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THE IMPACT OF U.S. EXPORT CONTROLS ON NATIONAL SECURITY, SCIENCE AND TECHNOLOGICAL LEADERSHIP

HEARING

BEFORE THE

COMMITTEE ON FOREIGN AFFAIRS
HOUSE OF REPRESENTATIVES

ONE HUNDRED ELEVENTH CONGRESS

SECOND SESSION

JANUARY 15, 2010

Serial No. 111–80

Printed for the use of the Committee on Foreign Affairs

Available via the World Wide Web: http://www.foreignaffairs.house.gov/

U.S. GOVERNMENT PRINTING OFFICE

54–471PDF WASHINGTON : 2010

For sale by the Superintendent of Documents, U.S. Government Printing Office
Internet: bookstore.gpo.gov Phone: toll free (866) 512–1800; DC area (202) 512–1800
Fax: (202) 512–2104 Mail: Stop IDCC, Washington, DC 20402–0001

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THE IMPACT OF U.S. EXPORT CONTROLS ON NATIONAL SECURITY, SCIENCE AND TECHNOLOGICAL LEADERSHIP

FRIDAY, JANUARY 15, 2010

HOUSE OF REPRESENTATIVES,
COMMITTEE ON FOREIGN AFFAIRS,
Washington, DC.

The committee met, pursuant to notice, at 10:30 a.m., at Stanford University, Arrillaga Alumni Center, First Floor, 326 Galvez Street, Palo Alto, California, Hon. Howard L. Berman (chairman of the committee) presiding.

Chairman BERMAN. To everyone, good morning. And to those who may be watching these proceedings in Washington via the Internet, good afternoon.

Today's hearing is on the impact of U.S. export controls on our Nation's national security and our leadership in science and technology. We are holding it here in Silicon Valley because no State is more heavily affected by export controls than California—with our cutting-edge high technology industry, academic institutions and scientific and research establishments—and no region of the State has more experience with such controls than this one.

We are very grateful to Stanford University—and most especially to Dr. Hennessy, one of our witnesses—for hosting these proceedings and for all of the technical and logistical support they provide to make this day possible.

For the benefit of the people who are new to the subject, let's start with defining our terms. Through export controls, the Federal Government restricts the international transfer of what are called "dual-use" technologies—those that have legitimate civilian uses but also can be used for military purposes. This is a critical aspect of our national security policy.

But there is a growing consensus among security experts as well as academics and industry leaders that our current system of export controls needs to be updated in order to continue protecting sensitive technologies while also maintaining U.S. technological leadership.

So this hearing serves at least two related purposes. The testimony will help our committee prepare for a complete revision of the statute that authorizes our system of licensing and controlling dual-use technologies. And what we learn today will contribute to congressional oversight of the export control policy review that President Obama has ordered, and that is now underway.

Joining us on the dais today is a valued member of the committee for many years, Dana Rohrabacher from Southern California, who brings both a background and deep interest in national security issues but also many years of experience on the Science and Technology Committee in the House and a great interest in those issues as well; and Zoe Lofgren, who is the chair of the California Democratic congressional delegation and certainly familiar to people from this particular area and who, in fact, I remember back—it seems like 8 or 10 years ago—being heavily engaged in one aspect of this in the encryption issue; and Anna Eshoo, in whose district Stanford University is located and who is chair of the Intelligence Community Management Subcommittee of the House Permanent Select Committee on Intelligence, as well as many other things. So great interest and background for all of the people who are on the panel today.

While neither Zoe nor Anna are members of the Foreign Affairs Committee, they are highly interested in the issue. And given the nature of this as a field hearing, I have invited them to participate as if they were members of the committee.

Export controls don't get a lot of public or media attention. They have been an important part of the U.S. national security establishment since 1949, when our current control system began as a part of NATO.

Here in California, many of our 61,000 exporting firms, such as Applied Materials in Santa Clara, and an increasing number of our academic and research establishments, such as Stanford, have significant compliance responsibilities.

You practically have to have a Ph.D., or a law degree—or maybe both—in order not to run afoul the increasingly complex U.S. export control regimes. The regulations now fill more than 2,000 pages. There are frequent changes—two dozen were announced last year alone. More than 2,600 items and technologies are subject to controls, just in the dual-use area.

Exporters and universities are required to check six separate lists of potentially dangerous individuals and groups, with thousands of entries, before allowing access to controlled goods and technological information.

In many cases, government approval is required, and the growth rate in applications and approvals of licenses is phenomenal: 21,000 licenses were issued in 2008; double the number from 10 years ago.

Universities and other research institutions face a particular set of compliance challenges, as the U.S. moves to broaden and tighten the rules governing access by foreign students and researchers to science laboratories and research facilities.

These rules, aimed at regulating the transfer of technological knowledge—as opposed to goods—increasingly are affecting our high-tech companies as well.

Moreover, the worldwide diffusion of sensitive goods and technological knowledge has a significant impact on national security. These are the same technologies that drive scientific advances and commercial progress.

Examples: Thermal imaging cameras are being used in the latest collision avoidance systems for vehicles, while remaining a key ad-

vantage for our forces on the battlefield; encryption is an important defense for individuals, companies and governments against cyberwarfare and cybercrime—this has been in the news lately—while at the same time shielding communications among terrorists from interception by law enforcement authorities; commercial software reportedly is being used to defeat our unmanned drones in Afghanistan; bioengineering and nanotechnology carry the promise of prolonging life and curing disease, but can also be turned to designing a new generation of bioweapons. These are just four examples; there are countless others.

This area of public policy raises complex questions—and there are no easy answers. Clearly, our national security requires a continued effort to prevent our adversaries from misusing the benefits of science and industry against us and our allies.

But just as clearly, we need to refine and update our export control policy and attendant regulations to sustain America's leadership in scientific research and discovery, and technology-driven industry. That, too, is part of protecting our national security.

Our committee, the Foreign Affairs Committee, is beginning the process of trying to enact a new statute to be the foundation in this area for U.S. policy. And today's hearing is in some ways the first formal step in that process.

I now would like to yield to my friend and colleague from the committee, Mr. Rohrabacher, for any opening comments he may wish to make.

Mr. ROHRABACHER. Thank you very much, Mr. Chairman. And, although there seems to have been a snafu caused by the holiday and communication between the Republican staff and the Democratic staff, I am sure that that will be corrected and more care will be taken. But I am very pleased to be here today to represent the Republican side of this issue. Although this is an issue that doesn't have, really, Republican and Democrat sides, it basically is an issue among all of us Americans about what standards we are going to have.

So it is appropriate we have a hearing on export control here in Palo Alto, which, of course, has been the seed bed for technological innovation in our country. No doubt we hold this hearing for the reason that current export control regime regulations are a serious impediment to much of the work that is being done here.

Let me state at the outset that I support export control reform. I support streamlining the system. I support removing barriers that hamstring U.S. companies. However, this reform needs to reflect the fact that there are nations who seek to do harm to both our national well-being and as far as our economic security as well.

There are nations that are controlled by repressive and dictatorial governments which are hostile to the United States and to the democratic ideals that we represent. These nations should not benefit from any reform of U.S. export control laws.

I strongly believe in free trade between free people, but trade with dictatorships almost by definition is trade that is manipulated, at least on one side of the equation. That would mean that it might end up being harmful to the United States economically as these repressive regimes manipulate the rules of the game on their end of the equation so that it helps their economy as com-

pared to mutually beneficial trade, but also they manipulate it in a way in which they can receive the benefits of technological research that has taken place in the United States and now will be put to use benefitting not only their economy but their military power as well.

I strongly support, then, a two-tiered system that rewards our allies and other democratic countries while keeping dictatorships and other rogue regimes at arm's length.

I would like to place in the record at this point some information from U.S. economic China report and studied review by commission report that was frequently issued, which talks about how China, in particular, has manipulated our trade and gotten their hands on technology and has been abusive to some of the standards that we would think are essential to providing guarantees that our country is not hurt by such trade.

Chairman BERMAN. Without objection, that will be included in the record.

[The information referred to follows:]

2009 US-China Security and Economic Review Commission Report
(Excerpt from pages 66-69)

Technology Transfers

The development of new and advanced technologies is paramount for staying competitive in manufacturing. China has been particularly successful in utilizing joint manufacturing ventures and joint research efforts to achieve technology transfers. Since the early 1990s, when China began aggressively to promote domestic technological innovation, it has developed policies to encourage technology transfers.278 Some of the early approaches that China used included setting requirements for foreign companies to donate equipment and to establish research labs.279 The United States recognized the danger of such transfers when it negotiated with China in the late 1990s on the terms of China's eventual 2001 entry into the WTO. In its WTO accession agreement, China was required expressly to forgo any forced technology transfer arrangements with foreign companies. (For more on the transfer of research labs by U.S. companies to China, see chap. 1, sec. 4.)

Despite such commitments, China has insisted that portions of commercial passenger jets be manufactured and assembled in China as a condition for purchasing them, a practice known as ''offsets.'' A key objective for China is acquiring technology from American and European aerospace companies so that it can independently manufacture its own aerospace products. (For further discussion of this issue, see the Commission's 2008 Report to Congress.)

As a result of these efforts, in June 2009 Airbus delivered its first commercial jet fully made in China. Airbus is expecting that China will need more than 3,200 passenger planes in the next 20 years, valued at almost $400 billion, an order book that Airbus certainly took into account when deciding to shift final assembly to China.280 In addition, AVIC, the state-owned Chinese aerospace company, has produced a regional jet for commercial sale that was developed with the benefit of technology and other assistance from western companies. In May 2008, Premier Wen Jiabao was reported to have said, ''This is the dream of several generations, and we will finally realize it. We should rely on ourselves to build the large planes' main technologies, materials, and engines.'' 281

General Market Conditions that Favor Relocation to China

This section describes three elements of China's industrial policy: (1) low wages and unfair labor standards, (2) lax enforcement of environmental protection laws, and (3) the manipulation of its exchange rate regime. China has made it profitable for companies from around the world to move production facilities to China and more recently to expand research and development there as well.282 ''In particular,'' said Ralph E. Gomory, a research professor

at New York University's Sloan School of Business, ''China is wisely exploiting the fact that the capabilities of today's global corporations are available to the bidder who offers the highest profit.'' The result has been to create jobs in China, particularly in export industries.

China's Low Wages and Unfair Labor Standards

Unions and worker rights organizations have complained that Chinese companies do not pay their employees even the Chinese minimum wage levels. Employers also withhold promised health benefits from employees and subject employees to forced labor.283 Last year, however, the Chinese government implemented a new labor law intended to combat forced labor, withholding of pay, and other abuses by providing for formal contracts and severance pay.284

Although the text of the new labor law seems to address the persistent injustices, the law's implementation and enforcement have been spotty.285 The major deficiency of the new labor law is the continued restriction on union organizing and collective bargaining. According to the Congressional-Executive Commission on China, the labor contract law does not include provisions to guarantee equal bargaining power between workers and employers. Because there is only one legal trade union in China (the All-China Federation of Trade Unions), which is required to ''uphold the leadership of the Communist Party,'' all the trade unions remain under the control of management.286

This new labor law provoked an outcry from some business organizations representing foreign-invested enterprises. They claimed that the legislation would drive up costs and make doing business in China more difficult.287 The American Chamber of Commerce in Shanghai complained that the law ''could have a negative impact on the investment environment in China,'' while the European Union Chamber of Commerce argued that ''the rigid provisions of the draft law will restrict employer flexibility, and ultimately will increase costs for Chinese producers.'' 288

China's Lax Enforcement of Environmental Protection Laws

China is rapidly becoming one of the most polluted countries in the world.289 Although China has some strict environmental laws on the books, the fines that can be levied to enforce the regulations are so insignificant that they are seen merely as a cost of doing business rather than a true deterrent.290 Furthermore, the Chinese state environmental protection agency is critically understaffed; it has 300 employees compared to the U.S. Environmental Protection Agency's 20,000 employees.291

China's weak enforcement provides a variety of cost advantages to both domestic and foreign industries. Companies operating in

China can save money by not providing protective equipment for workers, by not investing in expensive pollution control technologies, and by not properly disposing of their waste.292 Furthermore, some of China's pollution also reaches the United States, as the Commission heard during its 2008 hearing on China's energy policies and their environmental effects. U.S. scientists on the West Coast have used a variety of tools to trace the flow of air pollution from Asia (including China) and have found that air pollutants such as ozone and mercury do reach the United States and degrade air quality. (For further information, see the Commission's 2008 Report.)

The Chinese government acknowledges its environmental problem and has adopted the related goals of protecting the environment and shifting to cleaner energy sources. However, China's industrial policy continues to promote investment in energy-consuming production activities.293 For example, Beijing has spent lavishly on nuclear, gas, and wind power in an attempt to diversify the country's energy sources and move away from coal, and it has tried to close small coal mines.294 Despite those efforts, coal production jumped from 525 million tons in 2002 to 1.26 billion tons in 2008, and China increased its coal burning by 7 percent in 2008. China accounted for 43 percent of global coal use in 2008.295 The need for greater industrial production always seems to take precedence over environmental protection, especially now that China is struggling with declining exports.296

China's Exchange Rate Regime

Through strict capital controls and the coordinated efforts of the central bank and the Ministry of Finance, the government of China has frozen the value of the RMB at about 6.8 to the dollar since June 2008. If the RMB were allowed to float and to be traded on international markets, as is the case with most major trading nations, the RMB would climb in value.297 By keeping the value of the RMB artificially low, China provides an incentive to foreign corporations to shift production there, because it reduces the price of investing in China and makes their exports from China cheaper. China's currency manipulation has been addressed in previous Annual Reports and is also described in section 1 of this chapter.

Derek Scissors, an economist at The Heritage Foundation, suggests that encouraging Beijing to liberalize its capital account will allow money to move freely in and out of China, which was once one of the goals for China's admission to the WTO.298 "It was once assumed that the difficult process of liberalizing China's capital account would occur naturally as the country started complying with the conditions for its accession to the WTO," said Dr. Scissors.299 So far there has been no progress, and the Chinese government

has shown little interest in allowing multinationals, much less Chinese citizens, to freely send earnings or savings out of the country.
300
Capital account liberalization would allow for easier repatriation of profits by foreign firms operating in China. It would reduce state intervention in the Chinese economy. It would allow Chinese citizens and businesses to purchase goods directly from other countries and even to invest abroad, reducing trade and capital imbalances. Chinese banks would lose some of the guaranteed deposits they now enjoy. That, in turn, would inhibit the type of state-directed lending that has effectively blocked privatization and hindered competition.301 Dr. Scissors concluded that although such liberalization is still far in the future, it is a goal worth pursuing now.
He noted, however, that even if China were compelled to revalue the RMB against the dollar, the Chinese government's most obvious countermeasure would be to raise the export tax rebate, as it has already done several times since the global financial crisis reduced global demand.302

Mr. ROHRABACHER. Thank you. It will be part of my statement here.

The bottom line is that if you export to what seems to be an innocuous civilian entity in places like China, you are essentially exporting U.S. technology straight into the hands of the Chinese military. And we have learned that lesson before, Mr. Chairman.

We learned it the hard way in the 1990s when China received rocket design information from U.S. companies and that there was a transfer of technology that allowed China to perfect its missile technology.

Now, just last week the Chinese demonstrated an anti-missile system. We have to conclude that their ability to do this was probably helped back 15 years ago by U.S. companies. That's a travesty.

We are trying to reform the system to make trade with technology products easier among democratic nations. We must make sure that we do nothing that is going to help the Chinese build better rockets or build rockets that can shoot down our rockets.

Today we want to make sure that, for example, one of the issues that confronts us today is whether or not we are going to make our satellite companies more competitive by legislation that will permit them to launch their satellites on Chinese rockets. We should have learned our lesson 15 years ago when our national security was severely compromised by this very same policy.

Let me finish by saying that while companies at Silicon Valley stand perhaps the most to gain from export control reforms, they also stand the most to lose if we don't do export controls right because while so much is developed here at the cost of so many invested dollars and also the investment of the genius of our people who work here, if indeed we end up with laws that are so lax that our competitors or the competitors of these people end up with this technology, we are doing not our Nation a disservice, but we are doing the high tech industries here in this area a disservice.

And, finally, Mr. Chairman, it is fitting that we hold this meeting today considering that yesterday Google announced that it may be closing shop in China. Let me just note that by doing this, Google has demonstrated a very high standard, its patriotism, its high standards, commitment to ideals. Unfortunately, that does not reflect the same commitment from many people who head our corporations in the United States of America.

I would say to the President of Google—and I sent him a letter yesterday commending him as a moral giant, as compared to some of the moral pygmies that we have seen in other industries anxious to make short-term profit.

So today as we discuss this, let's keep that in mind. And, again, I would use this forum to applaud the high standards of patriotism and morality that the leaders of Google and I would hope that the rest of our technological leaders would follow their example.

Thank you very much, Mr. Chairman.

Chairman BERMAN. Thank you, Mr. Rohrabacher.

Congresswoman Eshoo?

Ms. ESHOO. Thank you. And good morning, Mr. Chairman, and welcome to not only Stanford but to the 14th congressional district, which I am so proud and privileged to represent to Congressman Rohrabacher.

Thank you for being here. You two honor us with your presence here and, of course, to my partner and outstanding friend, Congresswoman Zoe Lofgren, who has distinguished herself on these issues over the years. We have a great sense of pride about our relationship because we like to think that in her district, that there are two Members of Congress that work for them. And I know that there are two who work for my constituents because she is my partner.

It is so important, Mr. Chairman, to hold this hearing about potential legislative action to amend the Export Administration Act because of who and what we have here. Your leadership on this issue is vital to the future of our Nation's technology sector. And this hearing comes, as has been noted, at a very critical time in America's history.

Your decision to overhaul the current law will finally update a system plagued by restrictive relics. How we deal with this issue will help determine our future as either a global leader in innovation or a nation that sacrificed our economic future at the altar of inefficient, outdated, and unnecessary security options.

I commend your decision to jump start a debate that has been waiting so long for an effective champion. And a champion you are. We should all note that Howard Berman, Congressman Berman, is one of the most respected members of not only the House but the entire Congress. His knowledge of the issues that he takes on, no one really matches his knowledge. And so when I say an effective champion, I couldn't mean it more.

Anything approaching a complete overhaul of this legal framework was last completed, imagine this, during the Carter administration. At that time, no one could have foreseen laptops on every desk and phones in everyone's hip pocket. Some here recall using a typewriter at that time. I certainly do. [Laughter.]

I was really good at it. Spell check meant using Webster's Dictionary. And we considered a calculator to be the epitome of technological innovation. We chuckle now, but that is when this issue was really last seriously addressed. Computers were mostly relegated to the most very progressive office environments.

So obviously the world has changed. And our policies must as well if we are going to survive as a player in the current worldwide marketplace. There is a saying, "Adapt or perish." It is that simple.

So with your leadership, Chairman Berman, we will quickly fast forward away from the Cold War era export control policies that still linger today. As we initiate this revision, we need to make certain that our legislative efforts actually accomplish our goals.

At the most basic level, the export control debate represents the age-old tension between commercial and national security concerns. I identify with many of the things that Congressman Rohrabacher said. I have a serious and longstanding appreciation for the need to balance national security concerns with international competitiveness.

As the chairman said, I not only serve as a member of the House Energy and Commerce Committee but also the House Intelligence Committee. So we have to address both concerns. And I believe that we can, we should, and we will.

I am committed to safeguarding our borders, whether they're virtual or physical, but this security has to be smart. It has to be strategic and not a knee-jerk reaction to individual incidents.

Most of all, our policies and our laws should serve as an actual national security purpose and not put restrictions on exports of products that are already widely available.

This past week, as Congressman Rohrabacher stated, we were reminded of the importance of these industries, their integral relationship to daily life, and the bull's-eye placed on them by outside forced intent on theft and vandalism. When that vandalism takes place, I might add, it is the hijacking of American genius, intellectual property, and all that goes with it.

The massive cyberattack on Google and as many as 20 other companies should serve as a reminder that we have to safeguard our cyber resources. At the same time, we have to keep our competitive edge.

Decontrolling encryption products and making them more widely available globally will work to ensure that our data is protected and that the victims of attacks will be protected in the future.

Policy decisions, such as decontrolling encryption and revising export control regulations, also will advance the competitive position of our country and its companies in the global marketplace. This is another reason that fear cannot drive commercial and security policies.

So it is fitting that we are here, both at Stanford, which is in the heart of Silicon Valley. No region of the country is more heavily affected by export controls on technology. Our research institutions and cutting-edge technology companies play key roles in this discussion.

And a special thanks to President John Hennessy for not only hosting us but for being a witness here today, to Dr. Potter, to Ms. Murphy, thank you for being willing to cast light on this issue.

Congressional hearings are amongst the most important things that Members of Congress undertake. Without the hearings, without the expertise of those that bring forward information, we really cannot shape the kinds of policies that are befitting of our great country.

So, Mr. Chairman, thank you once again for your leadership and for the courage for taking this on because it is a heavy lift, but it is a lift that we really must take on so that we can allow American technology companies to compete on a level playing field with their foreign competitors while retaining the essential safeguards to keep our Nation and our innovative economic assets secure.

So thank you very, very much. And thank you to everyone that is in the audience as well.

Chairman BERMAN. Thank you very much. And thank you for the very kind comments.

Ms. Lofgren?

Ms. LOFGREN. Thank you, Mr. Chairman. And thank you for coming once again to the Silicon Valley. You have come here in the past on patent issues and other intellectual property issues. And we know of your commitment to make sure that the export control scheme that we have serves America well.

This, as you have mentioned, is something that has been of great interest to me for many years. As has been mentioned, the export control scheme was really devised during the Cold War. And certainly the economy that we have today is quite different than at that time with information moving globally, the pace of technological change astronomically faster, even in the military arena with the civilian production of material, as compared to during the Cold War.

So it is important that as we look at renewing the system, that we make sure that the controls are not over-broad, that they are not over-complicated, and that they are necessary. As we move forward, I know that we will be looking at what is in America's best interest as we control the export of material.

As you know, I chair the Immigration Subcommittee in the House Judiciary Committee. And so I want to touch on something that many people don't even know about, and that is something called deemed exports. When I mention that, people go "What the heck is that?"

Well, a deemed export is essentially sharing information with a citizen of another country. And if that information is controlled, it's not classified but controlled. Then there are prohibitions.

That is very problematic when it comes to a university setting. And I hope that Dr. Hennessy will mention it here, especially when you look at our wonderful advantage in American higher education by getting bright students from all across the world who come here and then want to stay here.

If you take a look, for example, according to the United States Department of Education, in engineering, 42 percent of master's students and 64 percent of Ph.D. students in American universities are nonresident aliens. In computer and information sciences, 39 percent of master's students, 61 percent of Ph.D. students are nonresident aliens.

According to the National Science Foundation, of all science and engineering doctorate recipients, 43 percent were non-U.S. citizens. Specifically non-U.S. citizens comprised 64 percent of Ph.D. graduates in computer science, 67 percent of Ph.D. graduates in engineering, 57 percent of Ph.D. graduates in math, and 51 percent of Ph.D. graduates in the physical sciences. And here at Stanford, more than 50 percent of the engineering and physical science Ph.D. students are foreign nationals.

Now, certainly the vast majority of these graduate students wish to stay and become Americans here with us. And I am hopeful that as we move forward in this Congress, we will come up with a sensible way to allow the best and the brightest in the world who want to become Americans and stay here and throw in their lot with us to more easily do that.

At any university setting, to prohibit science, basic science research, to half of your graduate students is a terrific impediment to the advance of basic science. And we have to come up with some solutions to this question.

I remember a number of years ago, I was visiting the science departments in Berkeley, our competitor, and they talked about a science study measuring waves from the sun. It was on a satellite, but it had nothing to do with satellite technology and that because it was launched, the foreign students from France and from Germany and Asia couldn't work on the basic science.

That really impedes the advance of knowledge. It doesn't help the Untied States in any way. So I am hopeful that we can update these rules and make sure that America is number one and stays number one when it comes to science research.

And I thank you, Mr. Chairman, for being here and Stanford for hosting us.

Chairman BERMAN. Thank you very much, Zoe. And I think President Hennessy's prepared testimony gets into a few of those issues as well.

We are done for a while. [Laughter.]

The reason we came here was to hear you. President Hennessy, again, thank you very much. And I want to thank all of the staff, both of the university and of our committee. It is not such an easy job to set up one of these things in a field hearing context. And Ed Rice and everybody else who worked on this, I am very grateful for their help.

Dr. Hennessy?

STATEMENT OF JOHN L. HENNESSY, PH.D., PRESIDENT, STANFORD UNIVERSITY AND CO–CHAIRMAN, COMMITTEE ON SCIENCE, SECURITY AND PROSPERITY, NATIONAL RESEARCH COUNCIL

Mr. HENNESSY. Thank you, Mr. Chairman. And thank you all for coming today to talk about this important issue. We appreciate your interest.

As you all know, I am President of Stanford University. And I also served as the co-chair with General Scowcroft of the National Academy's Committee on Science, Security, and Prosperity, which last year released the report, "Beyond Fortress America: National

Security Controls on Science and Technology in a Globalized World."

Although I will reference the committee's findings in my remarks today, I speak on behalf of the higher education and scientific research community, rather than as a representative of the committee or the academy.

It has become a broadly accepted principle that United States leadership in science and technology is crucial, both to our national security and our country's economic prosperity. What is less well-understood, however, is how dramatically the conduct of science and the technology has changed over the past two decades.

In this new century, the conduct of science takes place in a highly collaborative and geographically distributed research community. Thirty years ago, the United States dominated in many fields of science and technology. Today, the United States is still the overall leader. But in many fields, we are one of the leaders, rather than the sole leader. And in a few fields, including things such as flat panel displays, semiconductor memory, and advanced battery technologies, the United States is, arguably, not at the top.

Consider the source of papers published over the past 25 years by the American Physical Society. As you will see in the handout we attached to my written testimony, the trend is clear. The rate of publication among physicists outside of the United States and Western Europe has increased at an astonishing rate.

In the coming decades, remaining a leader requires that we fully participate in the international research community. To do so requires that unclassified information be able to flow among researchers and industry leaders in the various fields. And it requires the United States to continue to attract the best and brightest minds from around the world to work in our laboratories.

There is absolutely no question that the U.S. needs export controls to maintain military advantage on the battlefield and to sustain the homeland. However, as advances in science and technology have transformed our world and our ways of conducting research, many of the export control regulations that served the United States well 40 years ago no longer met the country's needs. The current system actually impedes our national security and thwarts our ability to compete.

Leadership in science and technology begins with attracting the best minds. We have a long and rich tradition of doing so. The United States Twentieth Century dominance in science and technology owes much to immigrants, such as Nikola Tesla, Albert Einstein, Edward Teller, Enrico Fermi, and An Wang. Indeed, Intel, Google, Yahoo!, and Sun Microsystems, as well as an estimated 52 percent of the Silicon Valley start-ups have one or more founders who were born outside of the United States.

At Stanford, we attract leading researchers and faculty from around the world. And, as Congresswoman Lofgren mentioned, more than half of our Ph.D. students in the physical sciences and engineering come from outside the United States.

As a matter of policy, we do not engage in classified research. That would limit participation of any of our students or faculty on the basis of citizenship. Our focus is on fundamental research,

which, by its very nature, is intended to be open to all and freely communicated.

Nonetheless, current export controls and related security measures have caused us great difficulties. For example, in the gravity probe B project, we see a situation similar to the one mentioned by Congresswoman Lofgren. A satellite launches the gravity probe project, but the instrument itself is a space telescope designed to test Einstein's theory of relativity. The design and the fabrication were basic research, and the technical details were openly published. It doesn't have a strategic use, but it happens to be on a satellite.

Because of ITARs, the international traffic and arms regulations, satellites are treated as munitions. Stanford researchers cannot share information about the particular design with foreign nationals. That limits our ability to publish about the design and to ensure that our colleagues accept and believe the results from the measurements. It also limits us with respect to deemed export as well, which requires us to monitor how that information might be shared with students here on our campus.

In another example, a U.S.-based Fortune 100 high tech company was given a DARPA contract to build a microchip that will attempt to simulate the human brain based on what we know about its electrical properties, clearly basic research.

A team from Stanford consisting of a faculty leader who is a U.S. citizen and a half-dozen students, some of whom come from the United States, but two are also from China, were proposed to collaborate on the project. But after the project began, we learned that the use of export control technology was central to the work. For the Stanford team to participate, our Chinese students would have to be excluded.

Stanford does not, nor will it, restrict participation of students on the basis of citizenship. Since the export control technology was deemed central to the project, the Stanford research team involvement and the benefit of their contributions have been greatly reduced.

A closely related problem was encountered in the area of biosecurity. Professor Stanley Falkow, one of the world's most distinguished researchers in the area of microbial pathogenesis, had been working on a non-pathogenic version of plague, a version that is actually used in the construction of the vaccine. After the USA PATRIOT Act, this organism was designated as a select agent, requiring greatly enhanced security and background checks on lab personnel.

Falkow viewed this as incompatible with his research approach. He ended up destroying the organism and stopped working in the area. The result was clearly a net loss for our country.

In these examples, our Nation can lose multiple times. We lose the benefits of the research. We lose senior faculty leadership in a field. And we reduce our ability to engage and retain young researchers.

As these examples illustrate, the negative impacts of control regulations can lead to a loss of scientific leadership and a reduction in our Nation's security.

Our goal should be to design national security controls without negatively impacting our ability to conduct fundamental research that can benefit the United States economically and militarily.

The growing trend to label fundamental research as "sensitive but unclassified" is a deep concern, since it would further blur the lines between controlled and uncontrolled research in an unpredictable fashion. There are policies in place that can serve as a straightforward and rational interpretation of export controls.

Through national security decision directive 189, for example, government agencies with concerns about work could specify restrictions when they issue the contract, including, when appropriate and necessary, classifying the work. Maintaining the openness of basic research as clearly intended in NSDD–189 is crucially important for the long-term health of U.S. academic research.

Export controls are a challenging and complex topic, and I am very pleased that this committee has undertaken this important task of examining them and considering the need for reform, which in the view of many is long overdue.

As you move forward, if there is any way my colleagues in higher education and the scientific community can assist you, we would be honored to do so. Thank you, Mr. Chairman.

[The prepared statement of Mr. Hennessy follows:]

Written Testimony of John Hennessy
Committee on Foreign Affairs
Friday, January 15, 2010

Good morning, Mr. Chairman and members of the Committee. My name is John Hennessy. I am president of Stanford University and served as co-chair of the National Academies' Committee on Science, Security and Prosperity. In January 2009, the National Academies released the committee's report, *Beyond "Fortress America": National Security Controls on Science and Technology in a Globalized World.*

Although I will reference the committee's findings in my remarks, today I speak on behalf of higher education and the scientific research community, rather than as a representative of the committee or the Academy.

It has become a broadly accepted principle that the United States' leadership in science and technology is crucial both to our national security and our country's economic prosperity. Last April, in a speech at the National Academy of Sciences, President Obama called science (quote)

> "more essential for our prosperity, our security, our health and our environment than it has ever been." (end quote)

The American Recovery and Reinvestment Act of 2009 approved by Congress included $17 billion for scientific research, research infrastructure and education, mostly through

the National Science Foundation and the National Institutes of Health. This followed on the promise of the America COMPETES Act.

What is less well understood, however, is how the conduct of science and technology has changed — over the past two decades in particular — as a function of both the end of the Cold War and the globalization of science and technology. In this new century, the conduct of science takes place in a highly collaborative and geographically distributed research community, with the Internet enabling exchanges of information at an unprecedented pace. Much of it — particularly the breakthrough advances and innovations — involves many players from wide-ranging backgrounds and areas of expertise. Thus today, excellent science happens not only in the United States and Europe but also in countries such as India and China.

Thirty years ago, the United States dominated in many fields of science and technology. Today the United States is still the overall leader, but in many fields we are one of the leaders rather than the sole leader, and in a few fields the United States is clearly not at the top. As noted in a quote cited in *Beyond "Fortress America"*:

> "Japan leads in a number of key technologies such as flat screens, Korea has become a world leader in semiconductor memory, Europe leads in some aspects of telecommunications and embedded systems, and China is increasingly a center for high-technology manufacturing." (end quote)

Or if we look at the attached graph showing the papers published over the past 25 years by the American Physics Society in *Physical Review* and *Physical Review Letters*, the

trend is clear: The rate of publication among physicists outside of the United States and western Europe has increased at an astonishing rate.

In the coming decades, remaining a leader requires that we fully participate in the international research community. To do so requires that unclassified information be able to flow among researchers and industry leaders in the various fields, and it requires the United States to continue to attract the best and brightest minds from around the world to work in our laboratories. As the Center for Strategic and International Studies' (CSIS) Commission on Scientific Communication and National Security noted (in a quote cited in *Beyond "Fortress America"*):

> "In a world of globalized science and technology, security comes from windows not walls." (end quote)

I would add that those windows onto global science are equally vital for scientific leadership and for economic competitiveness.

There is no question that the U.S. needs export controls to maintain military advantage on the battlefield and to sustain the homeland. However, as advances in science and technology have transformed our world and our ways of conducting research, many of the export controls regulations that served the United States well 40 years ago no longer meet the country's needs. The current system actually impedes our national security and thwarts our ability to compete. As the committee noted in its report, our success depends on our ability to "Run Faster." A more agile and responsive system of controls would

allow us to focus our energies on serious challenges, make informed decisions and make them more quickly.

I would like to look specifically at the impact of export controls on higher education in the U.S. and the implications for innovation.

Last week President Obama expanded the "Educate to Innovate" campaign, a K-12 initiative to inspire American students to excel in science, technology, engineering and mathematics, often referred to as the STEM fields. He was unequivocal about their importance, saying (quote):

> "Make no mistake: Our future is on the line. The nation that out-educates us today is going to out-compete us tomorrow." (end quote)

A strong educational foundation is key to the innovation that occurs later in universities and industry. Other countries realize this, as evidenced by the flow of international students to U.S. universities seeking degrees in the STEM fields.

So what is required to lead today and tomorrow? We must continue to attract and retain the best scholars and researchers worldwide and nurture their work by providing an environment that encourages innovation.

We have a long and rich tradition of doing so: The United States' 20th-century dominance in science and technology owes much to immigrants such as Albert Einstein, Edward Teller, Enrico Fermi and An Wang. Indeed, Intel, Google, Yahoo! and Sun

Microsystems — as well as an estimated 52 percent of Silicon Valley startups — have one or more founders who were born outside of the United States. Today, we continue to attract brilliant young minds from around the world, and it is important that we continue to attract and to retain them.

At Stanford, we attract leading researchers and faculty from around the world, and 32 percent of our graduate students are from countries other than the U.S., with the percentage of international Ph.D. students exceeding 50 percent in engineering and the physical sciences. As a matter of policy, we do not engage in classified research that would limit participation of any of our students or faculty on the basis of citizenship. Our focus is on fundamental research, which both by its nature and by National Security Decision Directive 189 is intended to be open to all and freely communicated.

Nonetheless, current export controls and related security measures have caused us difficulties. Let me give you three brief examples from Stanford.

Gravity Probe-B

> Gravity Probe-B is an experiment being undertaken to test Einstein's general theory of relativity. A satellite orbiting above the Earth houses an instrument that includes four spherical gyroscopes and a telescope, designed by Stanford researchers. The instrument's design and fabrication were basic research; for example, it required making the world's most perfect sphere, which is at the core

of the instrument. The technical details — blueprints and schematics — are openly published. It does not have a strategic use, but it happens to be on a satellite. Because the International Traffic and Arms Regulations (ITAR) consider satellites to be munitions, Stanford researchers are prohibited from providing "technical assistance" to foreign national students and scholars abroad by discussing the published performance characteristics of the materials and hardware used in the development of the probe. U.S. universities consider their ability to share the details of published research results to be a crucial element of scientific inquiry and a requirement for evaluating the instrument and its measurements of the basic physics of our universe. ITAR, however, considers the activity to be a "defense service" requiring an export license. With deemed export regulations, there are even limitations in sharing information with some international students here on our campus.

Synapse microchip

A U.S.-based Fortune 100 high-technology company has been given a DARPA contract to develop a microchip that will attempt to simulate the human brain based on what we know of the electrical properties of neurons and synapses. While this work is quite basic, the potential future applications from treating brain disorders to building autonomous systems are both widespread and of high impact.

This is the kind of research we excel in at Stanford, and the technology company has asked us to participate on the project. Our team is headed by a faculty member, who is a leader in his field, and includes half a dozen Stanford graduate students. The faculty member is a U.S. citizen; some of the students on the team were born outside of the U.S., and two are Chinese nationals. Soon after the project began, we learned that the use of export-controlled technology was central to the work. For the Stanford team to participate, our Chinese students would have to be excluded. Stanford does not, and will not, discriminate between its students or disadvantage them on the basis of citizenship: All of our students and faculty must be able to participate and contribute to the intellectually significant portions of research. Since the export-controlled technology is central to the project, the Stanford research team's involvement and the benefit of their potential contributions to the project have been greatly reduced. This has impeded the progress of the collaboration and Stanford's ability to contribute its full wealth of intellectual capital.

Vaccine creation

A closely related problem has occurred in the area of biosecurity. Professor Stanley Falkow, one the world's most distinguished researchers in the area of microbial pathogenesis, had been working with a non-pathogenic version of plague, a version actually used in the creation of a vaccine. After the USA PATRIOT Act, this organism was designated as a Select Agent, requiring greatly

enhanced security and background checks on lab personnel. Falkow viewed this as incompatible with his research approach, destroyed the organism and stopped working in the area. The result was clearly a net loss for our country.

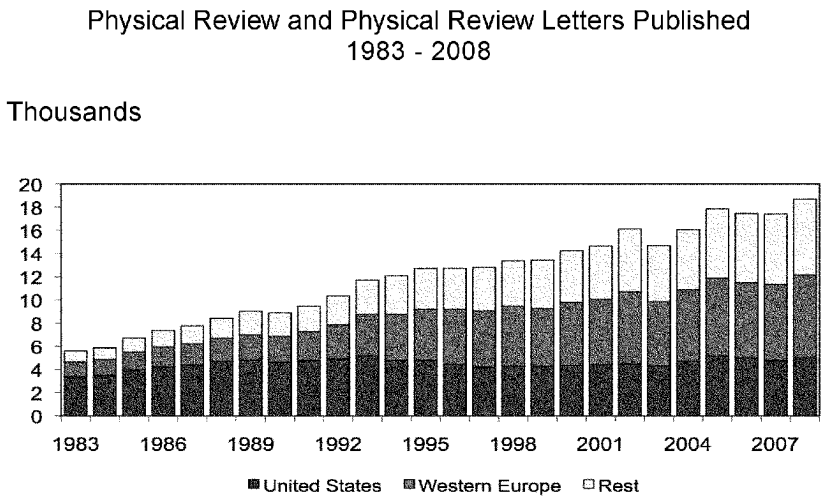
In these examples, our nation can lose multiple times. First we lose the benefit of input from great scientists, both students and faculty, and the advantages of their research contributions. Second, recognizing that many of the young researchers are likely to remain and contribute to the advancement of our country's knowledge in science and technology, we lose when we deprive them of opportunities to innovate. And the impact on students — who might have become loyal and contributing citizens and residents of our country — can be devastating. As these examples illustrate, the negative impacts of control regulations can lead to a loss of scientific leadership and a reduction in our nation's security.

Our goal should be to design national security controls without negatively impacting our ability to conduct fundamental research that can benefit the United States economically and militarily. The growing trend to label fundamental research as "Sensitive But Unclassified" is a deep concern, since it would further blur the lines between controlled and uncontrolled research in an unpredictable fashion.

There are policies in place that can serve as a straightforward and rational interpretation of export controls. Through National Security Decision Directive 189 (NSDD-189, also known as the National Policy on the Transfer of Scientific, Technical and Engineering

Information), for example, government agencies with concerns about work could specify restrictions when they issue the contract, including, when appropriate and necessary, classifying the work. Maintaining the openness of basic research as clearly intended in NSDD-189 is crucially important for the long-term health of U.S. academic research.

Export controls are challenging and complex, and I am very pleased that this committee has undertaken this important task of examining them and considering the need for reform. I will close with my thanks for the important work you are doing. As you move forward, if there is any way my colleagues in higher education and the scientific community can assist you, we would be honored to do so.



Chairman BERMAN. Thank you, Dr. Hennessy.

And, of course, I did proceed with your testimony without the introduction I was supposed to make of you regarding your background. I think it is probably known to most, but let me just for anyone who doesn't know remind people that, in addition to being the President of Stanford University, Dr. Hennessy started his career here as a professor of electrical engineering, chaired the Computer Science Department, served as the Dean of the School of Engineering, University Provost until now as President. And then in the information technology field, he is known internationally for his research and development of a revolutionary computer architecture. To this day, he continues his research in high-performing computing and as a co-founder of the MIPS Computer Systems, a cutting-edge developer of microprocessors.

And, most importantly for purposes of today's testimony, he is co-chair of the Committee on Science, Security, and Prosperity of the National Research Council, which has a number of national security science and industry leaders.

The committee issued a report last spring on national security controls, on science and technology. And that report was part of what got us to focus on moving ahead with our own project in this area.

Dr. William Potter is our next witness. Here the introduction will come before the testimony. [Laughter.] He is Director of the James Martin Center for Nonproliferation Studies at the Monterey Institute for International Studies. Dr. Potter is one of the nation's leading experts on nonproliferation, arms control, technology transfer, and security.

Twenty years ago he founded the Center for Nonproliferation Studies at the Monterey Institute. Under his direction, the center, now known as the James Martin Center, has become a recognized leader in the research and scholarship and the national security field.

Dr. Potter continues his academic work as the Sam Nunn and Richard Lugar Professor of Nonproliferation Studies at the institute. He has written extensively on security issues, including his latest book, "The Global Politics of Combating Nuclear Terrorism."

I have personally known and worked with Bill for many years. His institute does a very important job, I think, for our country and for the world in terms of the expertise and the people that it produces to work in this critical field. And he is well-prepared to give us expert advice on the security issues to be considered in updating and strengthening our export control system.

I will now also introduce Karen Murphy. And then we can go right to both of your testimonies. She is Senior Director for Trade at Applies Materials located in Santa Clara.

Ms. Murphy is responsible for export control compliance and other trade issues for this cutting-edge leader in nanotechnology, semiconductor manufacturing, and related fields. She has wide experience in the practical aspects of import and export, including as a licensed U.S. Customs broker. In recognition of her expertise, she serves on the Commerce Department's Advisory Committee on Export Control Regulations and has served on the Export Control

Subcommittee of the President's Export Council. We are pleased to have you with us today.

Dr. Potter, why don't you go ahead?

STATEMENT OF WILLIAM C. POTTER, PH.D., DIRECTOR, JAMES MARTIN CENTER FOR NONPROLIFERATION STUDIES, MONTEREY INSTITUTE OF INTERNATIONAL STUDIES

Mr. POTTER. Thank you. It is my honor and great pleasure to speak at the field hearing of the Committee on Foreign Affairs. I think the subject is very timely and important, and I applaud the committee and Chairman Berman for undertaking this initiative. It also is always a pleasure to return to Stanford, where I spent a wonderful time as a postdoctoral fellow many, many years ago.

By way of introduction and as a caveat, I wish to emphasize that while the center I direct covers the entire range of weapons of mass destruction and their delivery systems, my own expertise lies primarily in the nuclear sector and issues associated with illicit nuclear trafficking and the dangers posed by nuclear terrorism. And, as such, my remarks will emphasize these areas.

I also want to note that my remarks this morning constitute a much abbreviated version of my written testimony, which I have provided to the committee.

A number of recent studies, including the important NRC Council report, "Beyond Fortress America," have correctly observed that many U.S. export controls developed during the Cold War are ill-suited to meet today's national security challenges.

It is also the case that in an increasingly globalized world, one must be very cautious about imposing restrictions on the flow of information, technology, and scientists in the name of national security without very carefully weighing the costs and benefits of such action. It would be equally shortsighted, however, for the United States to abandon prudent export controls on dual-use technologies and materials directly relevant to nuclear, chemical, and biological weapons in the name of economic competitiveness on the grounds that some other states have failed to adopt stringent export controls.

Similarly, it would be most unfortunate from the standpoint of weapons of mass destruction proliferation were the United States to signal its diminished support for adherence to the export control guidelines of existing international nonproliferation regimes, based on the premise that some states have already disregarded inconvenient nonproliferation export control norms and practices.

Unfortunately, one can point to recent examples of both outmoded U.S. and international approaches to export controls and changes to export policy that have been detrimental to U.S. national security.

Illustrative of the problem of outmoded U.S. export controls are current nonimmigrant visa regulations that make it difficult for credentialed academic researchers to work with U.S.-based colleagues and for international students with advanced degrees in the science and engineering sectors to extend their stays in the United States for employment purposes. And here I fully endorse the NRC's recommendations with respect to remedies in this

sphere, but I also would note the need for more nonproliferation education and training in U.S. industry and academe.

Greater self-awareness and self-regulation regarding the security and export of WMD-related material, technology, and know-how may be the best antidote to more intrusive government controls.

Regrettably, it is also the case that U.S. national security was impaired when in the name of economic competitiveness and in pursuit of a new strategic partnership with India the United States gutted important components of its own domestic export control laws and led the charge to exempt one country from the export guidelines of the Nuclear Suppliers Group.

A similarly ill-considered congressional initiative in 2005 to make it easier to export highly enriched uranium to U.S. allies, promoted in the name of economics and medical necessity, directly undermined U.S. efforts to persuade other countries to combat nuclear terrorism by minimizing the use of highly enriched uranium in the civilian nuclear sector.

My point is not to contest the desirability of reviewing and, where appropriate, revising export policies to reflect new realities. I fully endorse such a general approach. It is essential, however, to guard against changes in those U.S. export controls that have served us well in curbing the spread of WMD and whose abandonment might inadvertently contribute to the proliferation of nuclear, chemical, and biological weapons.

Therefore, in thinking about where possible reform of export control regulations should be pursued, it may make sense to distinguish between export controls targeting WMD-relevant items and those directed at the much larger body of dual-use strategic goods unrelated to weapons of mass destruction.

Moreover, it is important to recognize that to the extent that the United States wishes other states to attach greater priority to the development and implementation of domestic nonproliferation export controls, as is required by U.N. Security Council Resolution 1540, it must lead by example.

I will leave it to leaders from industry and science to depict the shortcomings of the current U.S. export control system as they pertain to economic competitiveness and the unfettered exchange of ideas and information.

What I would like to highlight in my remarks this morning are several new nonproliferation realities and how associated WMD proliferation risks are compounded by gaps and weaknesses in the U.S. export control system and related international controls. I will then conclude with a few specific recommendations about what might be done to improve the situation.

Although the post-Cold War international environment has reduced the risks of a superpower nuclear exchange, it also has contributed to the growth of new challenges involving the spread and potential use of weapons of mass destruction. These challenges include the tendency on the part of many states to subordinate nonproliferation considerations to economic and political interests, the development of a global black market in sensitive dual-use technology and material related to the production and delivery of weapons of mass destruction, and the rise of non-state actors as nuclear suppliers, middlemen, and end users.

Although discussions of nuclear terrorism typically focus on the potential use by non-state actors of nuclear explosives, it is important to recognize the proliferation risks posed by non-state actors as suppliers of nuclear material, technology, know-how, weapons design, and conceivably the weapons themselves.

The extensive nuclear supplier network masterminded by Pakistani scientist A. Q. Khan is illustrative of this proliferation challenge. An analytically distinct but variant of this threat is the operation of non-state actors as middlemen, connecting nuclear suppliers, both state and non-state entities, with end users, which also might be either state or non-state actors.

Most available information indicates that Dr. Khan was the entrepreneur behind the emergence of what former IAEA Director General Mohamed El-Baradei has called a "nuclear weapons Wal-Mart."

Nevertheless, one should take care not to equate that international network with one individual or to assume that his enforced retirement has put illicit non-state nuclear suppliers out of business. Indeed, the so-called Khan network was relatively non-hierarchical and involved international leadership that was widely dispersed around the globe, including locations in Europe, Dubai, South Africa, and Malaysia. Few of its members were ever prosecuted, and even fewer were convicted and served prison terms.

It is to be expected that middlemen seeking business in brokering illicit nuclear trade will gravitate toward bases of operations in states with weak or nonexistent export control regulations and underdeveloped enforcement mechanisms.

Unfortunately, these traits are not limited to the developing world. Indeed, one is hard-pressed to find examples anywhere of successful prosecutions of illicit nuclear trafficking in which the accused received more than a slap on the wrist, leading some to conclude that there are greater penalties for driving under the influence in most countries than for driving with illicit nuclear goods.

The NRC study, among other reports, catalogues a long list of shortcomings in the current U.S. system of dual-use exports, most of which pertain primarily to controls outside of the narrow area of WMD-related commodities.

In my written testimony, I call attention to a number of those that do have relevance to the WMD sphere, including a cumbersome bureaucratic structure, morale problems among Customs inspectors and investigators, and the challenge of devising effective export controls in areas where new technologies are emerging most rapidly.

Here I would only emphasize that the logic of adjusting export controls to changing conditions should not mean simply relaxing or reducing controls. In some instances, it may be necessary to introduce more sophisticated and tailored approaches that are more effective as well as simply more efficient.

To be sure, one can identify significant shortcomings in both the design and performance of the major export control regimes internationally: The Nuclear Suppliers Group, the Missile Technology Control Regime, the Australia Group, and the Wassenaar Arrangement.

These deficiencies include non-membership of some key exporting countries, inconsistent implementation of catch-all and no-undercut provisions, inadequate reporting and intelligence sharing practices among member states, and a lack of familiarity by industry in member states of the provisions governing exports. These problems, however, should not obscure the very useful contribution to WMD nonproliferation made by the NSG, the MTCR, and the Australia Group.

It also should be noted that these nonproliferation regimes were not driven primarily by Cold War considerations or attempts to stymie the Soviet Union's quest for weapons of mass destruction.

Indeed, in the nuclear sector during much of the Cold War, the United States and the Soviet Union pursued remarkably similar nuclear export control and nonproliferation policies. And, in fact, Washington often found it easier to cooperate closely with Moscow on nuclear nonproliferation and export control issues than it did with some of its close allies. As such, I would argue, it does not follow logically that these export control arrangements should be scrapped or substantially modified simply because the Cold War has ended.

As one contemplates reforms for the U.S. export control system, one must be aware of the liabilities that result from divergent international practices and priorities as well as the shortcomings of existing international export control regimes.

It is also the case, however, that many states do follow the U.S. lead on nonproliferation export policy and that, by and large, nonproliferation export control norms and practices globally have become more prudent and widespread over time.

Although I would argue that the 2008 NSG exemption granted to India marked a major step backward in the international nuclear export control arena, it is all the more imperative to strengthen the NSG and other international mechanisms that focus on WMD proliferation.

A sound U.S. approach to nonproliferation export controls requires in my mind a two-pronged approach: First, recognition and retention of those aspects of the system that have performed well; and, secondly, introduction of new features that will enhance economic competitiveness and information and technology flow without weakening the international nonproliferation regime.

Let me conclude my prepared remarks by suggesting how these dual objectives may be pursued in tandem. Whatever the United States does, it must be very careful not to make matters worse for WMD proliferation. This dictum cautions against acceptance of the advice of those who would like to dilute or restrict further the catch-all provision that specifies the dual-use items or technologies not on the commerce control list may still require an export license if the exporter has reason to believe that the item is intended for the development, production, or delivery of nuclear, biological, or chemical weapons.

In fact,—and I think this is a particularly important point—an increasing number of companies today have made strides in incorporating the catch-all philosophy into their internal compliance programs, and greater efforts should be made to encourage the

adoption of WMD nonproliferation objectives as a component of corporate social responsibility goals.

A major step forward in promoting WMD-related export controls internationally was taken in April 2004 when the U.N. Security Council adopted resolution 1540, which, among other things, requires all U.N. member states to adopt and enforce effective laws which prohibit non-state actors from acquiring WMD, their delivery systems, and the materials needed to produce them.

Although few states directly challenge this mandate, its implementation has been undermined in many countries due to lack of resources and poor understanding of the relevance of the measure for their own security interests.

If U.N. Security Council resolution 1540 is to be effective as an export control initiative, it will be necessary for the United States to increase its support for regional and national 1540 training programs.

In the U.S., effective export control enforcement continues to be hampered by the lack of sufficient personnel to undertake proper end-use checks and aggressively pursue investigations of suspected violations. It does little good, for example, to identify new cases that merit investigation if one is unable to assign trained personnel to conduct investigations at home and abroad.

It is a necessary but not sufficient condition to adopt new rules and regulations internationally with respect to WMD-related exports. Equally important is the need to build a global nonproliferation and security culture in which government and industry officials, scientists, faculty, and graduate students who work with dual use WMD-related technology and materials in the nuclear, biological, and chemical fields learn to appreciate the potential dangers posed by these items and become familiar with the domestic and international regulations governing their use.

I will conclude my remarks by touching on the issue of nonproliferation export controls as it pertains to the university environment. At a time when the great majority of U.S. Government officials and politicians of different political persuasions agree on the dangers posed by WMD proliferation, it is surprising how limited the opportunities are for students at all levels of education to acquire formal training in the field.

In a very small way, the Monterey Institute of International Studies is trying to address this knowledge gap by offering a new master's degree program in nonproliferation and terrorism studies, the first of its kind in the world. But many more universities will need to follow suit if we are to train the next generation of nonproliferation specialists or even introduce our future leaders in government, science, and industry to the subject.

One practical step to remedy the problem, at least in the United States, would be to pass a National Nonproliferation Education Act, perhaps modeled after the National Defense Education Act or the National Security Education Act.

Such legislation, ideally funded by a one-time appropriation of about $50 million, would provide up to 50 fellowships per year to graduate students to pursue advanced multidisciplinary training in nonproliferation studies at the universities of their choice.

An act of this sort would have the dual positive benefit of attracting top-notch young talent to the field and encouraging more universities to offer courses on nonproliferation issues, including export controls, in order to attract tuition-paying students.

While not a short-term solution to our current predicament, this approach would help to create the next generation of experts on whom the United States will rely to tackle increasingly complex tasks of preventing the proliferation of nuclear, biological, and chemical weapons of mass destruction.

Thank you, Mr. Chairman.

[The prepared statement of Mr. Potter follows:]

Written Testimony of Professor William C. Potter[1] for the Committee on Foreign Affairs of the U.S. House of Representatives (January 15, 2010)[2]

I. **Introduction.** It is my honor and great pleasure to speak at this field hearing on Technology Security of the Committee on Foreign Affairs. The subject of the hearing is very timely and important, and I applaud the Committee and Chairman Berman for undertaking this initiative. It also is always a pleasure to return to Stanford where I spent a wonderful time as a postdoctoral fellow many years ago.

By way of introduction and as a caveat, I wish to emphasize that while the Center I direct covers the entire range of weapons of mass destruction and their delivery systems, my own expertise lies primarily in the nuclear sector and issues associated with illicit nuclear trafficking and the dangers posed by non-state actors and nuclear terrorism. As such, my prepared remarks will emphasize these areas.

A number of recent studies, including the important National Research Council report on *Beyond "Fortress America,"* co-chaired by Stanford President John Hennessy and General Brent Scowcroft, have correctly observed that many U.S. export controls developed during the Cold War were designed for a world that no longer exists and are ill-suited to meet today's national security challenges.[3] It is also the case that in an increasingly globalized world, one must be very cautious about imposing restrictions on the flow of information, technology, and scientists in the name of national security without carefully weighing the costs and benefits of such action. It would be equally

[1] William C. Potter is Founding Director of the James Martin Center for Nonproliferation Studies at the Monterey Institute of International Studies. He also is Sam Nunn and Richard Lugar Professor of Nonproliferation Studies at the Monterey Institute.

[2] I very much appreciate the comments on an earlier draft of this testimony provided by Jeff Abramson, Michael Beck, Cristina Hansell, Stephanie Lieggi, Miles Pomper, Robert Shaw, Arthur Shulman, Leonard Spector, and Jonathan Tucker.

[3] See National Research Council of the National Academies, *Beyond "Fortress America": National Security Controls on Science and Technology in a Globalized World* (Washington, DC: The National Academies Press, 2009).

shortsighted, however, for the United States to abandon prudent export controls on dual-use technologies and material directly relevant to nuclear, chemical, and biological weapons in the name of economic competitiveness on the grounds that some other states have failed to adopt stringent export controls. Similarly, it would be most unfortunate from the standpoint of weapons of mass destruction (WMD) proliferation were the United States to signal its diminished support for adherence to the export guidelines of existing international nonproliferation regimes, based on the premise that some states already disregard inconvenient nonproliferation export control norms and principles. Unfortunately, one can point to recent examples of both outmoded U.S. and international approaches to export controls and changes to export policy that have been detrimental to U.S. national security.

Illustrative of the problem of outmoded U.S. export controls are current non-immigrant visa regulations that make it difficult for credentialed academic researchers to work with U.S.- based colleagues and for international students with advanced degrees in the science and engineering sectors to extend their stays in the United States for employment purposes. I fully endorse the National Research Council's recommendations with respect to remedies in this sphere, but I also would note the need for more nonproliferation education and training in U.S. industry and academe. Greater self-awareness and self-regulation regarding the security and export of WMD-related material, technology, and knowhow may be the best antidote to more intrusive government controls.

Regrettably, it is also the case that U.S. national security was impaired when, in the name of economic competitiveness and in pursuit of a new strategic partnership with India, the United States gutted important components of its own domestic export control laws and led the charge to exempt one country from the export guidelines of the Nuclear Suppliers Group. A similarly ill-considered congressional initiative in 2005 to make it easier to export highly enriched uranium (HEU) to U.S. allies--promoted in the name of economics and medical necessity-- directly undermined U.S. efforts to persuade other

countries to combat nuclear terrorism by minimizing the use of HEU in the civilian nuclear sector.[4]

My point is not to contest the desirability of reviewing and, where appropriate, revising export control policies to reflect new realities. I fully endorse such a general approach. It is essential, however, to guard against changes in those U.S. export controls that have served us well in curbing the spread of WMD and whose abandonment might inadvertently contribute to the proliferation of nuclear, chemical, or biological weapons. Therefore, in thinking about where possible reform of export control regulations should be pursued, it may make sense to distinguish between export controls targeting WMD-relevant items (especially those in the nuclear sector where technological change has been less dynamic) and those directed at the much larger body of dual-use strategic goods unrelated to WMD. Moreover, it is important to recognize that to the extent that the United States wishes other states to attach greater priority to the development and implementation of domestic nonproliferation export controls, as required by United Nations Security Council Resolution 1540, it must lead by example.

I will leave it to leaders from industry and science to depict the shortcomings of the current U.S. export control system as they pertain to economic competiveness and the unfettered exchange of ideas and information. What I would like to highlight in my prepared remarks this morning are several new nonproliferation realities and how associated WMD proliferation risks are compounded by gaps and weaknesses in the U.S. export control system and the associated international regimes. I will then conclude with a few specific recommendations about what might be done to improve the situation.

II. **The Evolving Proliferation Challenge**. The world has changed in many ways since the end of the Cold War. Although the new international strategic

[4] For a discussion of the Burr Amendment, which required the modification of U.S. HEU export rules, see Anya Loukianova and Cristina Hansell, "Leveraging U.S. Policy for a Global Commitment to HEU Elimination" in William C. Potter and Cristina Hansell, eds., *The Global Politics of Combating Nuclear Terrorism: A Supply-Side Approach* (New York: Routledge, 2010), pp. 31-56.

environment has reduced the risks of a superpower nuclear exchange, it also has contributed to the growth of new challenges involving the spread and potential use of weapons of mass destruction. These challenges include the tendency on the part of many states to subordinate nonproliferation considerations to economic and political interests, the development of a global black market in sensitive dual-use technology and material useful for the production and delivery of WMD, and the rise of non-state actors as nuclear suppliers, middlemen, and end-users. Elsewhere I have analyzed how the first two developments have been affected by technological advances, as well as by changes in the international political and economic environment.[5] In the interests of time, I will restrict my oral testimony to a few new nuclear dangers posed by non-state actors.

Although discussions of nuclear terrorism typically focus on the potential use by non-state actors of nuclear explosives, it is important to recognize the proliferation risks posed by non-state actors as suppliers of nuclear material, technology, know-how, weapons designs and, conceivably, the weapons themselves. The extensive nuclear supplier network masterminded by Pakistani scientist A.Q. Khan is illustrative of this proliferation challenge. An analytically distinct but related variant of this threat, also illustrated in part by the Khan network, is the operation of non-state actors as middlemen, connecting nuclear suppliers—both state and non-state entities—with end-users, which also may be either state or non-state actors.

Most available information indicates that Dr. Khan was the entrepreneur behind the emergence of what former IAEA Director General Mohamed ElBaradei has called a "nuclear weapons Wal-Mart." Nevertheless, one should take care not to equate the international network with one individual or to assume that his enforced retirement has put illicit non-state nuclear suppliers

[5] See, for example, William C. Potter, "Non-State Actors and Nuclear Proliferation," in Morten Bremer Maerli and Sverre Lodgaard, eds. *Nuclear Proliferation and International Security* (New York: Routledge, 2007), pp. 194-212. See also Charles D. Ferguson and William C. Potter (with Amy Sands, Leonard S. Spector, and Fred L. Wehling), *The Four Faces of Nuclear Terrorism* (New York: Routledge, 2005).

out of business. Indeed, the so-called "Khan network" was relatively non-hierarchical and involved an international leadership that was widely dispersed around the globe, including locations in Europe, Dubai, South Africa, and Malaysia. Few of its members were ever prosecuted and even fewer were convicted and served prison terms.

Fortunately for nonproliferation, a large gulf usually has separated most individuals with ready access to nuclear material, technology, and know-how from those pariah states or terrorist organizations that covet nuclear weapons. In the former Soviet Union, for example, many of the documented attempts at nuclear trafficking were foiled when amateur thieves incautiously sought to find customers for their contraband. In stark contrast to would-be Russian nuclear entrepreneurs, the Khan network was distinguished by the direct and ready access of its leadership to both Pakistan's own civilian and military nuclear programs and that of prospective nuclear weapons aspirants. Although it is unlikely that future non-state actors will rival the Khan network in terms of its access to a wide array of sensitive nuclear commodities and practical experience in covert procurement for a dedicated nuclear weapons program, criminal and terrorist organizations will almost certainly attempt to link those with access to sensitive nuclear goods and services to state and non-state actors that covet such commodities.

It is to be expected that middlemen already engaged or seeking business in brokering illicit nuclear trade will gravitate toward bases of operations in states with weak or non-existent export control regulations and underdeveloped enforcement mechanisms. Unfortunately, these undesirable characteristics are not limited to the developing world. Indeed, one is hard pressed to find examples of successful prosecutions of illicit nuclear trafficking in which the accused received more than a slap on the wrist, leading some to conclude that **there are greater penalties for driving under the influence than for driving with illicit nuclear goods!** This phenomenon is not confined to the developing world, as evidenced by the difficulty officials from Australia, the European Union, and Japan, among other states, have experienced in prosecuting and convicting many of those implicated in various nuclear and

chemical weapons- related trafficking incidents.[6] The United States may have been more successful than most other states in prosecuting nonproliferation export control violations, because it now has a team of specialized prosecutors and a national coordinator, but it continues to be frustrated by divergent foreign laws and practices. To the extent that the United States is the pace-setter regarding export control enforcement, it is important that penalties for export violations be commensurate with the violation in order to serve a useful deterrent purpose.

III. **Gaps in the Current U.S. System and Practice of Export Controls.** The NRC study, among other reports, catalogues a long list of shortcomings in the current U.S. system of dual-use exports. [7] Many of these deficiencies pertain primarily to controls outside of the narrow area of WMD-related commodities. With respect to WMD controls in particular, I would call attention to the need to:

- *Reorganize the U.S. government bureaucracy for enforcing export controls.* When the U.S. Customs Service was incorporated into the Department of Homeland Security in November 2002, it was split into two separate agencies, Immigration and Customs Enforcement (ICE) and Customs and Border Protection (CBP). Both agencies have other high-profile missions (immigration control and border protection), which constrain their ability to enforce nonproliferation export controls effectively. As a result, many experienced customs inspectors and investigators have been demoralized by the reorganization and left the Federal service, while others are waiting to retire. One solution to this problem would be to reunite the two halves of the former U.S. Customs

[6] See, for example, Jonathan B. Tucker, *Trafficking Networks for Chemical Weapons Precursors: Lessons from the Iran-Iraq War of the 1980s*, Occasional Paper No. 13 (Monterey, CA: James Martin Center for Nonproliferation Studies, November 2008); Stephanie Lieggi and Masako Toki, "The Mitutoyo Case: Will Japan Learn from Its Mistakes or Repeat Them? Issue Brief, July 31, 2007, Nuclear Threat Initiative Research Library, www.nti.org/e_research/e3_html; and Kenley Butler, Sammy Salama & Leonard S. Spector, "Where is the justice?" Bulletin of the Atomic Scientists (November/December 2006), pp. 25-33.

[7] See also the website of the National Association of Manufactures at www.nam.org.

Service into a specialized agency that is separate from the immigration and border protection missions of DHS.

- *Improve U.S. cooperation with foreign customs services.* The Untied States cannot prevent WMD proliferation on its own but must cooperate with other like-minded states to control WMD-relevant commodities and equipment. The more countries are aware of illicit trafficking and have effective laws in place to counter it, including criminal sanctions and extradition treaties, the better the odds of success.
- *Devise effective controls in WMD proliferation-relevant areas where new technologies are emerging.* The logic of adjusting export controls to changing conditions should not mean simply relaxing or reducing controls. In some instances, it may be necessary to introduce more sophisticated and tailored approaches. One of the greatest challenges is to devise *effective* (as well as more *efficient*) controls in WMD proliferation relevant areas where new technologies are emerging, sometimes at a rapid pace.[8]

IV. **International Export Control Regime Deficiencies.** To be sure, one can identify significant shortcomings in both the design and performance of the major international export control regimes: the Nuclear Suppliers Group (NSG), the Missile Technology Control Regime (MTCR), the Australia Group, and the Wassenaar Arrangement. These deficiencies include non-membership of some key exporting countries, inconsistent implementation of "catch-all" and "no-undercut" provisions, inadequate reporting and intelligence sharing practices among member states, and lack of familiarity by industry in member states of the provisions governing exports. These problems, however, should not obscure the very useful contribution to WMD nonproliferation made by the NSG, MTCR, and the Australia Group.

[8] As part of a two-year study on the Governance of Emerging Dual-Use Chemical and Biological Technologies, the James Martin Center for Nonproliferation Studies is examining over a dozen emerging technologies (including chemical micro-reactors, viral synthesis, and synthetic genomics) that have enormous economic and/or therapeutic promise, but could also be used for malevolent purposes by terrorists or states.

It also should be noted that these nonproliferation regimes were not driven primarily by Cold War considerations or attempts to stymie the Soviet Union's quest for WMD.[9] Indeed, in the nuclear sector during much of the Cold War the United States and the Soviet Union pursued remarkably similar nuclear export control and nonproliferation policies, and Washington often found it easier to cooperate closely with Moscow on nuclear nonproliferation and export control issues than it did with some of its close allies. As such, it does not follow logically that these export control arrangements should be scrapped or substantially modified simply because the Cold War has ended.

Despite progress in expanding international support for prudent nonproliferation export control measures designed to address the growing threat posed by non-state actors, many countries today still regard WMD terrorism as someone else's problem. As my CNS colleague Dr. Jonathan Tucker has demonstrated in the realm of chemical weapons precursors, states either may "not share U.S. concerns about the need to prevent the diversion of dual-use materials and equipment to WMD programs or lack the resources to perform this task effectively."[10] A tendency to discount nonproliferation considerations is reinforced by "just-in-time" inventory practices and free-trade zones, which depend on and are designed to expedite and/or avoid export controls. Indeed, many exporters prefer to use ports and transit hubs where customs enforcement is minimal or lax, making them easier and faster to transit—but also facilitating illicit trade in WMD-related items. As Tucker observes, "[i]n addition to economic pressures, the lack of a global consensus on 'best practices' for customs inspections has hampered the development of international standards."[11] Yet another challenge is that throughout the Asia-Pacific region, information on cargo manifests is considered proprietary and few details must be declared.

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[9] See Congressional Research Service (Mary Beth Nikitin, Coordinator), "Proliferation Control Regimes: Background and Status," Updated January 31, 2008.

[10] Tucker, *Trafficking Networks*, p. 35.

[11] Ibid.

The difficulty of prosecuting export control violations—in the United States and abroad—further undermines the deterrent value of export controls. Many countries, including our closest allies do not recognize the U.S. legal concept of extraterritorial jurisdiction and do not permit the extradition of their citizens.

As one contemplates reforms for the U.S. export control system, one must be aware of the liabilities that result from divergent international practices and priorities, as well as the shortcomings of existing international export control regimes. It is also the case, however, that many states do follow the U.S. lead on nonproliferation export policy and that, by and large, nonproliferation export control norms and practices have become more prudent and widespread over time. This positive trend in strengthening domestic export controls is perhaps most obvious with respect to China's national trade control system, although further improvements in enforcement are still needed. Although the 2008 NSG exemption granted to India marked a major step backward in the international nuclear export control arena, it is all the more imperative today to strengthen the NSG and the other international mechanisms that focus on WMD proliferation.

IV. **Corrective Measures.** A sound U.S. approach to nonproliferation export controls requires a two-pronged approach: (1) recognition and retention of those aspects of the system that have performed well, and (2) introduction of new features that will enhance economic competitiveness and information and technology flow without weakening the international nonproliferation regime. Let me conclude my prepared remarks by suggesting how these dual objectives may be pursued in tandem.

Retain the "Catch-All Rule." Whatever the United States does, it must be very careful not to make matters worse. Among other things this dictum cautions against acceptance of the advice of those who would like to dilute or restrict further the "catch-all" provision in Part 744 of the Export Administration Regulations. This provision holds that that dual-use items or technologies that are not on the Commerce Control List may still require an export license if the exporter has reason to believe that the item is intended for the development, production, or delivery of nuclear, biological, or chemical weapons. In fact, an

increasing number of companies today have made strides in incorporating the "catch-all" philosophy into their internal compliance programs, and greater efforts should be made to encourage the adoption of WMD nonproliferation objectives as a component of corporate social responsibility goals.

Work with Other Countries to Reform Their National Laws and Practices. A major step forward in promoting WMD-related export controls internationally was taken in April 2004 when the United Nations Security Council adopted Resolution (UNSCR) 1540. This measure, among other things, requires all UN member states to adopt and enforce effective laws which prohibit non-state actors from acquiring WMD, their delivery systems, and the materials needed to produce them. Although few states directly challenge this mandate, its implementation has been undermined in many countries due to lack of resources, competing demands, and poor understanding of the relevance of the measure for their own national security interests. If UNSCR 1540 is to be effective as an export control initiative, it will be necessary for the United States to increase its support for regional and national 1540 training programs. To comply fully with UNSCR1540, it also would be desirable for states to amend their extradition treaties to cover WMD-related export violations.[12]

Increase Funding for Export Control Enforcement. Effective export control enforcement continues to be hampered by the lack of sufficient personnel to undertake proper end-use checks and aggressively pursue investigations of suspected violations. It does little good, for example, to identify new cases that merit investigation if one is unable to assign trained personnel to conduct investigations at home and abroad.[13]

Explore New Remedies for Export Control Violations. The demanding legal standard for proving criminal violations of the Export Administration Regulations suggests that new types of remedies are needed in an age of

[12] This point also is made by Tucker, p. 38.

[13] On this issue see "Testimony of Arthur Shulman," Hearing on the Export Administration Act: A Review of Outstanding Policy Considerations, House Committee on Foreign Affairs, Subcommittee on Terrorism, Nonproliferation, and Trade (July 9, 2009).

economic globalization. One promising approach is to impose financial sanctions against companies and persons involved in WMD-related trafficking, such as those mandated by the Iran Nonproliferation Act of 2000 and Executive Order 13382 of June 2005. Other possible sanctions against companies and persons involved in the trafficking of WMD-related materials and equipment include the denial of export rights to the United States or restrictions on individual travel.

Invest More in Nonproliferation Education and Training. It is necessary but not sufficient to adopt new rules and regulations internationally with respect to WMD-related exports. Equally important is the need to build a global nonproliferation and security culture in which government and industry officials, scientists, and graduate students who work with dual use WMD-related technology and materials in the nuclear, biological, and chemical fields learn to appreciate the potential dangers posed by these items and become familiar with the domestic and international regulations governing their use.

I will conclude my remarks by touching on the issue of nonproliferation export controls as it pertains to the university environment. At a time when the great majority of U.S. government officials and politicians of different political persuasions agree on the dangers posed by WMD proliferation, it is surprising how limited the opportunities are for students at all levels of education to acquire formal training in the field.[14] In a very small way, the Monterey Institute of International Studies is trying to address this knowledge gap by offering a new Masters degree program in Nonproliferation and Terrorism Studies—the first of its kind in the world. But many more universities will need to follow suit if we are to train the next generation of nonproliferation specialists or even introduce our future leaders in government, science, and industry to the subject.

One practical step to remedy the problem, at least in the United States, would be to pass a National Nonproliferation Education Act, perhaps modeled after

[14] "Nonproliferation Education in the United States, Part I: Undergraduate Education," *The Nonproliferation Review* (Fall/Winter 2002), pp. 9-30.

the National Defense Education Act or the National Security Education Act. Such legislation, ideally funded by a one-time appropriation of around $50 million, would provide up to 50 fellowships per year to graduate students to pursue advanced multidisciplinary training in nonproliferation studies at the universities of their choice. An act of this sort would have the dual positive benefit of attracting top-notch young talent to the field and encouraging more universities to offer courses on nonproliferation issues (including export controls) in order to attract tuition-paying students. While not a short-term solution to our current predicament, this approach would help to create the next generation of experts on whom the United States will rely to tackle increasingly complex task of preventing the proliferation of nuclear, biological, and chemical weapons of mass destruction.

Chairman BERMAN. Thank you very much, Dr. Potter. You have some very interesting ideas in there.

And, Ms. Murphy, we look forward to hearing from you.

STATEMENT OF MS. KAREN MURPHY, SENIOR DIRECTOR, TRADE, APPLIED MATERIALS, INC.

Ms. MURPHY. Okay. Mr. Chairman and members of the committee, member of the committee, and distinguished guests, again, I am Karen Murphy, the Senior Director for Trade at Applied Materials. I thank you for holding this hearing on export controls and for offering me the opportunity to testify before you today.

Mr. Chairman, in addition, thank you for your editorial in today's Mercury News. I particularly appreciated the comment on how export controls get little media attention. Holding a hearing in Silicon Valley is important because of the number of companies who have experience with these regulations and are located here.

I think the fact that the room is full of such representatives is in support of this premise. And probably no one in this room doubts the need for updating our export control system.

Applied Materials is based here in the Silicon Valley. We are a global leader in manufacturing equipment used to produce computer chips, flat panel displays, and solar photovoltaic cells. In our last fiscal year, our revenues were approximately $5 billion, of which more than 80 percent came from sales outside the United States. With so much of our business overseas, we devote considerable resources to trade compliance and welcome this opportunity to share our views.

An important concern, in addition to the comments around the Cold War, is that current regulations were really written around a business model that a company designed the product, made the product, and sold the product to one end user. Over the past 30 years, this model has evolved into a global supply chain, including engineering collaboration over the Internet and distribution partners located in countries close to our customers.

Today I will focus my oral comments on principles we need to keep in mind as we move forward on any export reform legislation and eventually regulations. My written testimony contains additional information you may find useful.

These principles are both U.S. national security and economic competitiveness depend on a strong, technologically advanced industrial base. R&D and technological innovation are now global in nature. Control mechanisms must be cognizant of and keep pace with advances in technology. Control regimes should be premised on a cooperative effort between government and industry. Export controls should be multilateral. And, finally, the export control process should be clear and simple, from its policy foundations to its execution and review.

We believe a modernized export control system built on these principles would do a much better job of protecting U.S. national security and facilitating our global competitiveness.

I would like to now spend a few moments describing how a revamped system would affect Applied Materials. In every one of our business segments, we face intense international competition. In

every business line, we are always looking for ways to run faster than that competition.

This is why we spend more than $1 billion annually on research and development. We look for scientific and engineering talent wherever we can find it, but being able to hire and retain this brain power is often difficult and sometimes impossible.

In physical terms, we perform research and development, both inside and outside the U.S. And, again, flexibility is essential if we are going to outrun our foreign competitors.

Another tool we use to stay competitive is through our global supply chain. In short, everything about our business, employees; facilities; suppliers; and our customers; and, of course, our competitors, are globalized. We need a system that recognizes this.

An effective control system should also be able to respond to technological changes. Our current system falls short, resulting in too many controls on technologies that are readily available from outside the United States.

For example, one of our tools is an etch system, which is used to create nano-scale circuits. We have a competitor in China that is proving technically competent and is making gains in the marketplace. It is also important to note that there are no U.S. etch tools, whether from our company or our U.S. competitor, installed at the leading U.S. manufacturer of semiconductor devices.

Our control lists are woefully outdated. And any updates to the Wassenaar control list take far to long to implement—that it is important to note that at the world's leading-edge manufacturer of semiconductor devices, there are no U.S. etch semiconductor pieces of equipment at that factory.

Chairman BERMAN. Because of controls?

Ms. MURPHY. No. Yes. No. [Laughter.]

Capability. What I am trying to say is the capability of the foreign equipment is clearly catching up, has caught up with the U.S.

Chairman BERMAN. Got it.

Ms. MURPHY. So here is another example. We have a competitor in China who makes similar semiconductor equipment that is proving technically competent and is making gains in the marketplace. Our control lists are woefully outdated. And any updates to the Wassenaar control list take far too long to be implemented here.

Recent example, the 2008 Wassenaar review list, the U.S. just published a few weeks ago, over 11 months after list changes were made. Is this acceptable? I don't believe so.

Controls are published as multilateral, but they must be multilateral in more than just their formal sense. Implementation should be similar among regime members so American companies are not always at a disadvantage.

Our competitors, including those in regimes and outside of regimes, are not subject to cumbersome multi-agency review process and conditions of approval that U.S. exporters are. Conditions are a problem for many U.S. exporters. Among our customers, for example, we have instances of identical tools with identical capabilities next to one another on a factory floor but with different license conditions.

This is crazy. I have got one with a pink bow, a red bow, a green bow. And depending what day it is, you can do this or that.

Finally, as technology and economies become more complex and intertwined around the world, the need for clarity and simplicity becomes even more imperative in an export control system. Our Cold War-based system implemented under IEPA is too creaky and unwieldy and, as the National Academies has pointed out, benefits no one but our competitors and adversaries.

In closing, Mr. Chairman, we are encouraged by the current appetite for change among all stakeholders. The stars are aligned as never before among Congress, the Executive Branch, academia, and industry. We hope and urge that this concurrence can produce an export control system that serves the interest of all of us.

I urge you to move forward to develop legislation that indeed protects the national security of the United States while enabling our global competitiveness.

[The prepared statement of Ms. Murphy follows:]

Testimony of Karen Murphy
Senior Director, Trade
Applied Materials, Inc.
Santa Clara, CA

Before the
House Committee on Foreign Affairs
Field Hearing
on
The Impact of U.S. Export Controls on National Security, Science and Technological Leadership

Friday, January 15, 2010

Mr. Chairman and members of the Committee, I am Karen Murphy, senior director for trade for Applied Materials, Inc. I thank you for holding this hearing on export controls and for offering me the opportunity to testify before you today.

Applied Materials, Inc., (Nasdaq: AMAT) is the global leader in nanomanufacturing technology solutions with a broad portfolio of innovative equipment, service and software products for the fabrication of semiconductor chips, flat panel displays, solar photovoltaic cells, flexible electronics and energy efficient glass. Founded in 1967, Applied Materials creates and commercializes the technology that helps produce virtually every semiconductor chip and flat panel display in the world. Our service products improve yield enhancement and increase productivity. Today, our expertise is also being used in solar photovoltaic (PV) panels that turn abundant sunlight into clean electricity.

Applied Materials employs approximately 12,600 people throughout the world. In fiscal year 2009, Applied Materials recorded revenues of approximately US$5.0 billion. With more than 80 percent of our revenues coming from sales outside the United States, export controls are an important issue for us.

We Need a 21st Century Export Controls Regime

We have been operating under a system of export controls that has changed relatively little for more than 30 years – since the Export Administration Act of 1979. On top of this obsolescence is a lack of specific statutory authority and instead a reliance on the International Economic Emergency Powers Act (IEEPA) as a legal basis. The fact that our current system is outmoded and in dire need of sweeping change is no longer questioned, as a variety of studies have pointed out over the years (most recently the National Academies' *Beyond 'Fortress America': National Security Controls on Science and Technology in a Globalized World*). More importantly, both legislative and executive branch policymakers appear to recognize the need for action.

As mentioned by other panelists, the United States is not the only supplier of technology. A look inside one of the most advanced chip manufacturing facilities in the world, for example, would reveal that there are no U.S. etch systems installed. (Etch systems are the tools that create the nano-scale electronic circuitry on the chip.) Among the foreign competitors in this technology is a Chinese company that is proving very technically competent. Moreover, because it is not subject to export controls of any kind, can move much more quickly in the marketplace. While this competitor has only confirmed 2-3 installed systems, in the

semiconductor equipment market this is a big deal. In a "copy exact" manufacturing environment, one tool is one too many as U.S. tools are replaced on customers' factory floors around the world.

Clearly, we need to modernize. We need change.

Accordingly, I would like to offer the Committee some basic principles that should guide the development of a 21st century export controls system. Many of these ideas will be familiar, as we have participated in the industry working groups that have developed these consensus principles over the past few years. These principles, which many good people have thought long and hard on, are –

Both U.S. national security and economic competitiveness depend on a strong, technologically advanced industrial base

R&D and technological innovation are now global in nature

Control mechanisms must be cognizant of and keep pace with advances in technologies

Control regimes should be premised on a cooperative effort between government and industry

Export controls should be multilateral

The export controls process should be clear and simple, from its policy foundations to its execution and review

I would like to discuss these principles – and our hopes that we really *can* enact fundamental changes – in the context of how Applied Materials operates. Specifically, (1) how we develop technology and conduct R&D; (2) how we operate in an age of a globalized supply chain; and (3) how we ship products and service them.

Research, Development and Technology

As is true for probably every high-tech company today, our technology development process is very different than it was in the past and depends on non-"home grown" talent (testimony from the other witnesses will talk to this new reality in greater detail). More than ever before, we need the flexibility to hire the best and brightest from a global pool of students to work both in the United States and abroad. In addition, we need to be able to partner with suppliers and customers to develop new and innovative products customers will buy. Students studying in the United States, but who are not U.S. citizens, are prejudiced in our evaluations due to the cost and administrative burden to bring them on board. Many of these students would like to remain in the United States and we should encourage this. We realize that jurisdiction on this issue resides in another committee, but we need a policy change that will help turn these people into Americans, not into competitors.

The need for flexibility in attracting and keeping talent is not limited to students – it is true for scientific and engineering talent throughout their careers. The business segments we operate in are all characterized by rapid change, whether in the technology itself, its application or its manufacturability. Our ability to respond effectively depends on our access to people who can develop the solutions to our customers' problems.

Globalized Supply Chains

Just as we seek our scientific and engineering talent from around the world, so do we seek suppliers from around the world. Current controls on technology sharing reduce our choices in suppliers. As an example, suppliers located in countries not party to the Wassenaar Arrangement require more compliance considerations than those in the regime. This is true even when the non-regime country has export controls that are similar to the United States. Singapore is a good example of this. To be effective, multilateral control regimes should be inclusive and not closed clubs.

Suppliers are becoming more sophisticated in their ability to deliver customer-ready components. These suppliers are more than a third party to Applied Materials; they are our manufacturing partner. The recent proposal for a license exception between related companies (ICT) should be expanded to allow for these relationships. Many of our suppliers are required to obtain a license from their local government as well as a U.S. re-export approval. This administrative burden causes delays in our ability to react to customer demand.

How Our Business is Affected

Approximately 30 percent of Applied Materials' tools and spare parts (based upon dollar value) are subject to export controls. U.S. exporters of semiconductor equipment and parts understand the importance of being able to ship and service in a timely fashion. Our competitors – both those party to export control regimes and those outside – are not subject to the cumbersome multi-agency review process and conditions of approval that U.S. exporters

are. U.S. Export Licenses are approved with more than 11 conditions and require reporting and verification visits. Foreign licenses carry only a condition around non-proliferation and have no reporting or audit requirements by their governments. In several cases, customers are now pushing back on these conditions.

It is not uncommon for some of our customers to have identical tools with identical capabilities next to one another on the factory floor, but with different license conditions. Similarly, while we have not had a license denied, when a customer shipment is delayed during the license process it can all too easily become a *de facto* denial because the customer selects another tool it can receive faster and without conditions. This situation has occurred in at least three instances at Applied Materials. One event was featured in a 2002 GAO report highlighting China and the semiconductor industry. These types of situations disadvantage not only Applied Materials as a reliable supplier, but all American companies. Buying from non-U.S. suppliers largely obviates these types of complications, which add needless cost and complexity to our customers.

Moving Forward

We are encouraged by the current appetite for change among all stakeholders. The stars are aligned as never before among the Congress, the executive branch, academia and industry. We hope and urge that this concurrence can produce an export controls system that serves the interests of all its stakeholders.

As the committee moves ahead with this important task, we stand ready to assist. In partnership, we can create fewer but more effective regulations so we control what we really can control. We should look to the rest of the world and keep foreign practices in mind as we re-design our own system. This should not be a U.S.-only silo. And we should examine the structure and makeup of current multilateral regimes to make them work more effectively. It is time to bring in those countries that are implementing export controls based on dual-use lists and non-proliferation principles. A system that is more transparent and accountable is in everyone's interests.

In closing, I urge you to move forward and enact legislation that protects the national security of the United States and, at the same time, enables our global competitiveness.

Thank you. I welcome your questions and the discussion.

Chairman BERMAN. Well, thank you. Thank all of you very much. You have all touched on important aspects of this with slightly different perspectives. And it has been very helpful.

We are not on a clock or anything, but maybe we will just sort of self-ration ourselves, which is dangerous when you deal with Members of Congress, [laughter] in terms of questions and perhaps have a few rounds, rather than asking every question I can think of before I yield to the next person.

I have some questions I have based on the prepared testimony. But something that occurred to me in the context of your testimony, Dr. Hennessy, and Zoe Lofgren's discussion of deemed exports, in the late 1990s, everyone now is focused on Iran's nuclear program and their missile program. But this was an issue as far back as the late 1990s.

At that time, one of the concerns was that Russian institutes were training Iranian students in some of the state-of-the-art technologies that they had and that as part of the desire for funding, it wasn't even so much of a calculated policy approach or to ensure you want to have technology but simply to finance the institute's work and pay the salaries of professors and all of that.

This line of basic research versus training in the knowledge of specific technologies that would have relevance for WMD programs or the means to deliver them, could you talk a little bit more about some of your thoughts on that?

Mr. HENNESSY. It is a very important area, obviously, Mr. Chairman. I think we neither seek from the university perspective to see people enter this country that would be a threat to the country. We don't want them as students. We don't want them as visitors. So I think an adequate visa screening process is certainly appropriate there.

We also by focusing our research on what we truly believe to be basic research; that is, research that is intended to be published, we believe, that that simply excludes the university from working in certain areas that would create the kind of example that you have alluded to here between Russia and Iran.

So, for example, in the case of building a highly precise telescope to go up in a missile, we are not dealing with the issue of how to design the missile or how to control it. We are simply designing the instrument that will ride atop that missile.

In fact, we don't need to have specific details about how the missile works. We may need to know some things, like how much vibration and stress will be induced on the satellite for the purpose of designing the satellite, but we don't need to know the kinds of details that would be important, for example, to an individual who might be interested in using that to build a missile to attack the United States.

Chairman BERMAN. Your research council that you co-chaired concluded that many of our current export control regulations no longer meet the country's needs. And that was a theme also of other witnesses here.

Because of that, the current system impedes our national security and thwarts our ability to compete, even as you acknowledge that we do still need export controls. This is sort of the heart of

the question for us as we embark on this process. Dual-use technologies by their nature can be used for benefit and for harm.

So I'm curious. How did your committee deal with sort of the fundamental question, what are the criteria that should be used by us, although I think the last thing we want is Congress writing the lists, maybe on campaign technologies but not on the process for who write the lists, what are the criteria that should be used to determine what should be controlled? This I think is almost essential for what we want to try and do here.

Mr. HENNESSY. I agree 100 percent. It goes to the heart of the question. What should be controlled?

I think here I would completely support what Dr. Potter said. We need to build very high walls around a set of very dangerous technologies, particularly related to weapons of mass destruction. That is the clear case that we absolutely need to deal with in our export controls. And we need to ensure that we are doing that in a way that is as effective as possible.

There is a related set of truly dual-use technologies, as opposed to certain technologies, which are really only for use in devising weapons. There is a set of related technologies that are used perhaps not for weapons of mass destruction but related things. That is where we begin to get into an area where you need a rational way for dealing with it.

I think one of the difficulties you see with the lists is that they tend to grow, they don't tend to shrink very much. So things go on the list. They never or rarely come off the list.

That obviously impedes both our ability to do our work as well as our competitive interests. And so a rational method that would, for example, sunset the list, forcing a review based on some methodology, as opposed to simply taking the easy way out, which is you leave things on the list, I think would be a rational approach to try to deal with that problem.

Chairman BERMAN. Dr. Potter, any thoughts on this?

Mr. POTTER. Well, I agree with what Dr. Hennessy just said, particularly the part where he agrees entirely with me. [Laughter.]

I think, indeed, it is important to distinguish those items which are dual-use WMD-related and the much, much larger category of strategic items, which when I read the——

Chairman BERMAN. Stop right there, though. If I were to take a list of, say, the Nuclear Suppliers Group, I would find technologies are directly for a nuclear weapons program, but wouldn't I also find dual-use technologies on such a list as well?

Mr. POTTER. That is correct. I mean, you have basically two lists for the Nuclear Suppliers Group. The one that was adopted, I think in 1992, focuses on dual-use nuclear technologies.

And so I don't want to suggest that you will not have difficulties in defining where you are going to want to retain controls, but it is still the case that those items constitute a very, very small fraction of exports. And you have a relatively small number of countries who are involved in commerce in those items.

So my sense is that the thrust of the NRC report really were related to those items which were not the focal point of my discussion, which was WMD-related. I think that distinction is probably

a good starting point in terms of where you are going to be able to make meaningful reform.

The greater difficulty is probably not in the nuclear sector, where the technologies have not been as dynamic. And so I think the lists basically that have served us well in the past continue to be for the most part useful.

You have more difficulties when you move into the biological sector. And so you may also note when I talked about the international regimes, which I thought generally have been doing a good job, I did not include the Wassenaar agreement because it moves away from my own focus on WMD technologies, equipment, and material.

Chairman BERMAN. I think for this round, I would like to ask one more question. Then I will pass it on to Mr. Rohrabacher. Go ahead. Yes, please?

Ms. MURPHY. I sort of want to comment on——

Chairman BERMAN. Come into this, absolutely.

Ms. MURPHY [continuing]. The control list philosophy.

Chairman BERMAN. Absolutely. Absolutely.

Ms. MURPHY. So I think that the control list should be—those items which you can control. So if there is no foreign competition and it has been identified as critical for the manufacturing of weapons or non-civilian products, then maybe that item should be on the list.

However, what is happening in the semiconductor device industry is that our customers are requiring us to achieve more and more devices in smaller and smaller spaces. And a lot of the materials that we are required to use and even some of the parts and components, such as items on the nuclear and chemical list, like baratrons and specialized valve and pressure systems, are on our machines now because those items achieve the results that our customers require.

So no longer can you look at a piece of semiconductor equipment and see 100 percent dual-use items contained on the machine, but as our customers require more and more solutions to their problem, we have to seek what I would call better, tighter restrictions or tighter specifications on some of the delivery systems and especially some of the materials.

And so I think that it is important to also acknowledge these requirements on clearly Applied Materials' and other companies' desire to have legitimate end users who make commercial products for civilian use.

Chairman BERMAN. Dr. Potter, how would you deal with that very specific example?

Mr. POTTER. I think it is important to start by asking what the purpose is of export controls. And you have alluded to that in your opening remarks. This is something that also is addressed in the National Research Council report.

I see export controls, first and foremost, as making it more difficult for some state and non-state actors to acquire military capabilities that could endanger U.S. national security. And although they may have the effect of impeding some legitimate U.S. exports, I think it is important that efficiency not be the only touchstone for determining what should constitute our reforms. I think one

also has to talk about effectiveness. I mean, economic cost is certainly important, but it is not the only criterion.

So I don't have a magic bullet to offer here. In some respects in the nuclear sector, it is even more complicated because you have Article 4 of the nonproliferation treaty, which also points to the inalienable right to peaceful use. And many countries will argue that they are not, in fact, being provided with the nuclear assistance to which they are entitled. So this simply further complicates the issue.

I would argue that, by and large, in the nuclear sector our export controls, including those in the international sphere—for example, the Nuclear Suppliers Group—have served us well. And so we need to be very, very careful in the name of reform not to inadvertently act in a fashion that compromises our national security in the weapons of mass destruction sphere.

So it is more of a principle. I can't give you a more specific response.

Chairman BERMAN. Shifting away from the nuclear, but let's take one of your examples, Dr. Hennessy. You talk about Professor Falco's work on plague vaccine and the obstacle that he ran into when security was tightened. It is a compelling story, but isn't there a case to be made that, especially with the plague, security needs to be tighter on that kind of research?

Mr. HENNESSY. I agree, Mr. Chairman, that there is a case for tightening security. Had he been working with the actual pathogen itself, then I think there was a very good case for it. He is working with a non-pathogenic version of the virus, specifically used in the design of the vaccine.

So there is a lower level, particularly, of security. And I think the key is to distinguish these extremely complicated cases. And I think we all have to agree that when we get into these kinds of issues, we are getting into issues where we need a level of expertise that is very hard to find to judge how to structure——

Chairman BERMAN. The kind you normally find in Congress. I understand. [Laughter.]

Mr. POTTER. I think that Karen made a point which applies to this case as well as others. And that really is the need for much greater cooperation among government, industry, and academe. If there is a readiness to try to be creative to address the legitimate security concerns as well as the obvious interests in academic freedom, then in most instances, one can find a reasonable solution.

I think you mentioned, President Hennessy, that Falco viewed it as incompatible with his research approach. I mean, that may be the case, but at many universities, there is work being done on these issues, and we have been able to satisfy also the export control requirement.

One can point to other cases at other universities where there have been clear violations. And most people would agree that the rules should have been followed and when they weren't, that there should have been consequences.

So I think the key here, really, is the spirit of cooperation, an attempt to reduce the bureaucracy where it is unnecessary. There is a great deal that can be reduced, but also there is an educational role here.

It is really important for those who choose to work in areas where there are these restrictions to better understand the restrictions and to also understand the reasons why there are restrictions. Nonproliferation awareness is crucial. And I don't think that, for the most part, industry and research on campuses have adequate access to that information and awareness.

Chairman BERMAN. Mr. Rohrabacher?

Mr. ROHRABACHER. Thank you, Mr. Chairman.

As usual, I don't think the issue is as complicated as is being presented. It is just that it requires tough decisions and requires us to be brutally frank about who is our enemy and a potential enemy of the United States and who isn't.

See, so far we have talked about how difficult it is to identify which technologies, et cetera, but if we, instead, spend our time and effort focusing on trying to identify which countries should have the controls, that takes a lot of pressure off identifying which technologies if you believe in a relatively free trade with certain people as long as the final destination is that country.

I am just going to ask the panel "Yes" or "No." Would you agree that reforms that loosen control over the export of our technologies, which loosens those controls to democratic and friendly countries, while maintaining controls and perhaps even expanding them on countries that are controlled by tyrannical regimes that may be hostile to America's national security interest is an acceptable approach as how to go forward with looking at these export controls? Basically I am asking you if——

Mr. POTTER. I would say that here simplicity is, unfortunately, not helpful. [Laughter.]

I am not sure how you characterize non-——

Mr. ROHRABACHER. So you are a no. What are you? [Laughter.]

Mr. HENNESSY. I am in favor of more complexity in a complicated issue.

Mr. ROHRABACHER. You are a no. [Laughter.]

Ms. MURPHY. I am not authorized to answer that question. [Laughter.]

Mr. ROHRABACHER. Well, let me just note if we are talking about Adolf Hitler or Joseph Stalin, there wouldn't be any laughs in the audience right now.

Mr. HENNESSY. Right.

Ms. MURPHY. Right.

Mr. ROHRABACHER. No, no. Let me. It is my time. Let me just note that in China, you have religious figures to this day that are being put in prison and the Falun Gong end up being put in these cells and they disappear. And we know what comes out of those prisons: The sale of human organs.

We are dealing with a ghoulish regime here that a lot of people are making profit off of. What is troubling me most about this issue is that we are treating China like we would treat Belgium or England.

The fact is we have a potential adversary that is the worst human rights abuser in the world, but we have companies that are making enormous profits, short-term profits, by taking our technology over there and improving their capabilities.

My theory about the technology that we are talking about that they have in China now that you just talked about is that you can trace it right back to some American capitalist who went over there to make a short-term profit or it can be traced right back to research that we financed by the United States Government somehow getting over there. But now you don't have the technology, and they do.

Well, I don't mind that when it comes to the English. I don't mind that if it comes to the Italians. I don't mind if it comes to some democratic country. But when you have a country that is still run by a group of people who throw people in prison for their religious convictions, a country that still looks at the United States as its long-term enemy, then there is something wrong.

I think that we had better start discriminating about which countries we treat as our friends because we treat our friends the same way we treat our enemies. Our enemies are going to take advantage of what we give them.

Back to your example, Dr. Hennessy, do you realize that Chinese students—have you ever read anything that Chinese students have been used by Chinese military intelligence to accomplish their goals?

Mr. HENNESSY. I am aware of that.

Mr. ROHRABACHER. Okay. And still you can make a statement to this committee that you are not going to discriminate against Chinese students?

Mr. HENNESSY. We are not going to take on research that would require us to exclude some students from the research program.

Mr. ROHRABACHER. Yes. And the one you were complaining about if I read it correctly was based on a DARPA grant.

Mr. HENNESSY. Correct.

Mr. ROHRABACHER. Okay. DARPA is what——

Mr. HENNESSY. Defense Research——

Mr. ROHRABACHER. Defense. My gosh. There is a relationship between defense and that grant. And you are complaining that we don't want to have Chinese students that will then take their knowledge back and be utilized by the world's worst human rights abuser?

Mr. HENNESSY. I think I am illustrating the difficulty that occurs in deemed export. The opportunity, then, is to conclude that you shouldn't do this kind of basic research in a university setting if you believe it really represents a threat to the country's security.

Mr. ROHRABACHER. Well, I would suggest that universities need to think that they are patriotic Americans, too, and that when we are up against an Adolf Hitler 10 years down the road, that yes, maybe it is a good idea that the American universities are helping build our capabilities. Don't you think that is true?

Mr. HENNESSY. I absolutely believe that. And I think you only have to look at this country's history to see that, in fact, academic scientists——

Mr. ROHRABACHER. Well, that is not consistent with what you just said. You know, the fact is that American universities don't have to worry about what we are building, the technology advances that we have as a country, and the competitiveness that we will have by that if, indeed, we are ensuring that that information isn't

going to people who hate the very ideals that represent the heart of America.

Scientists, university people are not citizens of the world because part of that world are people who are hostile gangsters who are murdering their fellow citizens to stay in power. The United States of America has higher ideals than that. And hopefully people in academe and hopefully people in the high tech industries understand that.

Now, what has happened from my perspective—and I have been following this for 20 years—is we have got so many corporations going over there to make short-term profit that we can't make those decisions. And all of this inability to set different standards for different kinds of countries comes down to that: Money.

Am I wrong that a lot of these big corporations finance this university and that that may be impacting decisions on what we can do to confront the possible hostile intent of China in the future?

Mr. HENNESSY. That is not a correct statement.

Mr. ROHRABACHER. Okay.

Mr. HENNESSY. While we do have money from various companies, the vast majority of our funding does not come from industry.

Mr. ROHRABACHER. Right. So there are not grants that have been brought in by major corporations to your university?

Mr. HENNESSY. There are grants from companies, but it is vastly overwhelmed by both the universities' own research dollars as well as, of course, research dollars coming down from the Federal Government.

Mr. ROHRABACHER. Not just this university, but I have seen this throughout our system where, time and again, we have these big corporate interests that are going over there to make a quick profit, by the way, at the expense of the American worker, who now doesn't make as much money because they have set up competition overseas.

And those same companies were supposed to influence the Chinese to make them more democratic. That was the theory. But, instead, what we have done is we have allowed them to use their influence economically and otherwise to influence our policy right here in this country.

And I think that this hearing is getting right to one of the very heart of the matter, that we are unable to set things up in a way that will prevent the Chinese, which is a potential hostile government to the United States, actually is hostile, maybe a potential enemy of our country, that it is impossible for us to differentiate between that and democratic countries. That is what is not working for us right now. That is why it is so complicated.

And, Mr. Chairman, I will just note that I have gotten passionate about the issue again. And I exposed myself. But I do feel passionately about it.

Chairman BERMAN. I know you do. I just will interject here. We had during the Cold War, my recollection of export control policies, the organization COCOM, which predated Wassenaar,——

Mr. ROHRABACHER. Right.

Chairman BERMAN [continuing]. Was about saying that there were certain countries for which we will not send certain kinds of dual-use technologies. But I do wonder as you carry out that logic,

does that mean that universities that want to do the kind of research that Dr. Hennessy talked about don't take Chinese students?

And, by the way, my recollection from 1989 was ones of the strongest forces for the democracy movement in China that culminated in Tiananmen Square was Chinese students who were in the United States at that time and who did not let us and Congress forget about what was going on there, the nature of their repression. I mean, in other words, the question is, how do we take what you say, which bears I think a lot of truth, and extrapolate into a logical policy that helps?

Mr. HENNESSY. Let me just say none of us is naive about the issues we face here. As a board member of the company you earlier praised, Google, and as the president of a university who had one of its undergraduates' account's hacked by this attack, a young woman who has participated in the free Tibet movement, we are not naive about it. We understand there are real challenges there.

Whether this country decides it needs to engage China or keep China at a distance I think is an important topic to discuss at the highest levels.

Mr. ROHRABACHER. Let us know this. If we have a student, Mr. Chairman, if a student comes here from China and he is a graduate student, and we are giving him the training and the access he needs to produce great things and he goes back to China, what we have done is subsidize China to the tune of hundreds of millions of dollars of research that that Chinese Ph.D. student now knows and can duplicate.

Some of the competitiveness that we were just talking about comes from the fact that we have provided our economic adversary and an adversary to our democratic ideals with this type of treasure that we have invested in——

Chairman BERMAN. Zoe, let's give him a green card. [Laughter.]

[Applause.]

Mr. ROHRABACHER. All right. Thank you, Mr. Chairman.

Chairman BERMAN. Anna?

Ms. ESHOO. Thank you, Mr. Chairman.

I said in my opening statement how important congressional hearings are. And for anyone who is in the audience who has never been a part of one, you are getting a real earful. You are being exposed to the various views that the Congress holds. And I think that it is healthy.

Having said that, it was not that many years ago when we all celebrated the triple birth to the Rohrabachers, triplets. And now I don't know whether they will eventually want to apply to Stanford or not.

Mr. ROHRABACHER. Oh, no. [Laughter.]

Ms. ESHOO. At any rate, thank you to our witnesses. What you have said is enlightening all the way around. Dr. Hennessy, from an academic standpoint, a scientific standpoint, unclassified materials, and how we grow that but also protect our national security.

As you said, no one here is naive. We are all patriots. We are all patriots. And in reauthorizing this and writing all the new protocols that guide us, there will not be any naiveté built into the legislation. We owe that to our great nation.

Dr. Potter, the spotlight that you placed on WMD and your extensive experience in this area is really invaluable to us. And to Ms. Murphy, from a commercial standpoint and from a company that is very important, not only here but to our country and around the world, your testimony is extraordinarily valuable, too.

I should add that there was an important announcement that that Secretary of Energy, Secretary Chu, made this morning. And I can say something about it because it was embargoed only up until 9 o'clock a.m. Pacific time. And that is that there are more than $37 million for next generation lighting. And obviously that creates opportunities for energy savings and manufacturing jobs. And Applied Materials will benefit significantly from that. So congratulations to you.

What each one of you said, there were an awful lot of heads that were nodding. So as we take your individual slice of this, we agree with you. I agree with you anyway.

I would like to mix it up a little bit. Where do you disagree with each other? Is there a disagreement? That would be helpful to us in how we draw this up.

I would like to give some credence to what Mr. Rohrabacher is saying. I wouldn't state it the same way, nor do I think that at this stage of life on this planet that we can afford isolationism. On the other hand, there are non-state actors and others obviously that are actively plotting and planning against us. That is my intelligence hat. I know that. I am not naive about it. We can build in the safeguards, I believe, to safeguard our country.

Where do you disagree with each other? Is there something in the testimony or knowledge that you have? Well, I am just asking you to kind of mix it up and maybe raise some red flags about what someone else said.

And this is all in a professional setting. So no one is going to take offense. But I think that it would be helpful to me and to the members here and those that are going to draw up the legislation because it is all part of the record.

Who would like to go first? Dr. Potter?

Mr. POTTER. Yes. I found the NRC report, which——

Ms. ESHOO. Can you move your microphone just a little closer so everyone can hear you?

Mr. POTTER. Excuse me. I thought that the National Academy, National Research Council report was, by and large, right on. And I think that Dr. Hennessy and Brent Scowcroft deserve a great deal of credit for it.

I would have preferred had there been a greater focus on how one could improve export controls in the WMD area, which I realize was not the principal orientation.

Ms. ESHOO. Yes. That was not the focus of their report, though.

Mr. POTTER. Right. The one area where I would take exception has to do with the support for the creation of an economic competitiveness exemption, which would eliminate, as I understand it from the report and from subsequent discussion, export controls on dual-use technologies where they or their functional equivalents are available without restriction in markets outside of the United States.

In my view, that recommendation, if implemented, would both be at odds with some international nonproliferation regimes to which the United States is party, and would also if it applied to the WMD area be foolhardy if a major U.S. national security goal is to make it more difficult for state and non-state actors to acquire sensitive WMD-related materials and technology.

These export controls may not preclude the acquisition by other states of their desired technology, but they may raise the costs and increase the time. They may have to go to countries whose products are not regarded as highly as U.S. products.

And so, if you wanted to put this more crudely, just because others are willing to sell us rope to hang ourselves, I don't think that means we should sell them the rope and make their task easier.

You asked. I mean, you are trying to be provocative, stir things up. And, while I would agree with a very large number of the recommendations, both in the NRC report and in Dr. Hennessy's testimony, we have to be very careful not to give all of our attention to economic competitiveness without also bearing in mind other threats to national security, particularly in the WMD area.

Chairman BERMAN. Would you yield?

Ms. ESHOO. I would be glad to, Mr. Chairman.

Chairman BERMAN. Wouldn't Dr. Hennessy if he were speaking right now say, "Well, we never intended that this exception apply in areas where we are parties to international agreements, treaty obligations,"——

Mr. HENNESSY. Correct.

Chairman BERMAN [continuing]. "Maybe even more informal groups, that that exception would trump controls for which there is a multilateral consensus"?

Mr. HENNESSY. Correct. I think that is a correct interpretation. And, as well, neither would this exemption, this competitiveness exemption, apply to truly strategic weapons materials. I don't think that was ever the intention as well.

The intention was to provide a rational way of dealing with the export controls around truly technologies which have true commercial use outside of that. And I think that was it.

I think, responding to Congresswoman Eshoo's question, I think the place where we would have an intensive debate, I suppose, would be when we got to various dual-use issues in the biological sphere. We have not had a large-scale international biowarfare attack on the U.S., either by a non-state actor or by a state.

The difficulty in the bio area is that essentially many of the core technologies other than, of course, the organisms themselves, are dual-use in nature. And that makes it extremely difficult.

If you want to be manufacturing drugs, you need to use certain instruments, which, of course, could also be used to manufacture biowarfare agents.

That is an extremely difficult area and one that has to be carefully looked at. It is one where the academic community and the scientific community have done some self-policing. And I think that perhaps gets back to something Dr. Potter said encouraging the use of the community to actually act as a self-policing strategy with respect to certain technologies.

Ms. ESHOO. Ms. Murphy?

Ms. MURPHY. It is hard to analyze the other speakers' testimony because, again, Applied Materials and most of the commercial companies, even here in the audience today, are not in the business of weapons. Our customers are not necessarily in the business of manufacturing weapons or delivery systems.

Our customers are making equipment or devices that are the display, the televisions, the solar panels. And even the chips that most of our customers build with our machines are for computers, communications, your cell phones, and other types of electronic equipment used for a variety of commercial uses. Even I think my refrigerator has more chips in it than my old microwave oven did. So it is just becoming more and more, our cars with a lot of the devices in them today.

But, again, the goal, again, is, really—I think some of the other comments—and I am sorry Mr. Rohrabacher left the room. I mean, we do have sanction availability to specific entities of concern. And we can't be scared to use that.

Export control legislation, this usually ends up happening that we get to this point, and we can't argue that this is a very complicated area—we don't want bad people to make things that will be of harm to the U.S.

So we do have sanctions available that we should use and lists of entities of concern that we can use as well in harmony with a rationalized control legislation.

Also, we touched on immigration, which is not a purview of this committee, obviously, but those regulations as well, again, need to be in harmony to prevent——

Chairman BERMAN. We do have the chair of the Immigration——

[Laughter.]

Ms. MURPHY. Yes, I know. We visit her all the time as one of our employees was also impacted by being arrested and impacted by issues around immigration. Again, students and other people who come to the U.S. under temporary permissions should be able to stay here quicker under legal programs, such as permanent residency and citizenship.

So, export controls should not be the focus of these other very complicated issues, such as sanctions and immigration. We still need a rationalized export control program that truly deals with the dual-use and commercial commodities.

Ms. ESHOO. Thank you.

I just have two other quick questions. Based on the testimony relating to the private sector and the university community, do you think, Dr. Hennessy, that they should be held to separate sets of export control laws and regulations? Would that help to bring a much clearer definition to the roles?

Mr. HENNESSY. It probably would because obviously there are different concerns that——

Ms. ESHOO. Right.

Mr. HENNESSY [continuing]. And different issues that come up. And I think what the universities really want to ensure is the freedom of research around basic research, fundamental research, and less so about applications of various pieces.

Ms. ESHOO. Something that hasn't come up in the testimony, we haven't mentioned it here at the dais, and that is that the agencies

that are charged with the responsibility of carrying out the export control laws that we have, State Department and the Commerce Department, both very different in terms of their missions.

Is that where all of this should be? Should they continue with their shared responsibility? Should we be looking at a new model? Has anyone given any thought to this? And if so, what might you suggest?

Mr. HENNESSY. I think there has been some thought about it. And I think what I would say is the current shared authority results in far more complexity and complication——

Ms. ESHOO. Right.

Mr. HENNESSY [continuing]. Than is necessary, I think, to do a good job with export controls.

Ms. ESHOO. Anyone else?

Ms. MURPHY. Yes. I believe it is touched in my testimony, the fact that, again, our partners in the regimes don't have the multi-agency. It is kind of a one-stop shop. They do seek expertise from their laboratories and their experts in defense community when making those difficult decisions.

Ms. ESHOO. Who has the best model, do you think?

Mr. ROHRABACHER. Don't say Germany.

Ms. MURPHY. Don't say Germany?

Ms. ESHOO. Don't say China. [Laughter.]

We are going to have the Fourth of July here.

Ms. MURPHY. Actually, I have been having very good experience with the Singapore government, who is not in the Wassenaar arrangement. Their Customs authority is the group that handles export licensing. And we have been having some very good discussions with them; and then maybe, secondarily, the U.K.

We have good discussions with them when we find we need export controls from their agency.

Ms. ESHOO. Thank you very, very much. Thank you, Mr. Chairman.

Chairman BERMAN. Zoe Lofgren?

Ms. LOFGREN. Well, thank you, Mr. Chairman.

It is interesting what seems obvious and we all agree on when you get down to the details becomes more difficult. And I think this is a prime example of that.

You know, in terms of controlling the export of material from the U.S., I think all of us agree that that is a burden and it is a burden that needs to be assumed if there is a benefit. The question I guess really can go, is there a benefit of any value that would justify that burden?

I remember hearing Dr. Hennessy a few weeks ago saying it is the buy it at Fry's standard, which is something I have actually used on the floor of the House. If you can buy it at Fry's, it is too late. So it goes to not only what is on the list but how fast that list changes.

At one point, a Sony PlayStation had too much computing power to be exported. And no one agreed that that was sensible. And, yet, it was impossible to change in any prompt way.

So I think some of what needs to come out of this change in the legislation is a system that is agile and quick, I mean, that is accurate but doesn't take forever so that the technology has moved so

much faster than the government has and that also that it has to be some way to inform the decision-makers about the technology.

We had big fights on MTOP standards and is that the right standard and supercomputers. Meanwhile the world moved past that into network computers. So the argument was meaningless. And, yet, we continue to hamper ourselves for no good reason.

The burden did not yield the benefit and security of the U.S. So I am hopeful that we can come up with some way, perhaps even the National Academy or the Research Council, who there is no way the government itself is going to necessarily possess the breadth of that information, but there ought to be a very meaningful advisory capacity that helps us avoid those mistakes.

In terms of—and I want to get back to the deemed export issue and what this means for universities today and where it leads us to. It has been interesting. Now, we know that if we are going to remain the first, we have to get the best minds in the world into our university systems and, to the maximum extent possible, allow those brightest people in the world to become Americans and be part of our team. That is part of our strategy for success.

We have touched on the immigration issues that we hope to remedy, but part of that is, how do you compete for the smartest people in the world?

Now, if you take a look at the universities—I mean, I don't want to give a whole list but Stanford and University of California and Harvard and M.I.T.—and others are others—are among the top universities in the world. And, yet, I have noticed in terms of competition for the elite minds of the world, we are now getting competition from Australia and Britain and other places for a variety of reasons.

What role does the deemed export rule have in terms of being able to attract the very top? I am not talking about undergraduate, but for your Ph.D. programs, what role does that have in the competition for the elite scientific minds in the Ph.D.-level student competition, Dr. Hennessy?

Mr. HENNESSY. I would say that students don't immediately see deemed export. They see the normal visa process as the thing they encounter. And I must say there have been a lot of improvements in the visa process since the difficult days that occurred as quite predictable after 9/11, but we would have a difficult time, student visas. But there has been a lot of improvement in that.

One of the lingering difficulties around visas is that there are still significant problems for short-term visitors coming to attend a conference. The result has been that a number of agencies have moved major conferences outside the United States. That means A) we are less well-represented at that conference but also that we don't send graduate students to international conferences. So our participation of our young people in that conference is hurt.

The more immediate difficulty of deemed export, then, becomes when we are doing a research project that has the potential of a deemed export control around it. It simply makes it impossible for us to participate in that research because we would not only have to have the students undergo, essentially provide all of the information for a background check, international students, but they would be prohibited from talking to other students, they would be

prohibited from having an open research group meeting, where a student who wasn't cleared couldn't come into the meeting and participate in the meeting. They couldn't discuss it with their fellow students. So all of the things I think that makes the U.S. academy work so well in terms of its intellectual vitality would break down if we started doing a lot of research that involved deemed exports.

Ms. LOFGREN. So essentially the universities are going to have to withdraw from an element of basic research?

Mr. HENNESSY. That is what basically happens. We basically don't do it or we at least try to limit it or we will try to find an industrial partner that can deal with that aspect of the research.

One of the things that became quite a concern a few years ago was the notion that all uses of potentially export controlled equipment would be controlled. That would have basically prevented foreign students from walking into a large number of our laboratories in the biological sciences and chemistry and engineering and using the equipment in pursuit of perfectly legitimate basic research that had nothing to do with an export controlled entity, but because the instrument itself was export controlled, the use of the instrument would be covered by deemed exports.

Ms. LOFGREN. As mentioned, this is complicated stuff, but it seems to me that if we want to stay number one, we have got to find a way to make sure that the top minds in the world want to come here and be on our team. And getting this right is part of that answer.

So I thank you, Mr. Chairman, for your work on this. And I look forward to not only following it but hopefully playing a positive role as we put together a sensible response to these challenges.

And I yield back.

Chairman BERMAN. Well, thank you. I notice it is 12:30. I have about 3 hours of questions left, but I think I am going to try and contain myself and follow up with some of you as individuals on some of these issues.

Do any of my colleagues want to get into—I mean, we really just, I think very helpfully, scratched the surface of this. I would love to, but this is not the last. It is the first, but it is not the last, of these hearings. And I thank you both for helping to, in many ways all of you to helping to, join the issue for us, understand some of the ideals we are going to have to face.

And I do want to make special note because I think Dana's comments about China, this will not be the last time that issue is raised. For one thing, Dana is going to still be around. [Laughter.]

And, secondly, it is going to be on people's minds. And even the events of the last couple of days have renewed that. Finding a sensible way through all of that and what is really effective, as opposed to what might feel good or something is very important for us.

Just on the issue of how do we in the U.S.—this is not the subject of this hearing, but the Internet repressive regimes and how should we react to them. They are different approaches. I think it is something our committee has to take another look at.

We have actually systematically questioned information for a number of companies, many in this area, on their concerns regarding joining the global network initiative, which advocates the com-

panies adopt corporate responsibility guidelines and collaborate with human rights NGOs to push back on some of these Internet repressive regime demands. I think we have to look at this more, but meanwhile we are going to proceed ahead with looking at the Export Administration Act.

I came to Congress in 1983 and went on the Trade Subcommittee. And, actually, you are right. The real reform of this, the real act was done in 1979, in Carter's last year. We made one reauthorization effort, did some changes. It was a very arduous process in 1985 and '86.

And I remember the fight was very much defined by the notion that you could not export an embedded microprocessor. But the Counsel General for the Soviet Union could walk down the street to the nearest toy store in San Francisco and buy a bunch and take them back with him when he went home.

But it is a different time now. And that is where your, Dr. Potter's, I think, presence here is very important. There are still hugely critical national security issues we have to deal with.

Thank you all for coming. We appreciate it. And, with that, the hearing will be adjourned.

[Applause.]

[Whereupon, at 12:32 p.m., the hearing was concluded.]

APPENDIX

Material Submitted for the Hearing Record

FULL COMMITTEE HEARING NOTICE

Committee on Foreign Affairs

U.S. House of Representatives
Washington, D.C. 20515-0128

Howard L. Berman (D-CA), Chairman

January 12, 2010

TO: MEMBERS OF THE COMMITTEE ON FOREIGN AFFAIRS

You are respectfully requested to attend an OPEN hearing of the Committee on Foreign Affairs, **to be held at Stanford University, Arrillaga Alumni Center, First Floor, 326 Galvez Street, Palo Alto, CA:**

DATE: Friday, January 15, 2010

TIME: 10:30 a.m. (Pacific Standard Time)

SUBJECT: The Impact of U.S. Export Controls on National Security, Science and Technological Leadership

WITNESSES:

John L. Hennessy, Ph.D.
President
Stanford University
and
Co-Chairman
Committee on Science, Security and Prosperity
National Research Council

William C. Potter, Ph.D.
Director
James Martin Center for Nonproliferation Studies
Monterey Institute of International Studies

Ms. Karen Murphy
Senior Director, Trade
Applied Materials, Inc.

By Direction of the Chairman

The Committee on Foreign Affairs seeks to make its facilities accessible to persons with disabilities. If you are in need of special accommodations, please call 202/225-5021 at least four business days in advance of the event, whenever practicable. Questions with regard to special accommodations in general (including availability of Committee materials in alternative formats and assistive listening devices) may be directed to the Committee.

COMMITTEE ON FOREIGN AFFAIRS

MINUTES OF FULL COMMITTEE HEARING

Day *Friday* **Date** *1/15/10* **Room** *Palo Alto, CA*

Starting Time *10:32 a.m.* **Ending Time** *12:32 p.m. (PST)*

Recesses [ ] (_____ to _____)

Presiding Member(s) *Howard L. Berman (CA), Chairman*

CHECK ALL OF THE FOLLOWING THAT APPLY:

Open Session [✓]
Executive (closed) Session [ ]
Televised [✓]

Electronically Recorded (taped) [✓]
Stenographic Record [✓]

TITLE OF HEARING or BILLS FOR MARKUP: *(Include bill number(s) and title(s) of legislation.)*
The Impact of U.S. Export Controls on National Security, Science and Technological Leadership

COMMITTEE MEMBERS PRESENT:
Howard L. Berman, Dana Rohrabacher

NON-COMMITTEE MEMBERS PRESENT:
Zoe Lofgren, Anna G. Eshoo

HEARING WITNESSES: Same as meeting notice attached? Yes [✓] **No** [ ]
(If "no", please list below and include title, agency, department, or organization.)

STATEMENTS FOR THE RECORD: *(List any statements submitted for the record.)*
2009 U.S.- China Security and Economic Review Commission Report; Submitted by Dana Rohrabacher

ACTIONS TAKEN DURING THE MARKUP: *(Attach copies of legislation and amendments.)*
n/a

RECORDED VOTES TAKEN (FOR MARKUP): *(Attach final vote tally sheet listing each member.)*

Subject	Yeas	Nays	Present	Not Voting

TIME SCHEDULED TO RECONVENE _____
or
TIME ADJOURNED *12:32pm*

Doug Campbell, Deputy Staff Director

Opening Remarks of Chairman Howard L. Berman
At hearing: "The Impact of Export Controls on National Security, Science and Technological Leadership"
Stanford University
Palo Alto, CA
January 15, 2010

Good morning – and to those who may be watching these proceedings in Washington via the Internet, good afternoon.

Today's hearing is on the impact of U.S. export controls on our nation's national security and our leadership in science and technology.

We are holding it here in Silicon Valley because no state is more heavily affected by export controls than California – with our cutting-edge high technology industry, academic institutions and scientific and research establishments – and no region of the state has more experience with such controls than this one..

We're grateful to Stanford University – and most especially to Dr. Hennessey, one of our witnesses -- for hosting these proceedings and for all the technical and logistical support they provided to make this day possible.

For the benefit of people who are new to the subject, let's start with defining our terms:

Through export controls the federal government restricts the international transfer of what are called "dual use" technologies – those that have legitimate civilian uses but also can be used for military purposes.

This is a critical aspect of our national security policy.

But there is a growing consensus among security experts as well as academics and industry leaders that our current system of export controls needs to be updated in order to continue protecting sensitive technologies while also maintaining U.S. technological leadership.

So this hearing serves at least two related purposes. The testimony will help our committee prepare for a complete revision of the statute that authorizes our system of licensing and controlling dual-use technologies. And what we learn today will contribute to congressional oversight of the export control policy review that President Obama has ordered, and that is now under way.

Joining us on the dais today is a valued member of our committee for many years, Zoe Lofgren, a Democratic representative of Southern California who is Chair of the California Democratic congressional delegation; and Anna Eshoo, in whose district Stanford University is located, Chair of the Intelligence Community Management Subcommittee of the House Permanent Select Committee on Intelligence, as well as many other things.

Export controls don't get a lot of public or media attention. They have been an important part of the U.S. national security establishment since 1949, when our current control system began as a part of NATO.

Here in California, many of our 61 thousand exporting firms – such as Applied Materials in Santa Clara – and an increasing number of our academic and research establishments – such as Stanford – have significant compliance responsibilities.

You practically have to have a Ph.D, or a law degree -- or maybe both -- in order not to run afoul the increasingly complex U.S. export controls regime. The regulations now fill more than two thousand pages. There are frequent changes -- two dozen were announced last year alone. More than twenty-six hundred items and technologies are subject to controls, just in the dual-use area.

Exporters and universities are required to check six separate lists of potentially dangerous individuals and groups – with thousands of entries -- before allowing access to controlled goods and technological information.

In many cases, government approval is required, and the growth rate in applications and approvals of licenses is phenomenal: twenty-one thousand licenses were issued in 2008, double the number from 10 years ago.

Universities and other research institutions face a particular set of compliance challenges, as the U.S. moves to broaden and tighten the rules governing access by foreign students and researchers to science laboratories and research facilities.

These rules, aimed at regulating the transfer of technological knowledge – as opposed to goods – increasingly are affecting our high-tech companies as well.

Moreover, the worldwide diffusion of sensitive goods and technological knowledge has a significant impact on national security. These are the same technologies that drive scientific advances and commercial progress.

-- Thermal imaging cameras are being used in the latest collision avoidance systems for vehicles, while remaining a key advantage for our forces on the battlefield.

-- Encryption is an important defense for individuals, companies and governments against cyber warfare and cybercrime, while at the same time shielding communications among terrorists from interception by law enforcement authorities.

-- Commercial software reportedly is being used to defeat our un-manned drones in Afghanistan.

-- Bio-engineering and nano-technology carry the promise of prolonging life and curing disease, but can also be turned to designing a new generation of bio-weapons.

These are just four examples; there are countless others.

This area of public policy raises complex questions – and there are no easy answers.

Clearly, our national security requires a continued effort to prevent our adversaries from mis-using the benefits of science and industry against us and our allies.

But just as clearly, we need to refine and update our export control policy and attendant regulations to sustain America's leadership in scientific research and discovery, and technology-driven industry. That, too, is part of protecting our national security.

Our committee, the Foreign Affairs Committee, is beginning the process of enacting a new statute to be the foundation for U.S. policy. Today's hearing is in some ways the first formal step I that process.

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