STATEMENT OF PETER A. FREEMAN

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HEARING ON

INNOVATION AND INFORMATION TECHNOLOGY: THE GOVERNMENT, UNIVERSITY AND INDUSTRY ROLES IN INFORMATION TECHNOLOGY RESEARCH AND COMMERCIALIZATION

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Austin, Texas

Good afternoon, Mr. Chairman and members of the Committee. I am delighted to have the opportunity to talk with you today about research partnerships in information technology and the contributions of NSF-supported research to U.S. competitiveness, both now and in the future.

I am Peter Freeman, Assistant Director of the National Science Foundation for Computer and Information Science and Engineering, and I head one of the seven directorates of NSF. In my remarks today, I will draw upon perspectives I have developed over my forty-five years in the IT field – in industry, academe, and government. As a Texan, that career started at Rice and began to mature here in Austin where I did my Master's degree. I consider myself extremely fortunate to have been party to the birth of computer science as a field – both here and at Carnegie Mellon University where I was in the first entering Ph.D. class. Since then, I have taken great pleasure in participating in the transformation of our society that research advances in IT have delivered. My position today at NSF provides me with both a domestic and an international vista on IT research and education, and its impact on a global scale.

I will focus my remarks today on four important areas: How NSF investments in information technology research promote innovation in IT and foster the development and commercialization of new applications. How NSF works with industry to support IT research. How NSF facilitates the use of research it supports in the commercialization of new products. And finally, how the topics and types of NSF programs in IT research complement investments made both by other federal agencies and by industry research programs.

The importance of IT research in contributing to growth in the economy is indisputable. Recent economic analysis tells us that the remarkable growth the U.S. economy experienced between 1995 and 2000 was spurred by an increase in productivity enabled almost completely by factors related to IT. In fact, productivity in the US has increased by an average of over 3.1 per cent a year since 1995. This progress is attributed to several factors: innovation in IT products, and, equally importantly, innovation in IT services that allow organizations to engender complementary innovations, such as changing business processes, workflow design, decision-making structures, interactions with suppliers, and customer relations. Increasingly, studies show that investments in IT AND changes in organization and work practices contribute to an enterprise's productivity growth and in the commercial sector, its market value.

One need look no further than the city of Austin to see how a research university with a major IT focus can have an impact on innovation and economic growth. The presence of the University of Texas at Austin was important in bringing the Microelectronics and Computer Technology Corporation (MCC) here in the 1980's. The MCC, first created to protect US interests in the computer market against foreign consortia, spawned a broad range of start-ups and attracted

high-profile corporations creating IT products that triggered the economic boom that has helped make Austin the dynamic city it is today.

Our nation's strong economic position in IT today is due largely to the fact that starting in the late 1950's we have been making critical investments in fundamental research. Let's look at a case in point – one I am sure you are familiar with - Google. In less than a decade, Google has revolutionized the way the world accesses information. It has also become a corporate powerhouse. On March 31, 2006, Google reported revenues of $2.25 billion for the quarter ended March 31, 2006, an astounding increase of 79% compared to the first quarter of 2005. Google's co-founders, Larry Page and Sergey Brin, while supported by an NSF-funded project on digital libraries at Stanford University, developed a new approach to online searching that quickly spread to information seekers around the globe. Google is now widely recognized as the world's largest search engine -- an easy-to-use free service that returns relevant results in just a fraction of a second. Who would have predicted that an investment totaling just thousands of federal research dollars would create a multi-billion dollar a year market and a service that has revolutionized the management of digital information.

As we look to the future, we must ask ourselves – what new products and services are out there on the horizon, but are not yet identified for the want of investments in basic research in IT. It is imperative that we make a robust and sustained commitment to the type of investments that a decade and more ago produced most of the fundamental concepts that fuel today's IT innovations.

NSF's CISE directorate is now the principal source of federal funding for university-based basic research in computer science, providing 86 percent of total federal support in this area. Now more than ever before, our nation's future is dependent upon NSF's support for fundamental research in IT. The fundamental research that is supported today will be enjoyed by and enhance the quality of life for generations to come.

To accelerate the transition of basic research outcomes into technological innovations that seed market competitiveness, NSF works closely with its partners in academe and industry.

For example, CISE supports nine IT-oriented Industry/University Cooperative Research Centers (I/UCRCs), a well-established and exceedingly successful program at NSF. I/UCRCs develop long-term partnerships among industry, academe, and government. The centers are catalyzed by a small investment from NSF, with the majority of research support provided by industry center members. CISE-supported IUCRC's focus on areas such as cybersecurity, a grave concern of this committee, e-design manufacturing, search and rescue robotics that contribute to homeland security, and wireless technologies. Each of these I/UCRC's contributes to the Nation's IT research base and enhances the intellectual capacity of the IT workforce through the integration of research and education, while simultaneously speeding the movement of research outcomes into the marketplace.

NSF also directly invests in IT research in the small business community, through the agency's Small Business Innovation Research (SBIR) program. To cite one example right here in Texas, NSF is supporting a research project conducted by a company in Dallas - Potential Research Solutions. They are developing new oil and gas reservoir IT management tools to optimize

hydrocarbon recovery. Powerful analytic tools have been developed that provide robust solutions of fluid flow problems with complex, heterogeneous rock properties. This is an industry first, providing the ability to generate a brand new line of desktop hydrocarbon reservoir management tools. In particular, the results of this project will provide software and services to optimally locate new wells within existing hydrocarbon reservoirs.

Having provided examples of industry-university partnerships already in place, I'd like now to turn my attention to a new activity that promises exceptional opportunities in the future.

CISE has recently called upon the broad IT research community, including academe and other private and public organizations, to form a community proxy necessary to guide the development of a major new opportunity in IT – a research facility concept called the Global Environment for Networking Innovations (GENI). As currently conceived, the GENI facility will provide IT researchers with the tools to explore transformational networking and distributed system architectures and services that will simultaneously advance science and stimulate innovation and economic growth. We hope GENI will increase the quality and quantity of experimental research outcomes supported by CISE, and to accelerate the transition of these outcomes into products and services to enhance economic competitiveness and secure the Nation's future. In planning for GENI, we are working with industry, other U.S. agencies, and international groups. GENI is the first in what we hope will be a series of major efforts to reinforce fundamental research at scale in the computer science field.

Having provided some examples of the IT research supported by NSF with the significant engagement of the private sector, I'd like to speak briefly to our interactions with colleagues in other federal agencies.

NSF's investments in IT research are made in coordination with our sister agencies. Coordination is enabled through the National Coordination Office for Networking and Information Technology Research and Development which reports to the Office of Science and Technology Policy and the National Science and Technology Council (NSTC). NSF plays a leadership role in NITRD activities, and I personally co-chair the NSTC's interagency NITRD subcommittee. As the focal point for coordination and policy development for the interagency federal IT research and development program, NITRD activities foster collaboration among federal agencies, university researchers, industry, and other members of the IT community. For example, NSF and the Departments of Energy and Defense have been making coordinated investments in fundamental research essential to the development of high performance computing software and tools. A study currently being conducted by the Council on Competitiveness with NSF and DOE support identifies five grand challenges in the oil and gas, chemical, and auto industries that provide concrete and quantifiable assessments of the economic benefits of high performance computing-driven innovation, describing some of the "what if" questions that high performance computing can address and the new opportunities for economic growth it can create. This is but one area of many in which agencies are working together to add value to the cumulative federal investment in IT research.

In my testimony today, I've tried to provide examples of the ways in which NSF works with its partners in the private sector and in government to stimulate economic prosperity. This

Committee clearly recognizes the importance of innovation to the vitality of our economy. The President's *American Competitiveness Initiative* (ACI) also quite rightly points out that our Nation's continued ability to lead in research is essential to maintaining a competitive edge in a global economy. With robust, sustained support for fundamental research in both the executive and legislative branches, we have a unique opportunity to strengthen our nation's investments in fundamental IT research, thereby securing our nation's economic future for many decades to come.