U.S. House of Representatives
COMMITTEE ON SCIENCE & TECHNOLOGY

Hearing on

Impact of U.S. Export Control Policies on Science and Technology Activities and Competitiveness

Testimony of

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Mr. Chairman and distinguished members, thank you for taking up this very important topic and for your invitation. I am honored to be sitting with two very distinguished co-panelists, Gen. Scowcroft and Mr. Young.

I am Vice President for Research at MIT and a space scientist. For over 35 years I have designed, built and used space instrumentation for scientific research. Although I represent the university community on this panel, I also have experience with matters of national security. I have served on the Scientific Advisory Board of the U.S. Air Force, and I currently

oversee MIT's Lincoln Laboratory, a facility that does classified national security research. I am also a Director of L-3 Communications, a Fortune 200 corporation. And I was privileged to contribute to the recently released National Academies' report "Beyond Fortress America," summarized by Gen. Scowcroft. My testimony is based in part on that report.

Allow me to begin by quoting one sentence: "The strength of American science requires a research environment conducive to creativity, an environment in which the free exchange of ideas is a vital component." [National Security Decision Directive 189, 1985]

This sentence comes from President Ronald Reagan's National Security Decision Directive 189. NSDD 189 establishes as national policy "that, to the maximum extent possible, the products of fundamental research remain unrestricted."

Reagan's NSDD 189 was promulgated in 1985, reaffirmed in 2001, and is still in force today. It provides the basis for the so-called Fundamental Research Exclusion embodied in current export control regulations in order to protect the enormous benefits derived from the "free exchange of ideas."

Our report finds that freedom of scientific inquiry and the free exchange of technical information are even much more important now than they were over 20 years ago when President Reagan signed his directive.

Let me cite four points:

First, whatever dominance we might have enjoyed in our scientific leadership in 1985, we are now one among many international players in nearly every technical field. In my own discipline of physics, both the world's biggest fusion energy facility, ITER, and the most powerful particle accelerator, the Large Hadron Collider, are located abroad. In our own, U.S. Physics journals in 2006, 70% of the publications now come from international authors – ten years ago it was 50%. In 2006 international inventors accounted for one half of the patents filed with the U.S. Patent Office [*Beyond Fortress America*; p 30]. No doubt both figures are higher now.

Second, even within our borders, a significant fraction of our scientific and engineering workforce comes from overseas. "The percentage of science and engineering workers in the U.S. who are foreign nationals increased from 14% to 22% from 1990-2000. In 2006 more than half the doctorate-level graduating engineers in the United States were foreign-born, as were 45% of the PhD recipients in the physical sciences, computer sciences, and life sciences" [*Beyond Fortress America*; p. 34].

Universities, like MIT, are international melting pots. Roughly 1/3 of MIT's current faculty were born outside the US. Forty percent of MIT's 6000 graduate students are international, and each year approximately 1600 international scholars bring their skills to MIT.

Third, thanks to the internet, both the *pace* and *geography* of scientific communications have exploded since 1985 – the *pace* is now *instantaneous*

and the *geography* is *global*. This rapid and pervasive interchange of ideas and innovation fuels remarkable advances. For example, the information technology revolution of the 1990's was a significant factor in fueling a remarkable 3% annual growth in U.S. productivity.

My fourth point is to suggest that, in the present national security and economic climate, a vigorous and innovative research community is more important than ever.

Universities are the primary performers of basic research in the U.S., and they are also the source of our future scientific and technical workforce. This human and intellectual capital is essential contributors to the national security and economic prosperity of the United States.

As a measure of economic impact, MIT research results in roughly 125 licenses for new technology and spawns 20-25 new start-up companies each year. A great many more companies, nearly 1,000, are founded each year by MIT alumni. A Kauffman Foundation report on MIT Entrepreneurship released last week gives a conservative estimate that if a nation were formed from the active companies founded by MIT alumni, it would have the 17th largest economy in the world. The real number is plausibly higher: 26,000 MIT alumni-founded companies employing over 3 million workers with annual world revenues over $2 trillion, comparable to the 11th largest nation's economy. Interestingly, half the companies formed by our non-U.S.-citizen alumni are located in the U.S., employing over 100,000 people [Roberts & Eesley, *Entrepreneurial Impact: the Role of MIT*, Kauffman Foundation, 2009]. Nationwide, roughly two-thirds of

internationals receiving PhD's in the U.S. stay in our country [*Nature* Vol 457, p. 522, 2009].

For universities, the primary area of concern regarding export controls involves restrictions on the sharing of technical data and information about controlled items with non-U.S. persons *within* the U.S. or abroad. These are often referred to as "deemed exports." There has always been considerable ambiguity around how or when NSDD 189's protection of fundamental research applies and whether – despite clear language to that effect in NSDD-189-- it covers the conduct as well as the products of research. Moreover, because the exclusion applies to universities, it does not facilitate interactions between universities and industry or national laboratories.

So, despite a Presidential directive protecting fundamental research, export controls continue to inhibit, retard or eliminate research projects that do not involve militarily relevant technology. Just last year one MIT research group abandoned a fruitful international space astronomy mission because of export-control impediments. The foreign partners are proceeding with out us, thereby leaving us out of the advances in science and technology they will be making on their own. Many more projects have been delayed by many months as control issues are sorted out. One colleague, leader of a major NASA mission, had to wait 18 months for a Technical Assistance Agreement so her French graduate student could access Mars data from a NASA computer system. There are hundreds of such stories of "sand in the gears" from export controls [e.g. see *Space Science and the International Traffic in Arms Regulations: A Workshop*, National Academies Press, 2008; *The Deemed Export Rule in the Era of*

Globalization, Department of Commerce, 2007; *Science and Security in a Post 9/11 World*, National Academies Press 2007].

A major difficulty is the broad scope of the export control regulations. For example, the State Department controls virtually all spacecraft systems, associated equipment and data, regardless of their actual military utility. And both State and Commerce often control technologies that are widely available outside the U.S. For many categories of the Commerce Control List, 1/3 to ½ of the items are controlled only by the U.S. [*Beyond Fortress America*; p. 34 p. 86]. And most importantly, none of the other countries has a provision comparable to our deemed export regulation [*The Deemed Export Rule in the Era of Globalization*, Department of Commerce, 2007, p. 6].

Several positive actions have been taken in recent years. The Department of Commerce formed the Deemed Export Advisory Committee (DEAC) and the Emerging Technology and Research Advisory Committee (ETRAC), on which I serve. And last June, Undersecretary of Defense John Young reaffirmed the fundamental research exclusion in DOD sponsored activities. But when I recently asked a senior Pentagon official if the John Young letter was having an effect, he replied that it was "too soon to tell."

Our report suggests that a more systematic and fundamental change is required, to move from a philosophy of *containment* and *retrenchment* to one of *prudent engagement*.

As Gen. Scowcroft describes, *Beyond Fortress America* recommends maintenance and proper implementation of the Fundamental Research Exemption. Proper implementation is critical, as numerous forces continue to eviscerate the spirit and letter of Reagan's NSDD 189. We also recommend the creation of an Economic Competitiveness Exemption to eliminate controls on dual-use technologies that are readily available outside the U.S. And we recommend steps for adjusting visa policies that will enhance our access to the reservoir of human talent in science and technology from foreign sources.

Your invitation, Mr. Chairman, asked me what your committee might do to address the negative effects of export controls. Allow me to respectfully suggest that this committee, through its oversight of key science agencies, could play a very important role by endorsing the change in philosophy as well as the detailed recommendations in our report, and by mandating that each federal agency under your oversight must formulate, implement a plan to carry them out and report to you on its progress.

Thank you for your attention.