AUTHENTICATED
U.S. GOVERNMENT
INFORMATION
GPO

S. HRG. 109–1088

MANUFACTURING COMPETITIVENESS IN A HIGH-TECH ERA

HEARING

BEFORE THE

SUBCOMMITTEE ON TECHNOLOGY, INNOVATION, AND COMPETITIVENESS

OF THE

COMMITTEE ON COMMERCE, SCIENCE, AND TRANSPORTATION
UNITED STATES SENATE

ONE HUNDRED NINTH CONGRESS

FIRST SESSION

JUNE 8, 2005

Printed for the use of the Committee on Commerce, Science, and Transportation

U.S. GOVERNMENT PRINTING OFFICE

61–908 PDF 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

SENATE COMMITTEE ON COMMERCE, SCIENCE, AND TRANSPORTATION

ONE HUNDRED NINTH CONGRESS

FIRST SESSION

TED STEVENS, Alaska, *Chairman*

JOHN McCAIN, Arizona
CONRAD BURNS, Montana
TRENT LOTT, Mississippi
KAY BAILEY HUTCHISON, Texas
OLYMPIA J. SNOWE, Maine
GORDON H. SMITH, Oregon
JOHN ENSIGN, Nevada
GEORGE ALLEN, Virginia
JOHN E. SUNUNU, New Hampshire
JIM DeMINT, South Carolina
DAVID VITTER, Louisiana

DANIEL K. INOUYE, Hawaii, *Co-Chairman*
JOHN D. ROCKEFELLER IV, West Virginia
JOHN F. KERRY, Massachusetts
BYRON L. DORGAN, North Dakota
BARBARA BOXER, California
BILL NELSON, Florida
MARIA CANTWELL, Washington
FRANK R. LAUTENBERG, New Jersey
E. BENJAMIN NELSON, Nebraska
MARK PRYOR, Arkansas

LISA J. SUTHERLAND, *Republican Staff Director*
CHRISTINE DRAGER KURTH, *Republican Deputy Staff Director*
DAVID RUSSELL, *Republican Chief Counsel*
MARGARET L. CUMMISKY, *Democratic Staff Director and Chief Counsel*
SAMUEL E. WHITEHORN, *Democratic Deputy Staff Director and General Counsel*
LILA HARPER HELMS, *Democratic Policy Director*

SUBCOMMITTEE ON TECHNOLOGY, INNOVATION, AND COMPETITIVENESS

JOHN ENSIGN, Nevada, *Chairman*

TED STEVENS, Alaska
CONRAD BURNS, Montana
TRENT LOTT, Mississippi
KAY BAILEY HUTCHISON, Texas
GEORGE ALLEN, Virginia
JOHN E. SUNUNU, New Hampshire
JIM DeMINT, South Carolina

JOHN F. KERRY, Massachusetts, *Ranking*
DANIEL K. INOUYE, Hawaii
JOHN D. ROCKEFELLER IV, West Virginia
BYRON L. DORGAN, North Dakota
E. BENJAMIN NELSON, Nebraska
MARK PRYOR, Arkansas

CONTENTS

	Page
Hearing held on June 8, 2005	1
Statement of Senator Allen	14
Statement of Senator Ensign	1
Statement of Senator Kerry	17
Prepared statement of Senator Lautenberg	26
Statement of Senator Pryor	22

WITNESSES

Clough, Dr. G. Wayne, President, Georgia Institute of Technology	27
Prepared statement	29
Frink, Albert A., Assistant Secretary for Manufacturing and Services, International Trade Administration, Department of Commerce	2
Prepared statement	5
Howell, Thomas R., Partner, Dewey Ballantine LLP	34
Prepared statement	37
Murray, Sebastian, President/CEO, FPI Thermoplastic Technologies	33
Prepared statement	34

APPENDIX

Inouye, Hon. Daniel K., U.S. Senator from Hawaii, prepared statement	53
Murray, Sebastian, supplementary information	54

MANUFACTURING COMPETITIVENESS IN A HIGH–TECH ERA

WEDNESDAY, JUNE 8, 2005

U.S. SENATE,
SUBCOMMITTEE ON TECHNOLOGY, INNOVATION, AND COMPETITIVENESS,
COMMITTEE ON COMMERCE, SCIENCE, AND TRANSPORTATION,
Washington, DC.

The Subcommittee met, pursuant to notice, at 9:30 a.m. in room SR–253, Russell Senate Office Building, Hon. John Ensign, Chairman of the Subcommittee, presiding.

OPENING STATEMENT OF HON. JOHN ENSIGN, U.S. SENATOR FROM NEVADA

Senator ENSIGN. Welcome to the first hearing of the Subcommittee on Technology, Innovation, and Competitiveness. I want to thank Chairman Stevens for the opportunity to chair this important Subcommittee. I also want to thank Co-Chairman Inouye and Ranking Member Kerry for their participation in this Subcommittee, and for their interest in manufacturing competitiveness.

Manufacturing competitiveness is a critically important issue to America in the 21st century. In today's economy, the global competitiveness of America's manufacturers is impacted by rapid improvements in computing, communications, and distribution technology, reductions in tariff and non-tariff barriers to trade, and litigation—for example, asbestos class-action lawsuits with over 730,000 claimants have already bankrupted 73 American companies and cost nearly 60,000 jobs.

Unreasonable medical malpractice liability jury awards increase healthcare costs. I hope that we can enact medical liability reform, which would result in significant savings to our entire healthcare system, and would help competitiveness in the United States.

Frivolous lawsuits make it extremely difficult for manufacturers of all sizes to function. In 2002, litigation cost the U.S. economy $233 billion, which is greater than the gross domestic product of Greece.

Taxation. The private sector pays $250 billion just to comply with our income tax laws.

And on the regulation front, economists estimate that compliance costs of Federal, state, and local government regulatory mandates are $1.2 trillion, more than double the 1988 level. Complying with Federal regulations, alone, costs manufacturers nearly $8,000 per employee, almost twice the average for all U.S. industries.

Litigation, taxation, regulation, healthcare, and energy costs add approximately 22 percent costs to U.S. manufacturers, as compared to the rest of the world.

American manufacturers are a cornerstone of our economy. The United States remains the world's top producer of manufactured goods. Making one dollar worth of goods generates an additional $1.50 in other economic activities. Nearly 15 million manufacturing jobs create an additional eight million jobs in non-manufacturing sectors, including retail, wholesale, and finance.

A healthy manufacturing sector is key to developing better jobs, fostering innovation, increasing productivity and obtaining higher standards of living in the United States. In addition, the United States cannot continue to grow and prosper in the new information economy if we cannot compete with countries like India and China. As private industry responds to dynamic market forces, the Federal Government should examine its appropriate role in this process.

Today, we are pleased to have two panels of witnesses to testify on the challenges and opportunities that confront American manufacturers today. Before the testimony begins, we'll give the Ranking Member an opportunity to make an opening statement. Any of the other Senators can submit their statements for the record.

In addition, we have received full written statements from all of our witnesses. We will include those statements in the record. But if the witnesses could summarize, so that we can have as much time for give and take questions, and make this more of a discussion this morning, I would greatly appreciate it. I'm here to learn, and I know that the Subcommittee is interested in hearing the views of the panels.

Our first witness will be Al Frink. Mr. Frink is the Assistant Secretary of Commerce for Manufacturing and Services. Prior to joining the government, Mr. Frink worked for 30 years in private industry, building an internationally recognized carpet manufacturing company, Fabrica International.

Mr. Frink, we receive your testimony.

STATEMENT OF ALBERT A. FRINK, ASSISTANT SECRETARY FOR MANUFACTURING AND SERVICES, INTERNATIONAL TRADE ADMINISTRATION, DEPARTMENT OF COMMERCE

Mr. FRINK. Thank you, Mr. Chairman. And good morning to you, Ranking Member, and members of this Subcommittee.

I'll begin by asking that my written testimony please be accepted into the record.

Thank you for asking me to appear today and providing me with an opportunity to discuss the current state of manufacturing. Like the Chairman said, American manufacturers are a cornerstone of America's economy, and embody the best in American values. Manufacturers are full partners in the effort to build the future of the country, with a thirst for new products and new opportunities. Simply put, a healthy manufacturing sector is a key to better jobs—jobs that foster innovation and higher standards of living for our Nation.

Strengthening American manufacturers is a top priority for the President, Secretary Gutierrez, and me. That said, the challenges facing U.S. manufacturers raise important questions for both in-

dustry and government. The President addressed these challenges by providing initiatives to help revive the economy. As a result, the manufacturing sector now has expanded for 24 consecutive months. And, though that number is good, we will not be complacent. The domestic and global economies are fiercely competitive, and we need to work very hard to stay on top.

Mr. Chairman, since taking office, I have made industry outreach a major priority. I have visited 71 manufacturing facilities, addressed 35 associations, chaired 57 manufacturing roundtables. In total, I've addressed over 14,000 manufacturers. And, I am pleased to report there is a renewed optimism in the manufacturing sector, as a majority of these firms have plans to increase investments and hire new workers.

The Manufacturing in America report was released in January 2004 by former Secretary Evans, and it represents in effect, my marching orders. We are making great strides, in that we have implemented 21 of the 57 recommendations in that book. The 22nd, and key, recommendation will be the establishment of an interagency workgroup on manufacturing. This is vitally important, because manufacturers' issues cut across numerous Federal agencies. As such, this group will provide a coordinated approach to challenges facing manufacturers. We expect to have this group in place within the next 2 weeks.

Also, to enhance the government's focus on competitiveness, we established the first-ever manufacturing council. This council plays an integral role in identifying priority manufacturing issues and providing advice to the Secretary.

With my newly created position and this council, along with industry associations, manufacturers now have the strongest voice they've ever had in Washington.

One of the many issues the council will address is innovation. The U.S. must have a policy environment that promotes innovation and helps industry grow and prosper. President Bush's 2006 budget addresses that need. It includes a record $132 billion for research and development. This represents a 45 percent increase from the budget in 2001. The proposed 2006 budget also allocates 13.6 percent of its discretionary funds to conduct research and development. In total, this represents the highest percentage dedicated to R&D since the Apollo program 37 years ago. Furthermore, this investment does not include nearly $200 million invested by businesses, and $27 million provided by states, colleges, universities, and other entities.

But, with that funding, we also need to work more intelligently with what we have. To address that, we have established an interagency working group on manufacturing R&D. This group will focus on the development and implementation of advanced manufacturing technologies.

In the area of intellectual property rights and particularly in view of all the recent technical advancements, intellectual property protection must be provided, especially for small manufacturers. For this reason, the Commerce Department has appointed trade specialists committed to protecting U.S. intellectual property in China and all over the world. In total, we have increased intellec-

tual property enforcement and compliance staff by 25 percent since 2001.

On the important issue of maintaining competitiveness, we continue to work to lower the costs of manufacturing in the U.S. As you stated, Mr. Chairman, the United States faces a 22.4 percent disadvantage, relative to our foreign competition. This advantage comes from burdensome high taxes, frivolous lawsuits, high energy costs, regulatory excesses, and healthcare costs—all the things you mentioned. This has its highest impact on small to medium-sized manufacturers, and they represent 98 percent of all manufacturing, and 70 percent of all new manufacturing jobs.

To maintain our cutting edge of technology, our tax policy must support innovation and entrepreneurship. Simply stated, that's why we needed to make the President's tax cuts permanent.

Streamlining regulations is another important component of our economic agenda. Manufacturing and Services (MAS) is now working closely with OMB to find ways to achieve regulatory objectives that minimize cost to U.S. manufacturers, while not compromising the spirit of those regulations.

In May, we launched an intensive 5-day training seminar for our analysts to develop expertise in the Federal regulatory process, and we are recruiting skilled economists to support this new initiative.

On standards and services, we have also engaged in an ongoing effort to address barriers associated with standards, which are now one of the greatest challenges in expanding exports. Our specialists are working diligently to address standards that affect competitiveness on both the domestic and the international fronts.

CAFTA is another vital instrument for boosting exports. We strongly believe in free trade. Eighty percent of all the exports coming into this country right now from that region are tariff free, and 90 percent of all agriculture is coming in tariff free. Our U.S. manufacturers do not currently share these benefits, but they will after CAFTA.

From my travels, I have seen firsthand why education and training are clearly critically essential to ensure our workforce is fully equipped to compete in the global marketplace. The President has a number of initiatives that will support education and workforce needs. One example is the $250 million in competitive community-based grants. And we at MAS are partnering with the Departments of Education and Labor to strengthen worker training in technical community colleges.

Mr. Chairman, as you listen to my comments, you can see that we have considerable work to do. But I should mention I'm also an optimist. If we can lift the burdens from our manufacturers, we firmly believe that their creativity, their innovation, and their work ethic will continue to make our economy the marvel of the world. I am very committed to working closely with this Committee to advance our vital manufacturing sector. And I thank you very much.

[The prepared statement of Mr. Frink follows:]

PREPARED STATEMENT OF ALBERT A. FRINK, ASSISTANT SECRETARY FOR MANUFACTURING AND SERVICES, INTERNATIONAL TRADE ADMINISTRATION, DEPARTMENT OF COMMERCE

Introduction

Good Morning, Mr. Chairman, Ranking Member and members of the Subcommittee. My name is Al Frink, Assistant Secretary for Manufacturing and Services in the International Trade Administration of the Department of Commerce. Thank you for inviting me to appear today to discuss the current state of manufacturing and solutions to strengthen manufacturing. I look forward to working closely with you and the other members in the months ahead.

Let me begin by reviewing the state of our very vital manufacturing sector.

Current State of Manufacturing

American manufacturers are a cornerstone of the American economy and embody the best in American values. They enhance U.S. competitiveness while improving lives domestically and internationally.

Manufacturers are full partners in the effort to build the future of the country in the marketplace for new products and ideas. Simply put, a healthy manufacturing sector is key to better jobs, fostering innovation, rising productivity, and higher standards of living in the United States.

The United States is the world's leading producer of manufactured goods. Standing alone, the U.S. manufacturing sector would represent the seventh-largest economy in the world—nearly equal to China's economy as a whole. The U.S. manufacturing sector also leads in innovation, accounting for more than 90 percent of all U.S. patents registered annually. Investments in technology create new industries and careers in manufacturing as U.S. firms introduce products and cutting-edge techniques. Perhaps most importantly, productivity in manufacturing has continued to rise significantly.

Strengthening American Manufacturing

Strengthening American manufacturing is a top priority for President Bush, Secretary Gutierrez, and myself. We are taking definitive steps to ensure that U.S. manufacturers remain competitive in the global marketplace. Manufacturing is an integral part of the U.S. and global economies. It is part of the network of inter-industry relationships that creates a stronger economy and the conditions for growth. The sector currently accounts for roughly 13 percent of GDP[1] and employs over 14 million workers.[2] The United States is the world's largest economy and has the world's largest manufacturing sector.

That being said, the challenges facing U.S. manufacturers raise important questions for both industry and government. For industry, the question is how best to reinforce the sector's strengths and maintain its competitive edge in an increasingly competitive global economy. The competitive pressure on U.S. manufacturers has forced them to cut costs, to adopt lean manufacturing techniques, and to implement quality assurance programs that guarantee zero defects in production. Innovation in products, processes, and services has become a key determinant for success. The right policies in Washington, D.C.—and across the Nation—can unleash the great potential of the U.S. economy and create the conditions for growth, prosperity, and job creation.

The President recognized this and responded quickly with an economic program of tax cuts and other initiatives soon after taking office. These initiatives are continuing to help revive the general economy, with expansion in the manufacturing sector beginning in mid 2003. Let me give you a few economic indicators to describe the current state of play in manufacturing:

- *Manufacturing output* in April 2005 was 10 percent above the levels in the fourth quarter of 2001.
- *Manufacturing exports* totaled $726 billion in 2004, which represents 63 percent of all U.S. exports of goods and services, and grew by 9.3 percent from a year ago.
- *Manufacturing profits* have continued their upward trend since the recession low and rose by more than 57 percent in 2004 compared to 2003.
- *Manufacturing wages and benefits* have increased since the fourth quarter 2001. Average hourly wages in manufacturing rose in May 2005 to $16.52, up 2.7 per-

[1] Bureau of Economic Analysis, Department of Commerce.
[2] Bureau of Labor Statistics, Department of Labor.

cent from a year ago. Benefits have increased 6.3 percent in the 12 months ending March 2005.

- *Manufacturing productivity* has increased 83 percent over the past 15 years, while productivity in the total non-farm economy has risen only 45 percent.
- *Institute for Supply Management (ISM)*—data indicates that manufacturing has had 24 consecutive months of growth.

At the Department of Commerce, we are confident that the outlook for manufacturing is good, but we cannot be complacent. The domestic and global economies are fiercely competitive and we will need to work very hard to stay on top. The Administration is committed to furthering conditions for economic growth and improving the overall competitive environment for U.S. manufacturers.

The President's Plan

President Bush is committed to policies that create the business environment that encourages innovation, lowers the cost of doing business, makes our economy more flexible and promotes economic growth. For example, the President's plan:

- Allows families to plan for the future by making tax relief permanent.
- Encourages investment and expansion by restraining Federal spending and reducing regulation.
- Makes our country less dependent on foreign sources of energy through a comprehensive national energy policy.
- Expands trade and levels the playing field to sell American goods and services across the globe.
- Protects small business owners and workers from frivolous lawsuits that threaten jobs across America.
- Lowers the cost of health care for small businesses and working families through Association Health Plans, tax-free Health Savings Accounts, and tax credits for employer contributions to Health Savings Accounts, Medical Liability Reform, and health information technology.
- Prepares workers for jobs of the 21st century by improving school standards, reforming workforce training and increasing the number of people served.

Implementing Recommendations From the *Manufacturing in America* Report

Mr. Chairman, in order to advocate more strongly for the interests of U.S. manufacturers, my first priority was to learn what was most important to them. As such, since taking office in September 2004, I have:

- Visited more than 71 manufacturing facilities;
- Chaired 53 roundtable discussions;
- Addressed 33 industry association groups;
- Participated in five President's Export Council meetings;
- Presided over three Manufacturing Council meetings;
- Attended 11 Chamber of Commerce meetings;
- Led an eight-day trade policy mission to China; and,
- Met with senior officials in Japan.

In total, I have addressed over 14,000 manufacturers.

I am pleased to report that there is a renewed optimism in the manufacturing sector as the majority has plans to increase investments and hire more workers.

We are making great strides in supporting the President's plan through implementing the recommendations of the *Manufacturing in America* report released by Secretary Evans in January 2004. With over 21 recommendations implemented thus far, the Department of Commerce will continue making progress to ensure the competitiveness of all U.S. industry. The recommendations are grouped in the following categories:

1. Enhance Government's Focus on Manufacturing Competitiveness.
2. Invest in Innovation.
3. Create the Conditions for Economic Growth and Manufacturing Investment.
4. Lower the Cost of Manufacturing in the United States.
5. Strengthen Education, Retraining, and Economic Diversification.
6. Promote Open Markets and a Level Playing Field.

I would now like to discuss with you our progress in each of these areas.

1. Enhance Government's Focus on Manufacturing Competitiveness

Establishment of the Manufacturing Council

Secretary Evans established the Manufacturing Council to provide oversight and advice on the implementation of the President's Manufacturing Initiative. Secretary Gutierrez is working with the Council and values its input. In fact, his first domestic trip as Secretary was to the Manufacturing Council's February 2005 meeting in Dearborn, Michigan. In addition, most recently, he hosted a Council meeting in Washington attended by Members of Congress.

The Manufacturing Council plays an integral role in identifying priority manufacturing issues and advising the Secretary. We will continue to work very closely with the Council, which has prepared reports on workforce issues, tort reform and market access. These on-going dialogues provide sound information regarding needs of U.S. manufacturing and the impact of Federal Government efforts.

Establishment of the Interagency Working Group on Manufacturing

Because manufacturing issues cut across numerous Federal agencies, Secretary Gutierrez has asked fellow cabinet secretaries to name a manufacturing liaison to serve on an Interagency Working Group on Manufacturing. This Working Group will facilitate a coordinated Federal approach to the challenges facing this sector both domestically and internationally.

Establishment of the Office of Industry Analysis

In January of 2004 the Administration launched the Office of Industry Analysis, which is responsible for assessing the cost competitiveness of American industry and evaluating the impact of domestic and international economic policy on U.S. competitiveness, particularly in the manufacturing sector.

2. Invest in Innovation

Introduction to Innovation Challenges

The rapid advancement in technology has presented challenges and opportunities to U.S. industry. The United States must have a policy environment that promotes innovation, and allows industry to grow and prosper. Success or failure will depend on our ability to support technology investment, research and development, and create new industries, new processes, and important services—setting the stage for advancing innovation. A partnership between the Federal Government, industry, and academia can accomplish this through strong support of research and development (R&D).

Federal Research & Development

President Bush's FY 2006 Budget request includes a record $132 billion for Federal research and development.

- This represents a 45 percent increase compared to 2001's $91.3 billion.
- President Bush's 2006 budget allocates 13.6 percent of total discretionary outlays to the conduct of R&D—the highest level in 37 years. Not since 1968 and the Apollo program have we seen an investment in R&D of this magnitude.
- In FY 2006, the Networking and Information Technology Research and Development (NITRD) program is budgeted for $2.2 billion, including research directly related to broadband technology.
- Since 2001, funding for nanotechnology R&D under the President's National Nanotechnology Initiative has more than doubled to $1.1 billion.

These investments are a reflection of the importance that President Bush assigns to science and technology to enhance U.S. competitiveness and our ability to solve challenges we face in health, defense, energy, and the environment.

Even in an environment of tight budgets, President Bush recognizes that one of the best tools we have for ensuring that the United States remains the world's innovation headquarters is to lead the world in cutting-edge fundamental research that industry can apply to its processes.

The Administration also recognizes that Federal R&D is just one part of the investment that keeps our Nation at the forefront of so many fields. Business and industry invests another $200 billion in research—the largest source of R&D funding in the U.S., providing 63 percent of total 2003 R&D funding. State governments, universities and colleges, and nonprofit institutions invest an additional $27 billion.

Interagency Working Group on Manufacturing R&D

The Interagency Working Group on Manufacturing Research and Development was established as a result of the President's Manufacturing Initiative in 2004. Par-

ticipating agencies include Commerce, Agriculture, Defense, Education, Energy, Health and Human Services, Homeland Security, Labor, National Aeronautics and Space Administration, National Science Foundation, the Office of Management and Budget, the Office of Science and Technology Policy, Transportation, and the Small Business Administration.

The goal of this multi-agency focus is to lead the development and promote the implementation of advanced manufacturing technologies for the benefit of the U.S. economy and the U.S. manufacturing sector, in particular. The Group will also improve planning, coordination, and collaboration among Federal agencies in these key technology areas and to increase the effectiveness and the visibility of the overall Federal manufacturing effort. The working group's objectives are to:

- Identify and integrate requirements;
- Conduct joint program planning; and,
- Develop strategies for the Federal Government's manufacturing R&D programs.

Its functions are to:

- Engage in interagency manufacturing R&D program planning and budgeting;
- Identify opportunities for collaboration, coordination, and leverage among agencies in specific technical areas related to manufacturing R&D; and,
- Identify agency priorities within these areas and gaps among them.

Protection of Intellectual Property

In such an age where competitiveness is increasingly determined by access to new ideas, rather than ownership of physical materials or fixed assets, an innovative society must have sound intellectual property rights (IPR) protection. This includes strong global enforcement, with faster processing of patents. This is of even greater importance today due to the convergence of nanotechnology, biotechnology, information technology, and cognitive technology that will create new industries and new jobs now and in the future.

The Commerce Department, through the U.S. Patent and Trademark Office, has placed an expert IPR Attaché in China to deal specifically with intellectual property rights abuses in that country. We have increased our intellectual property enforcement and compliance staff by 25 percent since 2001.

Secretary Gutierrez is committed to IPR protection and enforcement. He highlighted this commitment on his recent trips to Russia and China, where he sent a clear message that the gap between IPR laws and enforcement needs to be closed. He stated, "Violators need to face prohibitive financial penalties and real jail time, and it's time to do away with small, insignificant slap-on-the-wrist suspended sentences that allow IPR violators to go back into business."

To meet these challenges, the Administration is committed to upgrading the U.S. Patent and Trademark Office. Policies underway will allow the hiring of several hundred new patent examiners. This, in turn, will help ensure that the intellectual property rights of U.S. companies and innovators are upheld across the globe.

Strategy Targeting Organized Piracy (STOP!) Initiative

Commerce is a key member of the STOP! Initiative, which was announced in October 2004. The STOP! Initiative was created to coordinate government-wide activities to confront global piracy and counterfeiting. It seeks to:

- Secure and enforce intellectual property rights in overseas markets;
- Stop fakes at U.S. borders;
- Keep global supply chains free of infringing goods;
- Dismantle criminal enterprises that steal America's intellectual property; and
- Reach out to like-minded trading partners and build an international coalition to stop piracy and counterfeiting worldwide.

In order to provide a one-stop shop, we have established a hotline—(866) 999–HALT—which has received 300 calls since its inception in October of 2004, and set up a website, *www.StopFakes.gov*.

With this initiative, Federal agencies work with America's trading partners to crack down on global piracy and counterfeiting.

3. Create the Conditions for Economic Growth and Manufacturing Investment

If we wish to remain a nation of innovators, we do not want to over-tax industry and commerce and dampen the entrepreneurial spirit. There are key elements of the tax relief passed by Congress and signed into law by President Bush that will expire in a few years.

The Administration has urged Congress to make these vital tax reductions permanent so American families and businesses can make better decisions for their financial futures.

The President has proposed to make the Research and Experimentation (R&E) Tax Credit permanent. The R&E tax credit promotes private sector investment in research and the development of new advanced technologies.

4. Lower the Cost of Manufacturing in the United States

The National Association of Manufacturers has claimed that United States manufacturers faced a 22.4 percent overall cost disadvantage relative to our chief foreign manufacturing competitors as of 2002.

The cost disadvantage comes from:

- Higher corporate taxes;
- Frivolous lawsuits;
- Energy costs;
- Unreasonable and excessive regulatory burden, and
- Health care costs.

This burden has had the highest impact on small to medium-size manufacturers—which represent 98 percent of all manufacturing firms, half of all the manufacturing jobs, and 70 percent of all new manufacturing jobs.

Cost of Regulations

High regulatory costs have a negative impact on job creation. As mentioned previously, the U.S. manufacturing sector currently accounts for roughly 13 percent of U.S. GDP, employs over 14 million workers, and accounts for over 60 percent of U.S. exports. It is also still the largest in the world. However, the regulatory regime is substantial and compliance costs are rising.

The Office of Management and Budget (OMB) estimated that the cost of regulations imposed over the last 10 years by the U.S. Government is $35 to $39 billion per year.[3] A 2001 study by Crain and Hopkins found that manufacturing firms face a regulatory burden approximately six times greater than the average firm, and when adjusted for the number of employees, manufacturing firms face a regulatory burden per employee approximately two times greater than the average firm.[4] In addition, technology advances at times outpace the legal and regulatory system. Regulators must support innovators by incorporating private sector input in rulemaking.

Government-mandated regulations are designed to influence business behavior in favor of the public interest and focus on areas such as environmental protection, health and worker safety, national security, individual privacy, and commercial competition. However, contributions to the public good must be balanced against especially unnecessarily burdensome regulations that increase business costs, reduce productivity, and hinder job creation.

In addition, cost estimates often address only the direct expense of regulation compliance, such as reporting requirements and factory retrofitting, but these rules can also lead to increased prices, lower product quality, and other intangible costs like loss of business freedom. Most importantly, from a global competitiveness and economic growth standpoint, regulations can reduce innovation by inhibiting new ideas, constraining product development, restricting production process design, or encumbering marketing strategies.

Streamlining regulation is an important component in the President's economic agenda. The Administration has taken several positive steps toward targeting burdensome regulations for reform. The Office of Management and Budget's Final 2004 Report to Congress on the Costs and Benefits of Federal Regulations outlined 189 regulations nominated for reform through private sector input.

After a Federal agency review, including the Office of Manufacturing and Services, OMB published a list of 76 priority nominations. Manufacturing and Services (MAS) is now working with OMB to assess these regulations to find how any proposed changes might affect manufacturers. In MAS, we are focused on enhancing our regulatory expertise and will continue to work with OMB and other agencies.

---

[3] Draft 2005 Report to Congress on the Costs and Benefits of Federal Regulation, available at: *http://www.whitehouse.gov/omb/inforeg/regpol-reports_*Congress.html.

[4] Crain, W.M. and T.D. Hopkins 2001. "The Impact of Regulatory Costs on Small Firms." Report prepared for the Office of Advocacy, U.S. Small Business Administration. Available at *http://www.sba.gov*.

Tort Reform

We must also be mindful of the effect that higher levels of expected liability costs have on innovation. Due to the higher level of expected costs, firms often have to limit innovation, withhold a product from the market, or forgo hiring. If we are going to have an innovative society, we have to have a strong legal policy that supports innovation, entrepreneurship, and allows business to allocate risk in a transparent manner.

The President has proposed measures that would support this goal. We took an important step when Congress passed and the President signed legislation aimed at bringing back fairness to our Federal class-action lawsuits. We need to keep working to address other important related issues such as asbestos reform and medical liability.

Health Care Costs

Another aspect of competitiveness is health care costs. Healthcare costs represent the largest and fastest rising cost faced by U.S. businesses. In order to maintain a competitive and innovative environment where business and job-creation can flourish, we need to make health care more affordable and predictable.

In response, the President has proposed Association Health Plans that would afford small businesses greater leverage in negotiating the cost of health insurance with providers. This proposal allows small businesses to pool together to purchase health coverage for workers at lower rates. The Administration also worked to establish health savings accounts to give workers more control over their health insurance and costs. The Administration believes it is important to also reduce frivolous lawsuits against doctors and hospitals that drive up insurance costs for workers and businesses. In addition, the President's Health IT Initiative is designed to reduce errors, cut waste, and lower costs. The President's goal is to make electronic medical records universally available for most Americans in the next 10 years.

National Energy Policy

Energy costs are a major concern for manufacturers. Manufacturers consume about one-third of the U.S. energy supply—including 40 percent of the natural gas and 30 percent of the electricity. That is why the President's energy policy is really a manufacturing jobs plan.

President Bush believes the growing U.S. economy requires affordable, reliable, and secure supplies of energy. The President has outlined his broad vision to move America toward less energy dependence and urged Congress to enact a national energy policy.

5. Strengthen Education, Retraining, and Economic Diversification

Increasingly, sophisticated education and training systems are essential to ensuring that our workforce is fully equipped to compete in a truly global marketplace. A talented and skilled workforce allows manufacturing companies to succeed and drive innovation. Innovation increases the role of high value-added work to sustain our economic prosperity.

In order to stay competitive in the face of rapid technological change, we need to build the best skills and attract the best minds. Securing a high quality labor force requires an education system that is second-to-none and an effective worker training infrastructure that includes vocational training as well as worker retraining programs.

To address these issues, the President has a number of initiatives that would support U.S. manufacturers' education and workforce needs.

For example:

- The President has announced a new High School Initiative that will allocate $1.5 billion in his Fiscal Year 2006 Budget to ensure that every high school student graduates with the skills needed to succeed in college and in a globally competitive workforce.
- In the area of training, the President has provided $250 million in new competitive community-based grants under the Jobs for the 21st Century Initiative to strengthen worker training in technical and community colleges.
- He has also called for the creation of Innovation Training Accounts under which workers would have more choices about their training through increasing the use of personal job training accounts focused on instruction in high-growth job fields.
- Under the President's High Growth Job Training Initiative for Advanced Manufacturing, we have invested more than $60 million to develop model partnerships between employers, training providers, and the workforce investment sys-

tem, in order to identify and replicate best practices in workforce development that help U.S. manufacturers retain and increase their competitiveness in the global economy.

6. Promote Open Markets and a Level Playing Field

Opening export markets and removing trade barriers are the key to U.S. manufacturing competitiveness. Free and fair trade provides U.S. companies with new markets and opportunities for our products and services.

Free Trade Agreements

As an example of our approach to opening markets, the President has signed into law several new Free Trade Agreements (FTAs) that will enable U.S. manufacturers to compete on a level playing field in these markets for the first time.

The Chile FTA, which became effective on January 1, 2004, boosted U.S. exports to Chile by almost a billion dollars, and increased U.S. market share of Chilean imports for the first time since 1995.

Looking at another example—the U.S.-Australia FTA—more than 99 percent of U.S. manufactured goods exports to Australia have immediately become duty free. Manufactured goods account for 93 percent of U.S. exports to Australia.

CAFTA–DR is another vital instrument for leveling the playing field. Eighty percent of all exports from the CAFTA region enter the United States duty-free. U.S. manufacturers do not currently share in these benefits. However, they will under CAFTA. With this agreement, remaining tariffs will be phased out over the next 10 years.

Bilateral and regional FTAs help us encourage integration to meet some of U.S. industry's most important goals—a level playing field for exports, intellectual property protection, and a single set of standards leading to a more cohesive, integrated trading environment for our exporters and investors in that region.

The United States has concluded a total of ten FTAs—opening up the export markets of these countries to American industry and its workers. Of the ten agreements, the Bush Administration has entered into force FTAs with five countries—Jordan, Chile, Singapore, Australia, and Morocco (Morocco FTA in force as of July 1, 2005). New and pending FTA partners, taken together, would constitute America's third largest export market and the sixth largest economy in the world.

These agreements are meaningful for the United States. They are comprehensive and in many cases carry immediate benefits. They contain broad commitments that provide a predictable environment for our exporters and investors.

Standards

The Department of Commerce Standards Initiative launched by Secretary Evans in March 2003 underscores the need to have consistent technical standards worldwide. The initiative responds to strong U.S. industry concerns that barriers associated with implementation of foreign standards and technical regulations are now one of the greatest challenges to expanding exports.

Increasingly, technical standards are being mandated around the world through government laws and regulations. This is becoming a critical issue for global competitiveness, since they can either facilitate or impede international trade. In the United States, technical standards are largely voluntary and market-driven, although with strong government participation and support.

Many U.S. companies view discriminatory or unnecessarily trade restrictive standards as the primary trade barrier today, and it is estimated that standards issues impact 80 percent of world commodity trade. Major impediments to free trade include the establishment of standards specific to a nation or region, redundant testing and compliance procedures, and unilateral and non-transparent standard setting processes.

Open and transparent standards adoption generally has a positive effect on fostering innovation. Vendors that adopt the standard determined by the marketplace are rewarded by greater sales and production efficiencies. This, in turn, provides additional funding for new rounds of research and innovation.

The Department of Commerce supports the adoption of voluntary standards, whenever possible and the development of standards in an open and transparent manner with industry input. The Department also supports a policy of technology neutrality in government procurement and other public actions. Technology neutrality allows the market to decide which products are best and stimulates technology advancement.

Conclusion

Prior to this job, I have spent my entire career in the business sector building a manufacturing company. One of the lessons I have learned is that business contin-

ually needs to innovate to grow, produce new and better products, and remain competitive. Many manufacturers are implementing lean production procedures to remain competitive. While improved means of production is important, I continue to convey that without innovation there is no life after lean. American leadership in innovation and the development of new ideas and technologies holds great promise for our generation and the next.

There are no magic formulas. We realize there are many challenges facing U.S. manufacturing, and while we are making progress, there is much more to do. A strong and vibrant manufacturing sector is critical to providing jobs and maintaining a growing healthy economy.

Like the President and the Secretary, I am an optimist. I know that when we lift the burdens from our manufacturers, their creativity, their innovation, and their work ethic will continue to make our economy the marvel of the world.

I look forward to working with this Subcommittee to meet the challenges facing U.S. manufacturing and welcome any questions you may have. I am also very interested to listen to the views of the Subcommittee on how we at the Department of Commerce might best advance these efforts. Together we can work to ensure that the U.S. continues to remain the technological and economic power that it is well into the 21st century.

Thank you.

Senator ENSIGN. Thank you, Mr. Frink. We appreciate your testimony. I have a number of questions for you this morning.

You mention education. As I have gone around talking to various people, one of the statistics that comes out is the number of engineers that we are graduating in the United States versus the number of engineers that are graduating in China or in India. What specifically, does the President and his Administration plan to do to get more children to become interested in science and math? We have some of the finest colleges and universities in the world. I realize that the President believes passionately in improving K-through-12 education, and that the No Child Left Behind Act is making a positive impact on K-through-12 education. But, specifically, what are the Administration's plans for getting children interested in science and math, and motivating them in science and math?

Mr. FRINK. Well, I agree with your concern, and, what I hear, with regard to having engineers, is that China is producing about five times as many as we are. I would say that, to put that in perspective, they also have five times the population. But that does not minimize, in my mind, the concern for, and the need for, engineers.

The Administration has many programs that are in place to address this.

Senator ENSIGN. By the way, they are not graduating fives times as many lawyers.

[Laughter.]

Mr. FRINK. No. And I'm very——

Senator ENSIGN. We're probably graduating five times as many lawyers as they are.

Mr. FRINK. I am very pleased to be a part of an Administration that's probably short on lawyers and very strong on business people.

I can say what I'm doing in my area. I am very concerned about education. People who have gotten to know me from my speaking events know that if I have any legacy, it'll be driving education. I see a big concern with marketing of opportunities in manufacturing with regard to engineers—mechanical engineers. As I was part of

an awards ceremony on Saturday, one of the students accepting an award mentioned that his class will no longer be available, and that he will be the last graduate in mechanical engineering, which was a tragedy to hear. And I think that part of it is a bad marketing job. I'm a very big believer in marketing and what it can do. I don't think that it's been marketed effectively, in terms of academics knowing the opportunities that are there. I have found that there are so many job opportunities in the marketplace that it defies description. Of the 71 manufacturers I visited, almost all of them have "help wanted" signs hanging from their doors, but they need educated workers for the 21st century, workers with more advanced education, and they don't have the people. So, there's a demand, and there is a disconnect with the chain that creates the supply.

So, one of the reasons I want to get together—well, I have gotten together, so far, with labor—Emily DeRocco, in the Department of Labor, and Labor Secretary Chau, and will with the Department of Education, as well—is to form a committee, or a group, under the interagency working group. I know committees are not exactly the best term to use, so we're going to create a group that will seriously try to get together with the best minds of academia and the business community to come up with solutions for how we can drive education, especially in engineering, because that is a critical concern. So, that's a big part of my focus.

Senator ENSIGN. Well, thank you. I would love to hear any ideas that you all come up with, especially if any of the proposals that you put forward involve the Congress.

I want to take you down a little different road, toward the National Science Foundation. The President had proposed—and we've doubled funding for NIH, and, for the life sciences, we've done a good job on increasing funding. Some of the complaints that I've heard from the private sector, though, is that we are not paying enough attention to the physical sciences. I realize we're in tight budget times, and I am certainly a fiscal conservative. But there are areas where it is important for the Federal Government to spend its money. One of the areas where I believe we get pretty good bang-for-the-buck is investing in basic research. Investing in the National Science Foundation and the research it funds in the physical sciences helps our country to remain competitive in the global economy. Does the Administration think that we are adequately funding NSF?

Mr. FRINK. Well, I think what I would like to do is, rather than give you an inefficient answer, or a bad answer, I'd like to come back with that in the form of an educated answer.

I know that the President, as I mentioned in my report, has allocated $132 billion to research and development. Where it's allocated and where it goes, I don't have the breakdown. I think, in general terms, that program, like others, that drive manufacturing at the high-tech level or other levels, has been addressed in budget cuts. And I don't have, always, the good answer for that. I know that in business you have to make difficult decisions. And sometimes, unless you're in the forefront of that decision process, you may have a reason for why that decision was made. And so, my sense is that we should put some trust and faith in the people that

made those decisions for having had a reason, but I also believe that it's our job to question them.

Senator ENSIGN. I would encourage the Administration—you know, I'm a big believer in using the dollars that we have effectively. While $132 billion is a lot of money, the necessary question is how is its usage prioritized. You know, up here in the Congress, we have a lot of defenders of NASA, but NASA is one of the most inefficient bureaucracies that we have in the Federal Government, and a lot of the money we spend on NASA development could be spent a lot better at the National Science Foundation in grants and research that encourage innovation. There is not a lot of innovation coming out of NASA these days. But we continue to spend a lot of money there.

We ought to be looking at the dollars that we're spending, and using good metrics to find out where we're getting the bang for the buck. The Administration started doing that, and I realize, with the PAR, that they are about 60 percent through, of the dollars that they're measuring with metrics. But I would continue to encourage the Administration, in this area, especially when the dollars are so precious and when they can be stretched so far if we spend them correctly to use metrics in order to determine our return-on-investment.

I have some additional questions, but I want to turn it over to Senator Allen.

Senator Allen?

Mr. FRINK. Sure.

STATEMENT OF HON. GEORGE ALLEN, U.S. SENATOR FROM VIRGINIA

Senator ALLEN. Thank you, Mr. Chairman. I really want to commend you for holding this hearing. You and I both are very passionate about the technology, but competitiveness is absolutely essential for us, as a country. If we're going to compete and succeed, we need to embrace the advances of technology, particularly in manufacturing, for the manufacturing will be performed with greater efficiency, better quality, and less waste. It's the only way that we're going to compete and succeed. We're not going to be able to do it with lax environmental laws or low wages.

And I was looking at your statement here, overall, on—Mr. Frink—on the President's plan, things that are important. Tax policies—absolutely important if we're going to get investment in this country. We can't have taxes that are so high that it prohibits investment here. Same with regulations. Regulations need to be based on sound science, not political science.

What the Chairman talked about on education—a concern that I have, as well—is that the engineering graduates that we're matriculating in this country, they will be the ones, in the future, who will be designing and developing the new innovations, inventions, and intellectual property. And when you look at the numbers that we are matriculating, compared to China, compared to India, it is very worrisome. In fact, 40 percent of our engineering graduates are from overseas. Now, I want this country to be the magnet for the world's best minds. I want them to come here. And we need to be the world capital of innovation, including manufacturing.

So, most of the things you're saying here—make a great deal of sense. I keep this insourcing survey from the Organization for International Investment, and looking at their matrixes and things that are important for it. And I know my Chairman here, and I, worked together on repatriation of profits. If just U.S. companies get their money back in here to invest in this country, that's an important tax policy. Also, let's get companies from France, Germany, and Japan to invest in the United States to serve the North American market, rather than go to Brazil or somewhere else.

I'm not going to ask any more than the Chairman did, on the students getting interested in science and technology and engineering, but it really is important for the security of our country. The energy bill that we're going to be passing in the next few weeks will be important for security and jobs, and also competitiveness of our country, because energy costs matter.

Where we're behind, that are important issues, but we have a weak performance, are tax system, legal system, labor costs, and healthcare costs. So, those are important ones to address.

One other thing on our trade agreements that I'd like to ask you, Mr. Frink, is that we have free trade agreements, but what is the Administration doing to level the playing field, as far as manufacturers, globally? China, in the past, for example, for the fabrication of semiconductor chips—they have a 17 percent value-added tax in China on microchips; however, if they're designed in China, they get a rebate. And, in fact, if they're designed and fabricated in China, they get a 14 percent rebate. So, if you're a manufacturer assembling some product in China, and you get a choice between microchips, semiconductor chips, fabricated in the United States, or elsewhere, and it's a 17 percent tax, where it's a 3 percent tax if it's Chinese, it's not going to be too hard for—you know, a fourth-grader could figure this out, that, gosh, you're going to go with the cheaper chips. And so, it's important that we enforce trade agreements so there's a level playing field.

Could you share with us what the Administration is doing to make sure that there is a level playing field, that other countries, insofar as manufacturing, are living up to their agreements?

Mr. FRINK. Well, thank you, first of all, Senator. I think we're so totally on the same page, especially with regard to education. I'm so very pleased that both of you feel so strongly about that. It is the single most important concern I have for the future of manufacturing. And that was addressed in my marching orders, but probably not with as much emphasis as I've learned from being in the forefront of manufacturers.

As to the point about trade and what we can do to level the playing field, we provide, in our office, through the Office of Industry Analysis, most of the information that is used by our trade representatives, USTR. So, the input that we get, which will include what you just mentioned, is what we will provide USTR, in terms of the areas that we need to be addressing when we get in negotiations at WTO events, at the JCCT meeting, coming up in the Doha conferences. These are all the areas on which we provide information. And I think their arguing points are only as good as the information that we provide. And so, what we're trying to do is, not only provide the best information, but also quantify the impact so they

can see what kind of impact they're having on our economy, on the businesses. And I think that is such an important area within my Department. It's Manufacturing and Services. We have Jack McDougall behind me. He is our new Deputy Assistant Secretary for Industry Analysis. Jack comes from the private sector. He's going to take that department and, I think, bring some creative ideas on how we can take the information we generate and make it more effective at the point where it will be delivered. We can't personally deliver that, but we can provide the information.

And I think that Rob Portman, in this new position, is going to be an excellent choice to become the lead spokesman for our trade. And I think that the President's having put him in place is going to be a big factor in how we level the playing field as he leads our debates with regard to issues such as the one you mentioned.

Senator ALLEN. Well, thank you. And I think that the evidence that you present is important, whether that's in bedroom furniture, whether it's in semiconductors, whether it's in textiles, whether it's in protecting our intellectual property, or other areas that might arise in the future.

Let me finish, since my time's running out here. The other aspect, in addition to the tax and regulatory, energy, and education, which is important is research in key areas of the future. I actually do think that you're all misallocating a priority, insofar as NASA is concerned, and that's in aeronautics. The previous Administration cut aeronautics research and development by half. The proposals of this Administration are to cut it in half again. For the first time in history, our sales of aircraft in the United States were not first in the world; the Europeans were number one. The Europeans have a strategic plan to dominate by the year 2020 in aeronautics, and they're on their way to doing it. And I think it's shortsighted to—for our military capabilities, as well as civilian aviation and aircraft, to not have the next-generation or the new vehicle systems for lighter, faster, quieter, less-polluting aircraft, or hypersonic flight, as well. And so, that's the normal differences I suppose one would have between an Administration and legislative branch, but there are those of us who think that that is an important aspect for the future.

The other is nanotechnology. Senator Wyden was once a Member of this Committee, and I have moved forward, and the President signed, the Nanotechnology Research and Development Act. It is the largest increase, and I want to commend you all for following along with it, the largest increase in basic scientific research since the space program. And the nanotechnology area is a very multifaceted one. It'll affect life sciences, materials engineering, and microelectronics. And it is important that this country stay in the lead there. And I want to commend the Administration for, in a very tight and taut budget, making nanotechnology, which will affect manufacturing, particularly in materials engineering. Nanotechnology will affect everything we use, whether that's a vehicle or whether it's—especially the advancements in some of the biotechnology areas. So, I want to commend you all there. And, where you can, make sure that where we're investing in research and development, in coordination with the universities and the private sector, that we look at the competitiveness of this country, in com-

parison to what other countries are doing, whether it's in aeronautics or whether that's in nanotechnology.

Mr. FRINK. Thank you, Senator.

I have been in this new position a little over 8 months, and I have to say I'm still in the learning curve. One of the benefits I will have to help my education process will be the fact that I'm going, in a couple of weeks, to the biennial Paris Air Show, where I will be interacting with all the leading individuals that drive aerospace, and speaking about every area you were just talking about. And I'll walk away with a better sense of where we need to be. I get much more passionate in how I promote anything when I get to learn how it affects our economy. And I look forward to that. I'm going to ask hard questions. I'm always dubious of trips and how much effect you get from those. I'm going to walk away, hopefully, with a strong sense of that trip being worthwhile, and that I'll have a better understanding of where our limited dollars are going. And if I see there's a need, I will not hesitate to speak up and provide my recommendations as to where I see the need.

Part of my job is to provide advice—to take what I see from my front-line experience and move it up through the chain. So, I expect to do just that.

Senator ALLEN. Thank you, Mr. Frink.

Thank you, Mr. Chairman.

Senator ENSIGN. Senator Kerry?

STATEMENT OF HON. JOHN F. KERRY,
U.S. SENATOR FROM MASSACHUSETTS

Senator KERRY. Mr. Chairman, thank you very much. I apologize to the witnesses, and to you, for not being able to be here earlier. I had a meeting off campus, so to speak, which took longer than I expected.

I thank you for holding this hearing today. I think this is perhaps the most important topic before the nation, frankly. And the outcome of the subjects that we're talking about here today is really linked to a whole series of issues which aren't in the sole jurisdiction of this Committee, but which are critical to the Congress, itself—our tax policy, our budget, our fiscal policy, and our trade policy. They're all linked.

But what disturbs me, candidly, Mr. Frink—and I say this to the Administration, in absentia, in a sense—is that we really don't have a national plan. We're, sort of, drifting around on this topic. In the last 4 or 5 years, we've lost one out of every six manufacturing jobs. We've lost 2.7 million, total. There still was not one net new job created under this Administration in the last four and a half years. And, again, last month I think it was something like 70,000 or so lost. I've forgotten the exact figures, but you have to create about 300,000 just to stay even. And we're not.

You guys are cutting at least 90 percent of the Manufacturing Extension Program, which is hard for me to believe. I don't understand the rationale of that. Ask any small enterprise that's been involved with the Manufacturing Extension Program, and they'll tell you it has helped them take products to market, it helps them take them from laboratory to shelf. There are all kinds of upside benefits. But it's being cut. Why? So we can give the wealthiest

people in America another tax cut? You know, as a Senator you get the privilege of meeting with some of these wealthy people all the time, and, I'll tell you, I've sat with them, and not one of them has said to me, "I need this cut," or, "I want this cut." They'll take it. It'll put more cash in their pocket, and they'll sit there and tell you that, but it's not going to change their investment decisions. How they invest money, what they invest it in, is going to be the same, with or without the tax cut. It's going to be based on the prospect of a return-on-investment. It's going to be based on how fast they will earn money, and how well the marketplace is working. And our marketplace is not working very well, for a lot of different reasons.

Now, you know, astoundingly, when you measure, California lost 353,700 manufacturing jobs in the last 4 or 5 years; Michigan lost 210,000. My home state of Massachusetts lost about 110,000. And we're pretty good in our state, as they are in California and some other states in the country, at using technology to its advantage and making new jobs. There has been a slight upward tick in productivity. But, just this week, the Institute for Supply Management reported that the manufacturing sector is again losing momentum. That's their quote. They note that the rate of growth in new orders continues to decline, the employment index has failed to grow. And they openly question whether the manufacturing growth cycle is coming to an end. This economic slide has hurt businesses, investors, workers, and communities.

Now, I'm not suggesting to you—and I would never suggest this—that the government can control, completely by itself, the direction of the slide. We all know it's much more complicated than that, and there are other things that play in it. But all of us understand that we set an overall framework within which private investors make choices and have the availability of making those choices.

I had the President of Massachusetts Institute of Technology come to me the other day, the new president, and talk to me about their decline in the numbers of people of caliber who have been coming from abroad, partly because of 9/11, but also other transition that's taken place, the lack of American students going into science, math, biology, technologies, and basic sciences, in addition to the lack of commitment of the Federal dollars that used to be there in many of those areas. And so, there's a just general decline.

In Asia, they are catching up to us in areas of innovation where we have traditionally—in software and other things—been the leaders. They're turning out 300,000 engineers a year in China and India. We're going downwards.

That's the future. That is the future. And, you know, when somebody like Bill Gates tells us that American schools, even sometimes when they're working very effectively, are obsolete, we'd better stop and worry. I honestly—I don't see the Administration grabbing onto this with the kind of urgency and energy that it ought to be. We have the PCAST but many of the Council's own recommendations have been ignored, certainly not implemented. I've heard from executives at mid-sized manufacturing firms who say they've cut costs dramatically, but they still can't compete. Healthcare costs are the biggest drag on our economy. The only proposal of

this Administration are association health plans, which will affect, at maximum, maybe two million people. But we've got 47 million without healthcare, and we've got GM, Ford, with the equivalent of junk bonds. GM is now moving people to China for manufacturing. I mean, this is so much more serious than I think the Administration seems to grasp or be willing to deal with.

Tom Howell is going to point out, in his testimony today, what Japan and the EU are doing in a large-scale, long-range R&D project that's aimed at developing all leading-edge technologies. And these projects that they're engaged in are way beyond what we're doing, or even thinking about.

The fact is that the focus of some entities has been almost exclusively on tort reform, and, while all of us accept that we need some tort reform, and there's a reasonable place, with respect to tort reform, to wind up, it's such a larger playing field than just tort reform that it's, sort of, astonishing for me to see the lack of planning and implementation.

So, maybe, Mr. Frink, you want to respond to some of what I've just said, but I specifically want to ask you why it is that the Administration is cutting funding to these essential technology incubator efforts, like the Manufacturing Extension Program or even some of the basic science and research programs.

Mr. FRINK. Thank you, Senator. There's a lot on the plate there.

Senator KERRY. Yes, there is. But there is a lot on the plate.

Mr. FRINK. Yes, there is. Speaking to that specific program, there have been a lot of cuts in the budget, overall. I——

Senator KERRY. Why?

Mr. FRINK. Well, this year's budget has required cuts. And——

Senator KERRY. Why?

Mr. FRINK. I'm not the economist or the person who——

Senator KERRY. What's the priority? What is the priority of this Administration? What's the top priority?

Mr. FRINK. Jobs.

Senator KERRY. OK. And how are they going to create those jobs?

Mr. FRINK. Well, one of the things is my job, which itself was newly created. This is the first time in history that we've had a person, an individual, a lead advocate to help manufacturing. And I came from——

Senator KERRY. It's the only manufacturing job created in America.

Mr. FRINK. Well, it's a good one. It has the potential to make a difference. And we also have a manufacturing council.

Senator KERRY. But the top priority of this Administration, if you say it's jobs, why are they cutting the Manufacturing Extension Program? Why are they reducing investment in the sciences, in the grants? Why is it harder for kids to go to school? Pell Grants are down.

Mr. FRINK. I think, first, with regard——

Senator KERRY. So we can have a tax cut? That's the priority—is a tax cut.

Mr. FRINK. Well, I'm not a politician. I can't speak to what you might view as a priority. I can only tell you that my firsthand experience in the front lines——

Senator KERRY. But if you're going to come and tell me we don't have the money, why don't we have the money? It's a simple question.

Mr. FRINK. I don't know that we don't have sufficient money to meet our objectives. I think that a lot of what——

Senator KERRY. Well, why are you cutting it, then?

Mr. FRINK. Well, if I can finish, I would like to just say that I think, to some degree, government may be learning what business learned a long time ago, and that is how to get by with less and still produce great results. I don't know that we didn't have fat in many of the programs we've had. I don't know.

Senator KERRY. Fat in the Manufacturing Extension Program?

Mr. FRINK. I think that program was not intended to be disbanded. The support that was given was intended to keep all the centers up and running——

Senator KERRY. It's a 90 percent cut, Mr. Frink.

Mr. FRINK. I——

Senator KERRY. A 90 percent cut. That's——

Mr. FRINK.—believe the cut was 46 percent.

Senator KERRY. It was 90 percent.

Mr. FRINK. Well, the numbers I have show otherwise.

Senator KERRY. Well, what's the justification for 46 percent? The money doesn't go to people; it goes to a project.

Mr. FRINK. That's one area with regard to a bigger picture of what's being done to support manufacturing. I never look at one targeted area. You could say, "This is what we're not doing," but then there's also, "What are we doing?" I think the position that I have, the fact that we have a Manufacturing Council that's working at lowering the barrier costs for manufacturers around the country is a move forward.

Senator KERRY. The Manufacturing Council's report deals entirely with tort reform.

Mr. FRINK. That's——

Senator KERRY. That's what they've done.

Mr. FRINK. No, that's only one of the Subcommittee reports. The subcommittees have reported on tort reform, on the issue of healthcare. On energy, we're working on innovation. It provides advice. It just so happened that that one document was used by the President, almost verbatim, when he discussed the issue of tort reform, and the group, itself, felt very pleased that their work was responded to, which I think is——

Senator KERRY. How was it responded to?

Mr. FRINK. Well, as——

Senator KERRY. How has it been——

Mr. FRINK.—I said, the information that they put in their white paper, the President just about used their points in the white paper——

Senator KERRY. How has it been translated into the budget and into policies?

Mr. FRINK. Well, in the policies, I think that's what drove that decision recently with regard to tort reform, the first step in tort reform, that took place—was it in January, February?

Senator KERRY. I'm asking beyond tort reform.

Mr. FRINK. OK. We're on another subject. What was it—I'm sorry——

Senator KERRY. Well, I'm saying, how has the Council contributed to the budget or to any policy that's been implemented or that we're working on today?

Senator ENSIGN. Mr. Frink, after you answer this—I'm sorry, Senator Kerry—I'm going to have to go to Senator Pryor.

Senator KERRY. Absolutely.

Mr. FRINK. One thing I can tell you is this. I learned a very good lesson from Senator DeMint when I spent some time with him in South Carolina. He said, "Do not get discouraged with what you do and the fact that it doesn't show immediate results. Think of what you do as a big ship, and you move the wheel slightly, and perhaps the trajectory of how your decisions or what you influence moves down the line will show up, and, two secretaries from now, somebody might be taking the bows for what you accomplish."

I know that we are moving things in the right direction, and I have confidence that, down the line, a lot of what we do will show results. The Manufacturing Council is relatively new. It's less than a year old. It has just had its fourth meeting. It is still up and running. I am very optimistic. And the 14,000 manufacturers that I have seen in the short time I've been in this position have been bursting with optimism over how they feel the economy is moving in their behalf. Certainly, some of them have had some issues and areas of concern, but part of my job is to work on those areas, and I intend to do that. And I do have a passionate concern for people.

Senator ENSIGN. Go ahead, Senator Kerry.

Senator KERRY. I thank the Chairman for his indulgence on this, but let me just say to you, Mr. Frink, I know you're new to the job, but what I'm trying to emphasize is, there's a lot of frustration in a lot of sectors of our economy. I'm not speaking for myself, and I'm certainly not putting a party label on this. I have talked to manufacturers, to business people all over the country, and to educators across the country. The 2006 budget, unfortunately, has 4 percent less than the 2005 level for Department of Labor's training programs. It has 89 percent less for the Department of Education's vocational and adult education program. It has $104 million in cuts to the National Science Foundation's education and human resources account. I mean, I can go down a long list, where there's just a departure from the stated goals, or even the Council's findings, and what is really happening. And I think that's the frustration. And I ask you, take the time to go look at this, and be an advocate within the Administration for the reality here. Because the reality that most people feel out in the sector—I was just out in Silicon Valley, I was out talking to people—they're deeply frustrated and deeply concerned. And these are Republicans, Conservatives, Democrats, Independents, they're just business people trying to compete in an increasingly difficult world. And we've got to do a better job of helping create a framework for them to do it.

Senator ENSIGN. Senator Pryor?

STATEMENT OF HON. MARK PRYOR,
U.S. SENATOR FROM ARKANSAS

Senator PRYOR. Thank you, Mr. Chairman.

Let me ask this, Mr. Frink, if I may. Your position was created as a response to the growing concern in this country that we've lost about 2 million manufacturing jobs in 4 years. My question for you is, what would you consider to be your accomplishments to date in your new post? What have you been able to accomplish?

Mr. FRINK. Well, as I mentioned in my opening statement, I have reached out to and visited a considerable amount of the industry that I will be serving. There is a report that was written, called "Manufacturing in America," which represents my marching orders. That report has 57 recommendations. We have, to date, since I've been onboard, accomplished 21 of those recommendations. That report was a byproduct of roundtables that took place around the country, asking manufacturers what their concerns were about their ability to be competitive. And that report also included the recommendations to create my position, a manufacturing council, and many other recommendations, the total being 57. We have 21 completed. We'll expect to make that 22 in the next couple of weeks, because we'll have an interagency group on manufacturing. We have also put in a new Deputy Assistant Secretary for Industry Analysis, and a Director for Economic Analysis. We're going to continue to build a team that will ensure that the concerns of manufacturers are heard and addressed. We established the fact that the Council will play an integral role in identifying priority manufacturing issues. They organized a task force addressing a lot of the issues.

We're 8 months into this new position. I admit to the fact that I still have a lot to learn. But, I think that we have made progress. I've been on an 8-day trade mission, and I think that our best work is ahead of us, without a doubt.

Senator PRYOR. I will——

Mr. FRINK. And I think that for the period of time that we've been in place, we've made some measurable accomplishments.

Senator PRYOR. All right, well, let me ask that. You talk about measurable accomplishments. In the Manufacturing in America report that you cited a moment ago, it calls for you to lead a benchmark analysis to measure your progress. Have you done that yet? Have you done a benchmark analysis?

Mr. FRINK. We're working on that.

Senator PRYOR. OK. When will that be completed?

Mr. FRINK. Well, I think at the end of the first year. I think September 8th or 9th is when I was sworn in, so around the 8th or 9th, I think we should have that ready to show where we were and where we are now.

Senator PRYOR. And you said there's 57 recommendations in Manufacturing in America.

Mr. FRINK. Correct.

Senator PRYOR. And you've completed 21, soon to be 22.

Mr. FRINK. Implemented.

Senator PRYOR. Implemented.

Mr. FRINK. Yes.

Senator PRYOR. And does that mean those 21, soon to be 22, are done—right? They're done.

Mr. FRINK. Well, the work's started on those, for example, my position is not finished. I'm one of those 21 recommendations, so there's a lot of work I will be continually doing——

Senator PRYOR. No, I guess that's what I'm asking you. You talk about these 21, soon to be 22. Does that mean that they are—you said implemented or done or completed—I mean, does that mean that they're done, or they're all, sort of, works in progress?

Mr. FRINK. Works in progress.

Senator PRYOR. OK. So, you still have 30-some-odd—35, 36 recommendations to go. Do you have a timetable on those?

Mr. FRINK. No, sir.

Senator PRYOR. Will that be done——

Mr. FRINK. A lot of those require legislation. That's an area that I'm going to be working on. One of my targets right now is to get more familiar with the Hill and the people that will be able to make the decisions on a lot of the legislative parts of those recommendations so that I can advocate on behalf of manufacturers, where I view legislation needs to be moved.

Senator PRYOR. All right. One thing that Senator Kerry asked a few moments ago was about this Manufacturing Council Subcommittee on the U.S. Workforce. As I understand what you all said in that, and your response to that, was that—basically, you were talking about one subcommittee report, right? Not the entire effort, but one subcommittee.

Mr. FRINK. No, we actually have three subcommittees, but I think he was referring to the one on tort reform.

Senator PRYOR. Right. And you mentioned the President had cited that——

Mr. FRINK. Yes.

Senator PRYOR.—correct?

Mr. FRINK. I think that in all councils there is a bit of frustration as to the work they do and whether or not it gets used, and I think it was a big triumph for our council to know that the President cited its report on tort reform, with many of the recommendations, and used a lot of the facts contained in it to build a case for tort reform.

Senator PRYOR. As I understand—maybe I'm wrong about this—as I understand the work of that subcommittee, you looked at issues facing manufacturers, and the focus was healthcare and rising healthcare costs. And I would say—and I wonder if you would agree—that there are more challenges facing the manufacturer than just healthcare and healthcare costs. Would you agree with that?

Mr. FRINK. Absolutely.

Senator PRYOR. And as part of the Subcommittee's work, they seemed to focus on medical liability and tort reform——

Mr. FRINK. And energy and innovation.

Senator PRYOR. Right, but they seemed to focus on these two as part of the—as the solution for healthcare and rising healthcare costs. And I would say—and I wonder if you would agree—that healthcare and rising healthcare costs is more complicated than

simply tort reform and medical liability. Would you agree with me on that?

Mr. FRINK. I do. I would.

Senator PRYOR. What are—if you could list out the top—say, the top five challenges that American manufacturers are facing today, what are their top five, or maybe ten—I know I'm about out of time here—but what are the top five, or maybe top ten, things that we, in the Congress, should be focusing on to try to help our manufacturers?

Mr. FRINK. There are the big concerns. Probably number one would be healthcare costs, when you know of the automobile industry having cited as much as $1,700 per car is what healthcare affects, in terms of a single automobile. Tort reform: the Chairman referred to the $230-some billion, I think it's almost 900-or-so dollars spent per person in the United States as a result of frivolous lawsuits. Energy is a big factor. The manufacturing industry uses about 30–35 percent of all energy, so the issue of affordable energy is huge, to the majority of the manufacturing world.

We have, in America, a 22.4 percent higher cost of doing business than our foreign counterparts. These are the areas I have to work on. But the area that I have seen, the one that Al Frink has seen from his private-sector experience, is a critical concern for education. As I entered into this world and into a kind of very politically charged election—and a lot of it had to do with offshoring and jobs going away—I visited 71 manufacturers in a relatively condensed period of time, and every one of those companies had help-wanted signs hanging from the door: "Need help," "Desperately need help." The first company I visited was Benson Trucks. They produce one of the finest truck beds in the business. They couldn't find welders. They would hire 50 tomorrow, the head of the company, Gary, said. Mack Truck, if it could, would hire 100 drivers tomorrow. Can't even find qualified drivers. And he said, "Twenty-five percent of our drivers are women." I said, "What did the job pay?" He said, "It starts around $45,000. In a couple of years, with a good route, you could make $100,000." There's a tremendous shortage of qualified, educated help. Jobs are plentiful, but there's an insufficient number of trained people out there. So, I think education is probably the single most important area that manufacturing faces, moving forward.

Second is innovation. As I work on trying to lower the barrier costs for companies around the country, I think there's such emphasis placed on lowering barrier costs. I'm concerned about raising value. Manufacturing Extension Partnership teaches Lean and, perhaps, Six Sigma. That's important. But what I say is, what about life after Lean? What if that isn't enough? My answer to that is, without innovation, there is no life after Lean. We need to drive innovation to raise value.

And then, last, there are companies that can build a good product, that have innovation, but that don't know how to get that product on the market. The issue that doesn't get discussed—and it probably wasn't in the report on manufacturing initiatives—is marketing. It's part of what allowed me and my company in California to be successful. We built a marketing story. We created a value such that people paid more for our products due to the fact

that we were innovative, due to the fact we differentiated, due to the fact we had a great marketing brand, due to the fact that we didn't sell to one or two markets, we sold to seven, so we weren't affected such as a company, for example, that supplies the auto industry and loses a big customer, and now they're crippled. They need greater marketing—that needs to be taught. Small companies need to be taught, not just to lower their costs, but how to raise their value. How we get there, I haven't quite figured out, but I know it's a desperate need. So many problems can be solved by good marketing, for example, education, and the fact that we don't have people getting into engineering in the schools, and the schools are cutting classes that used to help drive our manufacturing educational needs. They don't see the need. Manufacturing hasn't done a good job in conveying the needs. Education is disconnected with manufacturing. I want to work to connect those dots, to drive education, and try to see if we can fill the educational needs for the future. I am desperately concerned about that.

Those are the areas where I see a tremendous need for government to provide help. I know education. I know innovation. I know how we can drive marketing, and the skills required for great marketing strategies. I think MEP possibly should be doing a job. I'm going to look into finding out more of what they do, and see if they have a good marketing strategy. I know that good marketing can overcome a lot of barrier costs.

China does not have a brand. Their brand is, "Made in China." We have brands in America. We can drive these brands. And I want to push American companies to recognize who they are, and not be afraid to compete.

Senator ENSIGN. Thank you, Mr. Frink. We appreciate your testimony. I want to call the second panel to the table. And, as they're coming forward, let me reiterate that it was very helpful to us to receive your testimony. I know you're new in this job, and it is difficult coming to Capitol Hill. So I appreciate what you went through.

Just as the next panel is coming forward, Senator Kerry mentioned that he has visited—he has gone out to Silicon Valley. And, you know, depending on our audiences, we all hear different things, and one of the top concerns that I hear from people is litigation. I mean, from almost every business sector I hear that the cost of litigation, the frivolous lawsuits, and the number of lawsuits are major problems that hinder the ability of American manufacturers to remain competitive in the global economy. But of the other issues that we talked about today, education is a major concern, huge to our industries out there, whether they are manufacturing or not manufacturing. It's a huge problem.

On taxation, the way that we treat our companies—especially if they are investing overseas—compared to the way the other governments treat their companies is problematic. Ireland fostered its entire high-tech industry by setting up a business-friendly tax code and regulations. In the United States, by contrast, excessive regulation is maybe the biggest tax that we impose on corporations. I don't know how many of you have been hearing about section 404 of Sarbanes-Oxley, but a lot of public companies are now talking

about going private. The cost of compliance with Sarbanes-Oxley is huge, especially for small and mid-sized companies.

In addition, healthcare is another major concern for companies and their employees. All the things that we are talking about today are very important topics to discuss in this Subcommittee. The last word in the title of this Subcommittee is "competitiveness," and one of the reasons that I was really happy that we got that word on there is because all of these things affect how we're going to keep jobs in America. And I know Republicans and Democrats, alike, want to do that, and that is one of the reasons for the hearing today.

Senator KERRY. Mr. Chairman, I'd ask unanimous consent that Senator Lautenberg's statement be put in the record, since he was not able to be here.

Senator ENSIGN. Without objection.

[The prepared statement of Senator Lautenberg follows:]

PREPARED STATEMENT OF HON. FRANK R. LAUTENBERG,
U.S. SENATOR FROM NEW JERSEY

Mr. Chairman:

I am sorry I am not able to attend today's hearing. But, I want to acknowledge one of my constituents, FPI Thermoplastics, and this company's extraordinary story.

Just 5 years ago, FPI lost a major client to a Chinese supplier that could provide its product more cheaply. FPI was threatened with bankruptcy, with dozens of jobs on the line.

In order to compete with the low-cost, Chinese supplies, FPI needed to modernize. FPI had the will and the work ethic to change, but it lacked the expertise to transform its operations.

Working with Robert Loderstedt, President of New Jersey's Manufacturing Extension Partnership (MEP) program, FPI was able to find savings it never thought possible—MEP showed FPI how it could use acquisitions to diversify its client base, save money by closing an offsite warehouse, find unneeded assets it could sell off, implement lean manufacturing techniques, and reduce its cost of debt.

Today, FPI is competing with China and winning, and it is growing rapidly. By investing about $210,000 in FPI, the MEP program helped FPI to produce millions of dollars in economic growth and dozens of manufacturing jobs that allow middle-class New Jerseyans to provide a good, stable and healthy living for their families.

FPI is just one of MEP's success stories. It is a shining example of the important role an active government can play in improving our manufacturing competitiveness and strengthening our economy. We must preserve vital programs like MEP that give businesses the tools they need to be competitive.

Senator ENSIGN. Now, I will introduce the second panel of witnesses. Dr. G. Wayne Clough is the President of the Georgia Institute of Technology. Dr. Clough is also a member of the President's Council of Advisors on Science and Technology. Dr. Clough is the Co-Chair of the National Innovation Initiative. Sebastian Murray is the President and CEO of FPI Thermoplastic Technologies. His company provides injection molded plastic products to companies like McDonald's and Bed Bath & Beyond. Thomas R. Howell is a partner at Dewey Ballantine, LLP. He has specialized in international trade matters for more than 20 years. In that capacity, he has represented several clients from the semiconductor industry.

Dr. Clough, we'll start with you.

STATEMENT OF DR. G. WAYNE CLOUGH, PRESIDENT, GEORGIA INSTITUTE OF TECHNOLOGY

Dr. CLOUGH. Thank you, Chairman Ensign and other Committee Members. It's a pleasure to be with you to talk about a very important subject. And I would like my written testimony entered into the record.

Senator ENSIGN. All of your written testimonies will be entered in the——

Dr. CLOUGH. Thank you.

Senator ENSIGN.—record. If you could summarize in 5 minutes or less, we'd appreciate it.

Dr. CLOUGH. Will do.

The ability of our high-tech manufacturing sector to compete in a rapidly-evolving world economy is linked to broader issues of competitiveness of our businesses and industries at large.

Senator ENSIGN. If you could just pull that microphone a little closer to you, it would be appreciated.

Dr. CLOUGH. Manufacturing is a special case within a larger context, where all our businesses will have to be willing to compete in the landscape that has changed as other nations target our technology-based economic sector with greater vigor and resources than ever before.

I've been fortunate to serve in a number of leadership positions in national and regional efforts. Some of these the Chairman mentioned, such as the National Innovation Initiative, which just issued a report in December on this broad topic. And I've had the chance to chair the Engineer 2020 Project for the National Academy of Engineering and serve on PCAST and as a member of the National Science Board.

I also have the great good fortune to be President of Georgia Tech, which is one of the top-rated manufacturing programs in the country, and also operates a statewide business incubator, as well as a manufacturing technology extension program that assists local manufacturing companies and is, in part, funded by the MEP program. Our activities range from those found in traditional industries, where we're trying to help our food processing and pulp and paper industries, as well as introducing new areas, such as nanotechnology, into what we're doing in manufacturing.

Now, we're all aware of the issues facing the manufacturing sector, in terms of growing global competition with nations that have significantly lower wages than ours. We're also learning to appreciate that, as we improve productivity and mature the manufacturing sector, this can lead to a decline in employment, even as the business is succeeding.

The key to employment seems to be a combination approach that seeks to keep the high-end jobs, where productivity is increased, but creates new manufacturing sectors or value-added propositions with it. So new jobs come and create jobs related to service and support for the manufacturing sector, such as logistics.

Every 3 or 4 years, Georgia Tech conducts a survey of manufacturers in Georgia, and I'll give you a few points that we've learned from our most recent survey.

Those companies that are successful exhibit a willingness to adapt and improve their customer focus. They need to work on new

product development. They have to have a record, typically, of filing patent applications. They need to sustain innovation as part of their culture, utilize upgraded computing and communications technologies, and have access to information resources and assistance in training their employees. And, obviously, these characteristics are likely to become more, not less, important in the future.

Because small-to-medium manufacturing-sized companies are often unable to afford some of the technical advice that the bigger companies would get, that they need to innovate. Initiatives like the Manufacturing Extension Program, we think, are important.

Now, the National Innovation Initiative looks at this issue at a much higher level, and it looks to the future health of all of our high-tech industry sector. These are some of the findings in the report, which is now on the website of the Council on Competitiveness. Some 200,000 copies of it now have been downloaded since it was published.

We need to find a balance in the Federal funding for R&D areas, like engineering and the physical sciences, to help form the ideas that will form the basis for new products and businesses. These areas have seen flat funding, or even a decline in the past decade. And we need to balance that portfolio in the future if we're going to succeed, even in areas like health.

Second, we need initiatives to encourage U.S. students to major in engineering and sciences to address workforce needs. And I'm very pleased to hear everyone express their concerns about these issues, because, in fact, our graduation numbers in science and engineering peaked in the 1980s, declined, more or less holding steady today, but certainly the competing nations that we're looking at are outproducing us, including the European Union, as well as China, India and others. And this gap will continue to grow if we don't do something to intervene. Added to this, recent studies show international students coming to work in our companies—or to get degrees at places like Georgia Tech have declined substantially in the past couple of years.

Also, we need programs for workforce training and support for transportable benefits for workers who are displaced by changes in technology. As you know, technology is changing at a very rapid pace, and we need to help those adjust as the job needs change.

And, finally, I would also encourage my fellow university presidents and university faculty members that it's time for universities to do this—to undertake innovation, to help our graduates better understand the new culture that they will be involved in.

Other recommendations also are included in the report that was published at the Summit for the National Innovation Initiative. They are important, but in the interest of time I won't go through them here.

We've decided that there's no way one entity can get this done. Multiple approaches to improving the innovation sector are needed if we're going to succeed. And the National Association of Manufacturers is one of our significant allies in this.

We're going to have a number of regional meetings, that are starting almost as we speak, to talk about local innovation strategies, talk about local conditions in different states, and about how we move forward. And, in addition, in October we're going to have

a national meeting with the Business Roundtable, the National Association of Manufacturers, the American Association of Electronics, and the Council on Competitiveness.

We're also working with the Departments of Commerce, Labor, and Energy, and with businesses, like IBM, who are taking leadership positions as we move forward. It has to be a public/private partnership, I think, if we're going to succeed.

So, in summary, the future for manufacturing in high-tech industries is not going to be secured by doing things the same old way. Competition for high-tech manufacturing is increasing rapidly as nations like China, India, and Korea build and invest in their educational and R&D programs. To succeed—and we are still in the position to succeed—we need to sharpen and support a national strategy for innovation that will allow us to maintain our share of this important market segment.

Thank you.

[The prepared statement of Dr. Clough follows:]

PREPARED STATEMENT OF DR. G. WAYNE CLOUGH, PRESIDENT, GEORGIA INSTITUTE OF TECHNOLOGY

Manufacturing is an essential part of our economy. Not only are manufactured goods the currency of world trade, but manufacturing is what creates wealth. It adds value to resources by making them do something more, which is something that services cannot do.

For most of the 20th century, manufacturing was based on the Henry Ford assembly line model. Each worker carried out the same small task over and over, and a standardized product rolled off the end of the line, each one identical to the one before. Few of the workers in those manufacturing plants had more than a high school diploma—if they even had that. Then, about three decades ago, global competition for manufacturing jobs began to heat up. Many companies realized that large pools of unskilled labor willing to work for much lower wages than those in the U.S. could be accessed by moving plants overseas. This led to a large scale shift of jobs out of our country. In part due to this out-migration of jobs, manufacturing accounted for only 14 percent of the U.S. Gross Domestic Product in 2001, down from 27 percent in the middle of the twentieth century. Manufacturing jobs declined from 30 percent of our workforce to less than 15 percent.

However, these numbers mask a second major shift that occurred in the manufacturing industry in the 1980s and 1990s. The manufacturing processes themselves began to be fundamentally changed with advances in technology, and this was accelerated with the invention of the microchip. Manufacturers rapidly adopted new technology that reduced the need for manpower while at the same time they integrated new management techniques that called for more sophisticated and adaptable workers. This led to a vast family of production tools that offer unmatched precision, quality, and efficiency—rom CAD–CAM to "just in time" and "demand-pull" manufacturing. The new technology that has infused manufacturing is capital intensive rather than labor intensive. Robotic arms now assemble products. Automated guided vehicles (AVGs) move supplies and products around the plant. Real-time communication feeds information back into the process in time to reduce the margin of defects to virtually zero. Salespeople with cell phones and laptop computers cover more territory in less time, and sophisticated logistics systems speed the products on their way. The entire process, from designing the product to shipping it, has been computerized. The skill levels expected of workers are now far beyond that of the earlier era.

The remarkable changes brought about by new technology have enabled manufacturing to outpace other sectors of the U.S. economy in productivity. Between 1977 and 2001, overall U.S. manufacturing output, measured in constant 1996 dollars, almost doubled. While productivity for the U.S. economy as a whole increased by 53 percent, manufacturing productivity rose 109 percent. Over the course of the past 25 years, overall prices rose by 140 percent, but productivity increases held the increase in the cost of manufactured goods to 60 percent.

The combination of increased automation and greater productivity meant manufacturers could meet market demand with fewer employees, so that instead of moving overseas as they had during the 1970s and 1980s, many manufacturing jobs ac-

tually began to disappear entirely. What has been happening in manufacturing is analogous to what happened previously in agriculture, which saw an ever-shrinking number of farmers feed an ever-growing world population. Backing this theory up, manufacturing has been shrinking not just in the United States but everywhere. Estimates are that 22 million manufacturing jobs disappeared worldwide between 1995 and 2002. A new buzzword appeared in the manufacturing community—"lights-out" plants—referring to facilities that are so automated that there is no one around who needs to see what they are doing. Even though advanced technology caused them to shed jobs, recent research indicates that had American manufacturers not moved rapidly to incorporate new technology and improve their competitive posture, the U.S. manufacturing sector would have lost even more jobs as more manufacturers closed their doors entirely.

At Georgia Tech, we see these factors reflected in the detailed survey of the state's manufacturers that we conduct every few years. We are presently in the middle of the 2005 survey, so 2002 is the latest for which we have final data. However, when you compare the 2002 data with the 1999 data, about half of Georgia's manufacturers underwent major changes in strategy or structure during that three-year timeframe. Most of these changes involved innovation and/or technology, and were aimed at quick delivery, adapting to customers, and providing value-added services.

The 2002 survey showed that companies with new-to-the-industry products, value-added service offerings, and substantial employee use of computers had significantly higher growth, profitability, and productivity than those who did not engage in these practices. About 60 percent of Georgia's manufacturers do some type of new product development, and more than one in five are developing products that are new to their industry. These companies who are innovating have significantly higher growth, profitability and productivity rates. Manufacturers filing patent applications—another measure of innovation—also had significantly higher return on sales. Those who introduced new processes experienced significantly higher return on sales and growth in value-added per employee, and firms with Web-based customer/supplier linkages or ordering capabilities had significantly higher returns on sales.

We have traditionally thought of factories as dusty, greasy, and full of rows of people operating clanking machinery. However, while manufacturing of that sort may still be needed to make some products, it will fall at the lower end of the economic spectrum, which we will cede to others. American manufacturing of the future will need to be focused on the high end of the economic spectrum if we want to maintain our standard of living. We will need to pioneer new manufacturing techniques and focus on the highest-possible leading-edge precision technological work that it is not possible to do in other parts of the world. The strategies even of the latter part of the last century—cost control, "total quality," and continuous productivity improvement—will not be enough. To win in the 21st century will require flexibility, collaboration, customization, precision, global market savvy and speed. To quote a recent statement on "Ensuring Manufacturing Strength through Bold Vision" by the leaders of the National Science Foundation, "The big winners in the increasingly fierce global scramble for supremacy will not be those who simply make commodities faster and cheaper than the competition. They will be those who develop talent, techniques, and tools so advanced that there is no competition."

During 2004, I was privileged to serve as co-chair, together with IBM CEO Sam Palmisano, of the National Innovation Initiative, sponsored by the U.S. Council on Competitiveness. We involved 400 of the Nation's best minds from academia, industry, and government in developing an action agenda designed to help the United States create an economy based on innovation. The National Innovation Initiative generated 30 recommendations that we grouped under three broad topics: talent, which is the human dimension of innovation; investment, which is the financial dimension of innovation; and infrastructure, which provides the enabling framework for innovation. All three of these have a bearing on the competitiveness of American manufacturing, so I will touch briefly on each one.

High-tech manufacturing operations require employees with a much higher level of skills. For example, technology and processes at the Timken Company, which is the world's leading manufacturer of roller bearings, have become so sophisticated that the company now looks for workers with bachelor's degrees for many of its entry-level positions. Georgia Tech's survey of Georgia manufacturers has identified human resource problems as their foremost worry. Yet the United States is falling behind in the education of technology workers. China, India, and the European Union each graduate more engineers than the United States and the gap will continue to grow based on present trends. Also, our past ability to rely on ample supplies of international science and engineering graduates will be tested as more of these students are enticed to take jobs in the growing technology businesses at

home, and as increasing numbers simply choose not to study here because of concerns about post-9/11 visa and export control policies.

One of the primary investments in innovation is R&D. In January of 2004, the Department of Commerce released the results of a series of roundtable discussions held with manufacturers around the Nation. Among the areas that manufacturers believe require immediate attention is a commitment to sustained and balanced R&D to ensure that the Federal Government reinforces rather than hinders innovation and bringing new ideas to market.

About the same time the Department of Commerce published its report, another report was released by the Subcommittee on Information Technology Manufacturing and Competitiveness of the President's Council of Advisors on Science and Technology (PCAST), chaired by George Scalise, President of the Semiconductor Industry Association. The PCAST report pointed out that as the speed of technology development accelerates, the linkage between research and manufacturing becomes much closer. Locating a manufacturing plant close to an R&D operation that is generating new process and product ideas facilitates the human interchange that speeds ideas from the lab to the marketplace. As a result, places with both strong R&D centers and manufacturing capabilities have a competitive edge. The good news is that some semiconductor manufacturers have remained in the United States rather than moving overseas despite the cost benefits of off-shoring, because they want to be close to the university R&D that is driving new developments. The not-so-good news is that the level of R&D being conducted in countries like China and India is improving and many U.S. and global companies are building R&D facilities in these countries. This means competition may increase for more sophisticated manufacturing jobs as well and if this is so, the United States may end up with a security problem as well as an economic problem.

The present technological superiority of the United States has flowed from the strong investments we made in scientific research since World War II, and that lesson has not been lost on those who aspire to compete with us. We need to not only consider improving investment levels in R&D, but also how they are distributed. A recent PCAST report showed that funding for research in key areas of engineering and physical sciences have declined while levels in other areas increased. In a world where future manufacturing developments will come from interdisciplinary research, care must be taken to support an appropriate funding portfolio.

As a part of the third topic, infrastructure, the National Innovation Initiative looked specifically at strengthening America's manufacturing capacity. We were concerned because while the United States remains the world's leading nation in the production of manufactured goods, our rate of growth in manufacturing production has remained virtually flat over the past 4 years. During the same time frame, 2000–2004, Asia (excluding Japan), Central Europe and the Balkans, and Latin America experienced strong growth in manufacturing production. Our high-end competitors—Western Europe and Japan—also outperformed us.

The National Innovation Initiative calls for the United States to design and implement a new foundation for high-performance manufacturing production. That means new human, organizational, financial, and policy models must be developed. New designs, processes, and materials need to be introduced and new manufacturing technologies should more rapidly be brought to the production cycle. We are moving in that direction, with flexible automation, complex numerically controlled tooling, precision engineering, distributed manufacturing, e-commerce to connect and manage supply chains, materials databases, and shared-use facilities for R&D and pilot production, which lowers the risks and barriers to entry. Technologies like these will not only increase productivity even further, but will also help to offset lower wages in other countries.

As a technological university, Georgia Tech has a wide range of experts devoted to evaluating what is happening in manufacturing, divining future opportunities for this core industrial sector, and developing the manufacturing technologies and methodology of the future. Several important themes are emerging from their work.

First, manufacturing technologies of the future will include molecular and nanomanufacturing, bio-materials and bio-processing, micro-electro-mechanical systems (MEMS), free-form fabrication, and new software control technologies. Ideas that will come more strongly to the fore include innovation, knowledge management, customer relationships, and waste reduction—not only in the manufacturing process, but also over the life of the product.

These technologies and ideas are expected to be expressed in the context of several inter-related trends, including movement away from mass production toward semi-customization; shifts away from centralized production locations to distributed sites; and the transformation of centralized business control toward collaborative relationships between distributed sites.

We can already see the trend toward customized manufacturing in the ability to order customized clothing from manufacturers like Land's End or L.L. Bean, and the opportunity for customers buying a car to send their specifications to the factory online rather than compromising on what a dealer happens to have on the lot. The next stage is expected to be "additive manufacturing," which enables end-users to participate in the design of more sophisticated products like hearing aids, dental restorations, eye glasses, and joint replacements. Additive manufacturing holds potential to embody an entire manufacturing system within a single, small machine. That has led some to predict that additive manufacturing machines for certain purposes will be introduced for use in the home within the next decade or two.

Even as manufacturing machines become smaller, so will the scale on which manufacturing takes place. Already the United States has seen a significant drop in machine tool production, which paralleled a significant decline in R&D spending in this area, as attention has shifted to microscale tools and machining. Nano-manufacturing is the place where nanotechnology will transform from an exotic research field to something that reaches out to touch all human civilization. Nano-manufacturing addresses not only work on the nano-scale, which is one-billionth of a meter, but also the engineering of new materials at the atomic and molecular level that have novel, unique, and improved physical, chemical, and biological properties. Nanoscale engineering can greatly expand the range of performance of materials and chemicals, as well as creating microscopic machines and systems.

Nano-manufacturing has the potential to impact virtually every human-made object, from automobiles to electronics, from advanced medicine to energy production. Three specific areas where we are working at Georgia Tech are nano-computers that utilize nanotubes as interconnections instead of transistors; disease diagnosis and controlled drug delivery; and optoelectronic materials. But successful implementation of nano-manufacturing will require standard measurements at the atomic level, special manufacturing environments, and micro-scale technologies and quality control mechanisms. It will also require the involvement of experts in a much wider range of disciplines than traditional manufacturing—including electrical engineers, physicists, chemists, biologists, and biomedical engineers.

Even as the leading edge of American manufacturing moves to unprecedented levels of sophistication, there are segments of the industry that cannot and should not be left behind. America's traditional manufacturing industries still have a relatively strong presence in our Nation's economy, and attention must be given to their competitiveness. The U.S. pulp and paper industry, for example, generates $100 billion of shipments a year—30 percent of the world's production. Technological innovation is important to keep such traditional industries competitive.

The growing need for the rapid development and deployment of very sophisticated manufacturing technology and techniques is particularly challenging for the Nation's 350,000 small and mid-sized manufacturers, who employ more than seven million people and comprise nearly half of the U.S. manufacturing base. These companies often lack the information, expertise, time, and money required to engage in the constant innovation and upgrading required to do well in today's competitive marketplace. However, with some timely assistance, they can also succeed. For the past 40 years, Georgia Tech has operated a state-supported network of industrial extension offices that serve Georgia's small and mid-sized manufacturers, and as part of our surveys of Georgia manufacturers we have tried to assess the benefits of that service. What the 2002 survey showed was that companies assisted by Georgia Tech had comparatively higher productivity—an average value-added increase of $3,000 per employee.

Finally, changes in manufacturing processes have significant logistics implications. The U.S. trucking industry transports more than three-quarters of the freight in the country, and changes in the manufacturing process have major consequences for the logistics of moving those loads. The trucking industry has already had to make significant adjustments to facilitate the implementation of just-in-time manufacturing, which requires greater load and time precision and more recently just-in-case policies designed to prevent and address unexpected disruptions in the increasingly tightly engineered supply chain. Future changes will require even more logistical sophistication.

The competition for manufacturing jobs and new applications and technology is going to grow in the future. We have to adjust to a changed landscape, and re-commit ourselves if we are to compete with nations that will have larger technological workforces and wage advantages for some time to come. Fortunately, the U.S. still has an edge and our society supports entrepreneurism and risk taking. However, the window of opportunity will be open only so long and we need to take action now if we are to succeed.

Senator ENSIGN. Thank you.

Mr. Murray?

STATEMENT OF SEBASTIAN MURRAY, PRESIDENT/CEO, FPI THERMOPLASTIC TECHNOLOGIES

Mr. MURRAY. Thank you for the opportunity to speak, Mr. Chairman and Senators.

A quick background on FPI Thermoplastic Technologies. We're a plastic injection molding company. We serve three primary markets: fire, safety, and security—our major account is Siemens; point-of-purchase display—our major account is Revlon; and food service—our major account is McDonald's. We have 120 employees, presently, and we are now adding 40 more jobs, to increase our employee count to 160. Our sales volume is $15 million in sales, and our sales are increasing to $25 million in 2006, which is a 66 percent increase. Our major competition is Asia, primarily. We also have competitors in Canada and the United States. FPI's competitive advantages are low-cost production, presently, superior design capabilities, and time to market.

A critical threat to U.S. manufacturing is low-cost competition from Asia, as we all know. Solutions for strengthening U.S. manufacturing are the MEP program, number one, and low-cost loans, through the SBA, for example, to help companies like "myselve's" invest in technology.

FPI faced dire financial circumstances in the year 2000. We lost a third of our sales with a major U.S. retailer to Chinese competitors. FPI was introduced to the MEP program regional office, NJ, New Jersey, MEP, and to Robert Loderstedt, its President, in the year 2000. The MEP program helped us develop a multi-pronged turnaround strategy. MEP implemented an acquisition strategy, which helped us add $3 million in annual sales volume, with two acquisitions. MEP helped us implement inventory management and control methods, which saved our company $480,000 per year in distribution expenses, and freed a million dollars in cash-flow. MEP implemented a lean manufacturing program, where we invested in automation and robots. We now have a robot at each of our 30 machines, with three- to six-months paybacks, and yielding dramatic gross margin increases. And MEP, last, helped us refinance our debt, and we reduced our annual interest expenses by about $100,000 per year.

In terms of the future of U.S. manufacturing, the future of FPI. Today, FPI is profitable and growing. We are securing new business through Internet auctions that include global competitors. Consequently, we are a low-cost global competitor successfully competing with Asian sources. We owe our survival and our success directly and completely to MEP. And we believe it is critically important that the U.S. Senate continue its support of MEP.

Thank you very much.

[The prepared statement of Mr. Murray follows:]

PREPARED STATEMENT OF SEBASTIAN MURRAY, PRESIDENT/CEO, FPI THERMOPLASTIC TECHNOLOGIES

Samuel Murray and I are 50/50 owners of a plastic manufacturing business located in Morristown, NJ. We employ 120 people and we have sales revenue of approximately $15,000,000.

Five years ago our business was on the verge of bankruptcy. A major U.S. retailer that accounted for a third of our sales changed its source of supply from FPI to a Chinese supplier. Since our sales had plummeted literally overnight and without warning we were in dire financial circumstances. We began to lose money and our cash-flow was hemorrhaging. Shortly thereafter our bank placed us in the work out group and we were heading down a path to liquidation.

We are a successful enterprise today primarily due to NJMEP, the New Jersey unit of the Manufacturing Extension Partnership (MEP) of NIST. In our hour of need we were introduced to NJMEP by the Morris County Chamber of Commerce.

Together with Robert Loderstedt, President of NJMEP, we implemented a multi pronged turnaround strategy to revitalize FPI including;

1. *Acquisitions*—NJMEP worked with us to roll up and acquire 2 smaller plastic injection molding companies to replace lost sales and to diversify our customer base.

2. *Inventory Management and Control*—NJMEP suggested we close an outside warehouse, which we did that saved us the $40,000 dollar monthly operating costs which resulted in a $480,000 annual savings which we used to implement the other phases of the turnaround strategy. Additionally, we sold excess inventory totaling approximately $1,000,000 improving cash-flow. Plus we implemented an MRP/MPS system and cycle counts to improve inventory management and control.

3. *Lean Manufacturing*—We engaged NJMEP to implement lean manufacturing techniques which lower our costs of production and increased our manufacturing efficiencies through the use process changes and automation, using robotics. Consequently we have raised our sales per employee from $80,000 in 2000 to $125,000 in 2005. Our goal for 2006 is $150,000 per employee.

4. *Banking Relationship*—NJMEP worked with us to refinance our debt by changing banks and lowering our interest expense with reduced rates and an extended term.

Today FPI is profitable and growing. Our sales volume is over 30 percent ahead of last year. In 2006 we expect our sales to exceed $25,000,000 an increase of 60 percent over 2005.

We are no longer intimidated by Asian competition. We have used this threat to spur FPI to become a global low-cost producer. None of this would have been attainable without MEP.

MEP is an essential asset and lifeline for American manufacturing. It is vitally important that the U.S. Senate continues its support of programs such as MEP that aid and strengthen American manufacturing companies.

Thank you for your time.

Senator ENSIGN. Thank you.

Mr. Howell?

STATEMENT OF THOMAS R. HOWELL, PARTNER, DEWEY BALLANTINE LLP

Mr. HOWELL. Thank you, Mr. Chairman and Senators.

I'd like to devote my remarks to one topic I've raised in my testimony, which is the factors that are driving the offshore movement of the semiconductor industry from the United States.

From where we stand now, the U.S. semiconductor industry is the world leader. We have about 50 percent of total global sales. Technologically, we lead in most areas. And we're in a very strong position. And at the moment, about 77 percent of all the manufacturing in the industry is still here in the United States.

The thing is that most of those wafer fabrication facilities, or fabs, as they're called, are current generation, which will become obsolete in the next 5 to 7 years, and that with respect to the next generation that's planned, the ratios are much different. We heard recently from an executive at Applied Materials, which is one of the companies that supplies the equipment for fabs, that forecast that there will be 30 fabs built in China in the next 3 years. During the

same time frame, 6 new fabs will be started in the United States. So, there's an enormous proportional shift in the direction of investment that's underway right now.

That's often seen as just a reflection of the fact that the market is growing for semiconductors in Asia, that the devices are being consumed in increasing proportion there. That doesn't explain the entire shift. There is a need to locate some production near a market, but, in fact, a country like Taiwan can serve markets all over the world with fabs built in Taiwan. So, just the fact that the market is moving to Asia to some extent does not explain the shift.

The most common explanation is, there's a cost advantage in Asia. And, in fact, if you take the effective government measures away and set that aside and look at just the cost of building a fab and operating a fab, the fact is, there isn't much cost difference between the United States, on the one hand, and Taiwan/China, on the other hand. Most of the costs are associated with equipment. It's an automated process. The equipment is the same equipment used in every area. It's produced by the same companies, and it costs the same. The input cost differentials—there are some, but there are not that many—are not that great. The labor costs are substantially lower in China and Taiwan, but they don't make up a very large portion of the total manufacturing costs. With a 300 millimeter fab—that is the current state-of-the-art—if the United States' costs were seen as a factor of a hundred, Taiwan might be 93; China, 90—which is really not enough to warrant a shift of all your production base from one region to another.

When you factor in the effect of government measures, however, the picture changes. And consider that we're talking about investments now that are $3 billion for a single fab, and moving to $6-to-$10 billion in the next generation. A company has to think very carefully about making those kinds of investments, and where they're going to make them, and where they're going to pay off the best.

One differential between China, Taiwan, and the United States is that a fab built in those areas will not pay any taxes. A company that operates a fab there is operating in, essentially, a tax-free environment—a permanent tax-free environment.

Another factor is that the land and structures are located, typically, in high-tech industrial parks that have been built there. We have them here, too, but the fact is, the incentives in the parks over there are more dramatic. A company building a fab in China right now, many of them are reportedly getting their land and structures provided for free. There are also the utilities, which are things like high-purity water, specialty gases, electricity, that sort of thing, are provided at concessional rates. And all that has a downward effect on operating costs.

Then you look at—there are also tax incentives for individuals. An individual who is a very talented engineer or production worker can get rich very quickly working in one of these countries, based on the tax structures. And I could explain that more in detail, maybe, if there's an interest in it.

Then, finally, there's the phenomenon of the foundry, which has developed, really, in East Asia. And the notion there is, given the rising costs and risks associated with building a fab, countries, be-

ginning with Taiwan and now moving to Singapore and China, have said, essentially, "Don't bother. We'll build the fab here. We'll take the risk. We'll absorb all the costs and risks of building that. Send us your designs, American companies. We'll make them here for a service fee, and you can sell them under your own label." And that's turned out to be a very dramatically successful business model. A lot of U.S. companies have become fabless and essentially have gotten out of the business of making semiconductors. They just design them. The designs go to Asia, where they're manufactured in foundries that are located there.

The upside of that is that the U.S. producer no longer has the cost or risks and all the other messy stuff that's associated with manufacturing. The downside is, the manufacturing, the skills, and the jobs are not in the United States anymore, they're on the other side of the world.

The first foundry was built with a large investment from the Government of Taiwan. It was considered too risky for the private sector to undertake that. Most foundries, if not all foundries operating in Asia, that I'm aware of, receive substantial government support. Essentially, the risk has been socialized in Asia. And so, what we see is a long-term trend toward more and more foundries. Most of these 30 fabs that I referred to that are being built in China will be foundries, and they will essentially be looking to take over the manufacturing functions of semiconductor companies outside the United States.

Senator Allen referenced the VAT tax, which China used very successfully to capture inward investment from other countries, particularly Taiwan. That was, essentially a violation of international trade rules used very successfully to capture inward investment from other countries that would have occurred elsewhere, but for the tax. The Administration has successfully challenged that tax. It has been revoked, as of, I think, this April. And it's a good model for dealing with other kinds of distortions like that, that distort investment patterns. However, we have to recognize that many of the measures that I have described are not clearly inconsistent with international trade rules; and so, those rules have got to be strengthened if we're going to get a handle on this problem.

Two other recommendations I would make: One is that there's a need to study differentials in tax policy between various markets and how they affect investment patterns. That issue is not well understood, and it is driving a lot of these investments.

Finally, there is a need for greater Federal spending on R&D. Senator Kerry referenced the large programs that are underway in Japan and the EU, in terms of spending. They dwarf anything that's underway here. And we're cutting back, and some of our programs, like the advanced technology program, are being zeroed out.

So, I think all those things would be excellent points of departure if we're going to try to address this problem.

[The prepared statement of Mr. Howell follows:]

PREPARED STATEMENT OF THOMAS R. HOWELL, PARTNER, DEWEY BALLANTINE LLP

Mr. Chairman and members of the Subcommittee, my name is Thomas R. Howell. I am a Partner in the Washington D.C. law office of Dewey Ballantine LLP, where

I specialize in international trade matters. Over the past 20 years I have represented a number of organizations representing U.S. semiconductor manufacturers, and in the course of that work I have prepared a series of studies of foreign industrial and R&D policies and their effects on international competition in microelectronics. The most recent of these, which I have provided to the Subcommittee, addresses China's emerging semiconductor industry. I am also a contributing author to a study recently published by the National Academy of Sciences, *Securing the Future: Regional and National Programs to Support the Semiconductor Industry.* My testimony today is my own and not presented on behalf of any client or organization. I appreciate the opportunity to appear before you today.

The semiconductor industry plays a vital role in the U.S. economy and national defense. In terms of value-added it may be the largest U.S. manufacturing industry, and semiconductors are a key enabling technology for a broad range of other industries, including computers, consumer electronics, motor vehicles, telecommunications, and aviation. The U.S. semiconductor industry is currently the world leader both in terms of level of technology and market share, with about 50 percent of world sales. However, it faces significant challenges to its leadership which arise out of foreign government policies that are designed to alter the terms of competition. These policies represent promotional strategies that fall into two broad categories, "leadership" and "close followership."

Leadership strategies. Japan and the European Union, the longstanding rivals of the U.S. in microelectronics, are pursuing promotional strategies designed to capture the leadership position from the United States with respect to market share and level of technology.

- Japan and the EU are implementing large scale, long range, industry-government R&D projects aimed at developing leading edge commercial technologies and state-of-the-art manufacturing facilities. Commonly these projects involve hundreds of millions of dollars in government funding, more than anything we currently see in the United States.
- The strategy in both Japan and Europe is to build on a perceived leadership position in cell-phone technologies and develop leading edge semiconductors with cell phone applications, as opposed to PC-based chips in which the U.S. holds the lead. The Japanese and European strategy is based on the belief that in the 21st century, most people, particularly in the developing world, will access the Internet through cell phones and similar hand-held devices, not desktop PCs.

It is unclear that these foreign efforts will result in a loss of U.S. market or technological leadership—in the past many large-scale government-funded R&D projects in microelectronics have fallen short of their goals or failed completely. But others have significantly affected the competitive balance. The EU's JESSI project, for example (1988–1996), is widely credited with contributing substantially to Europe's current strong position in cell phone technology. Japan's joint R&D projects have played a major role in establishing the Japanese industry's strong competitive position in microelectronics. And while Japan and the EU have substantially increased the level of government spending on microelectronics R&D, in pursuit of this strategy, the U.S. is moving in the opposite direction. U.S. Government funding of microelectronics R&D has been declining for a number of years and is projected to decline further in the coming decade. But the most complex challenge confronting the U.S. in microelectronics is not coming from Japan or the EU, but from China/Taiwan, who are pursuing a "close followership" strategy.

"Close followership" strategies. Under "close followership" strategies governments do not seek to achieve market or technological leadership but rather to integrate the operations of their own industries with those of U.S. companies, and, by so doing, not only remain one step behind the leaders but also capture high value-added technology-intensive industrial and research functions for their own economies. Taiwan has been the most successful practitioner of this strategy but it is now being emulated in countries such as Malaysia, Singapore, Thailand, Israel, and most significantly, China.

The "close followership" strategy actually enhances the competitiveness of individual U.S. companies by providing low cost, high quality production and design services to them. But it may pose a greater challenge to U.S. leadership over the long run because it is drawing offshore important parts of the U.S. microelectronics infrastructure, particularly in the area of semiconductor manufacturing. The danger is that over the longer term other key functions associated with semiconductor production, such as R&D and design, will follow the manufacturing functions to East Asia. At some point a substantial part of the education infrastructure that supports the industry could migrate there as well.

At present, roughly 77 percent of U.S.-owned semiconductor manufacturing is still located here in the United States. But much of this capacity is or will become obsolete over the next several years, and the trend is toward establishment of a larger proportion of the next generation of fabs outside the U.S. Earlier this year an executive at Applied Materials, one of the most important producers of semiconductor manufacturing equipment, indicated that 30 new fabs will be built in China in the next 3 years. During the same time frame, the same executive stated that there will be 6 built in the United States. In part this trend reflects the fact that China is the fastest-growing market for semiconductors in the world, with an estimated compound annual growth rate of 20–27 percent in 2002–2008, versus about 7 percent for the U.S. But relative regional market growth does not explain investment trends.

Nor do comparative costs explain current investment trends. The migration of some types of high tech manufacturing to Asia, such as assembly of electronics products incorporating semiconductors, reflects comparative cost advantages attainable by manufacturing in certain Asian countries. But the movement of semiconductor manufacturing to Asia is not being driven by comparative costs—that is, if government measures taken to modify those costs are removed from the equation. The same equipment and processes are used everywhere to make semiconductors. Materials and other costs do not vary greatly from region to region. Direct and indirect labor costs are much lower in China and Taiwan than in the U.S., but because labor costs are such a small proportion of manufacturing cost, the total cost differentials are not that great. If the manufacturing costs for a 90nm, 300mm wafer fab in the U.S. is given a factor of 100, the comparable cost in Taiwan would be 93 and in China, 90. But the picture changes when the impact of government policy measures is factored in.

To begin with, consider the size of the investment required to establish a single state-of-the-art wafer fab—currently between $2 and $3 billion for a facility that may be obsolete in 3–4 years. Only a handful of companies are in a position to undertake such investments, and given the volatility of the industry, an increasing number of companies understandably have reached the conclusion that risks associated with such large investments outweigh any potential for gain. How do governments affect this equation? In some countries governments have put up a substantial part of the total investment cost to establish a state-of-the-art fab. The world's first 300mm fab, for example, was built in Dresden, Germany with substantial funding from regional governments. But other forms of government support are probably more important than direct funding.

One of the most important forms of government measure has been support for the establishment of semiconductor foundries, a phenomenon that occurred first in Taiwan but has spread to Singapore, Malaysia, Israel, and, most importantly, China. Under the foundry model foreign producers, usually with substantial government backing, in effect say "we'll assume the costs and risks of building a fab. Give us your designs, and we'll make them for you, in return for a service fee." This is a very attractive proposition for a company trying to decide whether or not it can make a $3 billion investment to manufacture its designs. An increasing number of U.S. semiconductor firms are "fabless" and outsource all of their designs to foundries, while others are "fab-lite," outsourcing a significant part of their total production. In other words, the chip is designed here in the U.S., manufactured in China or Taiwan, and in many cases incorporated into an end product somewhere in Asia. The U.S. "fabless" company does not take any of the risks normally associated with building a $2–$3 billion facility. But the facilities themselves, and the skills to run them, increasingly reside elsewhere.

The first pure play foundry in the world, TSMC, was established on the basis of an equity investment by a special fund administered by the government of Taiwan. The investment would not have been attempted by the private sector because it was seen as too risky. Today I am not aware of a foundry anywhere in Asia that does not enjoy significant government support. In a number of cases governments have taken equity shares in foundries. Because the number of purely private, unsubsidized companies in the U.S. or anywhere else that are willing to invest $2–$3 billion in a fab is declining, government-supported foundries are accounting for an increasing share of global semiconductor production. Most of the new fabs being built in China will operate as foundries.

Tax policy is another particularly important form of government support. The world's most successful foundries are TSMC and UMC, both located in Taiwan. They control nearly two-thirds of world semiconductor foundry manufacturing. The government of Taiwan has implemented policies which ensure that these and other similar Taiwan-based semiconductor enterprises pay no taxes, year after year. In fact, in a number of recent years, TSMC's after-tax income has been higher than

its pre-tax income, reflecting the application of accumulated tax credits. China has now replicated Taiwan's tax holidays. Paying taxes, in jurisdictions like the United States, and paying no taxes in China and Taiwan, can have an enormous bottom-line impact and may constitute a very significant decisional factor in determining where to open a new fab.

Then there is infrastructure. The Silicon Valley phenomenon has been intensively studied abroad, and foreign governments have created their own versions of the Valley in many countries. These seek to integrate research universities, high tech manufacturing, and venture capitalists into a dynamic relationship that promotes innovation and entrepreneurialism. Perhaps the most successful version has been Taiwan's Hsinchu Science-Based Industrial Park, which has become a magnet for foreign and domestic semiconductor investment. In addition to tax-free status, soft loans, grants and other forms of financial support, enterprises located in the Park enjoy extensive infrastructural support, nearby research universities, and superb institutes of applied industrial research. China is now creating its own versions of Hsinchu, and in some of the Chinese parks, semiconductor producers are reportedly receiving free land and free structures from regional and municipal governments. They also receive preferential rates on electricity, water, and specialty gases, all of which lower their operating costs.

Then there are government incentives to individuals. One of the key advantages enjoyed by TSMC and UMC has been their ability to attract and hold many of the highest quality managers and engineers in the industry—it said that "they get the best people." A key factor in the competition for such talent is Taiwan's tax treatment of company stock and stock options given as compensation to individuals. Shares are taxed on their par value rather than on their actual market value at the time received, which may be many times par value. In addition, when the shares are sold, there is no tax on the income received (apart from a nominal transaction tax) because Taiwan has no capital gains tax. As a result, Taiwanese companies have been able to offer highly talented Taiwanese and foreign engineers the prospect of rapid accrual of substantial personal wealth. Taiwan has become a "talent magnet." Chinese tax policy, while not identical, seeks to replicate such incentives to individuals.

Finally the location of new investments can be driven by government investment incentives such as China's preferential value-added tax (VAT), which was revoked in April of this year after strong objections from the U.S. Government, Japan, the EU and Mexico. In 2000, the Chinese government established a preferential rate of value-added taxation (VAT) for domestically based semiconductor design and manufacture. While all imported devices are subject to a 17 percent VAT, under the new policy domestic designers and manufacturers of semiconductors received a rebate, resulting in an effective VAT rate of 3 percent. The preferential VAT policy effectively enabled China to "capture" a portion of Taiwan's semiconductor capability. Foreign investors, predominantly Taiwanese, rushed to the mainland and established new wafer fabs in order to benefit from the VAT preference. A talent rush to the mainland of experienced Taiwanese managers and engineers occurred. By 2003 roughly 20 new Taiwanese-owned fabs had begun operations on the mainland, were under construction, or were planned to become operational by 2008, all of them foundries. Executives at these new foundries cited the VAT preference, which gave them an "unbeatable" edge over imported devices, as the principal factor underlying their new operations. While China's preferential VAT has been revoked, it has arguably already achieved its objective of a massive drawing in of capital, technology and talent, enabling China to establish a modern semiconductor industry.

It has been suggested by some that the migration of semiconductor manufacturing to Asia represents a natural division of labor with more advanced countries, and that the high-end functions—R&D and design—will remain in the United States, Europe and Japan. But over the long term the design functions are likely to migrate to where the action is, which is where the manufacturing is located. This is happening already in Taiwan, in particular, which is now using its strength in manufacturing to build a strong design industry, with extensive government support. China, too, is following this path, although it is at an earlier stage of development. The long run danger is that so large a proportion of leading edge semiconductor manufacturing and design functions come to reside outside the United States that the top graduates from engineering schools see their future not in the U.S., but in China and Taiwan and other parts of the world. They will seek to build their careers there, not here. At that point, it would be very difficult to reestablish U.S. leadership.

It is not in our national interest to see the entire infrastructure for the design and manufacture of semiconductors to migrate outside of the United States. A recent report by a Defense Science Board task force concluded that the migration of

U.S. capabilities in semiconductors outside the U.S. posed "long term national economic concerns." Given that semiconductors are at the core of virtually all critical defense systems, the national security concerns are obvious. The problem we confront is that the commercial realities of the semiconductor business are leading to a relocation of design and manufacturing functions outside of the United States.

Identifying a comprehensive set of recommendations for addressing this problem effectively would take a sustained industry-government dialogue of the kind we saw in the 1980s in connection with the challenge from Japan. I would like to offer several preliminary suggestions:

First, it should be recognized that the present offshore movement of semiconductor production is being driven by deliberate government measures as well as by commercial imperatives. Therefore, the U.S. Government should continue to place a priority on the elimination of trade and investment distorting measures like China's preferential value added tax that violate international rules. China's use of a WTO-inconsistent measure to attract inward investment that would not have otherwise occurred was a serious market distortion in a strategic industry. The U.S. acted properly in placing a priority on the elimination of this measure. At the same time it should be recognized that many of the incentives used by governments to attract high technology investment do not clearly violate any WTO or other international rules, so there is a limit to what can be achieved by invoking existing rules. Over the longer term it will be necessary to negotiate the establishment of international norms on the use of government incentives for high tech investment.

Second, the U.S. Government needs to examine domestic tax polices that affect U.S.-based manufacturing in light of foreign tax policies that are functioning like a magnet for manufacturing investment. While I do not recommend any particular tax measure, the fact is that U.S. measures are needed to offset the effects of foreign tax holidays in some way.

Finally, we must recognize that competition in this industry is increasingly a competition for a limited pool of talented people, whether U.S. or foreign born. The U.S. has the lead in this area, and we shouldn't allow ourselves to lose it. This means above all maintaining our excellent system of research universities and ensuring that the world's leading edge R&D continues to take place here in the United States. Specifically we should increase, not curtail Federal spending on university-based, leading-edge R&D and other forms of support for U.S. research universities.

Senator ENSIGN. Well, I thank the panel. I think this panel of witnesses, along with our first witness, is raising some very, very important points that we, as policymakers, need to consider as we go forward.

I want to start my questions with Dr. Clough, especially with your experience in education. Education was—you know, we've heard so much about education. From your perspective at Georgia Tech, what can we do to get more people to pursue careers in engineering? Virtually every high-tech company tells me that they have job openings for computer software engineers. They just don't have enough engineers to hire out there. Should we give more financial incentives to those who pursue careers in engineering, math and science, to make it easier for people to select such careers? Obviously, I mentioned in my questioning of Assistant Secretary Frink, kind of, jokingly, that the United States graduates a lot more lawyers than China, but we graduate a lot fewer engineers. I mean, do we need to create more incentives and direct those dollars that we have to those who are becoming engineers? We're in tight budget times, but do we need to direct the dollars more toward those types of people and incentivize them?

Dr. CLOUGH. Good point. I think, first, we need to recognize we're in a different environment today. We are in an environment where we need to recruit from all segments of our population. And, frankly, engineering and science were probably at fault for not being aggressive about including women and minorities. Because that's the

majority of the population. So, we need to be able to recruit from that sector.

We need to do a better job, as was mentioned earlier, of marketing that and letting them know—I think universities have a stake in this. In other words, we have a role to play——

Senator ENSIGN. When you say "we," who's "we"?

Dr. CLOUGH. I'm thinking of universities, for the moment.

Senator ENSIGN. OK.

Dr. CLOUGH. In the sense that about—if you look at the national statistics, 50 percent of the students who start in engineering drop out. That's not an acceptable number. We've worked hard at Georgia Tech, and we've gotten it now up to 75 percent now graduate, who start. We believe we can do a better job of that.

So, I think we need to make engineering a more interesting field. That's what this program that I described briefly at the National Academy of Engineering was about, the Engineer 2020. How can you make engineering an attractive field for young people to go into, given that they have lots of alternatives? And so, I think we need to work on that, as well.

There are financial issues, clearly. Engineering is not—or science—is not a simple area to go into, and not a cheap area to offer the education in that area. I think Representatives Wolf, Boehlert, and Ehlers, for example, have offered a program, or proposed a program, of forgivable loans to young people who will undertake the curricula that are necessary to get degrees in this area, both, perhaps, in high school, as well as at the university level. And I think we should consider that.

In my day, when we started out in engineering—and I'm a first-generation college graduate; my parents were not able to go to college, because of the Depression and the times in South Georgia, where I grew up—we had the National Defense Education Act, and it was a wonderful program that encouraged young people, not only at the bachelor level—to take bachelors-level studies, but also master's- and Ph.D.-level studies. That program went away. Some of the reports that we've referenced out of PCAST, as well as out of the National Innovation Initiative, refer to the possibility of restoring that. It's not a terribly expensive program, but one, I think, that would be very crucial. I think you've got to address it all the way from high school straight all the way through to Ph.D.

Senator ENSIGN. Could you repeat that?

Senator ALLEN. What was that one, again?

Dr. CLOUGH. The National Defense Education Act. And you'll find many of the people who are working in government today, or nonprofits or at universities or in industry, had the benefit of that kind of support. And it makes a statement about the Federal Government's interest in this area.

I think the notion of balance in this portfolio—and our research portfolio is very important, because support for engineering and the physical sciences has been flat or has declined, while other areas have gone up. Now, there are good reasons for NIH funding to go up, so I'm not begrudging them that increase, but the signal, very clearly, to engineering and the physical sciences, and students who might consider those areas, not as important. There's not many research assistanceships in that area. And Senator Allen talked

about NASA; that's another good example where there have been some cutbacks in the kind of basic support that we need. And, as you may know, we participate in several of the things at Langley, with Virginia Tech—I taught at Virginia Tech for a number of years. So, I think we need to look at areas where we can, in fact, balance that portfolio, and, in doing so, make a statement, again, that these areas are important to the future of our country.

Senator ENSIGN. Great.

Mr. Murray, just really quickly on the Manufacturing Extension Partnership. I think it's great to hear how the New Jersey Manufacturing Extension Partnership program has worked for you. Similar programs may be working in other places around the country. What I would ask of you—and you don't have to answer it today—but, could you provide specifics on how it worked for you. One of the things that we have to do up here, as policymakers, is assess the success or failure of the programs that we fund. The MEP may have worked for you in New Jersey, but it may not be working in other parts of the country. I mentioned the word "metrics" before, and, we need to have good metrics to determine if we are having successes some places, and not others. We should never legislate by anecdote. It is a nice anecdote that we have of your company today, but we need to have verifiable statistics to show what it costs and what the benefits are. We do that cost-benefit analysis, because we are the stewards of the taxpayer dollars. So, if I could get from you, in writing, specifically how the MEP benefited your company. You mentioned some of the benefits of MEP, briefly today, but if we could obtain a more detailed account of your experience, we could then ask some of the other MEPs across the country if they are doing the same kinds of things that actually worked in a real-life situation.

Mr. MURRAY. Oh, absolutely.

Senator ENSIGN. Thank you.

Mr. MURRAY. I'll be happy to put that in writing to you, Mr. Chairman.* But, just briefly, we would be out of business today.

Senator ENSIGN. Right.

Mr. MURRAY. 150–160 jobs would be lost to Asia if MEP didn't exist. And people have said to us, "Well, why MEP? Why not turn to a private-industry group? Why not turn to a turn-around management group?" And the reason is, first of all, it would have cost us much, much more. The MEP cost to us was about $140–$150,000. It would have cost us three or four times that if we had turned to private industry. Plus, during our most dire times, we—the banks and our vendors worked with us, because they knew we were working with an agency like MEP, and they knew that MEP is a government organization. And, plus, the individuals that we worked with at MEP, many of them are former business owners and have gone through the same kind of troubles and problems that we faced.

So, our company would not exist if it weren't for MEP. MEP forced us to change how we thought and how we ran our business. We questioned every purchase, every cost, and we established very, very—you mentioned "metrics," Mr. Chairman—we established

*The information referred to can be found in the Appendix of this hearing.

very specific metrics on how to guide us and how to help us restore our company to profitability and increase our sales.

Senator ENSIGN. Great.

Mr. Howell, I'm going to call on Senator Allen next, and it's—I've heard the same thing from the chip manufacturers, exactly the same kind of experiences. Texas Instruments, because of our Invest in the USA Act last year, they're actually going to be building a plant in Texas, simply because of that. We always hear the difference in labor costs. Well, with chip manufacturers, that's not the biggest determining factor. So, we have to examine all of these other factors when we are looking at competitiveness issues.

Senator Allen?

Senator ALLEN. Thank you, Mr. Chairman. You asked most of the questions of Dr. Clough that I was going to ask, and I was taking notes. Please stay in touch with me, because I think one of the greatest future challenges of this country is to make sure we have the best minds who are capable to design the innovations and inventions of the future. And I appreciate your comments.

Senator ENSIGN. Senator Allen, I'm going to have to excuse myself. I have to attend a press conference over on the House side. Please take over, and then just turn it over to Senator Kerry.

Thank you.

Senator ALLEN. [presiding] Fine. Got it.

Let me ask you just one thing. On nanotechnology, the Nanotechnology Initiative that I mentioned earlier, sponsored with Senator Wyden. We have the Nanotech Caucus here—one of the key areas of it is to work with universities—colleges and universities, as well as the private sector and a number of Federal agencies involved in nanotech, everyone from Energy to Defense and others. Do you have any specific suggestions on how we can better help? Have you seen this initiative? It's fairly new since the President signed the bill, in 2003. Do you have any specific recommendations——

Dr. CLOUGH. I'll be glad to comment on it. And I was there when the President signed the bill. And, of course, it's essentially a $4 billion investment, significant investment—I think, a very important one. On PCAST, Congress actually granted PCAST the challenge, if you will, of oversight for the expenditures to gather intelligence, so we could get the sense that we're making a balanced investment in nanotechnology in the many different areas. There's also an interagency group that's looking at that, as well, and we just issued a report to Congress on that. I think it was to the Science Committee, on the House side. It's an excellent report. It's on their website. I think it documents very clearly where we are relative to our competition. And, in this field, the evidence is that we are staying on a level playing field with the competition in Japan, the European Union, and others. We are making at least similar investments, if not larger investments to those countries.

So, I feel very positive about the National Nanotechnology Initiative. I think it was a stroke of genius to go into this area, because it's so broad-based. We, at Georgia Tech, are very active in this area, and it's exciting. And Senator Kerry talked about the many ways that it can impact the world. And you've talked about it. And it's all very true.

Senator ALLEN. All right. Thank you.

Now, Mr. Howell, when I was Governor of Virginia, I worked very hard to attract semiconductor investment fabs into Virginia. In fact, I've got a change to the name, according to *U.S. News & World Report,* to the Silicon Dominion, where Siemens and Motorola invested at White Oak, and Toshiba and IBM, up at Manassas. They're now owned by Infineon and Micron. And so, I really do think the semiconductor industry, just for jobs, when you look at the indirect jobs—the suppliers, the vendors, the contractors, the toolmakers. I always liked to see what Applied Materials was doing, because you can determine what the next fabs will be. Once they can develop the 300 millimeters wafers, they can then determine whether they want to invest billions of dollars to upgrade from the 200-millimeter wafers. And, in fact, there's probably no—other than the automotive industry, there's no other kind of manufacturing that creates so many additional jobs from all those suppliers and vendors and contractors. And I'm glad the Administration eventually got around to getting after China on the VAT tax.

Another thing that happened was, with Hynix—and you're talking about countries subsidizing—and to the extent we can—and any recommendations you may have, where countries are subsidizing in an illegal way, we need to crack down on them. Hynix was subsidized unfairly and illegally by the South Korean Government. They were focused on DRAMs, or dynamic random access memory chips. And that's exactly what's fabricated in these two facilities in Virginia. And, by doing that, they're just dumping on the world market—and, in fact, in not just the U.S., but the rest of the world—and countervailing duties were imposed upon them.

As far as incentives, the way I see this country—and I see this, again, from my days as Governor—what we did was, created a Performance Grant Incentive Program to get those fabs—German, Japanese, U.S.—partnerships together, and they would get credits based upon the number—the amount of their production. It was a good business approach, that if they did not invest and produce the chips, they wouldn't be getting these performance grants. And all that's legal. And it's one way that at least Virginia became attractive and beat out California or Texas or other states for these investments.

You're saying that what Taiwan's doing, what China's doing, it's not—in some cases, it's not a violation of WTO rules. Therefore, what should we do—and you did not specify this specifically—what should we do, as the United States, as far as our tax policies—or should it be just left to the states to come up with these approaches so that we can compete? When you look at the number of fabs, in your testimony, being proposed in China, compared to this country, it's 20 to 1, almost, or maybe it's 10 to 1. And it's not just because of those costs, as you said, as far as labor costs; it's because of the land, it's because of the industrial parks, tax-free for the worker somehow, building these fabs as foundries for them. What can we do, as a country, as far as our policies—tax policies or otherwise—so that those fabs are built here? And I agree with you, it's a national security issue, as well. So, I'd like to hear your views, Counselor, on that.

Mr. HOWELL. Senator, first, I think that Virginia is a good example of state programs that are actually very dynamic, designed to

attract semiconductor investment to the states. And I think you'll find that most semiconductor fabs are located in states that have sought them through proactive programs—California, North Carolina, Massachusetts—probably ten states where most of the manufacturing is. And you see the same thing internationally, that countries that have not sought to create the semiconductor industry within their borders don't typically have one—Australia, Canada, those countries that have not pursued them. Abroad, they've been essentially created by governments.

States can do so much, in terms of providing incentives. They can provide tax exemptions and a variety of other things to industries. And I think most of those things do not violate international trade rules. As subunits of a Federal system they cannot close the border the way China did with its VAT—or they didn't close the border, but they raised a border restriction. A state can't do that. States can't affect Federal tax policy, either, so there's a limit to what they can do. They can do a lot, but they can't do everything.

The first question is a threshold question, before one looks at solutions to the differentials in taxes. What's the actual impact on locational decisions between, say, the U.S. and China or Taiwan, of the various Federal-level tax differentials? It has never really been studied. You can't apply the tax differentials to ten companies and say, "Here's the impact." It's definitely a dramatic impact on some companies. I think there's one U.S. company that said about a billion dollars per fab, in terms of cost savings, is attributable to that tax differential.

The first question, then, is, what's the real impact, and who is impacted by it? And then, I don't think it's necessary to say that we've got to replicate everything that's being done in China or Taiwan. I don't think it's feasible. There are equity issues, or fairness issues, as well, that have to be considered. And, in fact, the tax holidays are very controversial in Taiwan. Other industries think they're unfair. But I think if we knew the impact a little more, or had a better metric, as it were, on the impact of the tax differentials, it would be possible, then, to devise measures that would at least bring us to within a level of competitiveness as a location with those countries that is closer than it is now.

Senator ALLEN. Let me try to distill what you've said. Granted, the states can do things. Obviously, you work with the localities on the land, and prompt permitting, air permits matter, to get those. In fact, the folks with—what was White Oak, now Infineon, were very pleased that they got their air permit in 28 days, which was a third better than in Texas, and monumentally better than California, from their testimony, or their speeches. And I think the states also—we created a new engineering school, and I made sure that they had a focus in the engineering school at VCU in microelectronics, and they have a state-of-the-art clean room. That's important for training. That's something, all that we did as a state.

We can analyze various things of what other governments are doing. And I still need to—for us—I'm not at the Federal level—I'm trying to figure out, all right, what can we do, as a nation, to make sure that we recognize that competition? I'm not saying the Federal Government goes and condemns land in Georgia or Massachusetts and says, "Here, you can have this land free, because this

is in our national interest." We, obviously, have a different form of government than those countries. But if there's any tax policy that we may have on research and development, or investment, or, in some cases, say, earnings stripping, which is forced on foreign investors into this country—if a company from Great Britain or Germany or Japan invests in this country, they get a different tax treatment for their capital investment than does a U.S.-based company—are any of those sort of ideas worthy of consideration?

Mr. HOWELL. Well, I'd say, yes, they are. It's not just a question of comparative tax policies. I think that there are reasons that the United States is superior to either China or any other Asian locations for building a semiconductor fab. And they include better protection of intellectual property here, less likely to lose your designs or secrets than over there, political stability. It's also that people want to live here, and you can attract people here now from all over the world, still, to work in the fabs and in the research units, and so on.

So, it's not a question of being able to match them dollar for dollar, in terms of tax benefits. The idea, I think, would be to narrow the differential in that area and build on our strengths. One of the ways to do that is to make sure that the leading-edge R&D continues to be done here, and not there. And a way that can be promoted, both at the state and the Federal level, is by increasing spending on basic R&D in the universities. The smartest people want to come to where the cutting-edge work is being done. Right now, that's here. But that will change over time if we don't do anything about it. Right now, we are cutting back on that kind of spending, and it's being increased—not just in the Far East, but in Europe. The governments are saying, "We'd like to have that infrastructure of learning and spinoffs of commercial companies, building on the learning, to happen there." And that's something that probably doesn't have as big of a fiscal impact, as a tax holiday, or whatever, but has a dramatic impact on where people want to live and work, and especially the best people.

It is, to some extent, a zero-sum competition worldwide for getting those best people. Those help-wanted signs exist, certainly, in the high-tech area. There's a competition for the best, most-talented people, and one way for us to compete with that is by building on our excellent university system, and spending more.

Senator ALLEN. Thank you, Mr. Howell. That fits right in the beginning of my questions.

And I'll turn it over to Senator Kerry.

Senator KERRY. Thank you, Senator. Thank you very much.

Dr. Clough, a lot of people argue that trying to keep low-wage manufacturing jobs in our country is, sort of, a losing proposition, unless you can out-compete, which means innovating. Would you agree with that?

Dr. CLOUGH. Yes.

Senator KERRY. OK. I do, too. So, you've got to innovate. The key to innovation, obviously, to staying ahead, is basic research. Is that correct?

Dr. CLOUGH. That's correct. That's one of the elements.

Senator KERRY. And basic research depends on a commitment of the Federal Government, in this case, because the private-sector

has, in many cases, either refused to or pulled out of it, isn't that accurate?

Dr. CLOUGH. They're short-term oriented.

Senator KERRY. So, the key is the Federal Government's commitment to NSF, to NASA, to the Department of Energy, Office of Science, and so forth. Right?

Dr. CLOUGH. Correct.

Senator KERRY. In your testimony, you said, "We need to find a balance in funding."

Dr. CLOUGH. Yes.

Senator KERRY. I would presume, therefore, we do not have that balance today. Is that accurate?

Dr. CLOUGH. Yes, that's true.

Senator KERRY. OK. And that is because the Federal Government is making other choices.

Dr. CLOUGH. That's correct.

Senator KERRY. And the choice is to use its revenue in other forms, correct?

Dr. CLOUGH. I presume so.

Senator KERRY. Well, a tax cut, a tax expenditure, is an expenditure. We have X amount of revenue; we can put it here in a spending or investment program, or we can put it here in a tax expenditure, which is revenue foregone. Accurate?

Dr. CLOUGH. I assume so. I assume Congress also could make decisions within the existing budget to make some of these adjustments.

Senator KERRY. Well, we could. For instance—Mr. Frink is gone, but—I didn't get a chance to go back to him on it, but he pointed out in his testimony—I don't have it in front of me now. Do you have his statement? He pointed out, in his testimony, that we've increased significantly—I think it was a 45 percent increase, if I recall—yes, here it is. "This represents a 45—the Federal budget is—includes a record $132 billion for Federal research and development, a 45 percent increase, compared to 2001's $91.3 billion." But when you look inside of that, that money is not going to competitiveness or job creation research, it's going largely to weapons—defense research, very specifically, the Defense Department research. So, again, these are choices that we're making: Where are we going to put our money?

If we're going to compete effectively, which we all want to do—and, I mean, the long-term health of our country, the national security our country, will depend on the health of our economy.

Dr. CLOUGH. Right.

Senator KERRY. And if we're not able to create the next wave of jobs, and the next wave of high-value-added sector, we're going to be in trouble.

So, let me ask you: What is the most important thing that you think we can do, in your judgment, that will have a direct impact on what you're struggling with at Georgia Tech, and what they're struggling with at MIT and Carnegie Mellon, and all these other great universities and colleges—what do we need to do in our spending choices here to have the greatest impact on what you're trying to do?

Dr. CLOUGH. Well, I think we need to look at the research portfolio as an entity. And it tends to be hard to do, because a lot of it comes out of agencies. In other words, we know—and you well know—that DOE, for example, funds about 40 percent of the basic science research in the country, not the National Science Foundation. The National Science Foundation clearly funds a lot of science research, but DOE does, as well. The Department of Defense—it's not well understood, I think—in many cases, has, for many years, been the primary funder for electrical engineering, mechanical engineering and chemical engineering in this country. And, as they have had to cut back on 6.1/6.2 research, that funding has gone down, and that's where we've lost some significant funding, long-term funding for those critical areas in engineering.

Similarly, in some of the other areas, where, again, it's spread across a spectrum. So, that makes it a little bit more difficult than saying, for example, "We're going to improve health research, and so we'll double NIH's budget," which was a simpler proposition than it was. Some of the increase you referred to did, indeed, go to NIH; and that was a positive thing, in my personal perspective, because that's a big economic driver, I believe, in the future.

Senator KERRY. Well, again, that was a conscious decision that we did make.

Dr. CLOUGH. It was. And it was a good one.

Senator KERRY. We said, "We're going to put X amount more into NIH," and so we grew that.

Dr. CLOUGH. But I think we—I think you, in Congress, need to get very serious about watching how the flow of these funds comes from the different agencies, so that the portfolio is balanced. Clearly—and this is not just PCAST, or it's not just other—there are a number of entities that have commented on this, with clear statistics that the funding for engineering and the physical sciences, if not flat, has gone down at a time when that big budget for R&D was going up. And that's not good balance.

Senator KERRY. What's the long-term implication of, as you said, our competitor nations out-competing us at the moment, in terms of production of engineers and basic science?

Dr. CLOUGH. The long-term implication is that, obviously, we won't be competitive in that part of the economic spectrum that actually has generated 50 percent of the economic growth in the last decade. And that's what's frightening. We need to be in that space. We need to give all the young people in this country an opportunity to share in the possibilities that are in that space.

Senator KERRY. Would you say there is both a national-security and national-priority urgency in the fact that, in 1975, 70 percent of America's economic base was manufacturing and 30 percent was service. Today, it is reversed—70 percent is service, and 30 percent is manufacturing, and declining.

Dr. CLOUGH. Right.

Senator KERRY. What are the long-term security implications of that?

Dr. CLOUGH. Well, there are certain areas in manufacturing, clearly, we need to maintain in this country, regardless of all the competitiveness issues that we have. For example, semiconductors or nanotechnology, some of the areas are going to underline our—

underlie our ability to be secure, as a nation, in a threatening world. In addition, it will also affect economic competitiveness.

So, we need to decide, I think, as a country, where we really want to maintain a capability, under any circumstance.

Senator KERRY. And you also cited the workforce training component of this, which everybody understands is critical. There again, we're cutting, we're not growing, correct?

Dr. CLOUGH. Yes, that's true.

Senator KERRY. So, it's another wrong choice.

Dr. CLOUGH. Well, I think it's a choice we need to think very seriously about today.

Senator KERRY. Well, if we're cutting, and you think we shouldn't be cutting, we're not doing the right thing, correct?

Dr. CLOUGH. True.

Senator KERRY. Mr. Howell, your comments about the 90 percent, versus 93 percent and 100 percent, seem to be stating the case that wages, per se, are not the biggest factor in the noncompetitiveness of our playing field. Is that correct?

Mr. HOWELL. That's correct. At least in semiconductors.

Senator KERRY. Does that apply to other sectors, would you say?

Mr. HOWELL. The higher the technology level, and the more automated the production process, the more applicable that same logic is.

Senator KERRY. Well, now, we all understand that other countries are engaging in illegal trade practices, and that puts us at a significant disadvantage, in intellectual property. For instance, I think we're losing something like 24 billion bucks a year that we can measure, and that's obviously unmeasurable, just as an example. So, in order to level the playing field, you've got to enforce the WTO rules and use the rules available to you. And yet, the Import Administration, or the Commerce Department, International Trade Administration, which investigates dumping and countervailing duty cases, is going to be cut by 5 percent under the President's budget. The U.S. Trade Representative, who is responsible for representing the United States in cases brought to the WTO, is going to see a 7 percent cut. How are these cuts going to affect our ability to be able to create a fair playing field for our companies and stand up, since we're already behind the curve in that?

Mr. HOWELL. Well, they're going to hurt, obviously. And let me take USTR, for example. They are the agency that enforces the WTO rules. They bring the dispute settlement cases to Geneva. They are—and some former people that used to work for me are over there now—in my opinion, they are understaffed already. They haven't got enough lawyers, and they haven't got enough senior lawyers to bring the number of cases that need to be brought. And they, in most cases, are up against litigators on the other side who have got more people, more senior people, more expertise, and so on. And they ought to be expanding that capability, adding funding, adding people, building, if you will—in the same way that the antitrust division was expanded in the 1930s to make it a really effective enforcement agency. We ought to be building USTR, not cutting it. And I would say the same applies for the Import Administration. That's a very important part of our overall trade policy

structure, the ability to bring those cases. And if that's eroded, it's going to affect manufacturing. There's no question about that.

Senator KERRY. Let me just summarize by making a point that is fairly obvious. I led off with it in my early questioning, but budgeting is a zero-sum game. And these choices are staring us in the face, and they have been for years now. I've been here 22 years, and I am tired of listening to the same old arguments. It's the same-old/same-old every year. And the fact is that we are locked into a paradigm on the budget, where 43 percent of the deficit is due to a choice Congress has made to forego revenue, to have a tax cut. The average American is seeing their costs go up, and their total tax burden has gone up. I don't know anybody who has been reading, but they should be, the *New York Times* and *Wall Street Journal* series on what's happening in America to this have and have-not divide that's growing. It is deadly serious, in terms of the policy choices we're making here.

And I'd say to my friends on the other side of the aisle, if we're going to give meaning to these words and these hearings and these efforts by people—after all, here's a person, Mr. Murray, who has just told us that, if it weren't for the MEP, his company wouldn't be in existence today. We would have lost another 160 manufacturing jobs. That's repeated all over the country. And yet, here we are with a budget that wants to cut it. I don't get it, just as a matter of good old American common sense and, sort of, basic values. So, we can cut off our nose to spite our face, and it will do a lot more than that, the way we're heading, in terms of these budget choices that we're making, or we can take this to heart.

So, I regret that I've got a meeting that I'm already late for, and I would like to have drawn this record out a little more. And, again, I hope that, as a Committee, we can try to force some of these better choices here. And I thank each of you for taking time to be here.

Senator ALLEN. The record will remain open for 7 days for Members to submit statements, or they may ask you questions.

Let me say, in concluding this hearing, this is one I care a great deal about. There are dynamics, there are impacts, to the decisions we make. Tax policy matters. And having lower taxes will help spur investment in this country. And, in fact, a strong economy will get more revenues in. Then one needs to determine, what are the priorities in spending? And I think mostly in this proposed budget from the President, clearly homeland security and national defense are important. There will be differences, insofar as some of the other budgetary matters. And I think that we do need to spend money. It's a wise investment in aeronautics, in nanotechnology, in research and development. And we can look at probably the greatest invention, in my view, since the Gutenberg press, which is the Internet, as an example, a real objective lesson for us all. The Internet was developed—Federal program, DARPA—then it got applied to the private sector. It is a great vehicle for individual empowerment. It's an individualized empowerment zone, so to speak. And it is the best since the Gutenberg press. If it wasn't the Gutenberg press, Martin Luther's 95 theses on the Church of Wittenberg would have been read by very few people. And look at how broadband has expanded opportunities for people all across this

country. The policy of this country is to leave the Internet free of taxation. I've worked to make sure that avaricious state and local tax commissars don't impose 18 percent access taxes on the Internet, to help bridge that economic digital divide and make sure that there's investment for the Internet or broadband into small towns and rural areas. And whether that's by cable or telephone lines or even—now they're talking about over power lines, and eventually on Super WiMax, as well, wireless, and satellites, eventually.

So, you know, Ronald Reagan said there was a policy of the Federal Government, if it moved, tax it; if it kept moving, regulate it; and if it stopped moving, subsidize it. Well, in the Internet, we left that free, and look at how that's improved our lives for information and for communications, allowing Mr. Murray to have his business communicate all over the world. It is important for telemedicine. It is important for education. You undoubtedly have distance learning at Virginia Tech—or, excuse me, at Georgia Tech, as does Old Dominion and other universities across the country. So, these decisions, leaving investors to keep more of what they earn, does have a positive impact, but we do have to remember to make the right decisions in budgeting.

And from the President of Georgia Tech—and I know you're a good ACC school—you know what—one of the things you mentioned, as far as what we need to do in recruiting women and minorities, more minorities, into engineering and science technology, the analogy I give is that if you were a head coach and a general manager looking to the NFL draft, and you said, "We're only going to draft players from 40 percent of the country," and you'd only draft them from the Ivy League and the Big Ten, the result would be, you'd lose, and you'd get fired. And, as a practical matter, when you see women being a little over 10 percent of the engineering schools—Latinos, the fastest-growing group in this country, in single digits, are around 10 percent, 10 percent for African Americans—we really are only recruiting or incenting or enticing 40 percent or less of our country to get interested in engineering. So, we need to make sure all Americans recognize the great opportunities for jobs, good-paying jobs in this country. It's good for them, a fulfilling life for them and their families, but it's also important for the competitiveness of our country.

So, I want to thank all our witnesses here today for appearing, and for your insight. Your commentary and views will be used by many of us as bolstering our arguments. And I very much appreciate your shared concern, not just for your own institutions—your firm, your company, your wonderful university—but also for your care for the future of this country.

So, I thank you all, and this hearing is adjourned.

[Whereupon, at 11:25 a.m., the hearing was adjourned.]

A P P E N D I X

PREPARED STATEMENT OF HON. DANIEL K. INOUYE, U.S. SENATOR FROM HAWAII

Manufacturing is a critical component of this country's economic security. It drives growth and accounted for over 77 percent of the Nation's exports since 2000. However, our manufacturing base is quickly eroding. The recession took its toll on the economy as a whole, yet while other sectors have rebounded, manufacturing jobs have not recovered.

Some economists cite the country's strong productivity numbers as proof that the United States continues to maintain its manufacturing competitiveness, but the fact of the matter is that we have lost over 2 million manufacturing jobs in the past 4 years. And these are high paying jobs that average over $63,000 per year.

The trade situation is an even greater dilemma. The United States experienced the largest monthly trade deficit this past February as we imported over $161 billion worth of goods and services while exporting $101 billion. This left us with a monthly trade deficit of over $60 billion, the highest in history. Furthermore, this year's first quarter deficit was $174 billion, well ahead of last year's first quarter deficit of $139 billion, which ultimately resulted in a new record annual deficit of $617 billion. These are not the kind of dubious records we want to be setting.

Instead we should be setting new records in innovation and advancing the state-of-the-art with our research and development capability. In order for this country to compete economically, we need to make the necessary investments in basic research. Basic research is the foundation upon which entrepreneurs build the next great products that enrich our lives, improve our health, and provide for our security. Given this need, I find it perplexing that the President has provided such anemic funding for the National Science Foundation, the Nation's pre-eminent science research agency.

Other countries understand that R&D is the fuel that propels economic growth. Our industries are facing competition from both shores. The aerospace industry, one of our few leading export industries, is under attack from Airbus as market share has fallen from over 70 percent in the mid-1980s to slightly more than half today. In their European Aeronautics 2020 report, the European Commission is calling for an investment of 100 billion Euros. From the other side of the Pacific, our hi-tech industries are being enticed to build new multi-billion dollar facilities in China, India, and Malaysia. U.S. manufacturers are facing increasing pressure from global competitors who are able to win business through lower operating costs and discriminating trade practices. I know that I am not alone on this Committee, or in the Senate, when I call for greater enforcement of our trade agreements.

The government needs to take action and respond to the challenge to our economic livelihood. I applaud the President for creating a new position within the Department of Commerce to deal with some of these issues. Mr. Al Frink, who is before us today, was confirmed as the first Assistant Secretary for Manufacturing and Services. I look forward to hearing about what he has been doing over the past year and learning about what steps the Administration is taking to improve the outlook for this country's manufacturing capability.

I also look forward to hearing more about the Hollings Manufacturing Extension Partnership. MEP is one of the few programs that we have to assist small and medium-sized companies to better compete in today's global economy. In fact last year alone, MEP helped companies retain or create fifty thousand manufacturing jobs.

However, MEP, even with its track record of success, has not seen the Administration's support. This is particularly disturbing given that now is when these companies need assistance the most. In Fiscal Years 2003 and 2004, the Administration requested only $13 million each year for a $107 million program. This fiscal year's request is $46.8 million, which is still less than half the amount required to support the network of centers. I hope we can work to correct this imbalance.

The government can, and must, take positive action toward addressing the concerns I have outlined thus far. Other foreign governments are making the necessary investments in their infrastructure and workforce. If we continue to ignore the great

capabilities that have so far been the heart of America's competitive advantage, we risk falling behind.

FPI THERMOPLASTIC TECHNOLOGIES
Morristown, NJ

Hon. JOHN ENSIGN,
Chairman,
Senate Subcommittee on Technology, Innovation, and Competitiveness,
Committee on Commerce, Science, and Transportation,
Washington, DC.

Dear Senator:

Thank you for the opportunity to testify before the U.S. Senate Committee on Science, Commerce, and Transportation, Subcommittee on Technology Innovation and Competitiveness at the recent hearing on Manufacturing Competitiveness in the High-Tech Era. Not only did I enjoy sharing my experience with the Committee, I welcomed your comments and questions on the Manufacturing Extension Partnership (MEP) which I spoke so highly about.

As you know, the NIST Manufacturing Extension Partnership is a nationwide network of resources helping small manufacturers become more competitive. At the heart of the MEP are manufacturing extension centers locally positioned throughout the U.S. to address the critical and often unique needs of small manufacturers. Although my experience has only been with my local center, the New Jersey MEP, all MEP centers create significant impact for their local small manufacturers. In my testimony, I stated the incredible impact my local center has had on the manufacturers of New Jersey and more specifically, FPI. In your comments and questions, you had requested more information on the impact that other MEP Centers have had on their local manufacturers. I have since contacted NIST MEP and obtained the enclosed information regarding the impact of their services on their clients. As you will see, the program is not only a success in New Jersey, but is creating significant impact on the manufacturers nationwide.

Please let me know if you have any additional questions regarding the program or its impact following your review of the enclosed materials. Thank you again for the opportunity to testify and for your continued support of the American manufacturing industrial base. Manufacturers such as myself, would not be in existence if not for your support of programs such as MEP.

Respectfully,

SEBASTIAN MURRAY,
President and CEO.

2004 MEP Client Reported Impacts

State	Center Name	Cost Savings	Increased Sales	Retained Sales	Investment in Modernization	Jobs Created	Jobs Retained
AK	Alaska Manufacturing Extension Partnership	$0.00	$0.00	$0.00	$0.00	0	0
AL	Alabama Technology Network	$9,624,700.00	$49,790,000.00	$37,805,000.00	$27,435,200.00	432	969
AR	Arkansas Manufacturing Solutions	$7,916,200.00	$8,053,000.00	$23,565,000.00	$5,355,300.00	178	370
AZ	Arizona Manufacturing Extension Partnership	$5,574,400.00	$19,252,400.00	$18,270,000.00	$6,258,600.00	675	141
CA	California Manufacturing Technology Consulting	$45,905,115.00	$171,585,000.00	$260,723,000.00	$58,188,126.00	619	1926
CA	Corporation for Manufacturing Excellence (Manex)	$5,467,000.00	$16,200,000.00	$11,610,000.00	$5,750,000.00	38	151
CO	Mid-America Manufacturing Technology Center - Colorado	$5,261,000.00	$5,440,000.00	$2,979,000.00	$3,883,200.00	20	88
CT	Connecticut State Technology Extension Program	$7,494,000.00	$16,985,000.00	$37,437,502.00	$10,820,500.00	157	543
DE	Delaware Manufacturing Extension Partnership	$17,987,000.00	$5,403,000.00	$5,900,000.00	$4,782,500.00	117	138
DE	Delaware Valley Industrial Resource Center	$30,880,600.00	$61,515,000.00	$71,325,000.00	$11,342,900.00	200	867
FL	Florida Manufacturing Extension Partnership	$35,603,128.00	$57,663,000.00	$59,655,000.00	$34,308,800.00	461	1396
GA	Georgia Manufacturing Extension Partnership	$13,841,500.00	$25,700,000.00	$50,695,000.00	$24,080,700.00	713	831
HI	Hawaii HTDC- MEP	$36,000.00	$100,000.00	$85,000.00	$690,000.00	4	10
IA	Iowa Manufacturing Extension Partnership	$27,522,129.00	$46,727,000.00	$120,357,000.00	$31,462,974.00	453	696
ID	Idaho TechHelp	$6,173,000.00	$6,080,000.00	$9,350,000.00	$15,894,000.00	106	118
IL	Chicago Manufacturing Center	$5,793,332.00	$25,294,000.00	$46,855,000.00	$9,312,564.00	354	457
IL	Illinois Manufacturing Extension Center	$22,488,040.00	$33,516,000.00	$140,560,000.00	$24,530,477.00	294	1756
IN	Indiana Business Modernization and Technology Corporation	$2,456,000.00	$10,775,000.00	$19,750,000.00	$12,299,000.00	133	484
KS	Mid-America Manufacturing Technology Center	$8,261,500.00	$10,675,500.00	$9,736,000.00	$4,761,400.00	79	274
KY	Kentucky Manufacturing Assistance Center	$6,584,000.00	$26,400,000.00	$65,920,000.00	$18,757,000.00	193	272
LA	Manufacturing Extension Partnership of Louisiana	$7,116,947.00	$8,195,000.00	$4,409,000.00	$4,966,514.00	53	78
MA	Massachusetts Manufacturing Extension Partnership	$15,336,922.00	$35,277,500.00	$65,056,600.00	$17,909,700.00	188	711
MD	Maryland Technology Extension Service	$909,300.00	$2,353,000.00	$1,758,000.00	$624,000.00	26	22
ME	Maine Manufacturing Extension Partnership	$7,669,899.00	$9,681,700.00	$10,035,500.00	$4,453,324.00	95	335
MI	Michigan Manufacturing Technology Center	$10,630,820.00	$32,465,000.00	$58,863,803.00	$21,333,255.00	246	872
MN	Minnesota Technology Inc.	$4,509,900.00	$8,677,000.00	$10,200,000.00	$14,078,000.00	179	389
MO	Missouri Enterprise	$8,837,820.00	$60,545,000.00	$218,775,000.00	$28,160,700.00	395	2054
MS	Mississippi Technology Alliance	$18,068,500.00	$34,440,000.00	$39,600,000.00	$22,322,300.00	1118	1444
MT	Montana Manufacturing Extension Center	$1,643,500.00	$590,000.00	$1,113,750.00	$658,000.00	19	70
NC	North Carolina Manufacturing Extension Partnership	$7,833,501.00	$20,595,000.00	$36,025,000.00	$19,227,200.00	178	630
ND	North Dakota Manufacturing Extension Partnership	$925,000.00	$50,000.00	$2,010,000.00	$2,630,000.00	23	47
NE	Nebraska Manufacturing Extension Partnership	$2,327,885.00	$3,213,000.00	$7,297,681.00	$2,682,500.00	82	141
NH	New Hampshire Manufacturing Extension Partnership	$1,630,000.00	$5,240,000.00	$6,450,000.00	$8,840,000.00	72	60
NJ	New Jersey Manufacturing Extension Program	$6,526,001.00	$15,091,500.00	$19,825,000.00	$11,894,000.00	90	338
NM	New Mexico Manufacturing Extension Partnership	$4,224,300.00	$8,972,000.00	$10,469,500.00	$2,338,100.00	100	376
NV	Nevada Management Assistance Partnership	$2,821,500.00	$11,728,000.00	$8,073,000.00	$3,652,750.00	143	443
NY	New York Manufacturing Extension Partnership	$18,659,350.00	$55,826,000.00	$71,017,000.00	$27,046,720.00	1100	2117
OH	Ohio Manufacturing Extension Partnership	$97,498,400.00	$49,961,400.00	$167,547,500.00	$80,306,100.00	529	1289
OK	Oklahoma Alliance for Manufacturing Excellence	$21,688,425.00	$41,891,700.00	$33,557,000.00	$14,872,320.00	281	533
OR	Oregon Manufacturing Extension Partnership	$18,736,000.00	$3,499,000.00	$3,336,400.00	$3,202,681.00	123	44
PA	Catalyst Connection	$12,333,300.00	$23,421,000.00	$183,862,000.00	$29,065,900.00	216	1202
PA	Manufacturers Resource Center	$6,205,000.00	$44,201,000.00	$92,695,000.00	$17,032,000.00	197	1328
PA	Mid-Pennsylvania Manufacturing Extension Partnership	$7,163,750.00	$31,684,460.00	$53,899,000.00	$16,533,870.00	301	598
PA	Northeastern Pennsylvania Industrial Resource Center	$6,473,763.00	$14,802,000.00	$52,209,500.00	$18,566,500.00	153	736
PA	Northwest Pennsylvania Industrial Resource Center	$4,603,966.00	$39,261,433.00	$81,631,767.00	$19,350,298.00	231	1109
PR	Puerto Rico Manufacturing Extension Inc	$8,470,000.00	$10,554,000.00	$38,500,000.00	$8,468,900.00	174	628
RI	Rhode Island Manufacturing Extension Services	$344,378.00	$785,000.00	$563,000.00	$377,869.00	17	53
SC	South Carolina Manufacturing Extension Partnership	$23,902,050.00	$61,630,500.00	$75,580,500.00	$23,696,400.00	467	486
SD	South Dakota Manufacturing Extension Partnership	$0.00	$0.00	$0.00	$0.00	0	0
TN	Tennessee Manufacturing Extension Partnership	$3,604,100.00	$15,250,000.00	$37,526,000.00	$15,440,200.00	234	624
TX	Texas Manufacturing Assistance Center	$27,934,398.00	$96,084,400.00	$131,077,200.00	$29,680,850.00	682	1893
UT	Utah Manufacturing Extension Partnership	$14,624,700.00	$26,021,370.00	$17,330,000.00	$45,410,250.00	422	313
VA	Virginia's A.L. Philpott Manufacturing Extension Partnership	$2,331,368.00	$20,495,000.00	$18,284,000.00	$6,301,200.00	106	228
VT	Vermont Manufacturing Extension Center	$2,252,000.00	$500,000.00	$2,020,000.00	$680,000.00	10	45
WA	Washington Manufacturing Services	$12,448,500.00	$19,735,000.00	$21,110,000.00	$17,640,500.00	257	481
WI	Northwest Wisconsin Manufacturing Outreach Center	$9,829,400.00	$9,355,000.00	$4,650,000.00	$4,519,400.00	118	110
WI	Wisconsin Manufacturing Extension Partnership	$19,656,800.00	$48,971,000.00	$45,963,250.00	$37,382,924.00	784	1671
WV	West Virginia Manufacturing Extension Partnership	$567,500.00	$2,600,000.00	$13,990,000.00	$1,191,700.00	128	272
WY	Mid-America Manufacturing Technology Center - Wyoming	$2,309,000.00	$12,796,500.00	$8,685,000.00	$3,657,900.00	71	144
	TOTAL	$685,716,587.00	$1,482,446,163.00	$2,637,481,453.00	$910,466,868.00	14834	35401

* Independent follow-up of clients with projects completed in FY2003. Of the 4,885 completed the survey in FY2004. Measures are a conservative snapshot of benefits. Recurring or cumulative benefits may be larger.

MANUFACTURING EXTENSION PARTNERSHIP—MAKING A DIFFERENCE FOR AMERICA'S MANUFACTURERS

MANUFACTURING EXTENSION PARTNERSHIP

". . . an important resource for helping small manufacturers achieve the kinds of world-class gains formerly limited to larger companies. Their focus on value-adding activity on the shop floor is exactly right. The MEP network gets results—quickly and affordably."—Richard Schonberger, author, *World Class Manufacturing: The Next Decade*.

Small Manufacturers: The Foundation of American Industry

Manufacturing creates wealth for our Nation: wealth in the form of economic growth, increased jobs and robust trade in world markets. Productivity improvements by U.S. manufacturers are leading the Nation. Between 1992 and 2001, manufacturing productivity grew at double the rate of the entire economy: manufacturing productivity rose by nearly 36 percent compared to a 18 percent increase for the non-farm business sector. Approximately 350,000, small manufacturers account for over half the total value of U.S. production and represent 98.6 percent of all manufacturing establishments. They employ nearly 11 million people and account for two-thirds of all U.S. manufacturing employment. These jobs are high-skilled and high-wage, with production employees earning 50 percent more than retail employees per hour.

The Challenge for Small Manufacturers: Bridging the Productivity Gap

As critical as small manufacturers are to the economy, the productivity gap between large and small firms is widening. Between 1992 and 1997, productivity for large manufacturers grew by 22.6 percent versus 15.5 percent for small manufacturers. And as large manufacturers increase their dependence on suppliers for parts and services, the performance and capabilities of small manufacturers become even more critical to the competitiveness of all manufacturers and to the health of the

U.S. economy. Yet, according to a National Research Council report, "Many of these smaller firms, however, are operating far below their potential. Their use of modern manufacturing equipment, methodologies and management practices is inadequate to ensure that American manufacturing will be globally competitive."

Limited budgets, lack of in-house expertise, and lack of access to the newest technologies are but a few of the significant barriers faced by small manufacturers—barriers that MEP aims to help them overcome.

How MEP Is Making a Difference

Manufacturing Extension Centers

MEP is a national network of affiliated manufacturing extension centers and field offices located throughout all 50 states and Puerto Rico. Created in 1988, today's network delivers services to firms across the country and in Puerto Rico. Centers are funded by Federal, state, local and private resources to serve small manufacturers.

Each center works directly with area manufacturers to provide expertise and services tailored to their most critical needs, which range from process improvements and worker training to business practices and information technology applications. Solutions are offered through a combination of direct assistance from center staff and assistance from outside consultants. Centers often help small firms overcome barriers in locating and obtaining private-sector resources.

Partnerships

MEP provides small and mid-sized manufacturers with access to a wealth of tools, techniques and other resources through thousands of public and private affiliations. Initiatives with the U.S. Departments of Labor, EPA, National Association of State Development Agencies, the State Science and Technology Institute, the National Association of Manufacturers, state and local employment training organizations and hundreds of universities and community colleges are a few examples of how MEP leverages public and private resources to make a comprehensive range of technical services and assistance available to small manufacturers.

Each year, MEP helps thousands of manufacturers solve problems, increase productivity and achieve higher profits. Through continuous assessment and improvement of our products, services and service-delivery approaches, MEP is committed to meeting the strategic needs of small and mid-sized manufacturers as they negotiate the New Economy of the 21st century.

For More Information

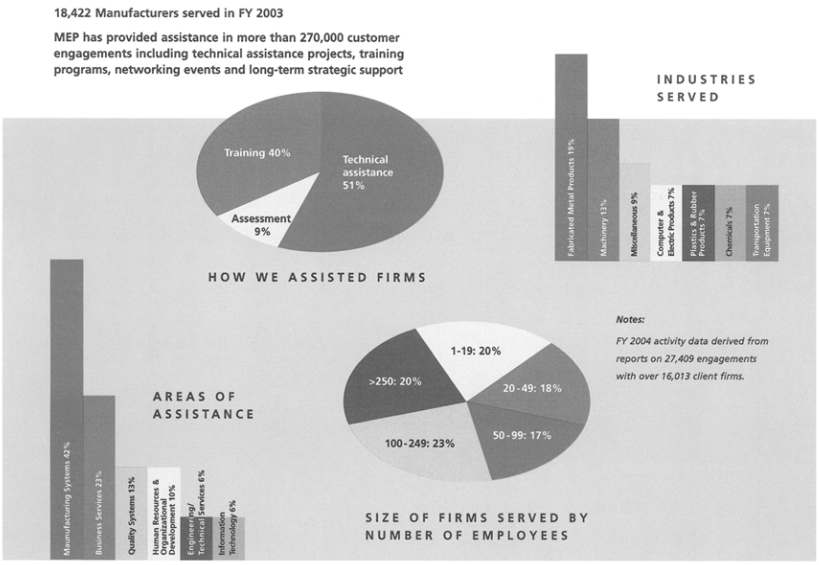
For a list of centers and other information about MEP, contact:

Manufacturing Extension Partnership
100 Bureau Drive, Stop 4800
Building 301, Suite C100
National Institute of Standards and Technology
Gaithersburg, MD 20899–4800

E-mail: *mepinfo@mep.nist.gov*—Or visit our website at *www.mep.nist.gov*

RESULTS: WHAT THE DATA SHOWS

FY 2004 MEP Activities



FY2004* MEP CLIENT-REPORTED IMPACTS

CLIENT-REPORTED IMPACTS
AS A DIRECT RESULT OF MEP ASSISTANCE

Increased/Retained Sales		$4.121 billion
New Sales	$1.483 million	
Retained Sales	$2.638 billion	
Cost Savings		$686 million
New Client Investment in Modernization		$912 million
Jobs Created		14,882
Jobs Retained		35,433

*Independent follow-up of clients with projects completed in FY2003. Of the 5,648 clients selected to be surveyed, 4,865 completed the survey in FY2004. Measures are a conservative snapshot of benefits. Recurring or cumulative benefits may be larger.

IMPACT: INDEPENDENT STUDIES

"Systematic evaluation studies have confirmed that the MEP is having a positive effect on businesses and the economy . . . has achieved national coverage and established local service partnerships . . . and most important . . . MEP services are leading to desired business and economic goals . . . "—Philip Shapira, Ph.D., Issues in Science and Technology, Spring, 1998, "Extending Manufacturing Extension"

Benefits to GA Manufacturers

Georgia MEP clients surveyed reported manufacturing benefits in the following areas:

- improvements to an existing process
- improvements in management skills
- improvements in employee skills
- improvements in an existing product or service

Furthermore, comparing Georgia MEP clients with nonclients found that assistance from the Georgia MEP increased the value-added of the average client plant by up to $443,000 between 1999 and 2001.[1]

PA Manufacturers Post Positive Productivity Gains

A study of Pennsylvania's Industrial Resource Centers (IRC) found that the program boosted the labor productivity of IRC clients by an average of between 3.6 and 5.0 percentage points per year. The study found that these productivity gains raised gross state product by about $1.9 billion. Finally, the study found that for every state dollar invested in the program, the program generated almost $22 of additional income to the state economy.[2]

Higher Productivity Growth for MEP Clients

Researchers at The Center for Economic Studies, U.S. Census Bureau, found that manufacturing extension clients experienced between 3.4 and 16 percent more growth in labor productivity over a five-year period than similar non-client firms. The productivity growth of the 1,559 firms studied translates into $484 million in additional value-added at client firms.[3]

Based on these results, a second study estimated that this value-added increase translates into $1.3 billion in additional economic output over 5 years, leading to $213 million in additional Federal revenues and a $4.47 increase in real disposable income per capita.[4]

Value-Added Income and Jobs for NY

A New York Manufacturing Extension Partnership study found that the state's $5.3 million investment in the program between July 1995 and March 1997, combined with the Federal investment, generated an additional $227 million of value-added income in New York State. This growth, in turn, led to the creation of 2,600 jobs.[5]

GAO Survey Positive

An independent survey of MEP clients by the General Accounting Office found MEP had a positive effect on a firms performance in the areas of:[6]

- profits
- sales
- product quality
- workplace technology
- worker productivity
- customer satisfaction

○

[1] Georgia Tech Policy Project on Industrial Modernization. December 2002.

[2] "The Pennsylvania Industrial Resource Center: Assessing The Record and Charting the Future," By Nexus Association for the Ben Franklin/IRC Partnership Board. October 1999.

[3] *Journal of Policy Analysis and Management,* "Evaluating the Impact of Manufacturing Extension on Productivity Growth," by Ronald S. Jarmin, Winter 1999.

[4] "Estimating Economic Impacts of Government Technology Programs: Manufacturing Studies Using the REMI Model," by M.A. Ehlen and S.F. Weber, economists for the National Institute of Standards and Technology, 1997.

[5] "Evaluation of the New York Manufacturing Extension Partnership," by Nexus Associates for New York State Science and Technology Foundation/Empire State Development, 1997.

[6] "Manufacturing Extension Programs: Manufacturers' Views of Services," U.S. General Accounting Office, Report GAO/GGK–95–216BR, August, 1995.