programs that target small business innovation. The President's initiatives on nanotechnology and information technology have created strong incentives for private sector R&D funding in these areas, and have provided strong intellectual property protections to stimulate innovation and enhance U.S. competitiveness.

Space Science and Exploration The President has committed the U.S. to a long-term human and robotic program to explore the solar system and beyond. Described by the President as "a journey, not a race," this plan differs profoundly from the Apollo paradigm of a single massive project requiring a budget spike and an aggressive schedule. The new vision is sustainable and long-term, balancing robotic and human roles and using a step-by-step approach to address the risks and costs within a steady and realistic flow of resources. The vision also focuses on technology advances that are equally important to progress at home on Earth. Anticipated advances in robotics, human-computer interface, electronic and mechanical miniaturization, and applications of nanotechnology should continue the impressive record of space technology developments that benefit all Americans. Experience with other space programs has shown that a strong, sustained vision for space exploration, with clear and challenging milestones, will inspire future generations of young people to study math, science and engineering.

Conclusion

I have emphasized the strengths of our research enterprise more than its weaknesses, because the strengths dominate. The weaknesses are also well documented, and are receiving a great deal of attention. Among them are our continued reliance on imported intellectual talent for advanced work in science and engineering – a practice that is threatened by changes in our visa practices after 9-11. Improving the visa process by itself, however, will not solve this problem. Deep changes are required to improve educational practice and encourage wider participation in technical fields among underrepresented populations. Another challenge is the shrinking of horizons in industrial research, combined with post cold-war stagnation in funding for research in physical sciences and engineering. These trends have combined to produce gaps in fields that are important for future technologies. PCAST and other advisory boards have examined these issues and recommended courses of action that are reflected today in national budget priorities. There are no magic bullets for these issues, however, and they will not be resolved in a single budget cycle, especially during a time of serious budget constraints.

The United States is investing more in research and development than all other G-8 nations combined. Current priorities for research funds clearly identify fields likely to be important for future economic competitiveness. The quality of research produced by our universities, industrial and national laboratories is unsurpassed by any other nation. As other nations develop their research capabilities, and seek ways to reap economic payoffs from research investments, they emulate our structures and processes, as best they can. As we act to make our system even stronger, let us be proud of the strengths of the United States research and development enterprise.

Thank you for inviting me to speak in this important Forum.