Written Testimony of

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The National Science Foundation and Science Priorities

Chairwoman Hutchison, Ranking Member Nelson, and members of the Subcommittee, thank you for this opportunity to testify on the National Science Foundation's research and education priorities. For over fifty years, NSF has been charged with being a strong steward of the nation's scientific discovery and innovation process that has been crucial to increasing America's economic strength, global competitiveness, national security, and overall quality of life.

For many years, the United States economy has depended heavily on investments in research and development – and with good reason. America's sustained economic prosperity is based on technological innovation made possible, in large part, by fundamental science and engineering research.

Innovation and technology are the engines of the American economy, and advances in science and engineering provide the fuel. This underscores the larger rationale for the President's American Competitiveness Initiative (ACI) – in which NSF will play a significant role. The ACI encompasses all of NSF's investments in research and education.

In short, the NSF mission is to look toward the frontier – to identify the most innovative and promising new research and education projects. NSF specifically targets its investments in fundamental research at the frontiers of science and engineering. Here, advances push the boundaries of innovation, progress, and productivity.

We identify such frontiers by sticking to our proven, "bottom-up" philosophy. The best ideas come directly from the scientific and engineering community. We support workshops, conferences, and symposiums to tap the extraordinary talent of the community in plotting innovative strategies for research and education directions for the future.

Each year, we also see over 40,000 of the best and brightest ideas – which come to us in grant proposals. We engage over 50,000 scientists, engineers and educators in the competitive, merit review of these proposals. All NSF proposals are evaluated through use of two National Science Board approved merit review criteria. In some instances, however, NSF will employ additional criteria as required to highlight the specific objectives of certain programs and

activities. For example, proposals for large facility projects also might be subject to special review criteria outlined in the program solicitation.

Through these processes, which require direct interactions with the scientific and engineering enterprise at large, NSF has an extraordinary impact on scientific and engineering knowledge and capacity – despite the agency's small size. While NSF represents only four percent of the total federal budget for research and development, it accounts for fifty percent of non-life science basic research at academic institutions. We are the second largest funding source for R&D at colleges and universities behind only the NIH, and provide the majority of federal support for basic research at colleges and universities in the social sciences, environmental sciences, non-medical biology, mathematics, and computer sciences.

Moreover, NSF is the *only* federal agency that supports *all* fields of science and engineering research and the educational programs that sustain them across generations. We are among the top three federal funding agencies for nearly every science and engineering discipline, and the third-largest federal sponsor of physical sciences research. Specifically for physical sciences and engineering, NSF funds more than 40 percent of all federally supported academic basic research. These research efforts reach over 2,000 institutions across the nation, and they involve roughly 200,000 researchers, teachers, and students.

We look forward to providing an even greater reach as part of the ACI. As you no doubt know, the President's request for NSF for 2007 is $6.02 billion, or an 8 percent increase over the appropriation enacted last year. This year's requested increase represents the first step in the Administration's firm commitment to double the NSF budget over the next 10 years.

Before I get into the details of our FY 2007 request, let me first expand upon the question of priority setting at the Foundation. Although my testimony above mentions some of the mechanisms for priority setting for NSF – how they are set both across and within accounts and among agency objectives, let me briefly expand upon those points, as this is an excellent starting point for gaining a proper perspective on NSF, because setting priorities is at the core of what we do every day.

The most important source of information for setting priorities comes from the research communities themselves. The research proposals that we receive help identify the leading edge of research and areas ripe for greater investment. The broader research communities also provide continuous input in the form of advice and analyses from myriad National Academy reports, analyses by professional societies, and national and international workshops and conferences. Our Committees of Visitors provide top-to-bottom reviews of existing programs and help formalize research priorities within and across disciplines. Ultimately the priorities reflected in our budget request are refined through consultations with the Deputy Director, the Assistant Directors, the National Science Board, and the Office of Science and Technology Policy. Finally, they are negotiated with the Office of Management and Budget in developing the President's budget request to Congress.

This year's budget request has four priority areas:

(1) Advancing the frontier;
(2) Broadening Participation in the Science and Engineering Enterprise;
(3) Providing World-Class Facilities and Infrastructure; and
(4) Bolstering K-12 Education.

The first of these – *advancing the frontier* – is at the heart of everything NSF does. In a science and technology-based world, to divert our focus from the frontier is to put our nation's global preeminence in science and engineering at peril.

Frontier research is NSF's unique task in pursuing the Administration's research priorities within the larger federal research and development effort. Over the years, NSF has advanced the frontier with support for pioneering research that has spawned new concepts and even new disciplines. The NSF budget provides strong support in fundamental research for activities coordinated by the National Science and Technology Council (NSTC).

For example, NSF is the lead federal agency supporting NSTC's Networking and Information Technology Research and Development (NITRD) program. The '07 budget includes investments of $904 million in NITRD – an increase of $93 million.

A highlight of the Foundation's contribution to NITRD is a $35 million investment – an increase of $10 million – in Cyber Trust. Cyber Trust supports cutting-edge research to ensure that computers and networks that underlie national infrastructures, as well as in homes and offices, can be relied on to work even in the face of cyber attacks. It's part of a larger effort in cybersecurity research, which totals $97 million.

NSF is also the lead in the multi-agency National Nanotechnology Initiative (NNI). NSF's '07 investment in NNI is $373 million, an increase of $29 million. Of that total, $65 million will fund Nanoscale interdisciplinary research teams (NIRTs). These awards encourage team approaches to address nanoscale research and education themes, where a collaborative blend of expertise is needed to make significant contributions.

NSF will invest $205 million – an increase of $8 million – in the interagency Climate Change Science Program. NSF supports a broad portfolio of research activities that provides a comprehensive scientific foundation for understanding climate and climate variability. Climate has a pervasive effect on the U.S. through its impact on natural resources, the economy, and the environment, so this is work of great significance to the nation.

NSF investments in basic research in Homeland Security also increase by $42 million to $384 million. An important new effort will support a program of fundamental research on novel technologies for sensors and sensor systems to improve the detection of explosives, with a particular emphasis on Improvised Explosive Devices (IEDs).

Fundamental research can play a vital role in helping to stem this threat, and at the same time, advance the entire field of sensor research. A focal point of this $20 million dollar activity

will be improving the sensitivity and fine resolution of sensors to recognize threats earlier than current technologies.

The International Polar Year (IPY) in 2007 to 2008 will mark the 50th anniversary of the International Geophysical Year. That was a year in which unparalleled exploration of Earth and space led to discoveries in many fields of science – and we hope to emulate that success. The U.S. vision for IPY, articulated by the National Academies,[1] urges the U.S. scientific community and agencies to participate as international leaders.

The Administration has asked NSF to lead U.S. IPY activities. In 2007, we will invest $62 million to address major challenges in polar research. Key research programs include: Observing Environmental Change in the Arctic; Studying Ice Sheet Dynamics and Stability; and Life in the Cold and Dark.

Recent advances in elementary particle physics strongly suggest that we are on the verge of a revolution in our understanding of the nature of matter, energy, space, and time. NSF will expand its substantial investment in elementary particle physics by $15 million. The opportunities for discovery today are greater than at any point in the last half-century, particularly for the study of dark matter, dark energy, and the physics of the universe.

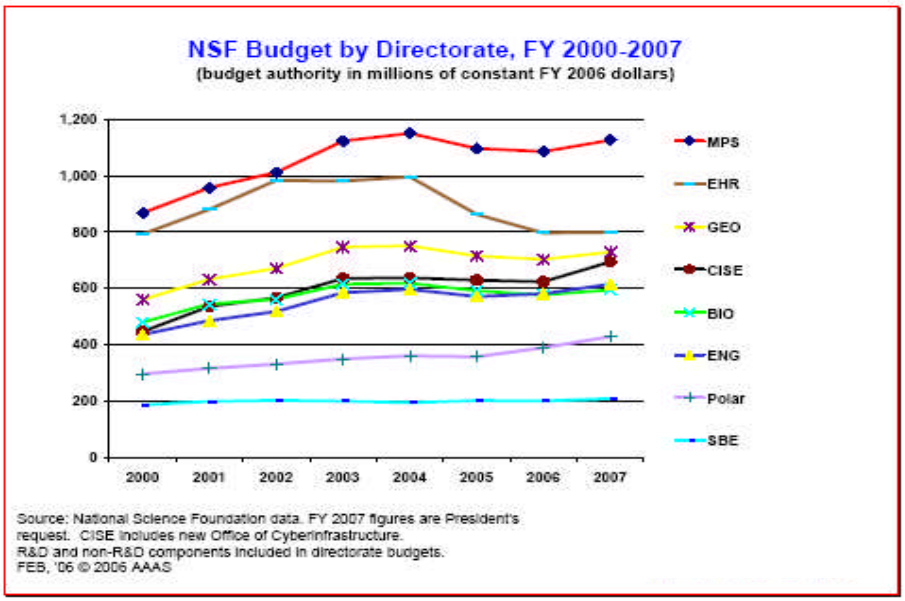
A new research effort to address policy-relevant Science Metrics is funded initially at $6.8 million, through the Social, Behavioral and Economic Sciences Directorate. The goal is to develop the data, tools, and knowledge needed to establish the foundations for an evidence-based science policy. NSF intends to pursue this in close cooperation with other agencies.

To fulfill our ACI obligations, NSF will invest to: (1) generate fundamental discoveries that produce valuable and marketable technologies; (2) provide world-class facilities and infrastructure that will transform research and enable discovery; and (3) help prepare the nation's scientific, technological, engineering, and mathematics (STEM) workforce for the 21st Century while improving the quality of math and science education in America's schools.

In pursuit of these goals, NSF will continue to make major contributions to America's innovation systems by advancing new scientific and engineering concepts. The President's FY 2007 budget for NSF will increase funding for research and related activities by 7.7% to $4.7 billion.

Each of our research directorates would receive increases between 5 and 9 percent after several years of flat or declining funding, enabling them to increase average award sizes, numbers of research grants, and success rates for research grant applications. The increase will also enable the directorates to support as many as 500 more research grants and provide opportunities for approximately 6,400 additional scientists, students, post-doctoral fellows and technicians to contribute to the innovation enterprise.

[1] *A Vision for the International Polar Year 2007-2008*; National Academies Press.



In our efforts to advance the frontier, we also aim to enhance development of the nation's talent pool by integrating research and education. This longstanding NSF practice facilitates the direct transfer of new concepts to the private sector as graduate students involved in discovery enter the work force.

It means, however, providing students with significant research experiences throughout their schooling. The world-class scientists, technologists, engineers, and mathematicians trained in this way can transfer new scientific and engineering concepts from universities directly to the entrepreneurial sector as they enter the workforce. This capability is a strong suit in U.S. competitiveness, and one of NSF's greatest contributions to the nation's innovation system.

As a priority within our overarching educational mandate, NSF will continue to emphasize programs aimed at tapping the potential of those underrepresented in the science and engineering workforce – especially minorities, women, and persons with disabilities. Support for our *Broadening Participation* priority will total over $640 million in '07.

Three highly successful programs form the core of this investment: the Louis Stokes Alliances for Minority Participation, the Alliances for Graduate Education and the Professoriate, and the Centers of Research Excellence in Science and Technology. These programs increase by $16.2 million – or 24 percent.

Broadening participation also applies to institutions. In '07, we will increase efforts to ensure that the U.S. enjoys a strong capability in science and engineering across all regions of the country. NSF will invest $100 million in EPSCoR, the Experimental Program to Stimulate Competitive Research.

Providing World-Class Facilities and Infrastructure is our third priority for 2007. NSF has a long-established role in providing state-of-the-art infrastructure to meet major research

challenges. Our strategy is to invest in tools that promise significant advances in a field of research and to make them widely available to a broad cross-section of investigators.

Total funding in the Major Research Equipment and Facilities Construction (MREFC) account is $240.45 million. This investment funds five on-going projects and two new starts.

Two new projects are the feature attractions of our major equipment investment in 2007: the Alaska Region Research Vessel (ARRV) and the Ocean Observatories Initiative (OOI). Both projects will help to fulfill the Administration's 2004 U.S. Ocean Action Plan, developed in response to the U.S. Commission on Ocean Policy.

ARRV is a ship that will dramatically improve access to Arctic waters. With an operating year as long as 300 days, this ship could accommodate some five hundred researchers and students annually. A variety of complex regional and global ecosystem and climate studies require a technologically advanced oceanographic platform to conduct field research at the ice edge as well as in ice up to three feet thick.

OOI is an integrated observatory network, distributed among coastal and deep-sea sites that will help advance our understanding of oceanographic and geological features and processes. With these fundamentally new tools for local, regional and global ocean science, researchers and students will now have continuous, interactive access to the ocean.

As our facilities increase in sophistication and capability, so does the amount of data they produce. The sheer volume of information is overwhelming our current computational capacity.

Cyberinfrastructure is likely to be a key factor in addressing this problem – and also in establishing and continuing global research excellence for many years to come. That makes it a significant NSF priority. In 2007, funding for cyberinfrastructure research and development will reach $597 million – an increase of $77 million, or 15 percent.

NSF will invest $50 million to begin the acquisition of a leadership-class high performance computing system. This will be our first step on the road toward computation and data processing for petascale-level science and engineering. It will be a major milestone in NSF's multi-year plan to provide and support a world-class computing environment that will make the most powerful high performance computing assets broadly available to the science and engineering community.

I come to the last, but not least, of NSF's four priorities for '07: *Bolstering K-12 Education.* Today's youngsters face a world of increasing global competition. We depend on the excellence of U.S. schools and universities to provide them with the wherewithal to meet this challenge and to make their own contributions to America's future.

We clearly need to do more to build strong research foundations and foster innovation in K-12 science and mathematics education.

In line with Administration's focus on this vital national priority, NSF will invest $104 million in a new effort named Discovery Research K-12 that aims to strengthen K-12 science, technology, engineering, and mathematics education. We will refocus our efforts on a vital cluster of research in three well-defined grand challenges: (1) developing effective science and mathematics assessments for K-12; (2) improving science teaching and learning in the elementary grades; and (3) introducing cutting-edge discoveries into K-12 classrooms.

We will also increase funding for the Graduate Teaching Fellowships in K-12 Education – better known as GK-12 – by nearly 10 percent to $56 million, supporting an estimated 1,000 graduate fellows. By pairing graduate students and K-12 teachers in the classroom, this program has been particularly successful in encouraging effective partnerships between institutions of higher education and local school districts.

Today, I have only been able to scratch the surface of the FY 2007 priorities. With the first installment of the ten-year commitment to double NSF's budget, we will be able to capitalize on the many areas of emerging promise already on the horizon.

That means generating quality programs year, after year, after year—and continuing to lead the federal momentum toward more robust business practices as we put tax dollars to work for the nation. NSF is one of three agencies recognized as models of excellence in Grants Management, and we will continue that tradition.

The President's commitment to doubling the NSF budget will allow NSF to concentrate its vision on the frontier and on the talent needed to keep us there. For the foreseeable future, the scientific and engineering community at large must work in a larger global context includes an increasing international competition, a deepening globalization, and an escalating demand to meet long-standing social needs.

Our priorities and programs at NSF have been shaped by our country's grassroots experts through decades of peer-reviewed, merit-based research. Our 50 years of basic research investments – in discovery, learning, and innovation – have a longstanding and proven track record of boosting the nation's economic vitality and competitive strength.

Madam Chair, I hope that this brief overview of NSF's priorities conveys to you NSF's commitment to advance science and technology in the national interest. I am very appreciative of the Subcommittee's long-standing bipartisan support for NSF, and I would be happy to respond to any questions that you have.