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Letter to the President about PITAC's upcoming interim report on a national research program in information technology, (June 3, 1998)

## **Report to President Clinton on Information Technology**

June 3, 1998

President William J. Clinton  
The White House  
1600 Pennsylvania Avenue  
Washington, DC 20500

Dear President Clinton:

Last year you asked our Committee to provide advice about the direction of the national research program in high performance computing and communications, information technology and the Next Generation Internet. We shall refer to these programs collectively as "information technology." We are developing a report evaluating the effectiveness of federal funding of the information technology research endeavor. We expect to deliver an interim version of that report by July. Here we summarize its most salient points.

In the past, sound federal R&D investment strategies carried out over long periods of time have laid the foundations for dramatic advances in many diverse areas including farm production, aeronautics, space, and health disciplines. Similarly, the funding for federal R&D in information technology has been instrumental in creating the boom in computing and communication which is responsible for much of the current national economic growth as well as for major advances in health care, public safety, and other critical areas. This relationship between information technology research and economic prosperity a decade later has been clearly documented by the Brooks-Sutherland report, "Evolving the High Performance Computing and Communications Initiative to Support the Nation's Information Infrastructure" (NRC 1995).

We are concerned, however, that over the past decade federal funding for information technology research has focused increasingly on short-term results at the expense of long-term, high-risk investigations. There are two reasons for this. First, most of the funding for information technology research lies in federal agencies for which information technology is a secondary concern, subordinate to the primary mission. Second, the total amount of funding is so limited relative to the need that these

agencies are forced to make priority decisions that favor the immediate challenges. If left unchecked, this trend away from innovative, long-term research in information technology will interrupt the flow of ideas that are needed to fuel the information economy and solve critical national problems.

To secure the nation's future prosperity and the health and welfare of its population, we must continue to make rapid progress in information technology research and development. If federal R&D activity in information technology is allowed to stagnate, not only will we fail to sustain the growth we have enjoyed over the past decade, we will postpone the solution of problems of critical national importance. To ensure that this does not happen, we recommend that over the next five years federal funding for information technology R&D be doubled or better, from one billion dollars per year to two billion or more. For this increase to be effective, the research and development investment must be creatively managed to ensure that sufficient attention is given to innovative, long-range projects and that the effort remains focused on information technology broadly defined rather than on support for specific applications.

Our report summarizes many areas of computing and communications that could make dramatic strides forward with increased support for long-term research. Three topics of particular importance are:

- Methods for efficiently creating and maintaining high-quality software of all kinds and for ensuring the reliability of the complex software systems that now provide the infrastructure for much of our economy.
- Techniques for ensuring that the national information infrastructure -- communications systems, the Internet, large data repositories, and other emerging systems -- is reliable and secure, and can grow gracefully to accommodate the massive numbers of new users and applications expected over the coming two decades.
- Continued invention and innovation in the development of fast, powerful computing systems and the accompanying communication systems needed to implement high-end applications ranging from aircraft design to weather and climate modeling.

Increasing research funding will help to address another problem faced by the nation and discussed at length in our report -- the shortage of high-technology workers. To increase the number of computer science bachelor's graduates significantly, we need more faculty members. To increase faculty sizes, we need to produce more Ph.D. computer scientists. We cannot do that without increasing the number of students entering graduate school or recruiting a larger percentage of those students into academia when they finish. Although salary is a major factor in a student's decision not to go to graduate school, an equally important factor is the perception that universities are no longer the place where the most exciting work is being done. It is likely that substantial increases in funding for long-term research would change that.

Although investment in long-term research in universities educates future information technology professionals for careers in academia, industry and the public sector, it cannot by itself solve the current serious shortage of skilled workers. New programs are needed to educate more people with these skills, to re-train information technology workers whose skills have become outdated, and to ensure adequate participation by

women and minorities. We also need to ensure that every American emerges from school with the skills needed to prosper in an information-rich society.

Not only is the overall level of funding for information research inadequate, but the current system for managing information R&D is not appropriate to the task. In the past information technology has been considered largely the byproduct of research in other areas and increasingly has been combined with programs whose primary function has been to fund infrastructure and technology transfer. This must change if we are to make progress on fundamental problems in computing and communications. We recommend developing a new approach to management of civilian information technology R&D with the goal of providing adequate levels of multi-year funding to pursue longer-range research agendas. Both large multi-investigator projects, such as centers, and smaller efforts involving a few researchers should be supported. While the new program should be responsive to application needs, it must have information technology as its fundamental objective. Moreover, the program needs to be managed in a way that allows greater flexibility and more risk-taking.

The U.S. is approaching the 21st century with one of the most prosperous economies in history. Information technology presents enormous opportunities for growing the economy and improving health care, education, public safety, the environment, and many other areas of importance to the nation. To capitalize on these opportunities, we should be increasing, not reducing federal investments in this critical area. We urge you to take steps now to ensure that the nation continues to enjoy the fruits of the current boom in high technology.

Respectfully,

Bill Joy  
Co-Chairman

Ken Kennedy  
Co-Chairman

Presidential Advisory Committee on High Performance Computing and  
Communications, Information Technology, and the Next Generation Internet