THE ROLE OF RESEARCH UNIVERSITIES IN SECURING AMERICA'S FUTURE PROSPERITY: CHALLENGES AND EXPECTATIONS

HEARING

BEFORE THE

SUBCOMMITTEE ON RESEARCH AND SCIENCE EDUCATION

COMMITTEE ON SCIENCE, SPACE, AND TECHNOLOGY

HOUSE OF REPRESENTATIVES

ONE HUNDRED TWELFTH CONGRESS

SECOND SESSION

WEDNESDAY, JUNE 27, 2012

Serial No. 112–93

Printed for the use of the Committee on Science, Space, and Technology

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

U.S. GOVERNMENT PRINTING OFFICE

74–730PDF WASHINGTON : 2012

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

COMMITTEE ON SCIENCE, SPACE, AND TECHNOLOGY

HON. RALPH M. HALL, Texas, *Chair*

F. JAMES SENSENBRENNER, JR., Wisconsin
LAMAR S. SMITH, Texas
DANA ROHRABACHER, California
ROSCOE G. BARTLETT, Maryland
FRANK D. LUCAS, Oklahoma
JUDY BIGGERT, Illinois
W. TODD AKIN, Missouri
RANDY NEUGEBAUER, Texas
MICHAEL T. McCAUL, Texas
PAUL C. BROUN, Georgia
SANDY ADAMS, Florida
BENJAMIN QUAYLE, Arizona
CHARLES J. "CHUCK" FLEISCHMANN, Tennessee
E. SCOTT RIGELL, Virginia
STEVEN M. PALAZZO, Mississippi
MO BROOKS, Alabama
ANDY HARRIS, Maryland
RANDY HULTGREN, Illinois
CHIP CRAVAACK, Minnesota
LARRY BUCSHON, Indiana
DAN BENISHEK, Michigan
VACANCY

EDDIE BERNICE JOHNSON, Texas
JERRY F. COSTELLO, Illinois
LYNN C. WOOLSEY, California
ZOE LOFGREN, California
BRAD MILLER, North Carolina
DANIEL LIPINSKI, Illinois
DONNA F. EDWARDS, Maryland
BEN R. LUJÁN, New Mexico
PAUL D. TONKO, New York
JERRY McNERNEY, California
TERRI A. SEWELL, Alabama
FREDERICA S. WILSON, Florida
HANSEN CLARKE, Michigan
SUZANNE BONAMICI, Oregon
VACANCY
VACANCY
VACANCY

SUBCOMMITTEE ON RESEARCH AND SCIENCE EDUCATION

HON. MO BROOKS, Alabama, *Chair*

ROSCOE G. BARTLETT, Maryland
BENJAMIN QUAYLE, Arizona
STEVEN M. PALAZZO, Mississippi
ANDY HARRIS, Maryland
RANDY HULTGREN, Illinois
LARRY BUCSHON, Indiana
DAN BENISHEK, Michigan
RALPH M. HALL, Texas

DANIEL LIPINSKI, Illinois
HANSEN CLARKE, Michigan
PAUL D. TONKO, New York
TERRI A. SEWELL, Alabama
SUZANNE BONAMICI, Oregon
VACANCY
EDDIE BERNICE JOHNSON, Texas

CONTENTS

Wednesday, June 27, 2012

THE ROLE OF RESEARCH UNIVERSITIES IN SECURING AMERICA'S FUTURE PROSPERITY: CHALLENGES AND EXPECTATIONS

WEDNESDAY, JUNE 27, 2012

HOUSE OF REPRESENTATIVES,
SUBCOMMITTEE ON RESEARCH AND SCIENCE EDUCATION,
COMMITTEE ON SCIENCE, SPACE, AND TECHNOLOGY,
Washington, DC.

The Subcommittee met, pursuant to call, at 10:01 a.m., in Room 2318 of the Rayburn House Office Building, Hon. Mo Brooks [Chairman of the Subcommittee] presiding.

RALPH M. HALL, TEXAS
CHAIRMAN

EDDIE BERNICE JOHNSON, TEXAS
RANKING MEMBER

U.S. HOUSE OF REPRESENTATIVES

COMMITTEE ON SCIENCE, SPACE, AND TECHNOLOGY

2321 RAYBURN HOUSE OFFICE BUILDING
WASHINGTON, DC 20515-6301
(202) 225-6371
www.science.house.gov

Subcommittee on Research & Science Education Hearing

The Role of Research Universities in Securing America's Future Prosperity: Challenges and Expectations

Wednesday, June 27, 2012
10:00 a.m. to 12:00 p.m.
2318 Rayburn House Office Building

Witnesses

Mr. Charles O. Holliday, Jr., Chair, Committee on Research Universities, National Academies

Dr. John M. Mason, Jr., Associate Provost and Vice President for Research, Auburn University

Dr. Jeffrey R. Seemann, Vice President for Research, Texas A&M University and Chief Research Officer, The Texas A&M University System

Dr. Leslie P. Tolbert, Senior Vice President for Research, The University of Arizona

Dr. James N. Siedow, Vice Provost for Research, Duke University

U.S. HOUSE OF REPRESENTATIVES
COMMITTEE ON SCIENCE, SPACE, AND TECHNOLOGY
SUBCOMMITTEE ON RESEARCH AND SCIENCE EDUCATION

HEARING CHARTER

The Role of Research Universities in Securing America's Future Prosperity: Challenges and Expectations

Wednesday, June 27, 2012
10:00 a.m. - 12:00 p.m.
2318 Rayburn House Office Building

1. Purpose

On Wednesday, June 27, 2012, the Committee on Science, Space, and Technology Subcommittee on Research and Science Education will hold a hearing to examine the challenges faced by the Nation's research universities. The hearing will provide an opportunity to discuss the future outlook for these universities and to discuss the recently released National Academies study, *Research Universities and the Future of America.*

2. Witnesses

Mr. Chad Holliday, Jr., Chair, Committee on Research Universities, National Academies

Dr. John M. Mason, Jr., Associate Provost and Vice President for Research, Auburn University

Dr. Jeffrey R. Seemann, Vice President for Research, Texas A&M University and Chief Research Officer, The Texas A&M University System

Dr. Leslie P. Tolbert, Senior Vice President for Research, The University of Arizona

Dr. James N. Siedow, Vice Provost for Research, Duke University

3. Overview

- The Nation's research universities provide the backbone for the science, technology, engineering and mathematics workforce essential for U.S. prosperity. These universities not only contribute to the academic researchers who work to move basic scientific research forward but also those who comprise the STEM related workforce in the country.

- Today, U.S. research universities are faced with a number of challenges including restricted budgets, rising costs, and global competition. These challenges may be hindering the work of the Nation's universities and the ability to shape the essential workforce of the future.

- In 1862, President Lincoln signed the Morrill Act (P.L. 37-108), which laid the groundwork for the development of public research universities across the Nation. The 150th anniversary of this legislation provides an opportunity to reflect on the current challenges facing such universities today and look toward the future of U.S. universities.

- On June 14, 2012, the National Academies released *Research Universities and the Future of America*, a report detailing ten recommendations for key stakeholders to ensure U.S. research universities maintain their capabilities and grow their strengths.

4. Background

The Nation's research universities work to sustain the science, technology, engineering and mathematics workforce essential for U.S. prosperity. These universities produce not only the academic researchers who work to move basic scientific research forward but also those trained to transition from basic to applied technologies and the overall STEM-related workforce for the country. Today, there are a number of challenges facing U.S. research universities, including restricted budgets, rising costs, and global competition that may be affecting the way they conduct business.

Research universities play a critical role in our **Nation's research and development enterprise. In** 2009, academic institutions performed over half (53 percent) of the Nation's total basic research, a percent that has risen steadily in recent decades. [1] However, the traditional funding model for public research universities has been under stress lately as states facing challenging fiscal climates have chosen to invest less in these institutions.

According to the 2012 NSF Science and Engineering Indicators:

- From 2002 to 2010, state funds for operating expenses of all public institutions of higher education increased by 21 percent. For major public research universities, state funds increased by only 8 percent dropping the states' share of their total operating funds from 28 percent to 19 percent.

- When adjusted for inflation, total state expenditures for public higher education were essentially flat over the decade, while the amount going to major public research universities decreased by 10 percent.

- Between 2002 and 2008, total enrollment at major public research universities increased by 8 percent and undergraduate enrollment at all public four-year institutions increased by 22 percent.

- Over the decade, per-student state support to major research universities dropped by an average of 20 percent in inflation-adjusted dollars. In ten states, the decline ranged from 30 percent to 48 percent. [2]

---

[1] National Science Board. 2012. *Science and Engineering Indicators 2012*. Arlington VA: National Science Foundation (NSB 12-01). http://www.nsf.gov/statistics/seind12/start.htm.
[2] Ibid.

According to Dr. Ray Bowen, Chairman of the National Science Board (NSB), "...the decline in support for postsecondary education, especially public research universities, is a cause for great concern as we examine the condition of U.S. global competitiveness."[3] As other nations recognize the need for both a highly skilled workforce and research base in order to compete in a knowledge-based global economy, these governments have begun investing in upgrading and expanding their higher education and research enterprises. The number of students in developing countries earning science and engineering degrees has risen. In 2008, the U.S. produced only 4 percent of the world's engineering degrees while 56 percent were awarded in Asia, including a third in China.[4]

The challenges U.S. research universities are facing may inhibit their work producing the future workforce. Examining these challenges and possible measures to overcome these challenges and forge stronger universities and partnerships between these institutions, federal and state governments, industry and other key stakeholders, is an essential step on the road to recovery.

The Morrill Act

In 1857, Justin Smith Morrill, then a second term Republican Congressman from Vermont and later a Senator, introduced the first land-grant bill in the U.S. Congress. The bill passed in 1859 only to be vetoed by President James Buchanan. In 1861, Rep. Morrill introduced another land-grant bill that increased to 30,000 acres the grant for each Senator and Representative and added a requirement that recipient institutions teach military tactics. President Abraham Lincoln signed the amended legislation into law on July 2, 1862, during the heart of the Civil War.

The 1862 Morrill Act stated:

> Each State which may take and claim the benefit of this act, to the endowment, support, and maintenance of at least one college where the leading object shall be, without excluding other scientific and classical studies, and including military tactics, to teach such branches of learning as are related to agriculture and the mechanic arts, in such manner as the legislatures of the States may respectively prescribe, in order to promote the liberal and practical education of the industrial classes in the several pursuits and professions in life.[5]

In 1890, President Benjamin Harrison signed the Second Morrill Act to extend access to higher education by providing additional endowments for all land-grant institutions. States with dual systems of higher education were mandated to provide land-grant institutions for both systems. "As a result, 19 institutions were established as black land-grant institutions."[6] The schools that **are a part of the Second Morrill Act are known as "the 1890 land-grants" and help comprise a**

---

[3] National Science Board Press Release. January 17, 2012. *States Reduce Funding for Research Universities as Asia Produces Far More Scientists and Engineers.*

[4] National Science Foundation, *Science and Engineering Indicators, 2012, Appendix Tables*, Table 2-32.

[5] http://www.loc.gov/rr/program/bib/ourdocs/Morrill.html,Thirty-Seventh Congress, Sess. II, Ch 130, 1862. p. 504.

[6] Matthews, Christine M. *Federal Research and Development Funding at Historically Black Colleges and Universities.* Congressional Research Service. p. 5.

portion of the Nation's Historically Black Colleges and Universities. In 1994, Native American tribal colleges were granted land-grant status through passage of the Improving America's School Act of 1994 and are sometimes called the "1994 land-grants."

Currently, there is at least one land-grant institution in every state and territory of the United States, as well as the District of Columbia.[7] They are often the largest employers in their community, if not their state, and are engines of economic activity.[8]

Research Universities and the Future of America

In May 2005, at the request of Congress, the National Academy of Sciences (NAS) began a study of "the most urgent challenges the United States faces in maintaining leadership in key areas of science and technology." NAS assembled a high-level panel of senior scientists and business and university leaders and produced a report, *Rising Above the Gathering Storm: Energizing and Employing America for a Brighter Economic Future*. The House Science, Space, and Technology Committee embraced a number of the recommendations in the report and included them in the 2007 *America COMPETES Act*. This Act was broadened and reauthorized in 2010. However, a number of realties raised in the report remain relevant today:

> Although many people assume that the United States will always be a world leader in science and technology, this may not continue to be the case inasmuch as great minds and ideas exist throughout the world. We fear the abruptness with which a lead in science and technology can be lost—and the difficulty of recovering a lead once lost, if indeed it can be regained at all... This nation must prepare with great urgency to preserve its strategic and economic security. Because other nations have, and probably will continue to have, the competitive advantage of a low wage structure, the United States must compete by optimizing its knowledge-based resources, particularly in science and technology, and by sustaining the most fertile environment for new and revitalized industries and the well-paying jobs they bring. We have already seen that capital, factories, and laboratories readily move wherever they are thought to have the greatest promise of return to investors. [9]

The ability of the United States to remain a world leader in science and technology relies greatly on the strength and success of our universities. As such, in 2009, Representatives Ralph Hall and Bart Gordon and Senators Lamar Alexander and Barbara Mikulski requested the National Academies work to produce another report, this time identifying the top ten actions needed to be taken in order to maintain the excellence of U.S. research and doctoral education. The request expressed concern that America's research universities were "at risk" and asked the National Academies to assess the future of research universities by asking what Congress, the federal government, state governments, research universities and others can do to ensure future success

[7] http://www.csrees.usda.gov/qlinks/partners/state_partners.html#maps.

[8] Examples include: California - http://www.careerinfonet.org/oview6.asp?soccode=&stfips=06&from=State&id=11&nodeid=12, Florida - http://www.careerinfonet.org/oview6.asp?soccode=&stfips=12&from=State&id=11&nodeid=12, and Minnesota - http://www.careerinfonet.org/oview6.asp?soccode=&stfips=27&from=State&id=11&nodeid=12.

[9] National Academies Press, *Rising Above the Gathering Storm*, 2005, p.3-4.

of these institutions, which now face an array of challenges, from unstable revenue streams and antiquated policies and practices to increasing competition from universities abroad. In response, the National Research Council convened a committee of leaders from academia, industry, government and national labs to draft the report which outlines various findings and recommends ten specific actions.[10]

The study was set up to identify the ten biggest challenges facing universities by focusing on:

> Research and doctoral programs carried out by research universities and associated medical centers; Basic and applied research in research universities, along with collaborative research programs with other components of the research enterprise (e.g., national and federal laboratories, federally-funded research and development centers, and corporate research laboratories); Doctoral education and, to the extent necessary, the pathways to graduate education and research careers; and Fields of study and research that are critical to helping the United States compete, prosper, and achieve national goals for health, energy, the environment, and security, with a focus on science, engineering, and medicine.[11]

In carrying out this charge, the study committee was, at a minimum, instructed to:

> Describe and assess the historical development, current status, trends, and societal **impact of research universities and the "ecosystem" of this set of institutions in** the United States, placing these institutions in the context of the nation's research, innovation, and industrial enterprises and the nation's system of higher education; assess the organizational, financial, and intellectual capacity of public and private research universities in the United States, including reference to research universities internationally to the extent possible with existing data; and envision the mission and organization of these diverse institutions 10-20 years into the future and the steps needed to get there.[12]

The report identifies a set of specific challenges:

- Federal funding for university research has been unstable and, in real terms, declining at a time when other countries have increased funding for research and development (R&D).

- State funding for higher education, already eroding in real terms for more than two decades, has been cut further during the recent recession.

- Business and industry have largely dismantled the large corporate research laboratories that drove American industrial leadership in the 20th century (e.g., Bell Labs), but have not yet fully partnered with research universities to fill

[10] National Academies Press, *Research Universities and the Future of America*, 2012, p.192.
[11] http://sites.nationalacademies.org/PGA/bhew/researchuniversities/PGA_069487.
[12] Ibid.

the gap at a time when the new knowledge and ideas emerging from university research are needed by society more than ever.

- Research universities must improve management, productivity, and cost efficiency in both administration and academics.
- Young faculty have insufficient opportunities to launch academic careers and research programs.
- There has been an underinvestment in campus infrastructure, particularly in cyberinfrastructure that could lead to long-term increases in productivity, cost-effectiveness, and innovation in research, education, and administration.
- The cost of sponsored research is not fully covered by those who procure it, which means that universities have to cross-subsidize sponsored research from other sources.
- A burdensome accumulation of federal and state regulatory and reporting requirements increases costs and sometimes challenges academic freedom and integrity.
- Doctoral and postdoctoral preparation could be enhanced by shortening time-to-**degree, raising completion rates, and enhancing programs' effectiveness in** providing training for highly productive careers.
- Demographic change in the U.S. population necessitates strategies for increasing the success of female and underrepresented minority students.
- Institutions abroad are increasingly competing for international students, researchers, and scholars. [13]

According to the **Report, America's research universities have emerged as a major national asset in light of the Nation's economic goals among other things.** The government-university partnership established in the Morrill Act grew over time to include industry and philanthropy and **has led to significant benefits for America's economy and quality of life. Lasers, radar,** synthetic insulin, blood thinners, magnetic resonance imaging (MRI), computers, and rocket fuel are among the countless innovations in which university research has played an essential role; however, as identified above, universities are faced with significant challenges for the future.

The Report, acknowledging that balanced commitments from each partner as well as flexibility will be necessary to accomplish the necessary goals, lists ten specific actions that should be taken to secure the future for these universities. These recommendations are designed to accomplish the following three broad goals:

[13] National Academies Press, *Research Universities and the Future of America*, 2012, p.4-5.

Revitalize the partnership. The first four actions will strengthen the partnership among universities, federal and state governments, philanthropy, and the business community in order to revitalize university research and speed its translation into innovative products and services.

Strengthen institutions. The next three actions will streamline and improve the productivity of research operations within universities.

Build talent. **The final three actions will ensure that America's pipeline of future** talent in science, engineering, and other research areas remains creative and vital, leveraging the abilities of all of its citizens and attracting the best students and scholars from around the world. [14]

The ten specific actions to achieve the above goals are:

1. Within the broader framework of U.S. innovation and R&D strategies, the federal government should adopt stable and effective policies, practices, and funding for university-performed R&D and graduate education so that the nation will have a stream of new knowledge and educated people to power our future, helping us meet national goals and ensure prosperity and security.
   - The federal government should work to review and modify burdensome and inefficient policies and practices governing university research and graduate education.
   - As the economy improves over the next ten years, the federal government should invest in basic research and graduate education sufficient to produce the new knowledge and educated citizens the Nation needs to reach its goals.
   - **In the President's annual budget request, OMB and** OSTP should develop and present a federal science and technology budget that addresses priorities for sustaining a world-class U.S. science and technology enterprise. [15]

2. Provide greater autonomy for public research universities so that these institutions may leverage local and regional strengths to compete strategically and respond with agility to new opportunities. At the same time, restore state appropriations for higher education, including graduate education and research, to levels that allow public research universities to operate at world-class levels.
   - State governments should provide their public research universities with sufficient autonomy and agility to navigate an extended period with limited state support.
   - As state budgets recover from the current recession, states should work to restore and maintain per-student funding for higher education.
   - Federal programs designed to stimulate innovation and workforce development at the state level should be accompanied by incentives to stimulate and sustain state support for their public universities. [16]

---

[14] National Academies Press, *Research Universities and the Future of America*, Summary, 2012, p.4.
[15] National Academies Press, *Research Universities and the Future of America*, 2012, p.7.
[16] National Academies Press, *Research Universities and the Future of America*, 2012, p.9.

3. Strengthen the business role in the research partnership, facilitating the transfer of **knowledge, ideas, and technology** to society, **and accelerate "time-to-innovation" in order to** achieve our national goals.
   - The federal government should continue to fund and expand research support mechanisms that promote collaboration and innovation
   - The federal government should make the R&D tax credit permanent and implement new tax policies that incentivize business to develop partnerships with universities.
   - The relationship between business and higher education should become more peer-to-peer in nature.
   - Businesses and universities should work closely together to develop new graduate degree programs that address strategic workforce gaps for science-based employers.
   - Collaboration among national laboratories, the business community, and universities should be encouraged.
   - Universities should improve management of intellectual property to improve technology transfer. [17]

4. Increase university cost-effectiveness and productivity in order to provide a greater return on investment for taxpayers, philanthropists, corporations, foundations, and other research sponsors.
   - **The Nation's research universities should set and achieve bold goals in cost containment,** efficiency, and productivity in business operations and academic programs. Universities should strive to limit the cost escalation of all ongoing activities — academic and auxiliary.
   - University associations should develop and make available more powerful and strategic tools for financial management and cost accounting.
   - Working together with key stakeholders, universities should intensify efforts to educate key audiences about the unique character of U.S. research universities and their importance to state, regional, and national goals. [18]

5. Create a Strategic Investment Program that funds initiatives at research universities critical to advancing education and research in areas of key national priority.
   - The federal government should create a new Strategic Investment Program to support initiatives that advance education and research at the **Nation's research univ**ersities.
   - Universities should compete for funding under these initiatives, bringing in partners that will support projects by providing required matching funds. [19]

6. The federal government and other research sponsors should strive to cover the full costs of research projects and other activities they procure from research universities in a consistent and transparent manner.
   - The federal government and other research sponsors should strive to support the full cost of research so that it is no longer necessary to subsidize sponsored grants by drawing on resources intended to support other university missions. Both sponsored research policies

[17] National Academies Press, *Research Universities and the Future of America*, 2012, p.11.
[18] National Academies Press, *Research Universities and the Future of America*, 2012, p.12.
[19] National Academies Press, *Research Universities and the Future of America*, 2012, p.13.

and cost-recovery negotiations should be developed and applied in a consistent fashion across all federal agencies and academic institutions. [20]

7. Reduce or eliminate regulations that increase administrative costs, impede research productivity, and deflect creative energy without substantially improving the research environment.
   - Federal policymakers and regulators (OMB, Congress, agencies) and their state counterparts should review the costs and benefits of federal and state regulations, eliminating those that are redundant, ineffective, inappropriately applied to the higher education sector, or that impose costs that outweigh the benefits to society.
   - The federal government should make regulations and reporting requirements more consistent across federal agencies. [21]

8. Improve the capacity of graduate programs to attract talented students by addressing issues such as attrition rates, time-to-degree, funding, and alignment with both student career opportunities and national interests.
   - Research universities should restructure doctoral education to enhance pathways for talented undergraduates.
   - Research universities and federal agencies should ensure that they improve education across the full spectrum of research university graduate programs.
   - The federal government should significantly increase its support for graduate education through balanced programs of fellowships, traineeships, and research assistantships provided by all science agencies that depend upon individuals with advanced training.
   - **Employers that hire master's and doctorate level graduates should engage more deeply in** research university programs by providing advice on needed curriculum and utilizing tools like internships and student projects. [22]

9. Secure for the United States the full benefits of education for all Americans, including women and underrepresented minorities, in science, mathematics, engineering, and technology.
   - Research universities should engage in efforts to improve education for all students at all levels in the United States.
   - Research universities should assist efforts to improve the education and preparation of those who teach science, technology, engineering, and mathematics (STEM) subjects in grades K-12 and strive to improve undergraduate education.
   - All stakeholders (federal government states, local school districts, industry, philanthropy, universities) should take urgent, sustained, and intensive action to increase the participation and success of women and underrepresented minorities across all academic and professional disciplines. [23]

10. Ensure that the United States will continue to benefit strongly from the participation of international students and scholars in our research enterprise.

---

[20] National Academies Press, *Research Universities and the Future of America*, 2012, p.15.
[21] National Academies Press, *Research Universities and the Future of America*, 2012, p.15.
[22] National Academies Press, *Research Universities and the Future of America*, 2012, p.16.
[23] National Academies Press, *Research Universities and the Future of America*, 2012, p.18.

- Federal agencies should ensure that visa processing for international students and scholars who wish to study or conduct research in the United States is as efficient and effective as possible, consistent with homeland security considerations.
- To ensure that a high proportion of non-U.S. doctoral researchers remain in the country, the federal government should streamline the processes for these researchers to obtain permanent residency or U.S. citizenship.
- The federal government should proactively recruit international students and scholars. [24]

[24] National Academies Press, *Research Universities and the Future of America*, 2012, p.19.

Chairman BROOKS. The Subcommittee on Research and Science Education will come to order.

Good morning. Welcome to today's hearing entitled "The Role of Research Universities in Securing America's Future Prosperity: Challenges and Expectations." The purpose of this hearing is to examine the challenges faced by the Nation's research universities. The hearing will provide an opportunity to discuss the future outlook for these universities and to discuss the recently released National Academy Study, "Research Universities and the Future of America."

In front of you are packets containing the written testimony, biography, and truth-in-testimony disclosures for today's witnesses. I now recognize myself for five minutes for an opening statement.

We are pleased to welcome our witnesses to discuss the challenges faced by the Nation's research universities, as well as the findings and recommendations from the June 14 report issued by the National Academies, "Research Universities and the Future of America." I think we can all acknowledge the importance of our Nation's research institutions; therefore, I look forward to working with my counterparts on the Subcommittee to review measures that Congress, the Federal Government, State governments, research universities, and industry can take to improve these vital resources.

Innovation has remained a part of the fabric of this Nation since its founding. Particularly in today's tough economic times, research universities play a vital role in America's ability to maintain its competitiveness in an increasingly technologically developed world, and the knowledge and skills produced by our Nation's research graduates provide the fuel for these endeavors.

The Morrill Act of 1862, signed by President Lincoln, established a partnership between the Federal Government and the States to build land grant institutions that would address the challenges of creating a modern agricultural and industrial economy for the 20th century. This partnership continues with an even broader support of the Nation's educational, research, and economic endeavors. Three of our distinguished witnesses today come from these land grant institutions. It is my understanding that other Vice Presidents for Research from a number of these land grant institutions are in the audience today, as they are all in town to celebrate the 150th anniversary of the Morrill Act. To them, I offer a special welcome and thank you for your hard work and dedication.

According to the recently released National Academies report, requested in 2009 by now-Full Committee Chairman Ralph Hall and other Members of Congress to identify the top 10 actions to be taken in order to maintain the excellence of United States research and doctoral education, America's research universities have emerged as a major national asset, which supports the Nation's economic goals, among many other things. The challenges faced by these institutions, which are discussed in the report, range from unstable revenue streams and antiquated policies and practices to increasing competition from universities abroad.

Today, we will continue to examine the future outlook for these universities, while taking into account the recommendations from the National Academies report. I look forward to a comprehensive

discussion with our witnesses, and I thank them for taking the time out of their busy schedules to help the Subcommittee with this important oversight role.

The Chair now recognizes Mr. Lipinski from the great State of Illinois for an opening statement.

[The prepared statement of Mr. Brooks follows:]

PREPARED STATEMENT OF SUBCOMMITTEE CHAIRMAN MO BROOKS

Good morning. We are pleased to welcome our witnesses to discuss the challenges faced by the Nation's research universities as well as the findings and recommendations from the June 14 report issued by the National Academies, *Research Universities and the Future of America*.

I think we can all acknowledge the importance of our Nation's research institutions; therefore, I look forward to working with my counterparts on the Subcommittee to review measures that Congress, the Federal Government, State governments, research universities, and industry can take to improve these vital resources.

Innovation has remained a part of the fabric of this Nation since its founding. Particularly in today's tough economic times, research universities play a vital role in America's ability to maintain its competitiveness in an increasingly technologically developed world, and the knowledge and skills produced by our Nation's research graduates provide the fuel for these endeavors.

The Morrill Act of 1862 established a partnership between the Federal Government and the States to build land grant institutions that would address the challenges of creating a modern agricultural and industrial economy for the 20th century. This partnership continues with an even broader support of the Nation's educational, research, and economic endeavors. Three of our distinguished witnesses today come from these land grant institutions. It is my understanding that the Vice Presidents for Research from a number of these land grant institutions are in the audience today, as they are all in town to celebrate the 150th anniversary of the Morrill Act. To them, I offer a special welcome and thank you for your hard work and dedication.

According to the recently released National Academies report, requested in 2009 by now-Full Committee Chairman Ralph Hall and other Members of Congress to identify the top 10 actions to be taken in order to maintain the excellence of U.S. research and doctoral education, America's research universities have emerged as a major national asset, which support the Nation's economic goals, among other things. The challenges faced by these institutions, which are discusssed in the report, range from unstable revenue streams and antiquated policies and practices to increasing competition from universities abroad.

Today, we will continue to examine the future outlook for these universities, while taking into account the recommendations from the National Academies report. I look forward to a comprehensive discussion with our witnesses, and I thank them for taking the time out of their busy schedules to help this Subcommittee with this important oversight role.

Mr. LIPINSKI. Thank you, Chairman Brooks, and I thank you for holding this hearing and thank the witnesses for being with us today. And I think this is probably the biggest audience that we have had here for a hearing, so that is good to see.

I fully agree with Chairman Brooks' comments about the importance of the Morrill Act. Its passage 150 years ago was undoubtedly an important milestone in our country's history.

Research universities are extremely vital to our Nation's—a vital part of our Nation's R&D infrastructure and are thus critically important to America's future economic success. And that means American jobs, so it is especially important today when everyone is asking us where are the jobs going to come from? They are going to come from innovation. Innovation, really, to a pretty significant extent—and I think we could do more with that—comes from our research universities.

I understand all this from personal experience as a student and Assistant Professor at some of our Nation's finest research universities. I never pass up an opportunity to name them—Northwestern, Stanford, Duke, University of Tennessee, and Notre Dame. I appreciate the opportunity to explore in depth the challenges all of our research institutions currently face and discuss possible steps that both the government and universities can take to help address these challenges.

Research universities' contributions to the health, security, and prosperity of the American people cannot be overstated. Advances in the fields of medicine, biotechnology, the development of critical new military technologies, and countless economically important companies and products can be traced back to research conducted in university labs.

In addition to contributing immeasurably to our economic prosperity and well-being, research universities also train the next generation of scientists, engineers, and innovators. For anyone who is interested in the role that the Federal Government played in starting up Silicon Valley by funding research at Stanford University, you should read online at *SteveBlank.com*; he has a secret history of Silicon Valley, which is very interesting. Now, that is military funding, but we are looking at all federal funding here. But a lot of people don't understand the role that federal funding does play at our research universities. And then, as you see with the history of Silicon Valley, that a lot of people think that it was all private, but much of that was originally started from public funding.

More broadly, university-government partnership that began 150 years ago with the Morrill Act has been critical to making many of these contributions possible. The Federal Government's support of academic research and patent laws to expedite the commercialization of such research has helped make many of our research universities the best and most productive in the world. Today, a number of countries are attempting to emulate our system, and they are increasingly competing with us to attract the world's top talent.

Unfortunately, I say this is a time when research universities face acute challenges that threaten their ability to continue to provide a world-class education and help ensure the United States remains a global leader in innovation. The financial stress and resulting budget deficits our country has faced in recent years have forced the Federal Government to back away from bipartisan commitments to significantly increase support for basic research at universities. At the same time, public universities have received less financial support from state governments, putting increased pressure on funding sources like tuition to make up the difference.

Despite the fiscal challenges we face, we in government cannot afford to jeopardize our Nation's future prosperity by not providing sustained and predictable support for scientific research and affordable education. At the same time, I believe that research universities need to adjust to this new fiscal environment by finding new and innovative ways to operate. I also believe that it remains well within the ability of our universities to continue to deliver a top-notch education, allow creativity and innovation to thrive, and at-

tract some of the best researchers and students from around the country and the world.

In closing, there are a couple of issues in particular that are raised in the NRC report that I look forward to discussing today. First, I am very interested in hearing about efforts to accelerate the pace at which discoveries make their way from lab to the market, and we welcome your thoughts on how the Federal Government can help you in these efforts.

Also, I would like to hear about any initiatives at your universities aimed at addressing the high attrition rate of students in STEM subject areas and the need for greater diversity. Related to that, I would like to learn more about how you are working with industry to make sure you are graduating students with the skills that they need in the workforce.

Thank you again, Chairman Brooks, for holding this important hearing, and I look forward to a productive exchange with our witnesses. With that I will yield back.

[The prepared statement of Mr. Lipinski follows:]

PREPARED STATEMENT OF SUBCOMMITTEE RANKING MEMBER DANIEL LIPINSKI

Thank you, Chairman Brooks, for holding this hearing, and thank you to the witnesses for taking the time to be here today. I fully agree with Chairman Brooks' comments about the importance of the Morrill Act. Its passage 150 years ago was undoubtedly an important milestone in our country's history.

Research universities are an extremely vital part of our Nation's R&D infrastructure and are thus critically important to America's future economic success—that means American jobs. I understand this from personal experience as a student and as an assistant professor at some of our Nation's finest research universities, Northwestern, Duke, Stanford, Notre Dame, and the University of Tennessee. I appreciate the opportunity to explore in depth the challenges all of our research institutions currently face and discuss possible steps that both the government and universities can take to help address these challenges.

Research universities' contributions to the health, security, and prosperity of the American people cannot be overstated. Advances in the fields of medicine and biotechnology, the development of critical new military technologies, and countless economically important companies and products can be traced back to research conducted in university labs. In addition to contributing immeasureably to our economic prosperity and well-being, research universities also train the next generation of scientists, engineers, and innovators. For anyone interested in the role the Federal Government played in starting up Silicon Valley by funding research at Stanford University, you should read online *The Secret History of Silicon Valley* by Steve Blank.

More broadly, the university-government partnership that began 150 years ago with the Morrill Act has been critical to making many of these contributions possible. The Federal Government's support of academic research and patent laws that expedite the commercialization of such research have helped make many of our research universities the best and most productive in the world. Today a number of countries are attempting to emulate our system, and they are increasingly competing with us to attract the world's top talent.

Unfortunately, I say this at a time when research universities face acute challenges that threaten their abililty to continue to provide a world-class education and help ensure the United States remains the global leader in innovation. The financial stress and resulting budget deficits our country has faced in recent years have forced the Federal Government to back away from bipartisan commitments to significantly increase support for basic research at universities. At the same time, public universities have received less financial support from State governments, putting increased pressure on funding sources like tuition to make up the difference.

Despite the financial challenges we face, we in government cannot afford to jeopardize our Nation's future prosperity by not providing sustained and predictable support for scientific research and affordable education. At the same time, I believe that research universities need to adjust to this new fiscal environment by finding new and innovative ways to operate. I also believe that it remains well within the

ability of our universities to continue to deliver a top-notch education, allow creativity and innovation to thrive, and attract some of the best researchers and students from around the country and the world.

In closing, there are a couple of issues in particular that are raised in the NRC report that I look forward to discussing today. First, I am very interested in hearing about efforts to accelerate the pace at which discoveries make their way from the lab to the market, and would welcome your thoughts on how the Federal Government can help you in these efforts. Also, I would like to hear about any initiatives at your universities aimed at addressing the high attrition rate of students in STEM subject areas and the need for greater diversity. Related to that, I'd like to learn more about how you are working with industry to make sure you are graduating students with the skills they need to succeed in the workforce.

Thank you again, Chairman Brooks, for holding this important hearing, and I look forward to a productive exchange with our witnesses. With that, I yield back.

Chairman BROOKS. Thank you, Mr. Lipinski.

If there are Members who wish to submit additional opening statements, your statements will be added to the record at this point.

At this time, I would like to introduce our witness panel for today's hearing. Our first witness is Mr. Charles O. Holliday, Jr., Chair of the Committee on Research Universities for the National Research Council of the National Academies. Mr. Holliday currently serves as the Chairman of the Board for the Bank of America Corporation. From 1998 to 2008, he served as the Chairman of the Board and Chief Executive Officer for DuPont.

Our second witness, I have a particular fondness in this area, although I am an Alabama grad as is my wife. My sons and my money went to Auburn University. They got good engineering degrees I will add. But our next witness is Dr. John Mason, Jr., Associate Provost and Vice President for Research for Auburn University. He is responsible for the university's research program development, sponsored programs, and technology transfer and communications initiatives. Prior to joining Auburn University, Dr. Mason was the Associate Dean for Graduate Studies, Research, and Outreach in the College of Engineering at Penn State University.

Our third witness, I want to welcome him to the Southeastern Conference, but without further ado, I am going to yield to Chairman Hall to introduce him more fully. Chairman Hall is Chairman of the Science, Space, and Technology Committee and from the great State of Texas.

Chairman HALL. Thank you, Mr. Chairman, and honored to get to introduce Dr. Seemann and to welcome you, Doctor, to—as Vice President for Research at Texas A&M University and Chief Research Officer for the Texas A&M University System. I am pleased to introduce you and I am trying to do it exactly as John Sharp instructed me to and with his help with getting my wayward daughter into Texas A&M. She is waiting for it to start. She may be in the crowd somewhere here. I hope you will see her through, Doctor, and be considerate with her and patient. All she wants is a degree.

Off the record a little, we have Texas A&M at Commerce and Texas A&M at Texarkana in my district, and great schools. Texas A&M at Commerce was at one time East Texas State Teachers College. I changed it when I was the Texas Senate to Texas State College. At that time my wife graduated from there and I had—I spoke to the student body at their graduation and got to hand her

her degree, almost made her reach for it two or three times, but I knew better than to do that. But as—and Texas A&M at Texarkana is doing wonders, but my wife didn't seek the diploma of Texas A&M diploma. She kept her Texas—the East Texas State University and that way that prohibited me from beginning to sleep with an Aggie. I was both proud and apprehensive for that.

But as Vice President, Dr. Seemann worked with faculty, staff, and administrative to expand and enhance the university's $700 billion plus research enterprise, which is quite a task. Prior to that, he—to coming to A&M—he served as Dean of the College of the Environment and Life Sciences at the University of Rhode Island. Dr. Seemann, we thank you for being here and joining us today as we thank each one of you. Thank you.

I yield back.

Chairman BROOKS. Thank you, Mr. Chairman.

And Dr. Mason, I would be remiss if I didn't add not only did my money go to Auburn and my sons get degrees but they have jobs. That is very important to a dad.

Our fourth witness is Dr. Leslie P. Tolbert, Senior Vice President for Research at the University of Arizona. As Vice President, she supports the creative activities of a 611 million research enterprise, promotes the application of new discoveries and innovations, and oversees the graduate programs of the university. Dr. Tolbert served on the faculty of the Georgetown University School of Medicine before joining the University of Arizona.

On a side note, my—one of my daughters is a teacher in South Carolina. We have a 1,100 square foot, two-bedroom condo in Washington, D.C., my wife and I. My daughter brought six people from South Carolina with her, teachers, and I can give you the play-by-play of Arizona's win over those Gamecocks on Monday night and I wasn't watching the game. But they were really talking to that TV. Congratulations on your national title in baseball.

Our final witness is Dr. James Siedow, Vice Provost for Research at Duke University. I love this panel. I am a graduate of Duke University, and that is where I met my wife most importantly. So thank you, Duke University. Dr. Siedow became a full Professor of Botany in 1987 and a Professor of Biology in 2000 and has been Vice Provost for Research since 2001. A recipient of the Trinity College Distinguished Teaching Award, Dr. Siedow's research is represented by more than 120 publications. And am I pronouncing that correctly? Is it Siedow or Siedow?

Mr. SIEDOW. Siedow.

Chairman BROOKS. Siedow, okay. Thank you. I just wanted to make sure. Thank you, Dr. Siedow.

As our witnesses should know, spoken testimony is limited to five minutes each after which the Members of the Committee will have five minutes to ask questions.

I now recognize our first witness, Mr. Charles Holliday. Mr. Holliday, you are recognized for five minutes. Thank you.

STATEMENT OF MR. CHARLES O. HOLLIDAY, JR., CHAIR, COMMITTEE ON RESEARCH UNIVERSITIES, NATIONAL ACADEMIES

Mr. HOLLIDAY. Chairman Brooks, thank you very much. It is an honor to be here today representing the National Academies and my 22 colleagues on the Committee. A point of reference is the National Academy went out to seek this Committee; they only had to call 23 people. So it gives you a feel for how important it was to these very busy cross-section of business leaders and academic leaders to be a part of this work.

As you have pointed out our report, if you look at our entire title, it is actually 17 words. And I know people will want to shorten our title so we have a suggestion. We would like to call it the Prosperity Report. And if you would like a long title, you can call it the Prosperity and Security Report, because what I would like to present to you today it is because of our Nation's research universities that we enjoy such prosperity and security today and we hopefully laid out a plan to continue that. And I believe my colleagues on this panel here today will reinforce that.

Let me briefly talk about the findings we had and then some of our recommendations, particularly those that we think are actionable right away. The good news is we have a commanding lead in research universities in the world. Thirty-five to forty of the top 50 are in America and that is extremely strong. And as I mentioned earlier, that is contributing greatly to our prosperity. But I must report to you we also found that our public universities are on thin ice. The cuts in funding—25 percent on average since 2002 to 2010, some as high as 50 percent—are straining them significantly. And we believe we are in jeopardy of losing that strength. And so many of our recommendations speak directly to the importance of them and what we must do.

Keep it in perspective that 60 percent of the federally funded research comes from those public universities and 70 percent of our Ph.D.s. So they are absolutely critical to the system.

The key products—and you have mentioned this in your opening comments—are the talent, the people that come out, and the discoveries and so we must be focused on both of those because that is critical to our success.

I would like to comment some about the role of business. I served for 37 years with the DuPont Company. For 11 years I was fortunate enough to serve as the Chairman and Chief Executive Officer. Our company was started by a university-trained French immigrant who came here 210 years ago and the reason DuPont is still a leading company today is because of our focus on research and because of our tight link with research universities.

I would like to tell you just a very brief story from my experience there. I was having a dinner with a researcher who was receiving his 100th patent that year, and we were having a discussion about what our direction should be around raw discovery research or focused research. I was insisting on more focused because we had to deliver to our owners. And when we asked me, well, then, where will we get this broad research? I said we will get it from our research universities. He agreed but he said, what if they are not

there? And my response was, they must be. And I can tell you from our two years of working on this Committee, the answer is they must be. It is so critical to our prosperity and security and we think a key role is to—how to make that happen.

If I could just comment briefly on some things we can do that don't necessarily take money—obviously, our report requires some money—but we think there are things we can do today. And you look at the bureaucracy that has built up over time, the regulations that we put on my colleagues here on this panel, we believe there are things we could do to streamline that, still get the right controls to make sure the taxpayers' money is being spent carefully, but we believe we could reduce that with time. We had the same message for the States because they have put too much on it to make a difference.

Second, we believe the business role is very important. Indeed, business does take the talented students and we license the great discovery research. The university is like that. They want us to give jobs to their students; they want us to use their research. But what we found from our work is too much of a buyer-seller relationship. We want businesses very actively involved so they are listening to the universities and guiding universities about what skills do students need to create jobs? What discoveries can they actually commercialize and create jobs? We think that is very important. We believe if you do that, you should take a hard look at the R&D tax credit. We think it should be made permanent but make it permanent in a very smart way. Reward companies that will have a 10-year relationship with the university, my colleagues here on this panel so that they can plan and we can plan. I think that would start a different system and I believe you can look at other countries in the world it is key. We believe funding cyber infrastructure is critical. We believe that will do a lot to improve the productivity at universities, which is a big thing that we can deal with.

If I could focus on just one last example, 55 percent of the Ph.D. engineering students in this country have temporary visas and we must find a way to keep them in this country. We must also work on STEM so more of those are native-born Americans. But as you think about keeping this country, I would like to leave you with one thought. You have one Ph.D. researcher. From my experience at DuPont, he likely will have one or two assistants that does the more routine tests. In today's information technology world, he will almost have a full-time information technologist helping sort the data. And then there are maintenance facilities on the equipment. You can easily then create five jobs for every Ph.D. And this is in the discovery stage. Once you get to the commercialization stage, obviously, it is many fold that. So these positions are not just great for discovery; they are really great for massive jobs.

We present to you the Prosperity Report. Thank you, sir.

[The prepared statement of Mr. Holliday follows:]

21

RESEARCH UNIVERSITIES AND THE FUTURE OF AMERICA

Statement of

Charles O. Holliday
Chairman of the Board, Bank of America,
Chairman and CEO, E.I. du Pont de Nemours and Company (DuPont) (retired)
and
Chair, Committee on Research Universities
Board on Higher Education and Workforce
Policy and Global Affairs
National Research Council
The National Academies

before the

Subcommittee on Research and Science Education
Committee on Science, Space, and Technology
U.S. House of Representatives

June 27, 2012

Introduction

Good morning, Mr. Chairman and members of the Subcommittee on Research and Science Education. My name is Chad Holliday. I am the retired Chair and CEO of DuPont and currently serve as non-executive Chairman of the Board of Bank of America. I am testifying to you today in my capacity as Chair of the Committee on Research Universities of the National Research Council (NRC). The Research Council is the operating arm of the National Academy of Sciences, National Academy of Engineering, and the Institute of Medicine of the National Academies, chartered by Congress in 1863 to advise the government on matters of science and technology. The Council's Committee on Research Universities released its report, *Research Universities and the Future of America: Ten Breakthrough Actions Vial to Our Nation's Prosperity and Security*, on June 14, 2012, and you have asked me to appear before you today to provide you an overview of its findings and recommendations. This testimony is accompanied by a copy of the summary of the report.

Context

Mr. Chairman, America in the 21st century is driven by innovation – that is, advances in ideas, products, and processes that create new industries and jobs, contribute to our nation's health and security, and allow us to achieve our national goals. Innovation in the United States, in turn, has been increasingly driven by educated people and the knowledge they produce. And our nation's primary source of both new knowledge and graduates with advanced skills is our nation's research universities. As such, this set of institutions represent a key asset—perhaps even our most potent national asset—for the 21st century.

Today, 35 to 40 of the top 50 research universities in the world are in the United States. And the strength of these institutions, public and private, is the direct result of forward-looking federal and state policies, largely enacted by Congress and often in periods of national crisis. Indeed, we can begin this story almost exactly 150 years ago during the Civil War with the enactment of the Morrill Land-Grant College Act of 1862 that established a partnership between the federal government and the states to build universities that would address the challenges of creating a modern agricultural and industrial economy. The story continues with the strengthening of this partnership during and following World War II: over the last 60 years, federal policies and programs have concentrated basic research in our universities and funded it through federal programs that have supported a unique and extremely productive combination of research and graduate education.

In 2009, Representatives Bart Gordon and Ralph Hall, then Chair and Ranking Member of the House Science Committee, and Senators Lamar Alexander and Barbara Mikulski requested that the National Academies prepare, as a follow-up to the landmark *Rising Above the Gathering Storm*, **a report examining more deeply the health and competitiveness of the nation's** research universities. **In their letter of request, they noted that America's research universities "have been the critical assets that have laid the groundwork**—through research and doctoral education—for the development of many of the competitive advantages that make possible the **high American standard of living." But they were also alarmed that while our research universities consistently rank among the best in the world they are nevertheless "under stress,** even as other countries are measurably improving the quality of **their research institutions."**

Indeed, our research universities today confront challenges and opportunities that require systematic response. Consequently, the Congressional request asked that the NRC assess the competitive position of our research universities and respond to the following question:

> *What are the top ten actions that Congress, state governments, research universities, and others can take to maintain the excellence in research and doctoral education needed to help the United States compete, prosper, and achieve national goals for health, energy, the environment, and security in the global community of the 21st century?*

In response, the NRC convened a committee of leaders in academia, industry, government, and national laboratories.[1] That committee has now delivered its report, *Research Universities and the Future of America: **Ten Breakthrough Actions Vital to Our Nation's Prosperity and Security.***

Key findings

Research Universities and the Future of America argues that the nation must reaffirm and revitalize the unique partnership that has long existed among research universities, federal and state governments, and philanthropy, and strengthen its links with business. It is this partnership that is central to the global strength of our institutions and what makes them a potent asset for our nation. University research has addressed environmental concerns, such as damage to the **earth's ozone shield;** produced new drugs and technology that improve health, including synthetic insulin, blood thinners, and magnetic resonance imaging (MRI); led to innovations that make our nation safer, such as imaging technology that scans containers as they enter our ports; and contributed countless products that have revolutionized our way of life, including lasers, rocket fuel, computers, and key components of the World Wide Web. And talented graduates of

[1] See committee roster at end of testimony.

these institutions have created and populated many new businesses that have employed millions of Americans.

Despite their success, our nation's research universities are now confronting challenges and opportunities that a reasoned set of policies must address in order to produce the greatest return to our society, our security, and our economy. *Research Universities* identified the following as especially important:

- Federal funding for university research has been unstable and, in real terms, declining at a time when other countries have increased funding for research and development (R&D).
- State funding for higher education, already eroding in real terms for more than two decades, has been cut further during the recent recession.
- Business and industry have largely dismantled the large corporate research laboratories that drove American industrial leadership in the 20th century (for example, Bell Labs), but have not yet fully partnered with research universities to fill the gap.
- Research universities must improve management, productivity, and cost efficiency in both administration and academics.
- Young faculty have insufficient opportunities to launch academic careers and research programs.
- There has been an underinvestment in campus infrastructure, particularly in cyberinfrastructure, that could lead to long-term increases in productivity, cost-effectiveness, and innovation in research, education, and administration.
- Research sponsors often do not pay the full cost of research they procure, which means that universities have to cross-subsidize sponsored research from other sources, such as tuition or clinical revenues.

- A burdensome accumulation of federal and state regulatory and reporting requirements increases costs and sometimes challenges academic freedom and integrity.
- Doctoral and postdoctoral preparation could be enhanced by shortening time-to-degree, raising completion rates, and enhancing programs' effectiveness in providing training for highly-productive careers.
- Demographic change in the U.S. population necessitates strategies for increasing the educational success of female and underrepresented minority students.
- Institutions abroad are increasingly competing for international students, researchers, and scholars, as other nations increase their investment in their own institutions.

Research Universities argues that we must address these issues in order to assure that our institutions continue to contribute the new knowledge and talented people our society requires.

Recommendations

The report provides ten strategic recommendations requiring strong actions from the federal government, state governments, universities, and business that are designed to accomplish three broad goals: (i) strengthen the partnership among universities, federal and state governments, philanthropy, and business in order to revitalize university research and speed its translation into innovative products and services; (ii) improve the productivity of administrative operations, research, and education within universities; and (iii) ensure that America's pipeline of future talent in science, engineering, and other research areas remains creative and vital, leveraging the abilities of all of its citizens and attracting the best students and scholars from around the world.

The report provides actions to be taken by recommendation. Here I wish to review, instead, the actions to be taken by actor.

Universities

We call on universities in our report to play a strong role in shaping the future for themselves, for those they serve, and for the nation.

First and foremost, the nation's research universities should set and achieve bold goals in cost-containment, efficiency, and productivity in business operations and academic programs, striving to limit the cost escalation of all ongoing activities -- academic and auxiliary -- to the inflation rate or less. In addition to implementing efficient business practices, universities should (1) review existing academic programs from the perspectives of centrality, quality, and cost-effectiveness, (2) encourage greater collaboration among research investigators and among research institutions, particularly in acquiring and using expensive research equipment and facilities, (3) adopt modern instructional methods such as cyberlearning, and (4) improve management of intellectual property to improve technology transfer.

By increasing cost-effectiveness and productivity, institutions will realize significant cost-savings in operations that may be used to improve their performance, allowing them to shift resources strategically and/or reduce growth in their need for resources such as tuition. Many institutions have already demonstrated that significant cost efficiencies are attainable. University associations should develop and make available more powerful and strategic tools for financial management and cost accounting that enable universities to determine the most effective ways to contain costs and increase productivity and efficiency. As part of this effort, they should develop

metrics that allow universities to communicate their level of cost-effectiveness to the general public.

In fulfilling their educational mission, research universities should engage in efforts to improve education for all students at all levels in the United States by reaching out to K-12 school districts and by taking steps to improve access and completion in their own institutions. Similarly, research universities should assist efforts to improve the education and preparation of those who teach STEM subjects in grades K-12. Universities should also strive to improve undergraduate education, including persistence and completion rates in STEM, and take urgent, sustained, and intensive action to increase the participation and success of women and underrepresented minorities. Research universities should also restructure doctoral education to enhance pathways for talented undergraduates, improve completion rates, shorten time-to-degree, and strengthen the preparation of graduates for careers both in and beyond the academy.

State Governments

For states to compete for the prosperity and welfare of their citizens in a knowledge-driven global economy, the advanced education, research, and innovation programs provided by their research universities are absolutely essential. And the importance of these universities extends far beyond state borders; these institutions play a critical role in the prosperity, public health, and security of their regions and the entire nation. However, an alarming erosion in state support for higher education over the past decade has put the quality and capacity of public research universities at great risk. State cuts in appropriations to public research universities over the years 2002 to 2010 are estimated to average 25 percent -- and range as high as 50

percent for some universities -- resulting in the need for institutions to increase tuition or to reduce either activities or quality.

Going forward, state governments should move rapidly to provide their public research universities with sufficient autonomy and agility to navigate an extended period with limited state support. As budgets recover from the current recession, though, states should strive to restore and maintain per-student funding for higher education, including public research universities, to the mean level for the 15-year period 1987-2002, as adjusted for inflation. Federal programs designed to stimulate innovation and workforce development at the state level, including those recommended in this report, should be accompanied by strong incentives to stimulate and sustain state support for their public universities, which are both state and national assets.

Federal Action

The study committee was acutely aware of – and robustly discussed—the current federal fiscal environment and, consequently, recommends both actions with little or no cost that could be taken in the short term and increased investments that should be made over time as the economy improves.

Federal Policies on Costs and Regulation

There are important actions that could be taken – in fact should be taken – in a constrained budget environment. First, the federal government and other research sponsors should support the full cost, direct and indirect, of research and other activities they procure from universities so that it is no longer necessary to subsidize these sponsored grants by drawing on resources intended to support other important university missions, such as undergraduate

education and clinical care. Both sponsored research policies and cost-recovery negotiations should be developed and applied in a consistent fashion across all federal agencies and academic institutions, public and private.

Second, federal policymakers and regulators (OMB, Congress, Agencies) and their state counterparts should review the costs and benefits of federal and state regulations, eliminating those that are redundant, ineffective, inappropriately applied to the higher education sector, or impose costs that outweigh the benefits to society. The federal government should also make regulations and reporting requirements more consistent across federal agencies so that universities can maintain one system for all federal requirements rather than several, thereby reducing costs. Reducing or eliminating regulations can reduce administrative costs, enhance productivity, and increase the agility of institutions. With greater resources and freedom, universities will be better positioned to respond to the needs of their constituents in an increasingly competitive environment.

Federal Investments

Over the next decade, as the economy improves, the federal government should invest in basic research, graduate education, infrastructure and technology transfer in order to produce the new knowledge and educated citizens the nation needs and to ensure that these are fully and productively deployed in our economy and society.

Congress and the administration should provide full funding of the amount authorized by the America COMPETES Act, doubling the level of basic research conducted by the National Science Foundation, National Institute of Standards and Technology, and the Department of **Energy's Office of Science.** By completing funding increases that Congress has already authorized, the nation would ensure robust support for critical basic research programs,

achieving a balanced research portfolio capable of driving the innovation necessary for economic prosperity. Together with cost-efficient regulation, this stable funding will enable universities to make comparable investments in research facilities and graduate programs. And because research and education are intertwined in universities, this funding will also ensure that we continue to produce the scientists, engineers, and other knowledge professionals the nation needs.

The federal government should, within the context of also making the R&D tax credit permanent, implement new tax policies that incentivize business to develop partnerships with universities (and others as warranted) for research that results in new economic activities located in the United States.

The federal government should significantly increase its support for graduate education through balanced programs of fellowships, traineeships, and research assistantships provided by all science agencies that depend upon individuals with advanced training. This rebalancing of support is designed to facilitate better alignment of doctoral education with national needs and with the careers of graduates. Furthermore, all stakeholders – the federal government, states, local school districts, industry, philanthropy, and universities -- should take urgent, sustained, and intensive action to increase the participation and success of women and underrepresented minorities across all academic and professional disciplines, especially in science, mathematics, and engineering.

The federal government should create a new Strategic Investment Program to support two 10-year initiatives: (1) an endowed faculty chairs program to facilitate the careers of young investigators during a time of serious financial stress and limited faculty retirements, and (2) a research infrastructure program initially focused on rapidly evolving cyberinfrastructure that will

increase productivity and collaboration in research and may also do so in administration and education. Federal investments in these initiatives would be intended for both public and private research universities, and they would require institutions to obtain matching funds from states, philanthropy, business, or other sources. Also of critical importance is the endowment of chairs, particularly for promising young faculty.

Federal agencies should ensure that visa processing for international students and scholars who wish to study or conduct research in the United States is as efficient and effective as possible consistent with homeland security considerations. In order to ensure that a high proportion of non-U.S. doctoral researchers remain in the country, the federal government should also streamline the processes for these researchers to obtain permanent residency or U.S. citizenship. The United States should consider taking the strong step of granting residency (a green card) to each non-U.S. citizen who earns a doctorate in an area of national need from an accredited research university.

Business Action

The role of business in the university-government-industry partnership is critically important and must be enhanced. As noted above, industry has largely dismantled the large corporate research laboratories that drove American industrial leadership in the 20th century (e.g., Bell Labs), but have not yet fully partnered with research universities to fill the gap. Nor have they adequately partnered with university programs to help produce the advanced graduates that industry needs.

Tax incentives and research support mechanisms can promote collaboration between business and universities that will lead to the creation and efficient use of knowledge to achieve

national goals—particularly the development of new products and US-located economic activity and jobs. In order for this to be successful, the relationship between business and higher education should become more peer-to-peer in nature, stressing collaboration in areas of joint interest rather than remaining in a traditional customer-supplier relationship, in which business procures graduates and intellectual property from universities.

Businesses and universities should work closely together to develop new graduate degree programs that address strategic workforce gaps for science-based employers. Employers -- businesses, government agencies, and non-profits -- **that hire master's and doctorate level** graduates should more deeply engage programs in research universities by providing internships, student projects, advice on curriculum design, and real-time information on employment opportunities.

Committee Process

The committee agreed to the above findings and recommendations following a rigorous process of information gathering and deliberation. As outlined in an appendix to the report, the committee solicited input for its study from a broad range of stakeholders during the course of several meetings. In parallel with our information gathering process, the committee deliberated its findings and conclusions by first considering the current strengths and weaknesses of our research universities and the opportunities and threats they face today and are likely to face over the next decade. This deliberation allowed the committee to brainstorm and discuss key issues over a period of time, including several committee meetings, and ultimately formulate the set of ten issues they agreed to address in the report.

The study committee reached consensus on the top ten report recommendations through thorough discussion that addressed strengths and opportunities, weaknesses and threats, but also difficult contextual issues that would affect actions and potential outcomes. These contextual issues included the current federal fiscal environment; pressures on state budgets over time; the intricacies of university finances, including cross-subsidies; increases in tuition, typically driven by pressures on other revenue streams; the kinds of productivity gains that universities can achieve, and under what scenarios; the appropriate roles of universities, government, and business in the development of technology and its transfer into the marketplace, and the importance of differences by industry; and the need for more effective communication of these complicated issues to the public. We were strongly motivated to present a mix of actions that were low-cost or no-cost as well as actions that required investments and we have done so. We believe we have presented a fair and balanced – as well as critically important – set of recommendations that require strong action from all key stakeholders in the university-government-industry partnership.

Your written questions asked if there were issues that were particularly challenging for consensus building. There was a concern at the outset that one such issue might be differences between public and private research institutions over steps to be taken to develop a way forward from the current economic and fiscal climate. No such difference materialized and, indeed, I can report that the entire committee was strongly unanimous in their recommendations regarding the importance of ensuring the strength of our nation's public institutions that are critical not only to their states and regions, but also to the nation. Another, related issue that might have also raised differences of opinion was the rhetorical question about the "right number" of research universities in the United States. The committee did not believe any group of people could

determine *a priori* what the "right number" of such institutions might be and that it would be damaging to try to do so. Instead, it is important to articulate a set of principles that would naturally lead to an appropriate, but fluid number: these include the importance of merit review, competition, and striving for excellence in faculty and students; they also include taking the opportunity to build capacity or incentivize regional partnerships when it makes sense for the benefit of the nation. The committee also believes that the ecosystem of research universities should be diverse. It will include large and comprehensive institutions that can aspire to excellence across the range of fields and others that, because of limited resources or a particular comparative advantage, should pick specific areas in which they should compete.

Lastly, I would like to note four additional items of national importance that came before us that we did not act on because other committees properly assembled for the task had been empanelled to do so. First, some members of the committee were interested in exploring the business model for research, particularly in the biomedical sciences. We did not take up this subject because the Advisory Committee to the Director of the National Institutes of Health had appointed a task force to examine the structure of the biomedical workforce and appeared to be ready to explore the issues raised before us.[2] Second, a related issue focuses on the status, conditions, and future careers of the nation's postdoctoral trainees. We addressed this in an oblique way through our recommendations on reform of doctoral education and the creation of an endowed chairs program, but the postdoctoral experience requires more in-depth examination. During the course of our work, the National Academies appointed a study committee, under the aegis of the Committee on Science, Engineering, and Public Policy (COSEPUP) to undertake just that and we await their final report. Third, the Experimental Program to Stimulate Competitive Research (EPSCoR) and similar programs play a fundamental role in the research

[2] This task force, by coincidence, also released its report on June 14, 2012.

university landscape. We might have looked more in-depth at that program. However, during the course of our study Congress mandated that the Academies undertake an assessment of the EPSCoR program and the Academies have appointed a study committee to do that, also under the aegis of COSEPUP. Lastly, committee members were very concerned that the full range of fields in the research university—across the physical sciences, life sciences, engineering, social sciences, and humanities—be preserved as critical to the core mission of education and research. We were pleased to note in our report that, in response to a Congressional request similar to ours, that the American Academy of Arts and Sciences has appointed a blue-ribbon committee that will soon release a report on strengthening the humanities and social sciences in higher education and society. As you can imagine, the committee received in its meetings a large range of issues and recommendations from well-informed and engaged individuals, universities, and associations. While we could not include all of them, the committee's records in its Public Access File will preserve them for possible use by similar committees in the future.

Conclusion

Mr. Chairman, I would like to note again, in conclusion, that during past eras of challenge and change, our national leaders have acted decisively to create innovative partnerships to enable our universities to enhance American security and prosperity. Today our nation faces new challenges, a time of rapid economic, social, and political transformation driven by an exponential growth in knowledge and innovation. A decade into the 21st century, a resurgent America must stimulate its economy, address new threats, and position itself in a competitive world transformed by technology, global competitiveness, and geopolitical change. In this environment, educated people, the knowledge they produce, and the innovation and

entrepreneurial skills they possess, particularly in the fields of science and engineering, are keys to our nation's future. So, it is essential that we reaffirm and revitalize the unique partnership that has long existed among the nation's research universities, federal government, states, philanthropy, and business. The actions recommended in our report will require significant policy changes, productivity enhancement, and investments on the part of each member of the research partnership. Yet they also comprise a fair and balanced program that will generate significant returns for a stronger America.

Mr. Chairman, thank you for this opportunity to address the Subcommittee on this set of issues so critical to our nation.

Committee on Research Universities
Roster

Chad Holliday, *Committee Chair*, Chairman of the Board, Bank of America, and Chairman and CEO, E.I. du Pont de Nemours and Company (DuPont) (retired) [NAE]

Peter Agre, University Professor and Director, Johns Hopkins Malaria Research Institute, Department of Molecular Microbiology and Immunology, Bloomberg School of Public Health, Johns Hopkins University [NAS/IOM]

Enriqueta Bond, President, Burroughs Wellcome Fund (retired) [IOM]

C.W. Paul Chu, T. L. L. Temple Chair of Science and Professor of Physics, University of Houston, and Former President, Hong Kong University of Science and Technology [NAS]

Francisco Cigarroa, Chancellor, The University of Texas System [IOM]

James Duderstadt, President Emeritus and University Professor of Science and Engineering, University of Michigan [NAE]

Ronald Ehrenberg, Irving M. Ives Professor of Industrial and Labor Relations and Economics, and Director, Cornell Higher Education Research Institute, Cornell University

William Frist, Distinguished University Professor, Owen Graduate School of Management, Vanderbilt University, and US Senator (retired)

William Green, Chairman and CEO, Accenture

John Hennessy, President and Bing Presidential Professor, Stanford University [NAS/NAE]

Walter Massey, President, School of the Art Institute of Chicago, and President Emeritus, Morehouse College

Burton McMurtry, Founding Partner, TVI

Ernest Moniz, Cecil and Ida Green Professor of Physics and Engineering Systems, Director of the Energy Initiative, and Director of the Laboratory for Energy and the Environment at the MIT Department of Physics, Massachusetts Institute of Technology

Heather Munroe-Blum, Principal, Vice-Chancellor, and Senior Officer of the University, and Professor in the Department of Epidemiology, Biostatistics and Occupational Health, McGill University

Cherry Murray, Dean, Harvard School of Engineering and Applied Sciences, John A. and Elizabeth S. Armstrong Professor of Engineering and Applied Sciences, and Professor of Physics, Harvard University [NAS/NAE]

Hunter Rawlings, President Emeritus and Professor of Classical History, Cornell University*

John Reed, Chairman and CEO, Citigroup (retired), Chairman, New York Stock Exchange (retired), and Chairman of the MIT Corporation

Teresa Sullivan, President, University of Virginia

Sidney Taurel, Chairman and CEO, Eli Lilly & Company (retired)

Lee T. Todd, Jr., President, University of Kentucky

Laura D'Andrea Tyson, S. K. and Angela Chan Chair in Global Management, Haas School of Business, University of California Berkeley

Padmasree Warrior, Chief Technology Officer, Cisco Systems

* Resigned in April 2011 upon his selection as the next president of the Association of American Universities.

Chairman BROOKS. Thank you, Mr. Holliday.

Next, we have Dr. Mason from Auburn University. Dr. Mason, you now have five minutes.

STATEMENT OF DR. JOHN M. MASON, JR., ASSOCIATE PROVOST AND VICE PRESIDENT FOR RESEARCH, AUBURN UNIVERSITY

Mr. MASON. Thank you. Chairman Brooks, Ranking Member Lipinski, Chairman Hall, and other Members of the Subcommittee. Thank you for the opportunity to participate in today's panel. My name is John Mason. I do serve as the Vice President for Research at Auburn University.

You may have heard it said that "research is to teaching as walking is to running; you have to do the first in order to do the second." If we want robust learning in this country, all the way from kindergarten to post-graduate level and throughout business and industry, it starts with the creation of new knowledge.

To put today's discussion in context, I offer the findings of a December 2011 report from Battelle and the *R&D Magazine*. They find that Asia, for the first time, will this year surpass the Americas in their share of total global research and development spending. The long-term implications for U.S. prosperity and security are profound.

Research, along with our missions of instruction and outreach, is part of Auburn's balanced attempts at enhancing competitiveness of our future leaders and our workforce. We focus on five strategic areas at Auburn. They are all interdisciplinary—energy and the environment, health science, cyber systems, transportation, and the STEM disciplines—those of science, technology, engineering, and mathematics.

We continuously work in partnership with federal agencies, business and industry to accomplish issues that are of national need. Auburn has produced breakthrough scientific discoveries such as the vapor wake canine that now screens passengers and cargo for explosives and also very proud that we educate such leading technology innovators such as Apple's CEO Tim Cook.

A priority research area right now at Auburn has been, and continues to be, security, the security of our cyber infrastructure, food supply, and energy resources. In that context, we view relevant fundamental research as the underpinning of industry. At Auburn, we have been referring to this as "putting ideas to work." Relevant fundamental research is that which industry can apply to innovate and create products and services. Our Auburn motto includes technology transfer. We have created and are sustaining an incubator for startup companies, a research park where technology transfer businesses are flourishing, and close collaboration with not-for-profit foundations.

Although these elements are not unique, very common among our universities throughout the United States, the key to all our success is how they work together for some goal and function, not as independent silos. Throughout this process, we pay particular attention to commercializing our inventions, one of the best ways of moving new knowledge and creating jobs.

Mr. Chairman, we believe that the recently released National Academies report has some insightful recommendations, and in the balance of the time, some quick response from Auburn University. We recognize and embrace the oversight and transparency that is necessary with public funds. However, on certain areas where there are redundant reviews and audits, it appears they are focusing on process rather than on results.

Regarding written recommendation number four on university productivity, I can assure you we will remain diligent in seeking and addressing efficiencies. It is important, however, to recognize that once the storehouse of academic and research mindsets are eliminated, they are unlikely to be restored in the future.

Recommendation number five deserves serious attention. Long-term partnerships and our relationship with business and industry will remove the uncertainty and will focus us on long-term items of national need. Unfortunately, short-term shifting of national priorities creates a perverse incentive to chase funding rather than chase the discovery that will create jobs in the United States.

In closing, I urge the Committee to consider the potential of the National Defense Education Act of 1958. It was at that point in time when we were focusing on space. The Federal Government helped pay tuition for those pursuing advanced scientific and engineering degrees and it helped to focus our research on areas of national need. While the national concern at that time was space, today it is the economic issues. Tuition waivers would be a very inexpensive way to accomplish research and economic development activities on national needs.

Mr. Chairman, we are confident that relevant fundamental research enables teaching, enhances our learning, and is a job creator. Thank you for examining these important issues, and I thank you for the opportunity to provide my testimony.

[The prepared statement of Mr. Mason follows:]

Dr. John Mason, Vice President for Research
Auburn University
Subcommittee on Research & Science Education
June 27, 2012

Mr. Chairman and members of the Subcommittee, thank you for the opportunity to participate in today's panel. The topic of today's hearing is critical not only to the future of higher education but critical to the future well-being of the United States and quality of life of every American.

My name is John Mason, and I have the privilege of serving as vice president for research at Auburn University. Mr. Chairman, Auburn is pleased to operate a research center in your district, and we appreciate your support and interest as we work with industry and other universities to advance cyber security, unmanned vehicle systems, aerospace engineering, biotech and much more.

You may have heard it said that "research is to teaching what walking is to running; you have to do the first in order to do the second."

If we want robust education in this country, all the way from kindergarten to the post-graduate level, it starts with the creation of new knowledge. Research is the foundation on which teaching and the transfer of knowledge is based.

When research is reduced, instruction and learning at all levels are diminished, especially in those disciplines where much of our innovation originates – those in science, technology, mathematics and engineering.

As research declines, bright kids do not select these tougher academic disciplines. U.S. industry and government have fewer skilled employees for the advanced positions that move our economy. And with fewer educators involved in research, there is less transfer of knowledge from faculty to the next generation of workers and to industry.

Mr. Chairman, to put today's discussion in context, I offer findings of a December 2011 report from Battelle and R&D Magazine. They found that Asia, for the first time, will this year surpass the Americas in the share of total global research and development spending. Asia will account for almost 37 percent of global R&D while the U.S. and other nations in the Americas will slip to 36 percent. In another study, Asia's R&D is rapidly expanding and shows no sign of "slowing down." The long-term implications for U.S. prosperity and security are profound.

Auburn is a land-, sea- and space-grant university with 25,000 students. We focus on five strategic, interdisciplinary areas in our research enterprise: energy and the environment, health sciences, cyber systems, transportation, and the STEM disciplines, those of science, technology, engineering and mathematics.

We work in partnership with federal agencies and American business and industry to accomplish objectives of national need. Auburn has produced such break-through scientific discoveries as the vapor wake canine that screens passengers and cargo for explosives and educated such leading technology innovators as Apple CEO Tim Cook.

A priority research area for Auburn is security – the security of our cyber infrastructure, food supply and energy resources. In cyber, Auburn experts are innovating across the broad cyber spectrum, from open source intelligence to workforce development to research for defense, homeland security and law enforcement agencies.

Auburn food safety scientists are leading an effort to improve education and training for food inspectors so they're better prepared to detect problems in the food supply. And Auburn food safety engineers are developing bacteria-detecting biosensors that will significantly improve the security of our food system.

In energy, Auburn provides leadership and expertise in biofuels. Researchers are developing an economically-viable and reliable system, from genetics to harvest, that delivers a stable supply of high-quality biomass feedstock to liquid fuel producers.

Auburn Research stands ready and willing to assist in these and other vital national challenges. We have more information online at www.auburn.edu/research.

In looking at the major challenges Auburn faces, similar to our peers, there are regulatory burdens placed on all recipients because of what appears to be the improper actions of a few. Increased audits, inspections and regulatory complexity rob valuable resources from the actual work. We recognize and embrace the value of oversight and transparency, but the balance has tipped much too far toward redundant reviews and audits that focus on process instead of results.

One example is the sub-recipient monitoring requirement found in OMB Circular Number A-133. States, local governments and non-profits are required to audit other federal grantees including universities through which federal funds flow. The same universities we're auditing are also audited by other universities. And those we audit are directly receiving federal funds, indicating the federal government's satisfaction with their performance and compliance. The multiple layers of review are financially onerous for both the federal government and research institutions.

As a result of reduced federal and state funding, we have been forced to eliminate some projects we can no longer sustain. A notable example is Auburn's Space Research Institute that recently closed as external support from NASA and industry was curtailed.

Research, along with instruction and outreach, is part of Auburn's institutional mission. It's part of our responsibility to enhance competitiveness of future leaders and our workforce. And, as previously mentioned, it provides the base of knowledge for economic development.

We view relevant fundamental research as the underpinning of industry nationwide. At Auburn, we call it putting ideas to work.

Relevant fundamental research is that which industry can apply to innovate, create or improve products and services, and, ultimately, create jobs. It came to the U.S. in the 1800s, following the German model of academic research and giving our country its ability to compete in the industrial revolution.

One of the most important pieces of legislation to our nation's economic foundation was the Morrill Act of 1862 that created land-grant colleges and universities. To this day, the Morrill Act continues to pay nationwide dividends as an economic development tool, in particular by solving problems and making agriculture and manufacturing more efficient and productive. A few years later, the Hatch Act energized research and experimentation in the land-grant system that was essential to the growth of our young nation.

At Auburn, our model combines research with technology transfer capabilities, an incubator supporting start-ups, a research park where technology businesses flourish, and close collaboration with an affiliated non-profit foundation. Although these elements are not unique, the key to their success is the relational operation of how they work together toward the same goal, rather than functioning as independent silos.

Results come in the form of licensing technologies to companies, formation of new businesses, established companies locating in our park, and development of collaborations between industry and Auburn faculty. New start-ups using technologies developed at Auburn include those in health services, public health, recycling, nano-medicine and agriculture production.

Working closely with industry is often facilitated through our non-profit research foundation, and those partnerships are key to our future competitiveness. And throughout this process, we pay particular attention to commercializing inventions, which is one of the best methods of getting new knowledge into the hands of users and creating jobs.

Attached for your information is a chart illustrating how each of the individual parts work together and link research to economic development.

Mr. Chairman, we believe the report offers insightful and forward-looking recommendations, and we urge Congress to consider them carefully and act accordingly.

With limited time, I offer specific comments on just a few.

In recommendations one and seven, we believe that a comprehensive review of policies and regulations is perhaps the most important of this report. Streamlining the process, relieving unnecessary and costly administrative burdens, and coordinating research priorities among disparate federal agencies will invigorate research universities exponentially.

Regarding recommendation number four on university productivity, we must certainly remain vigilant in seeking and addressing efficiencies. It's however important to note that cuts to programs have consequences. Once academic and research programs are eliminated, they're not easily restored.

Recommendation number five deserves serious attention. Long-term initiatives with universities in partnership with business and industry will help remove the uncertainty that wastes time and resources and hinders investigator creativity. Short-term shifting of national priorities creates a perverse incentive to chase the funding instead of the next discovery.

Finally, a national discussion on international students and scholars is long overdue. International graduate students are often the most skilled, but regulations involved in allowing them to work on projects are often counter-productive to the stated national security concerns.

In closing, I urge the Subcommittee to consider the potential of a program similar to the National Defense Education Act of 1958. Those fellowships were provided in the Cold War era out of fear the Soviet Union would control space. The federal government paid tuition for a student working on an advanced science degree. It helped with the debt load of students, focused research in an area of national need and defined career paths for young people with an interest in science.

While the national concern at that time was space, the concern today is economic. The tuition waivers are an inexpensive way to accomplish needed research on a national need. A program such as this one may represent another solution for Congress to consider.

Mr. Chairman, we at Auburn are confident that relevant fundamental research enables teaching and learning. We're confident that investment in relevant fundamental research is an investment in job creators. And we're confident that relevant fundamental research is the basis for prosperity and security.

Thanks to the Subcommittee for examining these important issues, and thank you for the opportunity to provide my testimony.

Chairman BROOKS. Thank you, Dr. Mason.

Our next witness is Dr. Seemann. Dr. Seemann, you have five minutes.

STATEMENT OF DR. JEFFREY R. SEEMANN,
VICE PRESIDENT FOR RESEARCH,
TEXAS A&M UNIVERSITY,
AND CHIEF RESEARCH OFFICER,
THE TEXAS A&M UNIVERSITY SYSTEM

Mr. SEEMANN. Chairman Brooks, Ranking Member Lipinski, and distinguished Members of the Subcommittee on Research and Science Education, my name is Jeff Seemann, and I have the privilege of serving as both the Vice President for Research at Texas A&M University and as the Chief Research Officer for the Texas A&M University System.

I want to begin by thanking you for the chance to come before you today to present testimony on critically important issues relating to the challenges and opportunities facing our Nation's research universities, and I want to specifically commend your leadership for making this hearing possible.

I would also like to extend my thanks to a fellow Texan, Congressman Ralph Hall, Chair of the Committee on Science, Space, and Technology. Chairman Hall continues a long and distinguished tradition of Texas leadership on science education and policy going back to Olin "Tiger" Teague, who chaired the precursor to today's Committee in the 1960s when Texas A&M made its bold move to join the Nation's major research universities. And I note that the portrait of Tiger Teague hangs over Chairman Hall's left shoulder.

Today, Texas A&M stands among the Nation's top 20 research universities, and its rapid rise to Tier 1 research status owes a great deal to the strong foundation provided by the State of Texas, to the institution's land grant roots, to its heritage as a military institution, and to major investments from the Federal Government. The release of the National Research Council's report on "Research Universities and the Future of America" offers an important opportunity to revisit, reevaluate, and reenergize the state of the university-government R&D partnership, a partnership that has helped make Texas A&M and our peers across America the great research universities that they are today.

It is remarkable how much of the prosperity of our Nation, its economic success, its leadership in innovation, and its world leadership have flowed from the R&D pipeline that originates with this partnership, a partnership fueled by the taxpayers of our States and Nation and catalyzed by the ideas and discoveries of our faculty. The productivity of our research universities and our Nation are inextricably linked. This is why we must recommit to and reinvest in this partnership.

I suggest that we can achieve rapid progress through the following four complementary actions, all reflected in the NRC's recommendations. First, research universities must take bold and aggressive steps to collectively and strategically focus on solutions to grand research challenges and areas of key national interest by prioritizing investments of internal resources into these areas and

breaking down traditional academic and organizational barriers that may stand in the way of this goal.

Second, federal agencies must continue, if not increase, support for these research priorities of shared national interest, particularly with targeted grant monies and support for young investigators and infrastructure development.

Third, research universities must take greater action to ensure that we utilize resources even more efficiently and transparently than we already do, aggressively eliminating unnecessary and redundant administrative activities and barriers in order to make the most of limited resources.

And fourth and finally, federal agencies and regulators must, in turn, act to reduce or eliminate unnecessary, overly burdensome, redundant, and costly regulatory and reporting obligations placed on the research operations of research universities and faculty. I promise you that we can do so without sacrificing accountability or safety.

By keeping our sights set on high-priority current and future national and global problems, by investing in and focusing on solutions and impacts, and by ensuring the efficient use of resources, we will guarantee the continued productivity of our world-class R&D pipeline. Alternatively, our Nation runs the risk of ceding its current leadership in innovation to other countries and reaching a plateau in our research competitiveness. This we cannot afford.

Texas A&M, with our long history of public service and our research enterprise that is dedicated to serving the national interest, looks forward to reaffirming our commitment to this partnership and to working diligently in collaboration with you and federal agencies to ensure that we can continue in the 21st century to serve and meet and our Nation's needs in the same highly successful way we did in the 20th century.

Thank you for allowing me to speak with you today.

[The prepared statement of Dr. Seemann follows:]

The University-Government R&D Partnership in the 21st Century: Shared Opportunities and Responsibilities for New Investments, Efficiencies, and World-Changing Impacts

Jeffrey R. Seemann, Ph.D.
Vice President For Research, Texas A&M University
Chief Research Officer, The Texas A&M University System
written testimony for hearing on

The Role of Research Universities in Securing America's Future Prosperity: Challenges and Expectations

Before the SUBCOMMITTEE ON RESEARCH AND SCIENCE EDUCATION

of the Committee on Science, Space, and Technology
of the U.S. House of Representatives

June 27, 2012

The University-Government R&D Partnership in the 21st Century: Shared Opportunities and Responsibilities for New Investments, Efficiencies, and World-Changing Impacts

Chairman Brooks and distinguished members of the Subcommittee on Research Science and Education, I thank you for your leadership and for the chance to present testimony on the challenges facing the nation's research universities.

My name is Dr. Jeffrey R. Seemann. I am vice president for research at Texas A&M University and chief research officer for The Texas A&M University System. I will use my testimony as an opportunity to identify what I believe are some *immediate* ways that we—the academy and government, as *partners* in the nation's R&D success—can improve and strengthen our collaboration.

In the 21st century, it has become increasingly evident that the once clear understanding of the essential connection between the country's outstanding research universities and the present and future prosperity of the nation is in question. There was a time in recent history, however, when that was not the case—shortly following World War II, the nation's leaders identified our institutions of higher education as *the* rooted and ready-made growth-vehicles for moving the nation forward, especially in the arena of strategic research and development (R&D).

As a result of the federal government's decision to make public and private universities the primary state and regional hubs for major, post-war R&D investments, a first-in-class physical and human infrastructure was developed that gave us the computer, radar, MRIs, rocket fuel, and synthetic insulin, to name just a few world-changing innovations. Today, this infrastructure—buttressed by state and federal funding and by partnerships with industry and philanthropy—remains the most productive and well-equipped R&D network in the world, with the finest human talent and physical capacity for solving the grand scientific, technological, and societal challenges of our time.

The release of the *Future of America: Ten Breakthrough Actions Vital to Our Nation's Prosperity and Security* by the National Research Council (NRC) offers a vitally important opportunity to re-open the university-government dialogue in a serious and highly engaged way, with a chance to balance the political, economic, and social priorities and sensitivities of our time with the historical context of how and why we joined in and created this partnership—and how and why it must continue.

Echoing many of the recommendations of the report, I believe there exists no more important R&D opportunity and responsibility facing the nation than to recommit to and reinvest in our university-government partnership. It is time for *both* partners to engage in a serious dialogue, initiate thoughtful internal self-analysis, and commit to a shared decision-making process that can lead to bold,

focused, and efficient investments for solving the important challenges of our time. We owe it to our predecessors, to our current citizens, and to our successors not to forsake or neglect the first-in-class R&D infrastructure that we have built together. Otherwise, I believe we could cede our current leadership in innovation to other countries and at best see a plateau in our competitiveness.

I want to focus on four, interlinked areas where we can achieve *immediate* gains and improvements, all of which are reflected in the NRC report:

- *Research universities* must take bold and aggressive actions to collectively and strategically focus on grand research challenges and areas of key national interest—by breaking down traditional academic and organizational barriers in order to solve the complex problems of our time and by prioritizing investments of existing internal resources and new external resources.
- *Federal agencies* must continue, if not increase, their support for our shared research priorities with significant and ongoing strategic investments—particularly with targeted grant monies and support of infrastructure development (physical and human) that crosses the spectrum from fundamental to applied research, and recognizes the importance of the social sciences in solving complex problems.
- *Research universities* must utilize resources efficiently and transparently, aggressively eliminating unnecessary and redundant administrative activities and obstacles in order to optimally focus limited resources on the pursuit of critically important research.
- *Federal agencies* and federal regulators must reduce and/or eliminate unnecessary, overly burdensome, and/or redundant regulatory and reporting obligations for universities and their faculty—without sacrificing accountability and safety—in order to maximize investments more directly into research priorities and allow faculty time to be optimally utilized.

The outcomes of these actions will help focus and accelerate the R&D pipeline, heighten impacts and innovation (i.e., provide solutions to grand research challenges), and increase return-on-investment (ROI) for our citizens' tax dollars.

The Partnership At Work at Texas A&M University—and the Extended Innovation Window

As vice president for research at Texas A&M University, I would like first to cover just a few examples at my institution that demonstrate our partnership at work and how it has built specialized capacities for pursuing major advances in research.

Last week, the U.S. Department of Health and Human Services (HHS) and its Biomedical Advanced Research and Development Authority (BARDA) announced a $285 million contract for the establishment of a Center for Innovation in Advanced Development and Manufacturing at Texas A&M. This center is designed to enhance our nation's emergency preparedness against emerging infectious diseases, including pandemic influenza and chemical, biological, radiological, and nuclear threats.

The establishment of this center at Texas A&M provides a perfect example of how some of the primary components of the post-WWII university-government pact continue to operate as designed, paying dividends for the American people and building on years of human and physical research-infrastructure development:

- From the beginning, the U.S. government designed its R&D investment process to fuel advancements at locations where scientific research would be best positioned to succeed. Whether the investment is $50,000 or many millions of dollars, the proposal and peer-review process is rigorous. Texas A&M's long history of involvement in national service and security—combined with our more recent commitment to research in the biomedical, life, and health sciences and commercial collaborations in biopharmaceuticals and national biosecurity—make us, along with our numerous industry, non-profit, and academic partners, an ideal candidate to lead this center. Our specialized infrastructure and expertise was built over a period that extends back to the University's founding.

- By directing resources into institutions focused on *knowledge generation* and *student mentoring and preparation*, the government's investments do double-duty: supporting areas of key national interest while helping train tomorrow's leaders and scientists (the problem-solvers of the future). Texas A&M, like many things in our state, is big, with approximately 50,000 students. In other words: If you want to establish a pipeline of influence and impact that reaches younger citizens, research universities—and especially large public universities like Texas A&M—are the best bang for your buck. In 2010, universities nationwide enrolled 10.4 million undergraduates and 2.9 million graduate students; projections for 2021 are 11.8 million and 3.5 million, respectively (http://nces.ed.gov). The new HHS BARDA center at Texas A&M will help train the next generation of scientific, engineering, medical, and policy professionals who will one day assume national leadership roles.

- Finally, the original backbone of our university-government partnership formed around the *joint* responsibility behind our R&D pursuits: It was agreed that the costs of conducting research and of tending to infrastructure development would always be shared. Texas A&M was able to compete and secure the BARDA opportunity due to specialized capacity and infrastructure built through funding from the state of Texas and through focused and strategic investments on campus. The contract, with a duration of up to 25 years, also builds on support from The Texas A&M University System, Brazos County, and the state of Texas in growing new jobs in the burgeoning biopharmaceuticals industry. Not to mention, our many industry, non-profit, and academic partners in the new center contribute intellectual and physical expertise of their own, which was built over many years.

This award would not have been possible without the shared commitment of the university, the state of Texas, and the federal government—past, present, and future. Together, we have equipped ourselves to meet the challenge of rapid-response to biological threats.

The strong foundation that made Texas A&M successful in competing for the BARDA contract extends back to our post-Civil War origins, when universities and state and federal governments engaged in our original partnership to solve real-world problems: The Morrill Act, approved by the U.S. Congress in July 1862, enabled the creation of the nation's land-grant institutions, a deliberate and collective focus on areas of key national interest. The colleges and universities who owe their origins to the Act—Texas A&M and 76 other institutions that serve the nation, states, and our underrepresented populations—are rooted in practical application of learning and research, bringing both to the masses. The university-government land-grant partnership laid the groundwork for the democratization of public higher education. This year marks the 150th anniversary of that milestone—yet another cause for reflection and perspective-gathering on the state of the nation's research universities.

Texas A&M did not begin its own evolution into "research university" status until the late 1960s and 1970s, relatively later than many of our peers. Since that time, the institution's rise from a small, all-male military school to a comprehensive research university has been meteoric: Texas A&M University now stands among the nation's top 20 institutions in terms of total research expenditures, as measured by the National Science Foundation (NSF). Like the success mentioned above, that rise can be linked directly to the strong foundation provided by the state of Texas, our land-grant roots, and the work ethic and service tradition that is part of the fabric of our Aggie community.

How did we get here? Under the leadership of Major General Earl Rudder beginning in the 1960s, Texas A&M realized that new opportunities available through the federal government's R&D focus could serve as a tremendous boon to the state and the nation. Rudder recognized that with the right resource infusions, Texas A&M could leverage its unique strengths to purse major basic and applied research challenges.

But even a true visionary like General Rudder could not have predicted Texas A&M's eventual leadership and activities in fields within engineering, agriculture, the sciences, architecture, liberal arts, government, business, education, geosciences, and veterinary medicine—much less imagined an announcement akin to last week. (The term "biotechnology" had not yet entered scientific parlance during his time.) By setting in motion a vision that built on our land-grant heritage, Texas A&M is now realizing what was once unimaginable.

General Rudder also could not have predicted the myriad future impacts of one of Texas A&M's most significant early additions to its research enterprise. With funds from the Atomic Energy Commission in 1964, Texas A&M built an "atom smasher" on campus. The establishment of the cyclotron was not without controversy and required a major leap of faith for the state of Texas, who complemented the U.S. government's multi-million dollar investment with a supplementary multi-million dollar contribution of its own. Once constructed, cancer patients traveled great distances for treatment with the cyclotron, creating an immediate fit with the practical application and outreach of our land-grant mission.

More importantly, through the investment in the cyclotron and a commitment to national priorities, Texas A&M became a leading university-based center in the U.S. for nuclear studies: basic nuclear science and forensics, energy applications and sustainability, environmental impact determination, nuclear threat reduction, biomedical applications and social impact measurements, and nuclear policy. The commitments around the cyclotron were critical in paving the way for Texas A&M to build the largest nuclear engineering program in the U.S.; to become a center for pursuing and testing experimental treatments in cancer and medical conditions; to grow infrastructure (e.g., two nuclear reactors) integral to the education of future nuclear scientists and engineers; and to attract expertise and talents in the social sciences and public policy that would help build capacity to focus on human impacts of nuclear use, security, and non-proliferation. As such, the investment was important to the eventual build-up of expertise in political and social sciences at the George Bush School of Government and Public Service.

A more recent example of our university-government partnership at work occurred in 2004, when Texas A&M President Robert Gates had the vision and commitment to invest in a facility (Texas A&M's Interdisciplinary Life Sciences Building (ILSB) designed to bring together researchers in the biological, chemical, and life sciences. It was a major investment and also not without its

skeptics. Built largely through funding from the state of Texas, the $100 million-plus facility provided Texas A&M with a much-needed resource: a space thoughtfully designed to bring faculty and students together in ways that transcend their respective disciplines and research interests, stimulating the collaborations necessary to solve critical scientific problems.

Today, because of the ILSB, we are attracting top researchers in structural biology, neuroscience, and bioinformatics to Texas A&M and—with the help of institutional, state, and federal funding—outfitting their labs with the most state-of-the-art equipment. Scientists like Texas A&M's Dr. James Sacchettini can now pursue the cutting-edge research necessary for contributing to breakthroughs in areas of national and global significance. Dr. Sacchettini uses crystallized proteins to design and deliver "structure guided drugs" to treat critical global diseases, including tuberculosis, a resurgent bacterium that now infects approximately one-third of the Earth's population. With the research labs and facilities in the ILSB, combined with federal research funding from the National Institutes of Health and Department of Defense, researchers at Texas A&M are looking for new ways to more effectively combat this disease.

In the end, the true fruits of Bob Gates' vision, coupled with the large investment from the state of Texas that resulted in the construction of the ILSB, will not be seen until well into the future. But I can assure you that researchers like Dr. Sacchettini are the nation's best hope to pursue the novel preventions, vaccines, and cures for the world's most insidious diseases.

Over a period of six decades, the nation's research universities and our state and federal governments have erected a human and physical infrastructure for solving problems of national priority that is second to none. The current "less than ideal" economic climate, at both the state and federal levels, along with other short-term crises, have pushed both partners into concerns over research productivity and capacity for future innovation—concerns that we could be in danger of ceding our leadership to other universities in other countries. To prevent this, it is imperative that we not take our accomplishments for granted, nor allow our important partnership to erode. We should recommit to this epoch-making collaboration, acknowledge the shared opportunities and responsibility to face important research challenges, and invest limited resources effectively and efficiently to achieve our goals.

The Need for Research Universities to Take Bold Institutional Actions Around Grand Research Challenges

To renew the university-government R&D partnership in the most meaningful way, I believe that the nation's research universities must begin by taking bold and transparent steps—intellectually and physically—to focus their respective research priorities on the grand scientific, technological, and societal challenges of our time. Those challenges include the "national goals" outlined in the NRC report (pages 25-27), including advances in medicine and healthcare, energy, security, and improved standards of living. More importantly, each research university must leverage its respective assets and capacities to pursue those challenge areas that best fit their strengths—then aggressively adjust investments and priorities around their home-field advantages.

Questions to guide the prioritization process could include: What are the most significant challenges that humanity will face in the foreseeable future, especially in the next 25-50 years? Where do my institution's strengths lie in relation to those challenges? What are the areas where my institution can truly achieve worldwide impact for research excellence and develop top-tier educational programs for students?

An aggressive university-based focus on grand research challenges would bring administrative and faculty leaders together to set institution-wide, research-related goals and establish investment priorities consistent with those goals. Each university could better position itself as a competitor for public and private research funding, for state support, and for philanthropic giving—as a united community dedicated to clear priorities and common principles.

I believe the NRC report provides a necessary opportunity to engage in a serious dialogue on how to maintain momentum and see our partnership flourish in the 21st century. Today, complex, real-world problems of national significance must be tackled by teams of individuals from a variety of academic disciplines. The nation's "One Health Initiative" is a perfect example of such an important effort: One Health is designed to focus on increased nationwide academic and industrial collaborations and communications in all aspects of health care for humans, animals, and the environment. The end goal is the advancement of health care for the 21st century and beyond by accelerating biomedical research discoveries; enhancing public health efficacy and wellness; and expanding the scientific and engineering knowledge base.

Texas A&M's distinct approach to "One Health"—what we call "One Health Plus," with the "plus" signifying expert infusions of research and resources focused on safe food and water supplies—seeks to leverage our many unique institutional capacities and commercial partnerships in this arena.

It is imperative that we not rest upon the laurels of our renown and expertise in this or any grand-challenge arena where we claim the aptitude and capacity to solve global problems (energy, biosecurity, etc.). Like all research universities, Texas A&M must ensure that the administration and infrastructure that formed around our traditional areas of excellence do not hinder future progress.

We must therefore take active steps to ensure that our federal, state, philanthropic, and corporate partners receive exceptional value in return for their investment in our shared university-government research priorities:

- 1) *Break down barriers to innovation in scientific research.* To increase innovation and productivity in our research programs, research universities must make strong commitments to realign and break down academic and administrative barriers. For example, faculty incentives and rewards could reflect an institutional focus on pursuing grand research challenges. Such an effort might include the reconsideration of promotion and tenure policies for early-career faculty in ways that encourage greater participation in research teams that cross disciplinary and administrative boundaries (e.g., departments and colleges) and allow a greater focus on research in areas of key national priority. Another example would be the consideration of industry collaborations in tenure proceedings, in addition to credit for faculty who secure patents and licenses for their innovations.

- 2) *Evaluate and reform existing structures to match 21st century realities.* Research universities must be aggressive in revising existing structures and entities on campus to match the realities of the 21st century and transforming dormant or dated infrastructure to make it part of the problem-solving R&D pipeline of the future. For example, at Texas A&M we are currently in the process of implementing a new vision for our industry-focused Texas A&M Research Park (developed in the 1980s) to create an environment that allows faculty to interact and innovate in new ways and increase connections between researchers and private industry. In essence, we are transforming an old park model—based on the anticipation of real-estate development and large industry involvement—into a modern, place-based innovation strategy that will help provide significant intellectual and economic return to Texas A&M, the local community, and the state of Texas. On another front, the University is considering a dramatic reorganization of our capacities in the biomedical, life, and health sciences in order to position the institution for even greater competitiveness in this arena.

- 3) *Align institutional initiatives with national priorities.* Universities must align program and infrastructure development around initiatives that resonate with the demands of resource providers, including private industry, non-profits, and public and private philanthropy. Collaborators and contributors (and taxpayers and companies) seek real impact. They want to know that their efforts will result in something meaningful, today and for generations to come. In higher education, donors specifically want to solve societal problems. Consequently, as Texas A&M prepares for a third comprehensive capital campaign, we are moving to a model that emphasizes challenge-areas where the University can have major impact (e.g., sustainable food and water supply for the world, energy independence in the U.S., policies and practices to strengthen democracy). At the same time, we will leverage unique traditions and core institutional values in ways that link donor passions with new institutional priorities—namely in solving societal problems.

The examples above represent three ways in which Texas A&M and its research-university peers can embark on immediate action to focus on areas of key national interest. Research universities must commit to instituting the internal prioritizing mechanisms and processes that allow us to keep up our end of the university-government partnership.

The Need for Federal Agencies to Invest in Shared Research Priorities

The price of doing groundbreaking research is not cheap, and research universities have been doing more with less for more than a decade. As part of our university-government dialogue, we should acknowledge this reality. And as universities like Texas A&M make hard-charging efforts to focus on grand research challenges, federal agencies must in turn commit to supporting our shared research priorities with significant and ongoing strategic investments.

Targeted grant monies and strategic infrastructure support are critical to the epoch-making advances in science and technology that have become the hallmark of our university-government collaboration. To properly leverage our existing intellectual and physical capacity, research universities must tend to the front lines and ensure that our equipment and laboratories remain first-rate and that our faculty do not depart for apparently greener pastures elsewhere.

- 1) *Support of physical infrastructure matters.* To push the cutting edge of scientific research, universities need the telescopes, microscopes, lasers, optical equipment, and latest in computer storage and processing equipment. State-of-the-art research equipment does not come cheap, and staying in front of new advances is an ongoing challenge. But for

the U.S. to remain the world's R&D leader, we cannot neglect the need for capacity-building in our science-, technology-, and cyber-infrastructure. Earlier, I referenced Texas A&M's cyclotron and ILSB: These represent shared commitments by the state and federal government and by the university to support substantial and cutting-edge facilities and capacities. They lead to important world-changing discoveries, help attract and bring together the top researchers, and provide uncommon educational opportunities for undergraduate and graduate students. The cyclotron demands continuous upkeep, funding for which was recently provided by the Department of Energy (DOE) and Robert A. Welch Foundation. The full potential of the ILSB continues to be realized through physical enhancements provided by the National Institutes of Health. In the end, our partnership and responsibility in maintaining the nation's R&D infrastructure is a never-ending enterprise.

- 2) *Creating new opportunities for our best and brightest researchers is critical.* To maximize our state-of-the-art physical resources, we must attract and support the top researchers to utilize the equipment and conduct research in our facilities. The federal government's support of Young Investigator Awards is critical to that equation. In times of limited funding, it is crucial to maintain and expand programs that help younger researchers put their considerable time, talents, and energy toward solving our most pressing national problems. At Texas A&M, some of our recent early-career awardees are doing important work on cybersecurity and on a molecular compound that dissolves the HIV virus on contact. These pioneering researchers deserve our continued support.

- 3) *Funding for cutting-edge frontiers is vital to push the boundaries of science.* Targeted funding for innovative research projects can help America solve national and global problems. The Advanced Research Projects Agency- Energy (ARPA-E) recently funded projects at Texas A&M that have the potential to make large, game-changing impacts in energy research. Dr. Mladen Kezunovic's research will provide new methods for controlling the power grid and associated electricity markets during sudden interruptions caused by the intermittent availability of renewable generation (wind and solar), cascading faults caused by extreme operating conditions and malicious attacks. Dr. Joe Zhou's ARPA-E-funded research is developing new materials that could reduce the energy required to adsorb carbon dioxide, creating a technology that greatly reduces carbon emissions in everything from transportation devices to power plants. A Texas-based startup has already licensed this technology to pursue commercial applications.

By supporting the nation's research universities in solving important national problems, federal agencies will continue their critical contributions to our long-standing partnership. And when federal agencies fund research at our universities, they not only help solve today's problems, they help train the next generation of researchers. Together, we have built the best apprentice program in the world: All research awards to universities deliver double bang for your buck, since a portion of every dollar ends up going to educate and train the undergraduate and graduate students who become our future researchers, business leaders, entrepreneurs, and teachers.

Also, as we continue to build our nation's scientific and technological competitiveness and train the next generation, it is crucial that we not overlook the huge pool of human and intellectual resources currently under-represented, especially in the Science, Technology, Engineering, and Math (STEM) fields. Young Investigator Awards are critical to this pipeline. Likewise, funding for programs that encourage the participation and success of underrepresented individuals within the academy, like the NSF Advance Program, help support the development of female and minority talent that will be necessary for the U.S. to stay competitive.

Recently, through our long and enduring relationship with the National Aeronautics and Space Administration's (NASA) Johnson Space Center, Texas A&M's Dr. John Giardino, along with research partners at Oklahoma State University, received an award that is designed to support and advance STEM education, motivate new generations of students to enter STEM careers, and promote a culture of life-long learning and interest in STEM knowledge. With efforts like this, Texas A&M has seen significant increases in the numbers of underrepresented students and faculty over the past few years, and we feel that support of similar initiatives, along with our institutional commitment to diversity, will result in further advances on this front.

To conclude, in order to be successful and move forward aggressively with new initiatives and efficiencies, research universities must know that strategic resource infusions from our federal agencies and partners—investments that have paved the way for the basic and applied scientific breakthroughs of the past—will continue in the future.

Need for Efficiency and Transparency on Both Sides

As we recommit to our university-government partnership and collectively focus on the grand research challenges of our time, it is absolutely critical that we become more efficient and effective R&D collaborators.

I have described ways in which research universities must take aggressive steps to retool internal structures and priorities around areas of key national interest.

There are two additional ways that both partners can take *immediate* steps to improve and strengthen our partnership:

- research universities must eliminate redundant and duplicative administrative structures and activities; and
- federal agencies and regulators must reduce unnecessary and overly burdensome regulatory and reporting obligations.

These shared commitments to greater financial efficiencies and the elimination of unnecessary activities will result in more time and resources that can be focused on solving important scientific, technological, and societal problems.

It is incumbent for institutions like Texas A&M to take a hard look at these realities, and then take the corrective steps that can strengthen our shared focus on key national priorities and increase productivity. We must be aggressive in cost-cutting in low-priority areas, eliminate unnecessary administrative activities, and move toward greater consolidation to achieve economies of scale. The resources gained can then be re-invested into research initiatives of national significance.

Through this process, universities will undergo some painful decisions. But they will be no less painful than the decisions that our elected representatives make when considering whether to fund the federal program to support healthcare today versus the scientific breakthrough that could solve national health problems 50 to 100 years from now.

As universities take aggressive steps to maximize and track efficiencies and optimize the impact of government investments, federal agencies and federal regulators must simultaneously reduce unnecessary and overly burdensome regulatory and reporting obligations.

As the costs of doing research have gone up and universities have had to do more with less, overreaching regulatory requirements have further strained already-lean resources. A report prepared for the U.S. Commission on the Future of Higher Education stated that, "there may already be more federal regulation of higher education than in most other industries." The NRC report's newly released recommendation on this matter—reducing regulations that are unnecessary and establishing more consistency across federal agencies—are right on target. We must pull together federal, state, and university experts to find the correct balance in all areas where regulatory and reporting requirements affect the conduct of research: research with human subjects and/or animals, export controls, effort reporting, financial reporting, conflict of interest/research integrity, select toxins and agents, hazardous materials, and the list goes on.

An oft-cited statistic from the 2007 Federal Demonstration Partnership Faculty Burden Survey found that 42 percent of faculty time was devoted to administrative activities, not active research (http://sites.nationalacademies.org/PGA/fdp/index.htm). As others have noted, part of the problem is that research universities have not been seriously engaged in how to solve this problem.

The NRC's report offers a golden opportunity to face this challenge head-on, together. Otherwise, we run the risk of impeding progress on important research and slowing the R&D pipeline.

Rest assured, research universities understand the fundamental importance of ensuring the safety of students, faculty, staff, and the public, as well as the need for accountability assurances. However, the relative costs of complying with certain regulations that go above and beyond what is required to ensure safety and security can come at too great a cost. The research is simply too important, the resources too scarce, and taxpayer dollars too precious. If we are serious about creating a successful partnership that can face and solve truly grand research challenges, the current regulatory burdens faced by our principal investigators and graduate students are unacceptable. We owe it to them to do better.

Recommitting to our University-Government Partnership

In conclusion, now is the time for the nation's research universities and the federal government to recommit to a forward-looking partnership, building on an already-strong foundation and history of success. The National Research Council's report has provided us with an opportunity to reaffirm our mutual respect and shared responsibility. As the vice president for research at a large Tier 1 research university, I am excited by the prospect of engaging in a serious and game-changing dialogue about how to improve and strengthen our research collaborations. The creativity and innovation spurred by our top-notch education system draws the best and the brightest from all over the world to our institutions of higher education. If universities and the government together focus on national grand challenges and prioritize our investments around them, I think we will be amazed at what we will continue to achieve.

With the government's strategic support of research initiatives at universities in the form of human and physical infrastructure, we will generate new discoveries and technologies that can help improve the nation's prosperity and security. These investments are the fuel for the American economy and the very essence of American competitiveness.

We recognize that times are tough and resources are lean, which is why research universities must act aggressively in maximizing efficiencies and increasing transparency. At the same time, the federal government can expect a much higher level of achievement from its university partners by reducing and eliminating overly burdensome regulations and reporting requirements that can slow important innovations.

By working together to capitalize on new investments and efficiencies, we will ensure that today's undergraduate and graduate students will inherit the tools, freedom, and encouragement to face the grand research challenges of tomorrow, safeguarding a strong STEM workforce and furthering the nation's global R&D leadership.

Texas A&M University, with our long history of public service and a research enterprise that serves the national interest, looks forward to reaffirming our commitment to this partnership and to working diligently on areas of key national interest.

Chairman BROOKS. Thank you, Dr. Seemann.

Our next witness is Dr. Tolbert from Arizona University. Dr. Tolbert, you may now proceed with your five minutes.

STATEMENT OF DR. LESLIE P. TOLBERT,
SENIOR VICE PRESIDENT FOR RESEARCH,
THE UNIVERSITY OF ARIZONA

Dr. TOLBERT. Chairman Brooks, Ranking Member Lipinski, Chairman Hall, and other distinguished Members of the Subcommittee, thank you for the opportunity to speak with you today about the importance of the research being conducted in our Nation's research universities. My name is Leslie Tolbert. I am Senior Vice President for Research at the University of Arizona in Tucson, Arizona.

Innovation driven by educated people drives our Nation's economy. The astounding research and education accomplishments in U.S. universities have been the backbone of our country's economic competitiveness, high living standard, and national security since World War II. During that time, the Federal Government has taken the lead in supporting this innovation, providing resources to universities to conduct research and graduate education in the national interest.

In recent years, this essential research support has not kept pace with research opportunities or with international investment. At the same time, State support available to cover research costs in the public universities has declined precipitously. Private industry, traditionally another important source of research, is focusing increasingly on applied research and development leaving to the universities most of the fundamental research and the unexpected discoveries that provide the foundation for all future applications.

How can the federal and state governments, the universities, and the private sector work together to ensure the long-term health of university-based research, which is the essential starting point for the innovation pipeline? The recently released NRC report—"Research Universities and the Future of America" or the "Prosperity Report"—makes some good suggestions.

I am here today representing one of our Nation's large public research universities on the 150th anniversary of the first Morrill Act, which established the public land grant universities. The University of Arizona is a large, comprehensive land grant university of 39,000 students. With annual research spending over $610 million, we rank among the top 20 public research universities in the Nation. We consistently rank first or second in the physical sciences overall and are among the top four universities in space sciences. Among other accomplishments, we design and build the largest telescope mirrors in the world, and we are the only public university to have served as mission control for a NASA mission, this one to Mars. We also provide for the State and the Nation leadership in smart agricultural water use and genetically based pest control, and advanced mining technologies. Approximately 27 percent of the University of Arizona's operating expenses go to support research.

Our total revenues are roughly 1/6 from State-appropriated funds, 1/4 from student tuition and fees, and the remainder from other sources, including externally sponsored grants and contracts, gifts, and investment income. Sponsored grants and contracts come primarily from federal agencies, including the National Institutes of Health, NASA, National Science Foundation.

Support from the State of Arizona has fallen very steeply in recent years. Our university-state support has fallen from 32 percent to 15 percent of our budget in the past decade with a reduction of almost 180 million in just the past five years. We are over $200 million behind in building renewal funds. With that reduction, our faculty number has dropped by 60 and older—in the last year—and older research buildings are being taken offline because of inadequate maintenance even as our student population continues modest growth.

As State support declines and the competition for federal funding gets tougher, efficiency and careful planning are more important than ever for us. We are using our limited resources strategically to support areas of research and education in which we already are clear leaders or where we have clear potential to be competitive for projects that will have a major impact on society and still also to provide relevant undergraduate and graduate education to students from diverse backgrounds.

Fundamental exploration and discovery is at our core, but we also work increasingly to push new findings out to practical application as quickly as possible, especially through expanding our industry relations to true partnerships. Increasingly, we perform research in large consortia where partners share expertise and share resources as an efficient mode of operation.

Toward bolstering the cutting-edge research and education in our universities, we endorse several specific recommendations from the NRC report. First, federal and state agencies must understand and support the absolutely critical role played by university-based fundamental research and the continuum from fundamental research through applied research and development to new product development. New knowledge is the feed corn for the rest of the R&D system. Without new ideas and insights, progress won't happen. Not targeted to particular application, fundamental research has impacts that are unpredictable and may not occur for years or decades, but that research is essential and has the power to transform society.

Second, universities should be able to recover as fully as possible the full costs of funded research, including full reimbursement of the so-called overhead costs that are intended to reimburse universities for the necessary expenditures that collectively support their research. This reimbursement has fallen behind over recent years, leaving the universities having to subsidize federally funded research with other funded. For my public universities, State funds continue to be key here, but declining state support makes this increasingly difficult.

And finally, regulatory controls on federally funded research should be streamlined as much as possible to minimize the administrative burden on both the Federal Government and the univer-

sities and maximize the impact of federal funds spent on university research.

Thank you very much.

[The prepared statement of Dr. Tolbert follows:]

WRITTEN TESTIMONY OF
LESLIE P. TOLBERT, Ph.D.
SENIOR VICE-PRESIDENT FOR RESEARCH
THE UNIVERSITY OF ARIZONA

HEARING ON THE ROLE OF RESEARCH UNIVERSITIES IN SECURING AMERICA'S FUTURE PROSPERITY: CHALLENGES AND EXPECTATIONS

BEFORE THE
SUBCOMMITTEE ON RESEARCH AND SCIENCE EDUCATION
COMMITTEE ON SCIENCE AND TECHNOLOGY
U.S. HOUSE OF REPRESENTATIVES
JUNE 27, 2012

Chairman Brooks, Ranking Member Lipinski, and other distinguished Members of the subcommittee, thank you for your leadership in calling this hearing on the important role of our nation's research universities and thank you for the opportunity to provide comments on that role from the perspective of one of the nation's large public land-grant research universities.

My name is Leslie Tolbert. I serve as the Senior Vice-President for Research at the University of Arizona, in Tucson, Arizona.

Background on Research in Universities: A Changing Landscape

For many decades, the U.S. has led the world in research and education. Early impetus came from the Morrill Acts of the 1860's, which established the nation's land-grant universities and laid the groundwork for our public university system. Land-grant universities were to provide "liberal and practical" education and research that would generate new knowledge to undergird the nation's growing agriculture and industries. The public universities more broadly would provide students of all backgrounds and means the opportunity for higher education and involvement in the research enterprise. The impact of these universities on society would be profound. More of the citizenry than ever before achieved college degrees, and university campuses became hubs of

discovery, innovation, and invention. As the federal government funded the research it saw as vital, federal funding agencies adopted a novel competitive system for distributing research funds, with much of the funding distributed on the basis of evaluations of proposals by peer experts. Our university system, and our competitive-evaluation system for distributing federal research funds to the most meritorious projects, became the envy of the world.

Private-sector companies were partners in this innovation ecosystem. Many of the largest companies, including pharmaceutical and information technology giants, formed laboratories that conducted wide-ranging fundamental exploratory research as well as more applied research and technical development of new products.

After World War II, the federal government took the lead in supporting the nation's innovation, providing huge resources to universities to conduct research and graduate education that would fuel innovation and invention. Both university and private-sector research flourished. Fundamental exploratory research, which is not targeted to particular outcomes or uses, thrived and was the wellspring for many life-changing technological advances.

In recent years, federal financial support for research has not kept pace with what is needed in order to take full advantage of the opportunities and is falling behind rates of support in other industrialized, and some developing, countries. Simultaneously, private-sector companies that do research and development (R&D) increasingly have tightened their focus to more applied research and development, leaving to the universities and national labs most of the fundamental (or "basic") research – and unexpected discoveries – that provide the foundation for all future applied R&D. In recognition of the strategic importance of basic research, the federal government continues to be the major source of funding for it, and in FY2009 universities performed 53% of that research (NSF Science and Engineering Indicators 2012 report at http://www.nsf.gov/statistics/seind12/c4/c4s1.htm).

Limitations in federal funding for university-based research today threaten our nation's prospects for continued leadership in the high-technology economy of tomorrow. In 2011, the U.S. Congress asked the National Academies to make recommendations about what the federal and state governments, the universities, and the private sector can do to ensure the long-term health of university-based research and doctoral education as the foundation for economic prosperity. The recently released NRC report, "Research Universities and the Future of America: Ten Breakthrough Actions Vital to Our Nation's Prosperity and Security," makes excellent suggestions.

Case Study of a Public Research University: The University of Arizona

As federal support of university research, while still substantial, fails to fully meet research needs, state universities face special challenges. The economic recession of the last four years has caused the state support that can be used for research-related expenses in most public universities to decline precipitously; in fact, even with the beginnings of economic recovery the levels of state investment in the universities continue to fall (National Association of College and University Business Officers, http://www.nacubo.org//Research/Research_News/State_and_Local_Government_Support_for_Higher_Education_Continues_to_Decline.html). The result is that state universities have a diminishing capability to provide the foundation for our researchers to be competitive for federal funding for research projects. For instance, while in the past the federal government provided major support for the provision of research facilities and equipment, today federal dollars are largely restricted to supporting research operations, with little targeted directly to the costs of providing the research infrastructure those operations depend upon. To fill this gap in federal funding, public universities have relied heavily upon *state* support, as well as their other institutional resources, to support their research infrastructure needs. Reductions in state support, in turn, are now making it increasingly difficult for us to remain competitive.

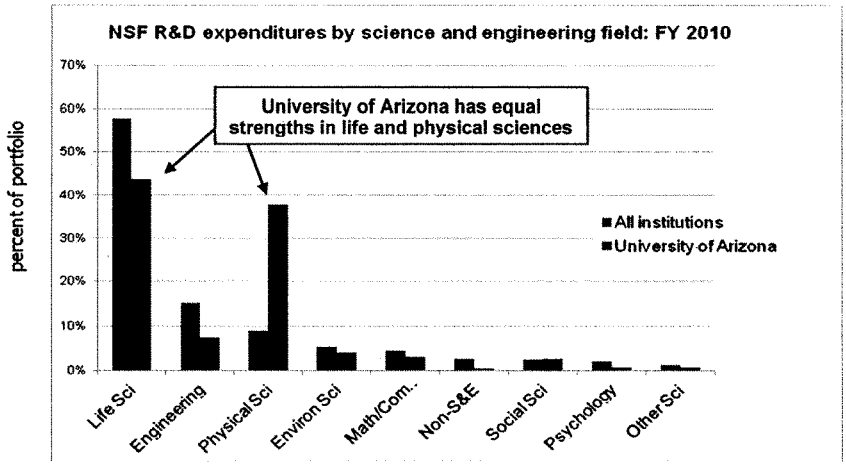
Below I will provide some examples of how the University of Arizona is addressing challenges posed to many public universities by the current economic climate.

Description of the University of Arizona

The University of Arizona is a large, comprehensive land-grant university of 39,000 students. With 10,700 direct employees and an additional 7,000 employees at our UA Science and Technology Park, we are one of southern Arizona's largest employers. Our annual research spending of over $610 million ranks us among the top 20 public research universities in the nation in research size. We consistently rank first or second in the physical sciences overall, and are among the top four universities in Space Sciences. Our research enterprise provides jobs at all skill levels, generally at higher wages than in the state economy overall.

Among other accomplishments, we design and build the largest telescope mirrors in the world and are the only public university to have served as Mission Control for a NASA mission, the Phoenix mission to explore the Martian surface. We provide, for the state

Figure 1. Distribution of University of Arizona's research portfolio by field compared to average of all U.S. universities



and the nation, leadership in smart agricultural water use and genetically based pest control and in advanced mining technologies, as a direct reflection of our land-grant mission. We also are home to one of the nation's top environmental science and policy institutes; taking advantage of our location, ours has a special focus on semi-arid climates and international border concerns. The Tucson region is known as Optics Valley, due to the large number of companies that spin out of our College of Optical Sciences.

Our strengths are rooted in fundamental science. As shown in **Figure 1**, compared to other universities we are unusually strong in physical sciences, with a portfolio that is almost equally balanced between physical and life sciences. Less of our portfolio is attributable to applied areas such as engineering and environmental sciences, although we have distinct strengths and are growing in these areas.

Our total annual budget is approximately $1.8 billion, comprising funds from multiple sources, as shown in **Figure 2**. State of Arizona support for its three public universities has fallen steeply in recent years: for the University of Arizona, state support has fallen

	FY2001-02 Actual		FY2011-12 Budget	
State Support	329,320	32%	263,701	15%
Net Tuition	140,096	14%	408,900	23%
Tuition Funded Aid	49,300	5%	175,200	10%
Grant & Contracts	330,083	32%	574,400	32%
Ancillary Units	95,655	9%	188,100	11%
TRIF *	15,799	2%	19,400	1%
Gifts & Endowments	35,407	3%	78,500	4%
Invest. Inc. & Other	31,781	3%	67,200	4%
TOTAL	1,027,441	100%	1,775,401	100%

Figure 2. Sources of funding for University of Arizona operations (in $thousands)

* TRIF (Technology Research Infrastructure Fund) supports university R&D and technology transfer related to the knowledge-based global economy through a six-tenths-cent increase in state sales tax.

from 32% of our total budget ten years ago to 15% in FY2012, with a reduction of almost $180 million in just the last five years.

We currently enroll 7,170 graduate students, about half of whom are enrolled in our 92 research-intensive doctoral programs and about half in our Master's degree programs. We administer 15 novel Graduate Interdisciplinary Programs, most of which offer the Ph.D. in STEM (science, technology, engineering, and math) areas. They have arisen in part to provide opportunities for students to learn how to engage in large-scale, collaborative research, which will be increasingly important in the 21st Century. Often the students themselves build bridges between faculty across traditional disciplines that eventually yield successful new federal funding for the kinds of large, high-impact projects that require collaborative efforts.

In addition to *graduate* programs focused on research, we have a long tradition of involving *undergraduate* students in hands-on research and other scholarly activity with faculty members, especially in STEM (science, technology, engineering, and math) areas. Our Undergraduate Biology Research Program, for example, was started in 1988 and through successful competition has received continuous funding from the NSF and from the Howard Hughes Medical Institute. Thousands of students have graduated from this and similar programs, armed with direct experience in framing and addressing important questions to advance our understanding of the world. They are well equipped for graduate/professional school and the workforce, with strong critical thinking skills and the will to take risks when needed to address difficult problems. The University of Arizona now is moving toward 100% participation of our undergraduate students in one-on-one research or creative scholarship activity with a faculty member before they graduate. We know that retention and graduation rates increase as students become engaged in active learning like this.

Addressing Challenges to Our Research Enterprise

What are some of the most important challenges currently faced by the University of Arizona in achieving our goals for increased levels of societally relevant research and research-intensive education?

- The *sharp decline in support from the state* affects our ability to compete for federal funding for research in numerous ways. For instance, we struggle to meet matching requirements on certain types of grants and to generate support for graduate students to work in labs, even in our top programs. Also, our physical infrastructure is aging and, as state funds for maintenance and renovation fall far behind the formulaic support that we are designated to receive – and less federal funding is available for infrastructure than in the past – our ability to provide enough modern laboratory facilities is threatened.
- *Fundamental research, in particular, tends to be marginalized* in discussions of the important roles that research plays in U.S. economic prosperity and international competitiveness. The University of Arizona believes strongly that we must continue to provide the inventive new ideas that may ignite whole new fields of application, because if universities do not do this, there will be few new ideas in the pipeline for the future. But this is often not recognized as being an *essential* university function.
- The *growing burden of compliance* with the increasing numbers and complexity of federal regulations consumes increasing amounts of time and money, leaving less for more direct support for research.
- The *full costs of research are not covered by our reimbursements* from the federal or state agencies that procure our research. "Indirect" costs are the common costs of doing research, the costs that cannot be ascribed to individual projects but that collectively are necessary for research to be conducted. Federal laboratories and industry are provided full reimbursement of indirect costs, but universities are not and so must subsidize them from other sources.

In facing these challenges, the University of Arizona embraces the basic premise that public universities provide special opportunities for personal advancement through education, for research that is conducted and analyzed through a broad societal lens, and for connection with the community at large. We work every day to maximize what we can offer to our stakeholders, especially in light of shrinking government support.

How budget cuts have changed the character of the University of Arizona

Budget cuts from the State of Arizona have had a serious impact on the University of Arizona. For example:

- We have had to raise the tuition we charge to students from the truly bargain levels of past years to $10,000 for resident undergraduates, a level at the middle of our peers, in order to more fully cover the costs of education.
- We have lost many faculty members, including some of our leading researchers, to other universities or to early retirement. The overall number of faculty is down by 60 in the past year.
- Demographically, our faculty is aging. Over recent years, we have not had the resources to hire new faculty to keep pace with retirements, so as the generation of faculty that made us a Research I institution leaves us, we do not have a strong generation of successors in place. Indirect cost dollars are a major source of start-up funds for new faculty, and as those are under-recovered we are unable to support new initiatives in response to new opportunities. To be aggressively entrepreneurial and innovative, we must be able to hire selected faculty in targeted areas, and we clearly are falling behind in our ability to do so.
- We have had to turn away from specific research-funding opportunities when the requirements for matching dollars were beyond our means. The funding entity would have doubled or tripled our investment, but we did not have the ability to make the initial investment.
- We struggle to meet the challenge of expanding our medical schools in Tucson and Phoenix. We cannot expand the College of Medicine to meet the state's needs without new faculty.

- Several of our historic laboratory research buildings are in such bad repair that we can no longer use them for research. When we renovate them, they will be office and classroom, not lab, buildings.
- "Temporary," trailer-like buildings constructed many decades ago to accommodate College of Medicine faculty continue to be used for biomedical research laboratories and offices and cannot be replaced with modern research facilities yet.
- We must teach more very large classes than ever before. To accommodate several classes of over 600 students, we have temporarily converted our major performance hall into a classroom for daytime use and are building other large classrooms into older buildings when we do renovate those buildings.

Cost savings and additional new funds are needed in order to buck these disturbing trends.

The need to find institutional efficiencies and make strategic investments

In light of the need to find funds to address issues such as those just described, the University of Arizona constantly seeks to find ways in which we can be more efficient in containing costs, right-sizing administration and oversight, and increasing productivity. Meeting this challenge requires self-study and change, and targeting our investments in selected strategic areas.

Although the University has a comprehensive research profile across the arts and sciences, we increasingly are focusing our research investments in five or six strategically selected areas. Four of these areas are:

1. Space Sciences – We are among the premier universities in the nation for land-based and space-based observation and exploration. In 2011, we won a major $800 million NASA project, called OSIRIS-REx, to study a near-earth asteroid. A member of our faculty will serve as the project leader, and the full team involves multiple other universities as well as the NASA Goddard Space Flight Center and Lockheed Martin.

This project will reveal new information about the origin of the universe and will give many dozens of students the opportunity to work on an exciting project that incorporates broad areas of science and engineering. The project also will incorporate a large program of outreach to K-12 students, who are so easily captivated by space exploration. The University will work hard to maintain its preeminence in the space sciences, which raises the profile of the entire university.

2. Bioscience/Biotechnology – The establishment of our interdisciplinary BIO5 Institute a decade ago generated a very successful collaborative environment in which biologists, agricultural scientists, biomedical scientists, computer scientists, and engineers collaborate easily and readily transmit their results out to practical application through technology transfer. In 2008, a BIO5 group was awarded the University's largest NSF grant ever, for a project called iPlant that has created a national cyberinfrastructure for molecular plant biologists, ecosystems biologists, information scientists, earth-imaging specialists, and others to tackle Grand Challenge problems in plant biology for the future. Our major focus now is to develop strength in translational and applied biomedical science, initially through the hiring of physician-scientists who will build bridges into medicine. The University of Arizona currently garners less funding from the NIH than do most universities with medical schools, but with our well-established interdisciplinary environment for research, we see a ripe opportunity to become stronger in this area. This expansion will take full advantage of new relationships we are building around the state through our College of Medicine in Tucson and its new arm in Phoenix, and will have a direct impact on medical education and healthcare for Arizonans.

3. Environment, Water, and Energy Sustainability – Our Institute of the Environment brings together major expertise in the science, engineering, and public policy of environmental sustainability from 300 faculty across the university, for collaboration locally and around the world. Their focus is to perform research and to transform research outcomes into useful knowledge for decision makers, consumers, and other stakeholders. Institute faculty and students have a special focus on understanding environmental impacts in a desert environment. They focus on such projects as arid lands

agriculture, solar energy and algal biofuels, and social policy related to environmental issues that cross borders or have disproportionate impacts on particular subpopulations. We are international leaders in some of these areas, and want to capitalize on our strength here to have a positive impact on the future.

4. Optics and Information Science and Technology – We have one of only three optical sciences colleges in the U.S. The faculty in that college are highly collaborative, with our space sciences faculty, with our biomedical scientists interested developing and testing non-invasive imaging technologies, and with computer science and engineering. A major NSF-funded Engineering Research Center in "Integrated Access Networks" has its home here. That ERC unites University of Arizona faculty with those from eight other universities in an effort to create optoelectronic telecommunications technologies that will enable seamless, cost-efficient aggregation of IT networks, and it encompasses a comprehensive plan for maximizing diversity among the faculty and students. Our optical sciences faculty lead the university in taking their research all the way to application in society, through the licensing of the knowledge they create and through the creation of dozens of spin-out companies, many of which have stayed in the Tucson area, giving it the nickname "Optics Valley." In our business college, the Management Information Systems program is one of the strongest in the nation. MIS faculty are among the users of our newly opened Research Data Center, which consolidates in a shared facility the high-end computing power needed by researchers who generate and analyze huge volumes of data (so called "big" data). With each passing year, more and more projects have major IT infrastructure needs that we meet with a combination of local and shared IT resources.

Research projects in all of these areas have direct impacts on our state, through stimulating school children's curiosity about space and science, to generating new ideas and new knowledge, to creating new companies, to educating a workforce ready to lead in a highly connected and highly technological world. In each of these areas of focus, our faculty and students collaborate with researchers in other universities both near and far, increasingly engaging in very large projects that involve large consortia of universities,

industry, and national laboratories. There are some instances, however, where additional faculty are needed in our own university to extend or fill gaps in expertise so that we can reach our full potential. As we find the funds to hire faculty to replace retirees or into newly created positions, we pay particular attention to how they fit into research interest-clusters, and we focus our resources on the faculty that complement the strategic areas. This is the way we can most efficiently build the research teams to tackle the Grand Challenge-type problems that face our society. However, it also takes money to provide and maintain the modern research space and infrastructure these faculty will need to make the promise of major research advances a reality.

Encouraging innovation and entrepreneurship

Entrepreneurship is encouraged and nurtured across the University of Arizona campus. Much of this activity has its formal home in the business college, which has a top-ranked entrepreneurship program that has been selected as a National Model Program by the U.S. Association for Small Business and Entrepreneurship. Students in the program are a resource for faculty developing business plans for their start-up companies, and a new venture for the program is the Innovation Law Lab that provides legal strategies and advice to innovation-based start-up companies in our region. Just this year, a new minor in Entrepreneurship is being offered to students across the university, so that scientists and engineers, for instance, can acquire a background that will help them to bring a business perspective to their work.

An entrepreneurial spirit is encouraged through another creative set of programs funded by the Technology and Research Initiative Fund (TRIF). TRIF is a special investment in higher education made possible by the passage of Proposition 301 by Arizona voters in 2000. The TRIF portion of the proceeds from a six-tenths of a cent increase in state sales tax is administered by the Arizona Board of Regents and distributed to the state's public universities. At the University of Arizona, TRIF funds support research in three of the strategic areas of research focus described in the section above, as well as translation of research results to clinical or commercial application and education of a workforce

prepared to lead in a knowledge-based economy. Funds also support specialized research facilities, our new technology commercialization program (described below as Tech Launch Arizona), and distance-learning activities.

A third entity, Science Foundation Arizona (SFAz; http://www.sfaz.org), also plays a key role in spurring innovation and connection to the business community. Created in 2006, SFAz is a nonprofit public-private partnership that was formed to invigorate Arizona's economy by making strategic R&D investments in the state's universities. With total funding of approximately $40-50 million each year, SFAz facilitates strategic collaborations between Arizona universities and industry, supports top-notch graduate students and postdoctoral researchers to come to Arizona's universities, and, as will be described in more detail below, administers a creative program to enhance STEM education in grade schools. One exciting research program funded by SFAz is developing advanced environmentally responsible technologies for mining, through a partnership between the University's Department of Mining and Geological Engineering and a number of leading mining companies. SFAz requires the companies to match SFAz's financial support for the program, and the resulting partnership is strong.

Technology commercialization and partnership with private industry

University of Arizona researchers share our new ideas and innovations in many ways: with other scholars through traditional academic channels, through formal technology transfer into the business sector, and directly with the community through many programs such as AZ Cooperative Extension – and our biggest pipeline of knowledge transfer is to and through our students. Students acquire new knowledge and the ability to think critically, test ideas, and work constructively in teams before they enter the workforce.

New knowledge, or intellectual property, developed at the University of Arizona has had a major impact on the economy in our region. For instance:

- Over twenty years ago, a professor of pathology developed an automated system for processing the histological slides that researchers and hospitals use to inspect tissue samples. He refined the system, with a focus on its use for cancer diagnostics, and in 2008, his company, Ventana Medical Systems, was acquired by the Roche group, one of the world's giant pharmaceutical companies, for $3.4B billion dollars. The company has expanded to over 1000 employees in the Tucson valley, hiring many graduates from the University of Arizona.
- In a similar vein, a University spin-out company, Selectide, which used an innovative technology that allowed scientists to attach individual compounds to tiny beads for specific testing, was acquired by another pharmaceutical giant, Sanofi, in 2004. That company is growing and developing as a neighbor of Ventana Medical Systems.

We currently are revamping our formal technology transfer and commercialization functions, in an effort to spawn more successes like those above, which have the potential to transform our quality of life and also to bring a significant licensing and royalty revenue stream to the University to add to our coffers. Tech Launch Arizona will bring together our offices of technology transfer and corporate/business relations and our business incubator and science park, to provide a more cohesive and entrepreneurial approach to taking ideas and inventions from the University of Arizona to market.

Our Science and Technology Park is already a powerhouse. With more than 7,000 employees, the UA Tech Park is another one of the region's largest employers. It is home to 50 high-tech companies and business organizations, including several emerging technology companies, as well as branches of five Fortune 500 companies. It includes a business incubator, which currently hosts 7 emerging companies, several of which are spin-offs from the University of Arizona. We currently are developing a second UA Tech Park, focused on biotechnology, and received $4.7 million in Federal Stimulus funds from the U.S. Department of Commerce to build the utility and roadway infrastructure that is allowing us to develop that property. Together, these tech parks will

provide a nurturing home for young companies emerging out of the university and also serve as a magnet for technology companies to relocate and stay in Tucson.

Enhancing STEM education and broadening participation in STEM fields

Several initiatives highlight our commitment to strengthening STEM competency in our students and enhancing diversity in STEM areas.

Our Graduate College administers several programs that provide students from underrepresented groups the opportunity to develop their STEM backgrounds and then to succeed as graduate students at the University of Arizona. In Fall 2011, almost 2000 graduate students at the University of Arizona were underrepresented minority, i.e., Hispanic, Native American and African American, a 53% increase in 10 years. Our students from underrepresented backgrounds represent 18% of the graduate student body, a significantly higher representation than any other AAU-member university. One of our most successful feeder programs is the Ronald E. McNair Achievement Program, a graduate school preparation program for University of Arizona undergraduates. Funded by the U.S. Department of Education, this program provides low-income, first-generation college, and underrepresented students with opportunities and activities to excel in their undergraduate studies and assistance in admission into doctoral programs. Many track into science and engineering programs.

Another program targets faculty diversity. This is our five-year NSF-funded ADVANCE program, which is aimed at eliminating the unconscious bias that can limit the success of women, and especially women of color, in the faculty ranks in STEM areas. The $3.3 million grant has enabled the university to create bias-awareness training for the committees that perform searches for new faculty and that evaluate faculty for promotion and tenure, as well as multiple career-development activities for women faculty. As important as any other aspect of the program is the attention that it brings to the University of Arizona, alerting women that ours is a welcoming academic community.

This year Science Foundation Arizona, mentioned above, launched the AZ STEM Network as a proactive approach to STEM teaching in Arizona's middle and high schools. The public-private consortium that developed the Network seeks to develop and disseminate effective education practices and teaching advances including state-adopted, internationally benchmarked Common Core Standards. The Network will provide educators, the business community, and private donors the framework and tools needed to integrate effective STEM learning into Arizona schools. The University of Arizona's College of Education has obtained a three-year grant from AZ STEM Network for $750K, plus matching funds from local business partners, to create the Southern Arizona Science and Math Internship Center. The Center will provide a three-year master's degree program that aims to improve the retention of math and science teachers who are teaching in middle and high schools, through stimulating coursework and paid internships in businesses that use math and science.

National Academies' 2012 Report on Research Universities

Maintaining America's universities' competitiveness in research, especially in the fundamental research that will provide the basis for major leaps in enhancing our prosperity and security in the future, has become a serious challenge. The new National Research Council report, "Research Universities and the Future of America: Ten Breakthrough Actions Vital to Our Nation's Prosperity and Security," makes multiple welcome recommendations to strengthen research and advanced education.

A major theme of the report is that federal and state governments, research universities, and industry must work in partnership to advance the capabilities and impact of our research universities to meet the nation's innovation and education needs.

While all of the recommendations deserve good attention, here we especially endorse three subthemes that relate to the items I have mentioned in this testimony and that the House Subcommittee on Research and Science Education may help to address.

1. Fundamental, or basic, research lays the foundation for the applied research that enhances our economy

Reference is made throughout the "Universities and Prosperity" report, but especially under Recommendation 1, that research and development are founded in the fundamental, or basic, research that is conducted in research universities. As the report is publicized, it will be most useful to universities if fundamental research is mentioned as often as the more applied research that is easier for the public to grasp. We must help the public and law-makers to understand that without fundamental research, there is no basis for applied research applications.

2. Funding agencies should more fully reimburse the real costs of the research they procure. (Recommendation 6)

The full costs of research include not only the funds given for specific projects but also the less visible costs that cannot be ascribed to individual projects but that are necessary for research to be conducted. Among other things, these costs cover administrative support and oversight and research facilities. Although federal laboratories and industry are provided full reimbursement of such "indirect" costs for research procured, universities receive only partial coverage. It is important to note that the partial coverage provided by federal funding agencies is provided as reimbursements for actual expenditures that have been meticulously audited for legitimacy. Fuller reimbursement of actual expenditures would decrease the subsidy that universities currently must provide if they are to accept federal funds to perform research in the national interest.

3. The regulatory burden of administering federal research funds should be re-examined and reduced where possible. (Recommendation 7)

As a federal grantee, the University of Arizona is a conscientious steward of public research investments. We understand the importance of compliance and regulatory oversight and strongly support the objectives of accountability and transparency. We

seek changes in federal policy that will simplify the complex and sometimes contradictory regulatory policies that cost us so much in assuring compliance with federal research policies. Simplification and streamlining of those policies would allow our limited resources to be used more effectively across the board on research, education, and public service. At the same time, federal oversight would cost less, freeing up funds for more direct support of research.

In addition to these three items, the University of Arizona believes it especially important to attend to Recommendations 5 and 8, which would create specific programs designed to fund graduate students and early-career investigators, helping to maintain a robust workforce pipeline, and to Recommendations 9 and 10, which will help us to diversify and strengthen the pool of scientists that we educate and then maintain in the nation's workforce.

While the federal and state governments work on the aspects of the recommendations that apply to government, the University of Arizona will do its part to be ever more efficient and effective.

Thank you for the opportunity to present this testimony.

Chairman BROOKS. Thank you, Dr. Tolbert.

Dr. Siedow, it is now your turn for five minutes. You may proceed.

STATEMENT OF DR. JAMES N. SIEDOW,

VICE PROVOST FOR RESEARCH,

DUKE UNIVERSITY

Mr. SIEDOW. Chairman Brooks——

Chairman BROOKS. Excuse me. Turn on your microphone.

Mr. SIEDOW. Oh, sorry. Chairman Brooks, Ranking Member Lipinski, Chairman Hall, and Members of the Subcommittee, thank you for your efforts to highlight research universities and the important role these institutions play in our Nation's security and economic prosperity. I am Jim Siedow, Vice Provost for Research at Duke University, and I am grateful for the invitation to be part of this critical discussion.

This is clearly a very important topic, not simply for those of us sitting at this table but also for the Nation as a whole, and I think it is very encouraging that our elected officials, including three Duke alums who sit on this Committee, see the NRC report and this topic as sufficiently important to hold this hearing.

It has been said several times already but cannot be reiterated enough that one of the cornerstones of the success of the United States has achieved as a Nation over the past 150 years since the enactment of the Morrill Act has been the partnership between the Federal Government and research universities, operating under the notion that universities with the support of federal and State governments would provide the fundamental research and new discoveries that would drive the development of new technologies, which in turn would underpin the Nation's economy. That was true in 1862; it was even more so in 1945 when Vannevar Bush eloquently restated the case in *Science the Endless Frontier*, and it is even more true today when we are locked in a struggle to maintain the primacy of our Nation and its economic system in the face of very steep competition.

We believe the NRC report does a very good job of making the case of the need to reaffirm and revitalize this unique federal-university partnership. No less important, however, is the case the report makes for the need to strengthen the linkages between research universities and industry. Many people have made note of the fact that in the aftermath of the dismantling of the large corporate research laboratories which drove much of this Nation's industrial leadership in the 20th century, universities and industry have yet to come together in a way that fills the resulting gap. While most research universities today can point to successful examples of interaction with industry, in some cases interactions of large consequence, for the most part industry comes to universities today when they have a question they want answered or a problem solved, reducing the partnership to more of a fee-for-service transaction and less of a union of coequals trying to address a corporate grand challenge or move a university discovery beyond the so-called valley of death and into the marketplace.

The large corporate laboratories of the past were masters at translating basic research discoveries into practical applications. Research universities today are hotbeds of basic discovery but remain somewhat slow and undercapitalized when it comes to translating these discoveries into useful applications.

In light of this situation, what is clearly needed is a new partnership between industry and research universities that is designed to address these shortcomings. As outlined in the NRC report, the Federal Government is best positioned to broker this partnership and to help bring about a more collaborative—and to quote the NRC report—"peer-to-peer" set of interactions between the two entities.

As has also been pointed out in previous testimony, a major challenge facing universities relates to costs associated with the growing number of research-related compliance regulations that have flowed down from federal agencies over the past 15 or so years. Most of the cost of administering these regulations have had to be borne directly by the university. To take Duke as an example, the research-related and quality-assurance cost to Duke is between—between the year 2000 and 2010 rose over 300 percent at the same time that our direct and indirect costs only increased 130 percent.

In addition to presenting the university with a challenge of continually keeping up and paying for new regulations, operationalizing our compliance responsibilities in many cases means flowing down these additional responsibilities to our research-active faculty. This has led to negative responses on the part of the faculty who see more of their time being committed not to carrying out funded research but to a myriad of mundane administrative duties. This is not to suggest that these regulations are unwarranted, only that the extreme to which some of these regulations have gone of late seems well beyond that needed to accomplish the original regulatory end. We support the recommendation in the NRC report that a thorough review of these regulations is in order.

Finally, while not a Committee recommendation per se, the overarching tenor of the NRC report on the development of my testimony for this hearing led me to ask whether another potential outcome of this assessment of the partnership between research universities and the Federal Government might not include a call for a formal look at the country's fundamental research portfolio in light of the future strategic needs of the country. In essence, does the current distribution of federal support for basic research align or not with where technology will most need to be advanced in the future if the country is to maintain its competitive scientific and technological edge?

I thank you for your time and interest, and I look forward to answering any questions you may have.

[The prepared statement of Mr. Siedow follows:]

Congress of the United States

House of Representatives

Subcommittee on Research and Science Education

The Honorable Mo Brooks, Chairman

Testimony of

Dr. James N. Siedow

Vice Provost for Research

Duke University

The Role of Research Universities in Securing America's Future Prosperity: Challenges and Expectations

June 27, 2012

Chairman Brooks, Ranking Member Lipinski and Members of the Subcommittee, thank you for your efforts to highlight research universities and the important role these institutions undertake in our nation's security and economic prosperity. I am James N. Siedow, Vice Provost for Research at Duke University and am grateful for the invitation to be part of this critical discussion.

Duke University is a relatively young institution, created in 1924, but it has quickly risen through the ranks to become one of the leading research universities in the nation. The campus, located in Durham, North Carolina, is home to 14,746 undergraduate, graduate and professional students and employs over 33,000 people, making it the second largest private employer in the State of North Carolina. Duke is an anchor in the Research Triangle Park (RTP), which was created in 1959 and remains one of the most transformational public-private partnerships in the country. RTP includes about 170 private, governmental research, and non-profit companies that employ more than 49,000 workers, making the region one of the nation's leading centers for research, science, and engineering with one of the highest concentrations of Ph.D.s and M.D.s in the world. More than 15 companies in the region have resulted from technological innovation at Duke or by Duke researchers.

The research enterprise on campus is robust. Nationally, Duke ranked 5th in FY2010 (the most recent year for which such statistics are reported by the National Science Foundation (NSF)) among all U.S. colleges and universities in total research and development expenditures, and second only to Johns Hopkins among private institutions. In FY 2011, the Duke research enterprise totaled just under $1 billion. This research is conducted by hundreds of faculty throughout the university. Over 80 percent of the research expenditures are associated with the School of Medicine, with the remainder being split among the other schools, most significantly Trinity College of Arts and Sciences, the Pratt School of Engineering, and the Nicholas School of the Environment.

The National Institutes of Health (NIH) is the largest federal sponsor of research across campus, accounting for $417 million or roughly seventy-five percent of all federal awards in FY 2011. The NSF and the Department of Defense are the second and third top federal sponsors of research, providing $45 million and $30 million respectively.

Duke also ranks first nationally in the category of industry-sponsored research and development expenditures, a ranking it has maintained for over a decade. Much of the activity in this area is associated with the Duke Clinical Research Institute (DCRI) which works with industry to oversee clinical trials. In keeping with the university's obligations under the Bayh-Dole Act and its mission of knowledge in the service of society, Duke actively seeks to translate its basic scientific discoveries into commercial opportunities. The university received $24.2 million in licensing and royalty income from patents in FY2011.

- **What are the major challenges facing your university's research efforts today? Has your university made any changes to its research enterprise in light of shifting federal and state funding?**

  The two major challenges facing Duke University research efforts today are 1) the lack of growth or even outright decreases in federal funding for basic research, particularly at NIH, and 2) the ever-growing list of federal regulations that have been promulgated on universities in recent years.

  Because Duke has a medical school with a top-tier research program, we are quite sensitive to changes in federal research funding particularly that at NIH. In 2008-09 we had witnessed a slight downturn in federal funding for research in the School of Medicine prior to the appearance of ARRA funding. The latter program stemmed this decreasing trend, at least temporarily, as Duke was one of the top recipients of ARRA funding among universities (ranking in the Top 20 for total ARRA funding and in the Top 10 for ARRA funding from NIH). As the expenditures for ARRA-funded projects have progressively decreased over the past two years we are beginning to see a return to the flattening and downward slope associated with the School of Medicine's federal research funding profile. The remainder of the university outside of the School of Medicine (referred to as the "Campus") is not as dependent upon NIH funding (only 37% of Campus externally supported research comes from NIH) and its research expenditures continue to show limited growth, led primarily by the School of Engineering's success in identifying and attaining new sources of DOD funding.

  Given the general mood regarding the future of federal funding for basic research, Duke has taken a number of steps to begin to address dealing with this funding picture. All the research-active schools at the university have instituted processes for providing bridge funding to laboratories that have lost a competing renewal but show a good likelihood of being funded in a subsequent resubmission based on the reviews of the proposal. The most sophisticated of these programs resides in the School of Medicine where there is a formal system for applying for such funds and a standing faculty committee that makes the decision to bridge fund or not. This program has been, by all accounts quite helpful in keeping research laboratories operational through temporary unfunded periods. Similar programs exist in other schools but the final decision about providing the bridge funds generally lies in the hands of the school's dean.

  There is a second area of relatively new activity within a number of Duke schools at present that is designed to enhance the effectiveness of attracting research funding. This the establishment of so-called Research/Grant Development offices that are designed to provide help to Duke faculty who are interested in applying for grants of $1M-plus (annual budgets) usually involving multiple investigators and having an interdisciplinary focus. These offices begin by looking for potential funding opportunities of this nature and then line up one or two faculty who might be interested in leading the development such a proposal. The Research Development group provides administrative, organizational and editorial help

throughout the proposal process, relieving the faculty of what are otherwise seen as major burdens in developing proposals of this nature and scope. While still at an early stage, Research Development groups have now been established in the Pratt School of Engineering, the School of Medicine, the Division of Natural Sciences in Arts & Sciences, and the Social Sciences Research Institute in Arts & Sciences. The initial results from the early adopters (Engineering and Medicine) have been quite positive with relatively high rates of proposal success, as has been seen elsewhere around the country when such groups have been established.

This emphasis on promoting larger multi-investigator, interdisciplinary projects is in keeping with Duke's own strategic commitment to fostering interdisciplinarity as a cornerstone of its research enterprise across the university. It also coincides with funding trends at numerous federal agencies, including NIH and NSF.

The second challenge cited above relates to the costs associated with the growing number of research-related compliance regulations that have flowed down from federal agencies over the past 10 to15 years. Because there has been no increase in the administrative component of the indirect cost recovery (F&A), which is currently capped at 26%, much of the cost of administering these new and/or enhanced federal regulations have had to be borne directly by the university. In that regard, the research-related and quality assurance costs to Duke between 2000 and 2010 rose over 300% at the same time that our direct and indirect costs each increased only 130%. These additional costs arose in a number of areas, including the Research Compliance Office, the Office for Research Integrity, Pre-award and Post-award Management, Information Technology, the Human Subjects Protection Program and IRB, Animal Welfare and IACUC, the Institutional Biosafety Office, and Clinical Trial Billing & Management.

This growth in compliance-related costs over the past ten years has been the result of several different compliance and/or regulation-related issues. Included among these are new areas of compliance that have been appropriately identified over this time frame (e.g., export controls, information technology security). While always an issue, oversight of clinical research has taken on larger dimensions in recent years, including enhanced protection of human research subjects and the increased complexity associated with site-based clinical research which is intertwined with unique clinical practices that can involve specialty- and even faculty-specific nuances. The need to develop robust IT systems for conducting research administration and compliance is imbedded in most all these changes. Additional costs have arisen from the need to modify our compliance operations to respond to OIG interpretations of existing regulations that change with some frequency and with audit experiences at other schools (e.g., effort reporting, monitoring of subcontracts, conflict of interest, appropriate charging of clerical and administrative expenses). Similarly, Congressional oversight can lead to a resulting focus by OIGs on specific, and often new, compliance areas.

In addition to presenting the university with the challenge of continually keeping up with new and/or modified research-related regulations, operationalizing our compliance responses

in many cases means flowing down new responsibilities not only to departmental grant managers but also to research-active faculty. This perceived piling on of new reporting requirements has led to negative responses on the part of faculty, who see more and more of their time being committed not to actually carrying out the funded research but to a myriad of mundane administrative duties. This has at times led to near mutinous conditions and a lot of upper administrative time is itself spent educating faculty as to the necessity of carrying out these duties. This is not to suggest that these regulations are unwarranted, far from it. Only that the extreme to which some of these regulations have gone of late seems well beyond that needed to accomplish the original regulatory ends.

Because Duke University is a private institution, we are not particularly dependent upon funding from the State of North Carolina. However, as a private institution we tend to be much more dependent than are most public institutions upon funding provided through our endowment and annual giving. In 2011 the value of our endowment was over $5.7B but that number represented a substantial recovery from its value in 2009 when the economic downturn of 2008 decreased the endowment value to under $4.5B, almost 30% less than its value the year before. In response to the decrease in this major source of funding, the university instituted cost-saving measures that ultimately equaled $125M annually. Because some of the personnel affected by these measures were associated with research administration, these measures did affect the research enterprise to some extent.

- **How does your university work with industry in terms of research conduct and application? What challenges does your university face in building and maintaining partnerships with industry?**

As noted previously, Duke University has consistently ranked #1 in industry funding in the annual NSF listing of Academic Research and Development Expenditures. In FY2009 industry-funded research at Duke was over $180M. It is important to reiterate that a large percentage of those monies (well over $120M in 2009) are associated with the very successful Duke Clinical Research Institute (DCRI) which was among the first and remains among the most successful academic contract research organizations (CRO) in the country for conducting clinical trials. Given the focused and structured nature of running a clinical trial, DCRI long ago developed a standard contract that works well for most of the organizations, particularly for-profit companies, that request its services. For that reason, there usually are minimal difficulties encountered in putting together a contract that can be agreed upon by both parties and that helps make DCRI the very successful organization it has become.

Duke University has also devoted considerable effort in recent years to enhance its interactions with private industry outside of DCRI. The university currently views private industry as a potential source of new funding for research if the expected losses of federal research support come to pass. Independent of DCRI, the Duke School of Medicine, much like other schools of medicine around the country have frequent interactions with industry, many of which include funding research studies either solely at Duke or in collaboration with

the industrial partner. This area of funding has increased for Duke, as it has for other universities, in recent years since the movement over the past decade or so of many pharmaceutical firms out of the large-scale basic research business.

Outside of the biomedical research arena, efforts to connect with industry within Duke's Pratt School of Engineering have also met with some degree of success; the volume of industry-funded research at the school has grown consistently in recent years. Here however is where we have run into the most difficulty trying to develop research agreements that are acceptable to both parties. It is important to note that the majority of contracts that Duke negotiates with industry are developed with relatively little difficulty or contention. However, in osme cases, negotiating a successful research contract can take many months, something that faculty in particular can find very frustrating. Most frequently the difficulties arise with some companies that raise issues, often associated with intellectual property (IP) rights, which we cannot accept. Negotiating around these can take months or even become deal-stoppers altogether.

The notion of a standardized contract or form that we can make available to a potential industrial collaborator up front on a kind of "take it or leave it" basis has been raised frequently as a way of avoiding back and forth negotiations for months on end. While this idea sounds good on the surface of it, our finding is that many of the non-medical contracts we negotiate with industries are unique to the particular company at issue and even if Step #1 were for Duke to given the company a standard form to take or leave, Step #2 would almost certainly involve negotiating changes in the standard contract that would be acceptable to the company (i.e., more or less what is done now).

Another issue related to industry funding of Duke research is that many companies balk at paying Duke's federally negotiated indirect cost rate of 57%. Because even that rate represents a value less than the actual indirect costs we incur, were Duke's research portfolio to become too heavily populated with industrial support, we would be subsidizing our research efforts to an even greater extent than we do already. So while we will continue to work to develop industrial funding of Duke research, we have to remain cognizant of getting that research funded in full, to the extent possible.

Finally when comparing research funding by federal agencies with that of industry, most companies turn to universities to get research carried out that they want to know the answer to but they cannot undertake themselves. Conversely, the ability to fund a research project over an extended period of time - i.e., so long as new results continue to appear – is one of the constructive hallmarks of NIH- or NSF-funded projects. Projects at these two agencies lasting 8 to 10 years are not uncommon. With industry-funded research, they are more generally looking to get a specific question answered, basic in nature though it may be and are not necessarily interested in funding a project long-term with the goal of seeing where it goes or hoping that something good will come out of it. This makes industry-supported research more short-term in nature and, as a result, less amenable to long-term planning from

the standpoint of the individual investigator who has to think about the support of students, postdocs and/or technicians going forward.

- **What is the responsibility of the Nation's research universities in encouraging participation in scientific research and preparing a STEM literate workforce?**

Research universities are uniquely positioned to play a leadership role in preparing a workforce in the STEM (Science, Technology, Engineering and Mathematics) fields, particularly given their inherent integration of research and teaching. This is a priority area for Duke University and several national, state and local programs have been enacted to that end, often with federal support, to both encourage and improve STEM participation in the K-12 level and retain students who have chosen STEM majors once on campus.

Many of the STEM initiatives on campus are organized through Duke's Pratt School of Engineering's Engineering K-PhD Program. The primary goal of the K-PhD program is to increase significantly the number of children, particularly females and underrepresented groups, who choose to pursue science-related careers. Some of the initiatives focus on after-school programs in the K-12 arena. One example is TechXcite, a national engineering after-school program sponsored by NSF will feature a Duke-developed curriculum to be utilized by the national 4-H program. TechXcite offers hands-on, vibrant exploration of STEM through seven theme areas.

Duke has also partnered with the nationally-based Project Lead the Way (PLTW) and the North Carolina Department of Public Instruction to develop the North Carolina Project Lead the Way program. Project Lead the Way is a rigorous STEM curriculum geared for elementary, middle and high school students. The North Carolina PLTW reaches approximately 100 schools in the state, impacting more than 14,500 students and 193 teachers. In addition, Duke hosts summer programs and camps for students and training programs for teachers.

In 2004, the Duke University Medical Center partnered with the Durham Public Schools through the Duke-Durham Neighborhood Partnership to create the BOOST (Building Opportunities and Overtures in Science and Technology) Program. BOOST aims to encourage Durham students in grades 5 to12, particularly underrepresented minorities, girls and students from economically disadvantaged backgrounds, to get involved in science, medicine and related fields. The multidimensional program features summer camps, year-long projects, research summits and mentoring opportunities to attract and excite students about science.

Of course, the job doesn't end once students interested in a STEM major enroll in college, and Duke has worked to improve its own curriculum and provide other programs designed to keep these students interested in and excited about STEM. The Duke Smart Home Program began in 2003 as a student-run project and has developed into a "living laboratory" for students interested in energy efficient technologies or "smart" living. Projects allow students

to move ideas into proof of concept, development of prototypes and, finally, install-ready technologies. This program also provides an opportunity for students to interact with industry, through collaborative research, product testing and internship opportunities, to name a few.

In addition, Duke's Pratt School of Engineering has engaged in a restructuring of its curriculum in order to provide more opportunities for first and second-year students to participate in hands-on, project-based activities, something that was previously reserved for third and four-year students.

- **What novel programs, practices, and organizational processes is your university employing to encourage innovation and American competitiveness?**

Oversight and coordination of innovation and entrepreneurship at Duke is housed administratively within an organization, Duke Innovation and Entrepreneurship (Duke I&E) Duke I&E is committed to: 1) building a community and fostering a culture at Duke that supports innovation and entrepreneurship; 2) creating resources and infrastructure to support faculty, students and alumni in ideation, planning and launching of new enterprises; and 3) celebrating Duke entrepreneurs who are addressing the world's problems through the creation of new ventures. Through Duke I&E efforts to promote innovation and entrepreneurship permeate all levels of campus activity from formal academic programs for undergraduates, graduates, and professional students to informal working groups to competitions open to entrepreneurs of all types. A brief overview of some of the programs available is presented below.

Duke has a wide array of academic programs, at both the graduate and undergraduate level that focus on entrepreneurship. Many of these programs are located, not surprisingly, in Duke's Fuqua School of Business. Among these Fuqua programs are: 1) the Program for Entrepreneurs (P4E) which assists entrepreneurs in launching new business and social ventures. It leverages Fuqua's academic research, courses and broad community of practitioners to work with entrepreneurs to define, plan, establish, and finance new ventures; 2) the Center for the Advancement of Social Entrepreneurship which is a research and education center that promotes the entrepreneurial pursuit of social impact through the thoughtful adaptation of business expertise; and 3) Invention-to-Application which is a year-long, experiential class for MBA, graduate biomedical engineering, engineering management, medical, and medical basic science students designed to integrate and expand their prior learning and draw on the experiences of teammates in order to understand and screen a group of real-world research projects based on their commercial potential.

Another academic program is housed within the Duke Law School. The Law and Entrepreneurship LLM Program operates at the intersection of the legal and business ends of new ventures and provides a valuable foundation for lawyers who plan to be involved with innovative ventures after graduation, either as advisers, executives, or CEOs.

There are many ways for students to get involved with entrepreneurship at Duke outside of the classroom setting. Graduate and undergraduate students can choose from a variety of student clubs and living groups. There are several networking opportunities for students, faculty and alumni – including interest groups for social entrepreneurship, mobile applications, biotechnology and many more. The annual Duke Start-Up Challenge (founded in 1999) is open to all Duke students to compete for seed funding for their enterprise. The competition has seven independent "tracks", including undergraduate team, social venture, life sciences, and women-led teams.

Research commercialization is the process of bringing research discoveries to market, so that they have a practical impact on people's lives. The Duke Office of Licensing & Ventures (OLV) is responsible for patents and technology licenses for Duke University and is the first stop for a faculty member or new venture team looking to commercialize technologies initially developed on campus. OLV is composed of a team of invention managers who have expertise in licensing, business development, marketing, and legal matters. The office reviews incoming invention disclosures and works within its investor network to identify startup opportunities and to create new companies.

There is also a number of specific funding and development support programs at Duke focused on particular areas of technology that are designed to assist new venture teams in navigating their technology through the commercialization process. These include: 1) the Duke-Coulter Translational Partnership Grant Program which is designed to accelerate the development of promising biomedical research programs that address important unmet clinical needs; 2) the Duke Translational Research Institute whose mission is to rapidly and effectively invent, develop, and test new drugs, diagnostics, and devices for human use; 3) the Biomarker Factory which is a company co-owned by Duke University and LabCorp that funds and manages the development and commercial launch of clinical diagnostics; 4) the Blackstone Entrepreneurs Network which presents a unique approach to accelerating the growth trajectory of promising start-ups in the Research Triangle Park. The Network reflects an unprecedented collaboration between the region's major universities, including Duke, UNC-Chapel Hill, NC State University, and NC Central University, the region's entrepreneurial community, and the private sector.

For Duke students considering starting a new venture or joining an early venture that does not necessarily involve Duke intellectual property? There are a variety of programs to help them get started and assist them as the venture develops. These include: 1) the previously mentioned Duke Start-Up Challenge which encourages students to plan and launch their own businesses, receiving feedback from experienced professionals and a chance to win seed capital; 2) the Program for Entrepreneurs (P4E) which lets Duke students receive course credit for work towards starting a company. Students with projects can attempt to join the program by pitching their ideas at an Idea Pitch Event; and 3) DUHatch, which has a primary focus of assisting student entrepreneurs in creating viable business ventures.

- **In light of the release of the National Academies report, *Research Universities and the Future of America*, please comment on the strengths and weaknesses of the recommendations.**

  Before addressing the specific recommendations, we should note that Duke University strongly endorses the three broad goals underlying the ten recommended actions. Those goals include the need to: 1) revitalize the partnership among universities, federal and state governments, philanthropy and the business community; 2) undertake actions that will streamline and improve research productivity at research universities; and 3) implement measures to ensure the pipeline of future talent in the STEM fields. It is essential to the future economic health and vitality of the nation that ways be found to successfully address these issues as the nation finds itself operating in an increasingly competitive world in which many of the comparative scientific and technological advantages the United States maintained in the past are no longer as significant or, in some cases, even present.

  Recommendation #1
  We stand fully behind the need for the federal government to adopt stable policies and practices for university performed research and development (R&D). This same notion underpinned the philosophy behind the Morrill Act of 1862 which initiated the partnership between the federal government and the nation's nascent university system. A primary driver of the Morrill Act was to foster research that would provide the United States a continual source of new technologies which would, in turn, allow the country to maintain a comparative advantage in an increasingly technologically competitive world. The need for the United States to maintain this scientific and technological advantage is even more critical today and the call encompassed in this NRC report to reexamine and renew that partnership could not be timelier.

  The call to raise national R&D funding to 3% of the gross domestic product and to provide full funding for the America COMPETES act, while not inherently unreasonable is probably a little unrealistic in the near-term in light of current fiscal realities facing the country. We firmly believe the principle of achieving an agreed upon level of national support for R&D is a conversation that should be undertaken but more realistically any implementation should be deferred until we get federal budgeting on more fiscally solid ground and the economy has gotten out of its current doldrums.

  Recommendation #2
  This recommendation is aimed at state-supported universities, of which Duke University is not one. However, we are supportive of the principles that underlay this recommendation. As one of the primary university players in the Research Triangle we have myriad interactions and collaborations with our near-by, state-supported, research universities and when they suffer we do feel that pain. We will leave elucidating the details of this recommendation to the three state institutions participating in this hearing.

Recommendation #3
Strengthening the relationship between universities and private industry needs to be a cornerstone of any national policy designed to strengthen America's research universities. As one of the three major research universities located in the Research Triangle we have seen the advantages to be gained from a 50-year partnership that includes research universities, state and federal governments, and private industry. The result is arguably one of the top research environments in the country, if not the world, particularly in the area of biotechnology. The nurturing environment provided in North Carolina has led directly to the appearance in the area of the R&D arms of many established companies and innumerable start-ups. Many of these start-up firms are derived from technologies that were originally generated as basic discoveries at the area's universities and were supported by federal and state funding.

Looking more specifically at the suggestions for implementation, we are supportive of measures that will strengthen the linkage between research universities and private industry and/or other research institutions (e.g., DOE national laboratories). However in this case, several of the suggestions in the report for implementation of Recommendation #3 are generally lacking in detail for accomplishing things that in several cases have been discussed by the vested parties (i.e., universities, industry, national laboratories, etc.) for years on end without clear resolution. Additionally, while we welcome any resources that support federal research, direct resources to support research via grants and specific programs are more preferable to our mind than most incentives provided through the tax code. In addition, it has been our observation that when most companies express an interest in funding research at Duke, they are not motivated to collaborate with us primarily because of the tax benefits (although one presumes they do not mind them). They generally want to collaborate with Duke because there is something they want done that they feel a Duke faculty member can provide for them.

Recommendation #4
At Duke University, we are very supportive of finding ways to increase research cost-effectiveness and productivity and see this as a constant driving force in our operations. As noted earlier in this testimony, in response to the 2008 economic downturn, the university was able to cut $125M per year from its annual budget. With respect to research we have an ongoing program to enhance research administration across the entire university, primarily through the increased application of advanced information technology within the grants administration structure.

We very much support the call for greater interaction among research institutions and would reiterate that a considerable amount of cooperation currently goes on among institutions within the Research Triangle. There are many examples. The libraries of the three major research universities have long been linked through the Triangle Library Network (TLN) which does a lot to bring down costs that would otherwise be associated with maintaining scientific journals and many books at more than one site. Nuclear physics in the area has long been linked through the presence of the Triangle Universities Nuclear Laboratory

(TUNL). This DOE-sponsored accelerator provides a very cost effective approach to maintaining nuclear physics programs at the three area universities. Talks are now underway among the three research universities regarding sharing a single major data storage facility among the three universities to save on the costs associated with this ever-burgeoning component of all of our research enterprises.

So while this recommendation is very much on target, it also represents a principle of operation that is already familiar to Duke, and most other research universities that we interact with, and recommends a goal we are continually striving to achieve. We also strongly support the implementation suggestion that research universities do a more effective job of better educating key audiences about the character of research universities and their importance to achieving state and national goals.

Recommendation #5
We are of the opinion that given the many fiscal issues currently facing the federal budget, coupled with the tenuous state of the nation's economic recovery, now is probably not the time to be discussing the possibility of establishing a new program of this magnitude (however laudable the goals that stand behind it). Serious discussion of this recommendation should probably be put on hold until the federal budget has achieved a more sound footing and the economy is back on a more positive track.

Recommendation #6
This recommendation addresses a relatively contentious issue, covering the full indirect costs (F&A) of research on federal grants and contracts. The many issues involved here are frankly too complex to be address with the simple recommendation that all indirect costs be covered, especially on a basis that no new costs be incurred by the federal government. This issue itself is also currently being considered by the OMB Task Force that is looking into streamlining a number of issues associated with federally-funded research. At this point, it is probably best to let that process run its course.

Recommendation #7
It is difficult not to be in favor of a recommendation to reduce regulations that increase administrative costs and are seen as impeding research productivity without improving the research environment. That is like apple pie on its surface. It is also the case that Duke University, like all research universities, wants to be seen as a good steward of taxpayers' dollars. However, as noted previously in this testimony, we have seen something of a tsunami in new regulations over the past decade or so at a considerable net cost to universities. Some of these new regulations seem to have only marginal, or even negative, effects on research oversight.

For example, as per federal statute (i.e., Bayh-Dole Act) we are cognizant of the need to transfer our basic science discoveries into commercial practice as efficiently and rapidly as possible. However, technology transfer is a complex process that is fraught with tripwires and there are many places where current regulations can hinder those efforts. One notable

example is Conflict of Interest regulations that are making it increasingly difficult for university inventors to remain fully engaged in moving their basic discoveries into the development stage on their way to commercialization because they judged to be too conflicted by current conflict of interest regulations. This is problematic because the inventors are the very people (from a technical standpoint) who should be most intimately involved at this stage of IP development and current conflict of interest guidelines can often serve to marginalize that involvement.

That having been said, the suggestions for implementation of this recommendation, to review current regulations to try and eliminate redundant and ineffective regulations and to make regulations more consistent across federal agencies, both are very reasonable things to do at a limited cost. Such an effort could lead to marked savings in terms of both dollars to the government and enhancements in research productivity.

Recommendation #8
We strongly support this general recommendation to improve graduate education programs in the U.S. with the goal of attracting larger numbers of brighter students into STEM graduate studies. Particularly pertinent among the implementation recommendations is the goal of making graduate students more aware of an expanded range of opportunities for the use of a graduate degree beyond the academy. Many such educational activities are currently taking place within graduate schools across the country and by scientific professional societies, but more needs to be done in the future to make STEM graduate education a more appealing option for K-16 students.

Recommendations #9 and #10
We strongly endorse the general tenor of both these recommendations, the first of which (#9) calls for improving the number and diversity of students in the STEM pipeline by reaching out to all levels of the education system and taking specific steps to improve access to women and underrepresented minorities .

Given the worldwide competition for students educated in STEM areas, the ability of the United States to attract foreign students trained in STEM subjects will be critical for allowing this country to maintain a competitive edge in science and technology in the future. To that end, the recommendation (#10) to streamline the process by which international students who want to study in the United States can obtain visas and doctoral students who obtain their degrees in this country can be allowed to remain here seems well justified and, within the constraints of national security considerations, worthy of relatively expeditious implementation.

Recommendation #11
While clearly not a committee recommendation per se, the overarching tenor of this NRC report and the development of our own testimony for this hearing led us to wonder whether another potential outcome of this reassessment of the partnership between research universities and the federal government might not be a call for a formal look at the country's

research portfolio in light of the strategic research needs of the country going forward. In essence, does the current distribution of federal support for basic research align, or not, with where technology will most need to be advanced in the future if the country is to maintain its competitive science and technological edge.

This suggestion could be seen as running afoul of those who feel this leads to the federal government placing bets on the future, something it should not be doing. The fact is we are already doing that with our current distribution of support for research and all this suggestion says is that it might behoove us to take a more strategic look at whether the research we currently support and the technology we will need going forward align to any extent or not.

Thank you for your time and for your attention to this important issue.

Chairman BROOKS. Thank you, Mr. Siedow.

I want to thank the panel for their testimony, reminding Members that Committee rules limit questioning to five minutes.

The Chair at this point will open the round of questions. Normally, the Chair would recognize himself first, but in this instance, I am going to exercise the Chair's prerogative and recognize a superior Chair, Ralph Hall from the great State of Texas.

Mr. Hall, you are recognized.

Chairman HALL. With that description, I am not sure you have recognized the right guy but I thank you for it. And I thank you for being a Chairman that recognizes the importance, as this full room indicates, of the subject matter that we are talking about today. As a matter of fact, Mr. Chairman, some three or four years ago, back—to be exact—June 22, 2009, Bart Gordon, who chaired Science, Space, and Technology for eight years and was a wonderful Chairman, an unusual Democrat, and I was the Ranking Member at that time. There were two Senators—Barbara Mikulski and Lamar Alexander—that signed this letter on June 22, 2009, addressed to Dr. Ralph Cicerone, President of the National Academy of Sciences; and Dr. Charles M. Vest, President of National Academy of Engineering; Dr. Harvey V. Fineberg, President, Institute of Medicine. They may be in the audience, some of them; I am not sure, but they certainly know about this hearing.

And we wrote to them asking, what are the top 10 actions that Congress, State governments, research universities, and others could take to assure the ability of the American research university to maintain the excellence in research and doctoral education needed to help the United States compete, prosper, and achieve national goals for health, energy, and environment and security in the global community of this 21st century? That was our letter. Unlike the problem Darrell Issa is having of getting any letters out of the Attorney General, they answered back quickly and their answer was this: "Research Universities and the Future of America," the summary there, the 10 breakthroughs and one by one took them as they were asked.

And I have—really the question I want to ask Mr. Holliday—Dr. Holliday but I want to ask Dr. Seemann first. In your testimony you stated that "each research university must leverage its respective assets and capacities to pursue those challenge areas that best fit their strengths and then aggressively adjust investments and priorities around their home field advantage." How has Texas A&M identified those assets and how have they handled those capacities?

Dr. SEEMANN. Well, thank you for the question and let me also commend you for your vision in asking the National Academy to deliver this report. And let me also promise you that I will look closely after your family at Texas A&M University.

Chairman HALL. Just so she passes.

Dr. SEEMANN. As we say in Texas, yes, sir.

Texas A&M was born as a great institution of agriculture and engineering and absolutely remains so and we have continued to grow on those strengths. More recently, we have begun to focus on the 21st century, I think the century that is increasingly about biology and the life sciences and begun to parallel developments in that arena. And over the past six to seven years, the State of Texas

has made important and critical infrastructure investments in this arena in very state-of-the-art facilities for preclinical studies, for genomic medicine, and most recently, for a national center for therapeutics manufacturing that have built on much of our capacity.

And that was rewarded, as you may know, last week in Texas by the announcement of a $285 million award from Health and Human Services Biomedical Advanced Research and Development Authority to do development and production of vaccines for emerging medical threats, including pandemic flu and bioterror potentials. And again, that has come from our institution recognizing what its strengths are, recognizing where the opportunities are down the road—and particularly in the biomedical and life sciences—putting in place in partnership with the Federal Government, in partnership with the State the necessary infrastructure to support this success. And again, last week in Texas was a great day for Texas and Texas A&M with this very large award that we think will continue to move us forward.

Chairman HALL. I thank you. I only have about 20 seconds left so I won't get to ask Mr. Holliday his question about the outlook for federal and State funding over the next seven years and how sometimes they glossed over some fiscal constraints that you have to take into consideration.

And my time is up. I yield back, but Mr. Holliday, I probably will send you something by letter, appreciate if you will answer it.

And Mr. Chairman, thank you very much for being generous and letting me go ahead with my interrogation. And I am still concerned about my granddaughter because I know my scholastic record—one time I made four Fs and a D and my dad punished me for spending too much time in one subject. I am not sure that she didn't get a little of that from me.

I yield back.

Chairman BROOKS. Thank you, Mr. Chairman. Know that I will defer to your wisdom any time, you just let me know.

I want to talk a little bit about our country's financial circumstances, and then I am going to follow that up with a question. Just to reiterate where we are, in November we blew through the $15 trillion debt mark. Sometime this year, we are going to blow through the $16 trillion debt mark. We have had three consecutive trillion-dollar deficits—$1.4 trillion, $1.3 trillion, $1.3 trillion. We are in our fourth year of what is likely to be a trillion-dollar deficit. What is the impact of all this? Well, two fiscal years ago our debt service cost was $196 billion. This past fiscal year that ended September 30, our debt service cost was $221 billion, which means that we had an increase of $25 billion in a one-year period of time. What does that mean? Well, that is more than the entire NASA budget, one year. And we have lost that for future generations where those funds are no longer available for endeavors of a NASA-size quantity.

We have got a lot of competing demands for Federal Government monies. We have got the programs that you all have brought out. We have got national defense. We have got all sorts of wealth transfer programs—food stamps, government housing, you name it. We have possibilities of significant tax increases, but to be quite

frank with you, to balance the budget would require more than a doubling of the income tax rates now being paid by all Americans who pay income taxes. And for those of you with an economic background, you can imagine the adverse effects that would have on our economy, the job losses and whether we would actually have an increase in revenue or a decrease in revenue is an open question.

So with that situation in hand, I am concerned about the report recommendation—particularly the Strategic Investment Program; that is item number five—along with some of the other recommendations and whether they are consistent with the outlook for federal and State funding over the next several years. Please expand on how the study committee considered the current fiscal environment in its deliberations. Further, I am concerned that recommendations for the creation of a new program—and that is the Strategic Investment Program, number five, that asks for another $7 billion per year—and covering the full cost of research don't take into account the Nation's true economic situation.

What are your thoughts on this? I understand how what you do is productive, but if we are going to come up with an additional $7 billion per year, where do you suggest it come from? Or how do you suggest we prioritize? That seems to be the task that Congress is faced with, properly prioritizing how our funds are spent.

Mr. Holliday, if you will go first but then we will just work our way down the panel.

Mr. HOLLIDAY. Thank you, Chairman Brooks.

Excellent point. We discussed that at great length in our committee. As we stressed in the committee, we believe it will take time to fully fund these programs. But we believe—in response to your question about where it comes from is we should focus on the things we can control today. Many members of this panel have talked about the regulations that we believe are choking down our universities. In the report, we show three examples of universities that have found the ways to save $60 to $75 million per year by looking at their own backbone operations, not the research itself but the support systems. And we believe those should be implemented.

Urging companies to partner with universities is a step in the right direction. A simple example from the University of Tennessee and DuPont—we both were working on next-generation biofuels. DuPont and University of Tennessee decided to pool together. It would be much more effective and cut through costs. I think if we put the framework in place where in the short term we can do much more of that.

If I could close with the question, though, is it is very important as you are considering deployment of funds to look at what are investments and what are costs? And we truly believe these are investments that get paid back multiple times—not immediately, but over time, to the country.

Chairman BROOKS. Dr. Mason, again, if there is any ammunition you can give me in this debate that we are likely to have in the halls of Congress, very much appreciate it.

Dr. MASON. Yes, Chairman Brooks. From a fiscal point of view in our State of Alabama and at Auburn University, cuts are very real. We have to make very clear decisions. I will assure you we

have had to understand with no new monies are coming in what do we do? We have made decisions at the local level as the Nation will have to what will we need to stop doing in order to do other things?

On the other hand, we tried to align our capabilities and our facilities with what we looked at national strategic areas. One of those is in the cybersecurity area. By sharing our research facilities with the private sector, with the federal agencies, with State agencies, and various forms of the private sector, we have been able to pool funding at a certain level to accomplish and create some new opportunities and job creation.

So my point is the reality is it may not be where all new revenues come from, but I do support the idea of the partnering among—across all areas.

Chairman BROOKS. Thank you, Dr. Mason.

Dr. Seemann.

Dr. SEEMANN. Yes, thank you.

I remind you what you know about—much better than I—about the federal budget and that is we exist as successes that we have talked about today, the innovation that comes from American universities in a sense is funded through the Federal Government out of that very small part of the budget, the discretionary part that is left over when all the big things are funded. So I remind you that from that little bit that is there come future cures for cancer, come solutions to our energy challenges, come answers to our climate change dilemmas, et cetera, et cetera. So at least holding onto the investments that you are making—and thank you for making them—I think are critical down the road for this country to continue to see the extraordinary contributions in the future that we have seen in the past.

But I would say as I said in my remarks, there are responsibilities in both—on both sides, the government and the universities. The first is to focus, is to pick and choose what it is we want to invest in and what we are going to let stand aside for a moment, what we are not going to invest in. And that is often one of the most difficult discussions both in government and at universities as to what we will do and what we won't do.

Secondly, again, on both sides—as I emphasized and as Mr. Holliday said—I still think there is a great deal of room left for efficiencies. Universities are working every day to be more efficient with the resources that you give us, but we think we can be more efficient.

On the other side, the regulatory burdens that are placed on us that we think are above and beyond are extraordinary costly to our universities and they directly take dollars away from supporting research itself. They take away dollars from working on cures for cancer. They take away dollars for finding energy solutions. They create burdens on our faculty that may consume up to 40 percent of a faculty member's time in non-research functions because of that. And that is really not what we want our best and brightest minds working on.

Chairman BROOKS. Thank you, Dr. Seemann. I am in wholehearted agreement.

Dr. Tolbert.

Dr. TOLBERT. Thank you, Chairman Brooks.

I would echo everything that my colleagues have said and simply add to what Dr. Seemann just said that in fact this regulatory burden is growing, and it has an impact on federal spending and university spending. We feel across the universities that internally we must continue to find efficiencies in the way we respond to regulatory oversight in the use of taxpayer funds, but also that we would like to be partners in developing rational policy that will streamline federal regulations. I can think of a couple of areas. One would be in export controls where there are redundancies and actually inconsistencies in—among some of the regulations. They are extremely important regulations. The easier they are to follow, the clearer they are, the less work it will take and the better job we will do at the universities and also on the federal side in assuring accountability. That would be one.

Another place would be effort reporting as a very specific example of something where we do sort of a whole separate shadow system of following effort on research grants that is probably not necessary and would be a place where we could find efficiencies.

Chairman BROOKS. Thank you, Dr. Tolbert.

Dr. Siedow.

Dr. SIEDOW. Thank you, Chairman Brooks.

We may have reached that point where everything that needs to be said has been said but not everybody said it, so I will just reiterate a couple of points that have been made, because I think they are fairly critical. One is not everything in this report can clearly be implemented in the near term. And there are some fiscal realities which you have pointed out which I absolutely agree with that mean we are going to have to think—the strategic program that they suggested may well have to be thought down the road when our economic and fiscal house is in better order. I think the suggestion is still good; it is just not viable at this point.

I would just—boy, let me hammer home. If you want to get—if you want to look at where we can get efficiencies or make strides right now, regulations are just burying us and we really do need to—as I think was recommended—it wouldn't be that costly to take a very hard look at the regulations now and see where we can streamline some of those.

Just to bring up an example that hasn't been brought up, I am really concerned at Duke at how the conflict-of-interest regulations are running right up against orthogonal to our attempts to technology transfer. I mean we talk about—again, we talked about speeding up the rate at which technologies get incorporated from the basic discoveries into application where that second step we are just—we are getting—we are running into potholes because the conflict-of-interest rules are taking the very professors who should be taking that next step out of the picture or at least marginalizing them to some extent.

Again, collaborations be it with industry, be it with other universities, I think many people in this room would be surprised at how much Duke and the University of North Carolina collaborate on a regular basis, particularly in the biomedical realm. Collaborations are just an excellent way to achieve efficiencies. I could go on. The list is quite long but I think there are—I guess the bottom line is

I think there are plenty of things in this—the NRC report where they have recommendations that in fact would not—would either cost much or might not even cost much of anything at all that need to be looked at very carefully in the near term.

Chairman BROOKS. Thank you, Dr. Siedow.

At this point I would like to thank Mr. Lipinski. It is abnormal for two Republicans to go back-to-back, but he and I discussed it and he was gracious enough to allow the Chairman of the Science, Space, and Technology Committee to go first followed by the Chairman of this Subcommittee.

And Mr. Lipinski, as you engage in your Q and A, I am not often liberal, but I will be likewise liberal and generous with your time as you ask questions and seek responses.

Mr. LIPINSKI. Thank you, Mr. Chairman. And I do have a lot of things that I want to explore with the panel, so I appreciate that.

So many things, trying to figure out where to start. First thing I think I just want to quickly make it clear for everybody the situation that public universities are in right now. I think, as Mr. Holliday said, the public universities are on thin ice right now. Dr. Tolbert, what is the percentage—can you tell us again what the percentage is of funding at the University of Arizona that comes directly from the State?

Ms. TOLBERT. Our current level of funding in the—is in the 20 percent range. It has fallen 40 percent in just the last few years.

Mr. LIPINSKI. And I don't know if Dr. Mason or Dr. Seemann can tell us anything about their universities, what percent comes from the State. Do you know?

Dr. MASON. Congressman Lipinski, I don't know the percentage but in the—I can do it in a different fashion, if you would allow me. I arrived at Auburn in '08 and since '08 from an $800 million appropriation, over $125 million, I believe, has been reduced. So, you know, whether that is a proportion of the entire university budget, but the implication of that is profound.

Mr. LIPINSKI. Dr. Seemann, do you have any——

Dr. SEEMANN. I am not—it is around the number at the University of Arizona. I came three years ago from the University of Rhode Island, and during my tenure there, that—the percentage of State support slipped below 10 percent. And I know there are a number of universities that are down at that end of the percentages of State support.

Mr. LIPINSKI. Well, I was going to say Dr. Tolbert is doing relatively well there at the University of Arizona, from what I hear. And I hear more along the lines in the State of Illinois down closer to what Dr. Seemann is talking about, 10 percent. So I just want—I don't think most people in this country understand how—they still see State universities and they think that there is a large percentage of the money for those universities that is actually coming directly from the State. So I just wanted to make that point.

Commercialization of university research, I think, is critically important here. We are investing a lot—the Federal Government is investing a lot, taxpayers are investing a lot in research at our universities across the country, and I think more needs to be done to—in commercialization. Is there anything specifically that anyone can

talk about that their universities are doing to help with commercialization? I will start with Dr. Siedow.

Dr. SIEDOW. We have—actually, you can go onto the Website. Actually, if you look in my written commentary, I actually pointed out we have an innovation and entrepreneurship program that basically tries to coordinate entrepreneurship across campus. And there we have the Duke Fuqua School of Business, the School of Law, the Medical School are all participants in any number—and when I say any number, the number is about—I think there are 12 different programs that I counted up when I was putting together the written testimony—that are various programs that are designed to either educate entrepreneurs or, in many instances, take actual IP and—as a part of the course—develop that IP and to try and move it downstream as it goes along. So we are—we really have—our strategic plan of several years ago focused on technology transfer and translation of our basic discoveries into application as one of our strategic goals. And we have worked very hard to bring that about. And again, if you look in my written testimony, there is a fairly good list of what we are doing and I think it is fairly impressive.

Mr. LIPINSKI. Anyone else like to comment what their universities are doing? Dr. Tolbert.

Dr. TOLBERT. Thank you, Chairman—sorry, Ranking Member Lipinski.

At the University of Arizona, we are changing the way we do technology commercialization, because we have not been as efficient and effective as we know we could be. One of the things we have done is to take a new dean of our business college, our College of Management, and give him strong control over the new direction we are taking with something we call Tech Launch Arizona. We have a top-ranked entrepreneurship program, and we are increasingly bringing the students and the faculty into that pipeline from basic research through to technology commercialization. We are bringing under one umbrella the functions of technology transfer and business incubation and movement into our technology park so that we can have an easier handoff. To the faculty member who is an innovator and an entrepreneur, it will be an easier process than it has been in the past.

And then finally, I would say we know that we are going to have to raise philanthropic funds to help us through—I think it was my colleague to the left who talked about a valley of death. There are several valleys of death for new intellectual property, and we can't raise those funds any way except to go out to the private sector and the philanthropic community to help us generate a fund that eventually we expect will be evergreen.

Dr. SEEMANN. And Texas A&M is doing all the same things that our peers are, but I would like to use the question to—in this arena to make a point about the relationship between research at universities and education and that they are not two separate things at our institutions, but rather they are inextricably linked even in this arena. It is critical that we teach our young people and our students about what it means and what has to happen to develop, commercialize, market technologies, create new companies, and I am very proud to say that my office, in this past year, in collabora-

tion with our Mays School of Business, has created a student innovation accelerator bringing some extraordinarily bright students of Texas A&M in partnership with faculties and ideas to create for them a place, an opportunity, the resources to begin thinking about how this happens and in fact probably, if it works like I want, seeing the next Facebook come out of a small investment in putting our students in that kind of environment.

Mr. LIPINSKI. I think that is a good point that this is all—we talk about commercialization; it's often lost that what we are talking about is education, educating students, educating faculty on how to commercialize, how to be entrepreneurs. So that is still all part of education. So if Dr. Mason—you don't have to add anything but if you have anything, go ahead.

Dr. MASON. Well, I am an academic so I have to add something but I will be very, very brief——

Mr. LIPINSKI. I understand that.

Dr. MASON [continuing]. And I appreciate the Chairman's allowance. Just two comments in transition, so in our incubator—that is what you will also see in many universities where we have student companies being formed, what better way than to take this intellectual knowledge right from the students, and the students are starting companies. These are investments that we are talking about. While they often are perceived as costs, but the fact is, imagine investing in our next generation in that manner.

Something even more specific, we are making transitions from what used to be referred to as technical licensing officers, a very regulatory type of approach. I oversee our 501(c)(3) technology foundation, and we now hire business development people who come from industry and also bring along with them the private sector investment portfolios and our contacts. So in response to the Chairman's question and to yours, literally, the private sector is also willing to invest. It is the partnership that we were looking for. So thank you very much for the amount of time.

Mr. LIPINSKI. And I wanted to—as people here have often heard me say—promote an NSF program called Innovation Corps that is teaching faculty members and teaming them up with faculty members, graduate students teaming up entrepreneurs and teaching them how to commercialize. And I think that we need to be doing more to sort of bring the best practices. From what you all have learned, that all of our universities have learned because a lot has been done in the past 20 years, especially in the last decade when we are talking about tech transfer, commercialization, and there are some different ways it is being done at different universities. And I think that we really need to collect all the best practices and—so that we—everyone learns from each other.

And the last thing I just want to say I think we could all agree up here in Congress to work on easing the regulatory burden, and I think that is something that we need to address further time in up here on Capitol Hill and making the changes that we can so that the Federal Government is not putting too many burdens on our universities.

Thank you very much. Mr. Chairman, I yield back.

Chairman BROOKS. Thank you, Mr. Lipinski.

I appreciate the patience of our two colleagues to my left. The Chair first recognizes Mr. Hultgren of the great State of Illinois.

Mr. HULTGREN. Thank you all for being here, so grateful for your time and your work. I am passionate about this subject and really do appreciate all that you have done.

So much of what you said really struck me. One thing right at the end of Dr. Siedow's testimony talked about almost as a—kind of a side comment but also maybe a challenge of looking at prioritization and how we actually are looking system-wide at basic scientific research and how we are spending money and are we doing it most effectively as we possibly could. I agree with that. I think we need to do that. I am frustrated being one of the new Members here in Congress feeling like we have very little vision as far as science policy goes for our Nation from the government, from our leadership and we need to change that. We need to be working with you and I want to be a part of that. I hope this—I know this Committee and Subcommittee will be part of that as well.

I think part of that discussion, though, has to be not just limited to basic scientific research but science and what should we be doing as a Federal Government? I think this is a really important discussion to have. I am privileged to have quite a few physicist constituents in my district who are much, much smarter than I am and they remind me of that often. But they are a wonderful help. And one of the things that they talk to me about and it just clicked with me is there is really two forms of science. There is Newtonian science and Edisonian science. Newtonian science really is basic scientific research. Why does something work and how are we going to discover new reasons why things work? And Edisonian science is how do we apply? How do we use what we know to make our lives better? Both are very, very important.

I absolutely am convinced that the private sector is very good at the Edisonian science, that if we are continuing to provide advancements in Newtonian science, private sector for the most part can step up and take the ball to the next part of applying it to make our lives better. But I am absolutely convinced that the private sector is not good at Newtonian science, that basic scientific research, and that is where we need our research universities to continue to step up, to continue to be funded, and I would say continue to work with our national laboratories. We haven't talked about that very much, but I think that is a key piece.

And I just feel like right now there is an attack against our national laboratories. I can't see it any other way where, again, many applied science line items are being increased 30 percent, 20 percent, and yet our national laboratories are being cut 10 percent, 15 percent. It is just—to me it is a misapplication of limited dollars that we have got where the private sector oftentimes can step in and do this applied science. No one other than universities, our national laboratories with the Federal Government's direction can really do this basic scientific research.

So I want to be a part of that discussion. We need your help. I think you are a really key resource in this along with our national laboratories to be able to do that.

One of the things I would challenge you all with—and I have talked to my own universities about this as well. I am privileged

to represent Fermilab and—so that is how I get my connection of all my brilliant physicists that I get to represent. But I am so proud of what they have done and the great work that they have done but also sense frustration from them right now of really getting the support that they need to do the great work that I know they can do moving us into the future. But I have encouraged them to continue to build the relationships with their research universities and have research universities reaching out to their Members of Congress and Members of the Senate to be talking about how important this is.

We all talk and believe in the importance of STEM education and getting young people interested in this, but we are not going to get them interested if there is not a place for them to be able to use that knowledge and education here in America. If they have got to go over to China afterwards to be able to use that or Russia or India or Europe, we have lost the battle.

And so I encourage you just to continue to be talking to your Members of Congress of how important this is. I have seen it very practically where there has been issues where I have tried to talk to one of my colleagues and say, hey, I need your help to sign on to this legislation. We don't get an answer. Finally, we will call a university in their district, university president calls this person. Five minutes later they are on our letter. So you have a power and I just encourage you to continue to use it. We need to hear from you of how important this is for current students at your universities, for your professors, for the research they are doing, but also for our K–12th graders who are interested in going into science and yet are saying maybe there is not a bright future for me in that and I will go somewhere else. No, we can't let that happen; it is too important. So I am getting up on a soapbox. I apologize for that.

But real quickly, in the last minute I have, one of the questions I had was brought up of regulation and the amount of time that is used dealing with regulation. And specifically wondered if one or two of you could maybe mention what reform could happen? What are some of the frustrations you have that is pulling you away from the research that could be done and some regulatory reform that we could be doing to free up our research universities to do the great work that they can do? Great, thank you.

Dr. TOLBERT. Congressman Hultgren, thank you for that question.

Between the two of us at this end of the table, we have suggested a couple of areas. There are many areas—I think this really deserves significant attention—many areas where we can imagine important efficiencies are available that will not decrease our accountability. We will be held accountable for spending the dollars correctly. One is conflict of interest, which you heard about from Dr. Siedow. And another one is effort reporting. It is an area that is too technical to go into in detail here but it—we really do have parallel shadow systems which is just really not necessary. It is not a good waste of time—it is a good waste of time.

Mr. HULTGREN. It is a waste of time.

Dr. TOLBERT. Excuse me. And then the other I would bring up again is export control. It is increasingly difficult. Dual use is an

important issue that has to be dealt with in great technical detail but, in fact, I think most universities have had to hire external legal counsel to help us interpret the ITAR—the International Trade in Arms Regulation—guidelines because they are virtually uninterpretable by us internally. And I think that that could be improved. Thank you.

Mr. HULTGREN. Thank you very much. Again, thank you all. If you have other suggestions and if it is okay if I can ask permission to follow up with you or my office to follow up with you on specifics of what we can do because we want to—I want to go after some of this. And again, we want accountability and I believe we can still have an accountable system without some of this crazy redundancy, without this waste of time, without a lot of things that are just outdated that just don't make sense any longer, new ways of doing something more efficiently.

My time is up so thank you so much. I will be following up with you if that is okay just to get other suggestions you might have.

I yield back.

Chairman BROOKS. Thank you, Mr. Hultgren.

At this point, the Chair recognizes the Chairman of our Space and Aeronautics Subcommittee, Mr. Palazzo from the great State of Mississippi.

Mr. PALAZZO. Thank you, Mr. Chairman.

Mr. Lipinski brought up some good points when he was talking about the commercialization and entrepreneurship and I think, Dr. Tolbert and Dr. Siedow, you pretty much covered those. But as a follow-up question—this was going to be for Mr. Holliday, so if you could just put your entrepreneurship caps back on—when the study committee was assessing the needs of our research universities, did you discover that most research campuses now have tech transfer offices? Or is it still a major impediment to moving research out of the labs? And also how about entrepreneurship programs like the ones Dr. Tolbert and Dr. Siedow mentioned in their testimony?

Mr. HOLLIDAY. Great question, sir.

Yes, universities have tech transfer offices, but they are not as efficient and effective as they should be. From my experience with DuPont, we actually deployed three of our best tech transfer people to go around and coach universities on how to do that. We put in place a net company that—where they could actually sell that from, so we think that is a very important place.

But what I would stress is if you start early on with partnering with entrepreneurs, partnering with businesses as they are developing the technology, then those routes to transfer it out become much more obvious and the technology is more fit for commercialization. Most discovery research at university is not ready to be commercialized. It still may take a year or two to be done so you have got to find the right partner to actually commercialize it, and that is what is critical.

Mr. PALAZZO. Thank you.

Dr. Mason, in your testimony you mentioned that Auburn's Space Research Institute was recently closed. What happened to the students, professors, and researchers who had been working at and through the Institute?

Dr. MASON. Yes, Congressman. When we all take on new jobs, you open a door and then you have to deal with what is behind the door. In that situation, we—the university had been trying to sustain the operations of that Space Research Institute. When I arrived there, the funding was not available through NASA and through others. Fortunately, over a four-year period we were able to, through attrition, some people were absorbed in other units, several of them went out and started some small companies, and then some of the facilities are now going to be shared with the University of Alabama at Huntsville. So in reality it was the productivity of trying to sustain something in separation from—so we primarily allocated to the locations that were best suited for trying to continue it.

But the fact is that no longer exists at that university, so if one were to stand up some new initiatives, one has to recognize that infrastructure and that personnel are not there. So whether it is my university or others, when we go through these cuts, that is what will happen. Things will have to be redeployed elsewhere. That will cause some inefficiencies to start them up again.

Mr. PALAZZO. Dr. Mason, that was well said.

Mr. Chairman, I yield back.

Chairman BROOKS. Thank you, Mr. Chairman.

At this point, I am going to close with one set of remarks. And I focused on recommendation number seven from your report, and it is one that the Committee and its witnesses have focused on extensively—reducing regulatory burdens. And it seems to me that to a large degree we have been talking at the 30,000-foot level, maybe even have gotten down to the 10,000-foot level, but as much as possible I would ask our witnesses and their colleagues to get into the weeds a little bit.

With respect to recommendation number seven, it says—and I am going to quote some particular parts—"federal policymakers and regulators and their state counterparts should review the costs and benefits of federal and state regulations eliminating those that are redundant, ineffective, inappropriately applied to the higher education sector, or that impose costs that outweigh the benefits to society. The Federal Government should also make regulations and reporting requirements more consistent across federal agencies that universities can maintain one system for all federal requirements rather than several thereby reducing costs. Reducing or eliminating regulations can reduce administrative costs, enhance productivity, and increase the agility of institutions."

If you would, I would appreciate it if you all could get some of your colleagues and yourselves to get into the weeds a little bit and identify specific regulations that you think that this Congress should be involved in the change of or the repeal of. Now, I would very much welcome that kind of in-the-weeds insight that you can share with us, this Committee, in written form. You can also address my congressional office in a written summary of the regulations that I am talking about with the C.F.R.'s. If you can identify them by number and section, that would be wonderful.

I was going to close my remarks at this point, but I see Dr. Siedow has his hand going up so if you would like to add a few re-

marks, inasmuch as I do have a degree from your university, I feel great deference.

Dr. SIEDOW. I appreciate taking advantage of that, and thank you for recognizing me.

I would just like to point out we can do that relatively easily. And point of fact, because last summer, in response to the OMB A–21 Task Force, they asked for examples of where we saw regulatory burdens, and we have actually—through the AAU, the auspices of AAU and COGR have actually developed a bunch—a whole list of in-the-weeds regulations that we think could use some help. So it will be a very easy thing for us to put together because we have done that within the past year.

Chairman BROOKS. Well, fantastic. If you could please communicate that list to the Subcommittee staff and to my office along with any justifications or reasonings, explanations as to why that particular provision needs to be changed or eliminated, I would very much welcome it. And I would love to be your champion with respect to overregulation by the Federal Government. I am familiar with the well-intentioned but sometimes counterproductive effect some of our regulators have in the Federal Government.

With that being the case, I want to thank the witnesses for their valuable testimony and the Members for their questions. In particular, I want to thank Mr. Lipinski for allowing the Chairman of the overall Committee, Mr. Hall, to go out of order.

The Members of the Subcommittee may have additional questions for the witnesses, and we will ask you to respond to those in writing. The record will remain open for two weeks for additional comments from Members.

The witnesses are excused and this hearing is adjourned.

[Whereupon, at 11:26 a.m., the Subcommittee was adjourned.]

ANSWERS TO POST-HEARING QUESTIONS

ANSWERS TO POST-HEARING QUESTIONS

Questions for the Record
The Honorable Mo Brooks

HOUSE COMMITTEE ON SCIENCE, SPACE, AND TECHNOLOGY
SUBCOMMITTEE ON RESEARCH AND SCIENCE EDUCATION

The Role of Research Universities in Securing America's Future Prosperity: Challenges and Expectations

Wednesday, June 27, 2012
10:00 a.m.

QUESTIONS FOR MR. HOLLIDAY:

1. In your testimony you noted that the study committee looked at the appropriate roles of universities, government, and business in the development of technology and its transfer to the marketplace. The Committee is very interested in ensuring the federal government maintains its responsibility for funding basic, fundamental research. However, there is often debate regarding the role of agencies like the National Science Foundation when it comes to funding more applied research. Did the study committee consider fiscal constraints on opening federal investment to more applied sciences? Did they consider the government's potential ability to pick winners and losers in funding more applied science? Did the study committee consider prioritizing basic over applied research? If any of the answers are yes, please explain.

Response from Mr. Holliday:
The study committee was cognizant of and robustly discussed the constraints of the current federal fiscal environment and, consequently, recommends both actions with little or no cost that could be taken in the short term and increased investments that should be made over time as the economy improves.

The committee was primarily interested in ensuring that the nation invested in a significant, stable, and sustainable way in university research. Our concern, in this regard, was the preservation of the capacity of university researchers to conduct the nation's basic research that leads to new knowledge, ideas, and innovations in the long-term. This focus, however, was not meant in any way to preclude federal investment, as appropriate, in applied research that is designed to meet national goals for security, health, energy, the environment, and more. It is critical that a portion of the federal science and technology investment portfolio, as distributed particularly through mission agencies other than NSF, is aligned with specific national goals.

2. In your testimony you noted that while industry has dismantled its large corporate research laboratories they have not yet fully partnered with research universities to fill the gap. What is stopping industry from moving forward on these types of partnerships? Why hasn't this happened organically?

Response from Mr. Holliday:
It is my belief, based on my experience with DuPont, that the largest firms understand the importance of partnering with research universities and already act on it. DuPont, for example, had a significant partnership with MIT to develop biotechnology for materials or industrial applications and another with the University of Tennessee for second generation biofuels. Companies like DuPont understand the value of such partnership and are large enough to have the contacts and take the risk.

Incentives are nonetheless important, particularly for bringing more moderate size (perhaps $2-6 billion in sales) firms into early-stage research partnerships with university researchers. The payoff–that is, the return on investment—for the taxpayer is innovation that leads to US-located economic activity and jobs which should be a condition of the federal investment.

3. The second recommendation in the National Academies report suggests "state governments should move rapidly to provide their public research universities with sufficient autonomy and agility to navigate an extended period with limited state support." Please describe the findings or examples of lack of autonomy that led to this finding? Did the study committee have any examples of states where governments had offered more autonomy? What are the results from the increased agility and autonomy?

Response from Mr. Holliday:
Today the most powerful forces driving change in higher education come from the marketplace, driven by new societal needs, the limited availability of resources, rapidly evolving technologies, and the emergence of new competitors such as for-profit ventures. Clearly, in such a rapidly changing environment, agility and adaptability become important attributes of successful institutions. Yet, even as state support has declined, the effort to regulate universities and hold them accountable has increased. To some degree, this is evidence of governments attempting to retain control over the sector through regulation even as their financial control has waned, since state support has dropped below 10% to 20% of operating revenues in many public research universities.

In fact, today most public research universities can rightly argue that the primary challenge for them is that they are both seriously underfunded through declining state appropriations and seriously overregulated by state policies in areas such as employment, financial affairs, bonding authority and contracting, tuition control, and open meetings requirements. In fact, in some states there have even been efforts to interfere directly with the curriculum and research agenda, particularly in controversial areas such as stem cell and climate change research.

One finds strong evidence of the importance of adequate institutional autonomy to the world-class quality of public research universities in states such as Michigan, Virginia, and California, long characterized by strong university autonomy, compared to the modest achievements of public research universities in more highly regulated state systems such as New York, Ohio, Illinois, and Florida. Since public research universities will be required to dramatically restructure their operations to sustain their quality during what is likely to be a generation-long period of inadequate state support, such autonomy and agility will become even more essential.

4. When the study committee was assessing the needs of our research universities, did you discover that most research campuses now have tech transfer offices or is that still a major impediment to moving research out of the labs? How about entrepreneurship programs like the ones Dr. Tolbert and Dr. Siedow mentioned in their testimony?

Response from Mr. Holliday:
The study committee was aware of university technology transfer offices and the key role they play in licensing specific inventions. However, we were less interested in that process than in finding new ways to have business and universities actually partner in the research in a synergistic way that made the whole greater than the sum of the parts. It is that kind of collaboration or partnership that will take the ecosystem to a new level of value-added and we need to develop processes to guide this toward our biggest problems and opportunities. We need to encourage existing companies with the capability to scale up fast to be more entrepreneurial.

The committee did not discuss entrepreneurship programs such as those discussed at the hearing. However, we were acutely aware that the best vehicle for "technology transfer" is in the people themselves: the education of students who go on to produce innovations in business, non-profits, and government; and the faculty and students who create start-ups that lead to new economic activity and opportunities for many more. This is why we focused on talent development in our last three recommendations that focused on improving STEM education, attracting foreign talent, increasing diversity, and better aligning graduate education for the careers that students will have.

Lastly, with regard to entrepreneurship, I would like to mention a new NSF program that has come to my attention, the NSF Innovation Corps (or, I-Corps). This program, launched by NSF Director Subra Suresh while our committee was undertaking its work, was not discussed and considered within the context of our work. Speaking personally, though, this public-private partnership appears to be a promising means for educating researchers and students about the process of identifying product opportunities and commercializing them. The program is one year old and should be followed and supported to see how it succeeds over time.

Dr. John Mason
Auburn University
Responses to Questions for the Record

1) *The National Academies report identifies "national goals" that include advances in medicine and health care, energy security, improved standards of living, and education of children and adults. What are your thoughts on the national goals identified in the report? Do you believe this list is comprehensive or are there any areas you think may have been missed?*

The report's "national goals" are comprehensive, timely and fully supported by previous and current research. Furthermore, the report makes clear that research and technology are critical to our economy and overall well-being.

However, my concern is not about its comprehensive nature or range of recommendations but rather its lack of specificity on next steps. Without an action plan for implementation, it will likely be no different from previous reports. In other words, it will generate positive discussion but little to nothing will be done to implement its goals and recommendations.

2) *Following the fourth report recommendation to improve university productivity, how challenging is it for research universities to eliminate redundant activities, programs and structures? What does this type of introspection require from your university?*

It is a lengthy process but a valuable one because of the consensus it builds for change and, in this case, retiring programs.

We closely studied numerous programs and eliminated those that no longer serve faculty and students efficiently or were not aligned with our mission of instruction, research and outreach. Task forces identified those areas where funds could best be invested to serve targeted institutional and national priorities. As a result, we have reinvested more than $5 million since 2010 toward enhancing research and creative scholarship.

Additionally, a university efficiency task force is now completing its final report recommending changes and next steps for the procedures and practices that guide the application of current and future institutional policies. The recommendations are designed to improve the general efficiency and effectiveness of the institution's operations. Recommendations fall into one of the following categories:

1) improve policies, procedures, processes and/or practices that could be revised, simplified, eliminated or established to improve efficiencies/effectiveness and better meet the needs of faculty, staff and students;

2) improve the communications and marketing of new policies, initiatives and procedures among the university community; and

3) improve coordination among administration and academic and operating units, organizations and affiliates.

In its efforts to develop a model of effectiveness, the task force also identified opportunities for potentially reducing costs, streamlining processes and building upon existing campus efficiency initiatives.

3) *In your testimony you noted that Auburn works in partnership with federal agencies and American business and industry to accomplish objectives of national need. How are these types of partnerships established and maintained? Can you provide us with some examples of outcomes from these partnerships? Do these partnerships strengthen the work of Auburn?*

Auburn eagerly seeks partnerships with federal agencies and American business and industry through direct personal contact. In the past three years, we have established two offices, a program development office and a research center in Huntsville, Ala., that engage external organizations with needs and requirements which can be served by university research and education.

Leaders of both offices meet with senior executives of government, business and industry on campus, in Washington and elsewhere around the country, advocating for the university's strategic research initiatives. Their staffs are directly involved in proposal development and submission as well as marketing and promotion of university capabilities.

These offices connect leaders from external organizations with university researchers who have the expertise and capabilities to help them. Furthermore, they organize and support the projects and programs that develop from these new partnerships.

Two of Auburn's major research initiatives have benefited directly from these efforts.

First, the Center for Bioenergy and Bioproducts was established to advance economic development in Alabama and the southeast by creating new energy and value-added products from natural resources that are abundantly available in the region. An initial university investment created laboratories and infrastructure for bioenergy research, which has resulted in partnerships with the Departments of Agriculture and Energy and a number of commercial energy producers and private land owners.

In one project, we collaborate with national manufacturers and Alabama companies to develop the technology and systems for harvesting biofuel feedstocks. For example, we work with Tigercat (www.tigercat.com) to design new machinery and Corley Land Services (www.corleyland.com) to demonstrate and test the prototypes. The end result positively impacts the biofuels industry as well as the pulp and paper industry that needs the same ability to cost-effectively fell, transport and process timber and forest residue. The industry cost-share matches federal support.

In a similar project, we work with Rentech (www.rentechinc.com) to develop transportation fuel through a gasification process. In this industry partnership, Auburn provides feedstock and Rentech tests the resultant jet and diesel fuel. The refining process improves the fuels' performance and the process to make it so it is cost-effective and affordable.

Second, the Auburn University Food Systems Initiative (AUFSI) was established as an interdisciplinary program to focus on the integrated "food system" that employs 18 percent of the U.S. workforce and feeds more than 300 million people. AUFSI is working in partnership with the National Institutes of Health, the Food and Drug Administration and the Department of Agriculture.

Finally, the Auburn Research and Technology Foundation and the Auburn Research Park were developed to mix research and the business community with the goal of fostering economic development and the university's research initiatives. In addition to facilitating the commercialization of university technologies and industry-university partnerships, the research park offers employment opportunities for Auburn's students and graduates.

In my verbal testimony, I talked about relevant fundamental research as the underpinning of American industry. These examples as well as other partnerships and investments made by Auburn not only strengthen our university research portfolio but contribute to the economic health of our nation.

4) *As I requested during the hearing, please provide a detailed list of specific regulations that Congress should consider amending or repealing due to their burdensome nature. Please explain each noted regulation, what it requires in order for implementation and why you suggest amending or repeal.*

One of the most burdensome examples is the sub-recipient monitoring requirement found in OMB Circular Number A-133. It was established by the Single Audit Act and implemented under guidance from the audit community. States, local governments and non-profits are required to audit other federal grantees including universities through which federal funds flow. The extent of the monitoring requirements in relation to actual benefits received is the major concern. We are required to examine the A-133 audits of other universities to whom we flow funds, determine the risk associated with any findings and require evidence of correction to such audit findings before we award a sub-agreement. The process must be repeated annually during the life of the sub-agreement.

On the surface, it does not seem unreasonable. However, looking more broadly, you see that we conduct these activities in duplication of every other university which provides funds to that same sub-recipient during the same fiscal year. That same sub-recipient is also receiving direct federal funds from federal agencies that are reviewing the audit report and monitoring the action plans of the sub-recipient. In other words, the same universities we are auditing are also audited by other universities, and those we audit are directly receiving federal funds, indicating the federal government's satisfaction with their performance and compliance.

In fiscal year 2006, we were cited on our A-133 audit for not thoroughly reviewing in a timely manner the audit report of another major university with whom we had awarded a $20,000 sub-agreement. The finding was not considered material. However, that same major university received approximately $400 million in federal funds that year, which is about three times the amount of federal funding we receive per fiscal year. Any university flowing funds to us then is required to evaluate our A-133 and, because of the finding, request

evidence that we corrected the oversight of missing review of our sub-recipient's audit report for the $20,000 sub-grant.

The result is a circular flow of multiple reviews of audit reports by multiple universities of other universities and, in this case, we are providing only $20,000 from a $400 million federal portfolio. In addition, we hired a full-time employee whose sole responsibility is managing subcontracting and compliance with A-133. The cost for that employee is not recoverable due to the federal cap on the facilities and administrative (F&A) cost rate.

The multiple layers of review are financially onerous for both the federal government and research institutions. We suggest thresholds of materiality and reduction in requirements to reduce further the duplication of effort and the costs associated with compliance.

Equally burdensome are federal statutes that limit F&A costs paid to land grant universities by the U.S. Department of Agriculture for cooperative agreements. Additionally, there are regulations on partial reimbursement of F&A for specific USDA programs. These regulations are outside the spirit and intent of other regulations promoting full cost recovery. They also fail to recognize that during development, negotiation and approval of our F&A rates, we are limited in what we can recover via administrative caps and seemingly inconsistent practices by federal F&A rate negotiators. Even with regulations allowing partial recovery, the current USDA trend is to further limit what universities are allowed to identify as our true costs.

The current Biomass Research and Development Initiative (similar to past specialty crop programs in USDA) limits F&A recovery to 22 percent of the federal funds we request. First, this limit is below the revised NIFA regulations allowing 30 percent of the federal funds requested. Second, they also will not allow the difference between the allowed rate and our federally approved rate to be used to satisfy the mandatory matching requirement.

We also are not allowed to identify the F&A costs associated with our direct cash match as part of the mandatory match requirement. The effect is less cost recovery on these grants than what broad federal regulations indicate is reasonable and allowable. It also sends a clear message that unrecovered F&A are not true costs to our institution because they cannot be used to meet the mandatory requirements for institutional contribution to a USDA grant.

The Association of Public and Land Grant Universities and other organizations have described many specific examples showing the burdens and costs to our universities for various regulations. The previous two examples are illustrative but represent only a small sampling of the oversight of university funded projects that focus not on science but on reviews, audits and reporting that rob valuable resources from the science. We recognize and embrace the value of oversight and transparency, but the balance has tipped much too far toward redundant reviews and audits that focus on process instead of results.

5) *You identified the challenging economic situation facing the Nation and your university. How have you prioritized programs or research areas at your institution? Do you feel you have lost anything significant to date?*

Auburn developed a proactive, five-year strategic plan targeting interdisciplinary research. Priorities are based on matching institutional expertise with areas of significant federal focus. These areas include the following: cyber security; energy and the environment; health sciences and food safety; science, technology, engineering and mathematics; and transportation.

We place emphasis on linking disciplines across campus with collaborating public and private partners, thereby assisting in transforming industries and creating economic opportunities for communities across the state, region and the nation.

For the most part, our losses result from a lack of capacity and infrastructure. In the current economic environment, we are not in a position to acquire much-needed high-quality laboratory space or add new faculty, particularly in the biosciences and engineering where returns on scientific and economic capital are significant.

6) *The report recommends taking steps to grant residency for non-U.S. citizens who earn doctorates in areas of national need. There are some who may want to ensure caveats that help to guarantee the Nation's safety. Likewise, it is equally important that American students receiving these doctorates have priority on potential jobs. What are your thoughts on this recommendation?*

It is vital that we take every step to encourage more American students to pursue undergraduate and advanced degrees and careers in science, technology and engineering. Doing so should be our first priority related to this recommendation.

In my remarks, I urged the Subcommittee to consider the potential of a program similar to the National Defense Education Act of 1958. Those fellowships were provided in the Cold War era out of fear the Soviet Union would control space. The federal government paid tuition for a student working on an advanced science degree. It helped with the debt load of students, focused research in an area of national need and defined career paths for young people with an interest in science.

Providing scholarships and fellowships is a relatively inexpensive way to get American students interested in fields of study where they are most needed. Providing research opportunities in these areas of critical national need and enabling American students to obtain security clearances as they earn their degrees will help guide them toward careers where shortages of trained, educated and cleared personnel exist today.

The U.S. faces stiff, global completion for technical talent from our allies and adversaries, and it impacts our national security and economic prosperity. While our first priority is educating American students to satisfy the scientific and technical needs we face, we should also consider, particularly in the short-term, mechanisms that allow foreign students educated in the U.S. to obtain positions where critical shortages exist, assuming all security safeguards are satisfied. In addition to helping us maintain global economic competitiveness, these American-educated foreign students often become great entrepreneurs who start companies, create jobs and advance the development of new knowledge.

7) *Please comment on the function of your university's tech transfer office, entrepreneurial programs with regard to STEM disciplines, and any associations with research parks and centers. Please include their roles in assisting faculty and students with moving research from the laboratory to commercialization, including the pre-commercialization stage or proof-of-concept stage.*

In summary, our operational model combines research with technology transfer, an incubator supporting start-ups, a research park where technology businesses flourish, and close collaboration with an affiliated non-profit foundation.

More specifically, the university's technology transfer office manages intellectual property. It receives invention disclosures, assesses the disclosures and takes appropriate action toward protection through patenting and copyrighting. It markets the intellectual properties and licenses them as appropriate to established and start-up companies. A new commercialization initiative focuses on forming start-up companies with university-owned technologies, including STEM disciplines. Finally, this office helps form business development teams, often including faculty and students, that create companies based on university-owned technologies, assists them to develop business plans, tutors them in presentations for investment capital, and prepares them for entering the Alabama Business Plan Competition.

Working with industry is often facilitated through the non-profit Auburn Research and Technology Foundation. It assists in seeking funding to support research on technology development that leads to commercialization. Furthermore, the foundation and the Office of Technology Transfer work together with the Auburn College of Business to link academic entrepreneurship programs with student start-ups in the business incubator.

124

Questions for the Record

Jeffrey R. Seemann, Ph.D.
Vice President For Research, Texas A&M University
Chief Research Officer, The Texas A&M University System

The Role of Research Universities in Securing America's Future Prosperity: Challenges and Expectations

Before the SUBCOMMITTEE ON RESEARCH AND SCIENCE EDUCATION

of the Committee on Science, Space, and Technology
of the U.S. House of Representatives

June 27, 2012

1. **The National Academies report identifies "national goals" that include advances in medicine and health care, energy security, improved standards of living, and education of children and adults. What are your thoughts on the national goals identified in the report? Do you believe this list is comprehensive or are there any areas you think may have been missed?**

It is hard to imagine how the list of "national goals" could be more comprehensive. The overarching categories are broad and meaningful and encompass many of the areas that have driven America's leadership in research and development (R&D), dissemination of knowledge, and democracy in the past. And I believe that a reinvigorated and fresh pursuit of these goals will enable our country to maintain that leadership position in the future. We, the nation's research universities, must now prioritize at the institutional level to focus our unique capacities toward each area in specialized ways. In other words, we need to drill down and identify the research strengths that will enable us to achieve maximum leverage and impact for the good of our nation's citizens.

Texas A&M has already begun this process by engaging its college leaders to identify and reach consensus on five grand-challenge areas upon which the University will focus resources and energy in the coming decades. Texas A&M's recently identified challenge areas include: Ensuring Health for Humans, Animals, and Ecosystems (One Health); Powering the Future of Our Nation and the World (Energy); Achieving a Secure Nation and a Safer World (Strengthening Democracy); Creating Entrepreneurs and New Ventures for Our Nation and the World (Economic Development); and Educating and Preparing the People of our Nation and the World for the 21st Century (Development of Human Capital).

Texas A&M's grand-challenge foci echo the goals set forth in the NRC Report—with an angle that emphasizes Texas A&M's strengths and expertise. The next step for the University will be to identify specific research programs and initiatives that are targeted toward these challenge areas and focus resources to ensure success. As part of that process, we must take bold steps to break down the traditional academic and organizational barriers that can prevent us from pursuing our goals with the full breadth and depth of our resources and intellectual capacities. And we must prioritize investments of existing internal and new external resources. Texas A&M has already made important steps in this direction. For example, we have established an internal Planning Grant Program to encourage principal investigators (PIs) to collaborate and pursue major grants that focus on areas of national priority, and we are aligning the focus of future fundraising initiatives around the grand-challenge areas listed above.

As stated in my testimony, I believe, that in order to continue to push the frontiers of scientific discovery and define the innovation forefront, it is imperative that we recommit to the university-government partnership that propelled the nation to its R&D leadership role. That begins with the respective research universities identifying their individual "assets for innovation" and maximizing efficiencies and investments in ways that target those assets toward addressing grand research challenges and key areas of national interest. Each institution brings a particular set of capacities and strengths—built over time with the help of state and federal partners—to bear on achieving these goals for the greater good of our nation's citizens.

2. **Following the fourth report recommendation to improve university productivity, how challenging is it for research universities to eliminate redundant activities, programs and structures? What does this type of introspection require from your university?**

Eliminating redundant activities, programs, and structures is a painful, but necessary and rejuvenating, process that every institution must undergo if we are to continually improve and remain competitive. Granted, no institution sets out to create redundant operations; however, as is the nature of any large enterprise, redundancies inevitably creep into the administrative mix, especially when growth is swift and significant. Texas A&M is a university that came to the "research university" arena later than many of our peers, with our initial and rapid rise in growth occurring in the 1970s and 1980s. You might say that, "We grew up big and we grew up fast." And as a result of that growth, we are now reaching the point where we must assess and reconsider redundancies that were created in the process—many of which may have been necessary actions and responses to support certain expansions of capacity and resources.

For example, serious discussions are now underway to consider reintegrating the College of Medicine, which branched off from the University in the early 1990s to create a state-wide health science center. The introspection required to embark on such an initiative is arduous and complex. As with the merger of any two organizations, real people are involved; and perhaps even more complex are issues surrounding funding streams and institutional accreditation. We are taking steps to address these areas; but the process is time consuming and replete with the mandatory red tape that can prove burdensome to many public research institutions. On the other side of the spectrum, this reintegration has tremendous potential to create new efficiencies and remove the administrative barriers that can slow down or impede important research collaborations between PIs across the institutions. And with the merger, the University would take a tremendous step forward in aligning resources around our "One Health" initiative, which seeks to advance health care for the 21st century and beyond by: accelerating biomedical research discoveries; enhancing public health efficacy and wellness; and expanding the scientific and engineering knowledge base.

Looking ahead, it is absolutely essential that Texas A&M continue to take steps to ensure that we remain focused on accelerating key research areas of national interest. The world's grand research challenges, in the end, must serve as the guiding principles to institutional change. We owe that to our citizens and taxpayers, as thoughtful stewards of an extremely important national R&D resource: the nation's research universities.

3. **At the hearing, it was noted that while industry has dismantled its large corporate research laboratories they have not yet fully partnered with research universities to fill the gap. Has your university worked to partner with industry to fill this gap? If so, have those partnerships resulted in any positive outcomes? If not, why not and would your university consider industry partnerships in the future?**

   Texas A&M University has a long history of successful partnerships with industry, owing primarily to the strong reputation and dedication of our researchers to discovery, innovation, and dissemination of fundamental science and scientific solutions to the nation's most pressing problems. As the model of industrial research engagement changes, Texas A&M strives to enhance our innate connection to industry by understanding the benefits and challenges each entity offers the other; managing the expectations of both entities in regards to each entities' mission, needs, and resources; and instituting policies and procedures to facilitate a desirable and mutually beneficial collaboration between partners.

   Texas A&M has successfully established partnerships with companies—both large and small—ranging from comprehensive collaborative research programs to targeted incremental innovations designed to solve specific process/production challenges. Industry partners actively engage the University in all phases of the research-development-commercialization spectrum, and the University proactively seeks industrial partners for collaboration, particularly in translational research projects. In fact, during FY2011, Texas A&M significantly increased its research sponsorships from industry/private partners over previous years.

   Texas A&M and its collaborators within The Texas A&M University System are working together to standardize common goals for industry engagement and implement a unified strategy for developing beneficial industrial partnerships. However, one issue regarding university partnership with industry should be noted. As discussed above, our researchers routinely pursue partnerships with industry to leverage federal agency funding of cutting-edge research. However, when funding has been received from industry, the federal agency has sometimes responded by decreasing their funding of the research. Obviously, this action is a disincentive for universities to pursue partnerships with and research funding from industry. This recently happened with a major research program at Texas A&M and has forced us to think carefully about whether an academic-industry partnership will truly lead to an increase in research productivity or only provide a short-term savings to the funding agency.

4. **As I requested during the hearing, please provide a detailed list of specific regulations that congress should consider amending or repealing due to their burdensome nature. Please explain each noted regulation, what it requires in order for implementation and why you suggest amending or repeal.**

   Please see attachment.

5. **You identified the challenging economic situation facing the Nation and your university. How have you prioritized programs or research areas at your institution? Do you feel you have lost anything significant to date?**

In my response to question 1, I addressed some of the steps that Texas A&M has taken and is taking to prioritize programs and research areas. This will be an ongoing process, with extensive engagement and feedback from University leadership and faculty.

As we move forward and stake greater claims to areas of national significance, the University will need to prioritize resources around these areas, even as we are doing more with less. Texas A&M has a history of success doing just that. *Smart Money* magazine ranked Texas A&M first nationally in 2011 for "payback ratio"—which the magazine defined as the earning levels of an institution's graduates compared to what they paid in tuition, fees, and related costs for their undergraduate educations. In other words, Texas A&M is already a very lean organization, with the lowest administrative cost ratio in the state of Texas and one of the lowest among our national peers. Low administrative costs have long been a hallmark of Texas A&M's operation, and a 2010 campus-wide reduction-in-force process—which demanded human resource cuts from every unit on campus—trimmed it even further.

On the whole, we continue to take bold, creative, and sometimes difficult actions to maximize resources and increase efficiencies to grow the research enterprise around areas of national significance (see response to question #2). As we take these steps, we must be assured that federal agencies will continue their support—and especially receive a guarantee that we are not penalized for initiatives to secure funding from other partners, such as industry (see closing to response #2).

6. **The report recommends taking steps to grant residency for non-US citizens who earn doctorates in areas of national need. There are some who may want to ensure caveats that help to guarantee the Nation's safety. Likewise, it is equally important that American students receiving these doctorates have priority on potential jobs. What are your thoughts on this recommendation?**

There is no question that the current efforts to retain many of the highly skilled researchers trained at American universities in science, technology, engineering, and math (STEM) is a step in the right direction to prevent the loss of the significant innovative contributions of many of these researchers that are sure to fuel future economic prosperity. At the same time, as a university that performs research in national security, including classified and restricted research, we are especially mindful of our commitment to the nation's safety.

In addition, Texas A&M is committed to increasing the pipeline of American students pursuing graduate degrees in STEM and has several programs designed for that purpose. For example, the College of Engineering has developed a highly successful graduate recruitment program that provides undergraduate engineering students recruited from schools across the state of Texas and the nation with an immersive summer research experience. The goal of this experience is to increase participant's interest in pursuing graduate studies, and there have been more than 550 participants since the summer of 2000. Further, Texas A&M makes it a priority to recruit domestic students that are underrepresented in the STEM fields and includes several minority serving institutions in the pool of schools from which participants are recruited. In 2011, 17 percent of participants were underrepresented minorities, and 35 percent were females. This program, called the Undergraduate Summer Research Grant Program, is modeled after the National Science Foundation (NSF) Research Experience for Undergraduates (REU), and works in conjunction with the REU sites on campus. Conservative estimates indicate that almost half of the participants from 2006 to 2010 who have completed their undergraduate degrees have matriculated into a graduate school in a STEM field. Surveys of our participants show a clear majority (usually around 75 percent) indicate plans for graduate studies. Programs such as these, performed in universities all over the nation, are steadily working to increase our domestic graduate student population in STEM majors. These students will undoubtedly help America maintain our technological edge and increase our global competitiveness.

7. **Please comment on the function of your university's tech transfer office, entrepreneurial programs with regard to STEM disciplines, and any association with research parks and centers. Please include their roles in assisting faculty and students with moving research from the laboratory to commercialization, including the pre-commercialization stage or proof-of-concept stage.**

The Texas A&M University System facilitates technology transfer through a centralized Office of Technology Commercialization (OTC), which serves the intellectual property management, protection, and commercialization needs of Texas A&M University and the other 11 universities, seven state agencies, and health science center that comprise the A&M System. Under this model, the OTC serves as a hub for Texas A&M's commercialization efforts across the state, directing management of more than 900 issued patents and 1500 patent applications relating to a portfolio of more than 2600 invention disclosures. On average, the OTC files for a new patent every other day and executes one commercial license agreement every week. According to a survey by the Association of University Technology Managers, the OTC ranks eighth in the nation in number of license agreements generating revenue and successfully commercializing an A&M-based innovation.

Texas A&M recognizes the importance and value of new ideas and technologies continually emerging from its research enterprise, and actively supports students and faculty in their innovative endeavors to facilitate bridges to the private sector—and ultimately to fuel our emerging role as a major hub for business incubation and entrepreneurial activity.

Texas A&M is at the center of an emerging biocorridor initiative developed in partnership with the Texas A&M System and our surrounding community to attract biomedical technology research and entrepreneurial activity. In June 2012, the Department of Health and Human Services announced an award of $285 million supporting vaccine and biosecurity research centered around this biocorridor initiative and designed to leverage the institution's connections with biotech and pharmaceutical industry partners. This award positions Texas A&M as the nexus of a new era for university-industrial collaborative research and commercialization of biotechnology in the United States.

Beginning in 2011, Texas A&M engaged a team of consultants with more than 100 years of collective experience in higher education strategic planning to conduct an assessment and create a new vision for the 200-plus acre Texas A&M University Research Park. Established more than 30 years ago to attract corporate and public research partners, the University now aims to revolutionize its Research Park by leveraging the resources of Texas A&M, the local community, and private businesses to reshape the park's business model to foster 21st century university-industry engagement and energize campus innovation and entrepreneurship.

Texas A&M is also in the process of planning and launching an applied creativity hub and business incubation center for student entrepreneurs. The new business incubator would occupy space in the University's Research Park and serve as a resource where current students, former students, faculty-researchers, and other interested stakeholders can evaluate marketplace challenges and opportunities to develop new solutions that foster student-led business start-ups.

Attachment

Recommendations for Regulatory Relief

Texas A&M University, along with our colleagues at Association of American Universities (AAU), Association of Public and Land Grant Universities (APLU), and Council on Governmental Relations (COGR) support the objectives of accountability, transparency, and safety that generally motivate the creation of regulatory requirements. However, as the research performed at our institutions has become more complex, there has been a growth of requirements which are overly burdensome, redundant, ineffective, and/or inappropriately applied to universities. As a result, the costs of doing research have gone up and universities have had to do more with less. These overreaching regulatory requirements have further strained already-lean resources. A report prepared for the U.S. Commission on the Future of Higher Education states that, "there may already be more federal regulation of higher education than in most other industries." An oft-cited statistic from the 2007 Federal Demonstration Partnership Faculty Burden Survey found that "42 percent of time spent on a research award is time spent on doing *administration* activities associated with the research award", not on active research (http://sites.nationalacademies.org/PGA/fdp/index.htm). Thus, reducing regulatory burden can have a substantial, immediate impact by maximizing federal investments more directly into research priorities and allowing researchers' time to be optimally utilized.

We believe the following recommendations for regulatory reform will have a high impact on the efficiency with which the university community can perform the cutting edge research that is so important to our nation's economic future and security. These reforms are a subset of those mentioned in the National Academies' report "Research Universities and the Future of America: Ten Breakthrough Actions Vital to Our Nation's Prosperity and Security" (http://www.nap.edu/catalog.php?record_id=13396, see Box 5-7.1) and represent what we believe to be the "low hanging fruit" to produce impactful benefits. More detailed information on these and other recommended regulatory reform is given in the attached article (outlined specifically in Table 1 page 61).

1. *Provide targeted exemptions for research universities similar to protections provided for small entities under the Regulatory Flexibility Act (RFA).* The RFA requires agencies to prepare and publish a regulatory flexibility analysis describing the impact of a proposed rule on small entities. In addition, agencies are encouraged to facilitate participation of the affected entities by holding conferences, roundtables, and public hearing on the proposed rule. The RFA encourages tiering of government regulations or the identification of "significant alternatives" designed to make proposed rules less burdensome. As a result of the RFA, in FY 2009 federal agencies created less burdensome regulations resulting in the added benefit of saving small businesses some $7 billion in regulatory costs (http://archive.sba.gov/advo/laws/flex/09regflx.pdf). This

law could be amended to included organizations engaged in conducting federally sponsored research.

2. *Extend coverage provided in the Unfunded Mandates Reform Act (UMRA) to research universities and allow institutions to better account for new regulatory costs, and to charge these costs to federal awards.* It is often not a single regulation that creates compliance challenges, but the stacking of regulations over time. The UMRA requires Congress and agencies to give special consideration of the costs and regulatory impact of new regulations on state and local governments, as well as on tribal entities. This Act was also intended to strengthen the partnership and communications between the federal government and these entities (http://www.gsa.gov/portal/content/245277). Extending coverage to universities would result in agencies being more responsive to the cost burdens of new requirements.

Additionally, the Paperwork Reduction Act (PRA) was designed to minimize the paperwork burden for entities and maximize the public benefit resulting from the collection and requirement of information by or for the federal government (http://www.archives.gov/federal-register/laws/paperwork-reduction/3501.html). This Act also strives to strengthen the partnership between the federal government and the state, local, and tribal entities and requires that all proposed regulations be analyzed for the paperwork that they require, and that paperwork be reduced to a minimum. Regulations creating new paperwork requirements must be cleared by the Office of Management and Budget (OMB). Unfortunately, agency projections of the paperwork burden are often underestimated and do not recognize the methods by which new reporting requirements will be paid. Although for some entities indirect cost reimbursement could pay for new regulatory costs, the 26 percent administrative cap placed on universities precludes additional recovery of these costs.

Thus, ever-increasing regulation, coupled with no ability to recover the costs of these additional regulations above the current administrative cap, causes university administrations to buckle under the responsibilities of accepting federal funds. Indeed most universities' indirect costs are, on average, significantly greater than the present reimbursement allowed under the 26 percent cap, due largely to federal regulatory requirements. In situations when new requirements are not effectively controlled to minimize cost burden, institutions should be allowed to establish a cost reimbursement mechanism in which the incremental costs can be recovered as a direct charge to the federal award. If recovery of the increased costs is not an option, then reduction of the burden by collecting and reviewing thoughtful feedback as to the impact of new regulations could prove to be very helpful to the research universities.

3. *Designate a high level official within OMB's Office of Regulatory Affairs (OIRA) to serve as Federal Ombudsman, responsible for addressing university regulatory concerns for seeking ways to increase regulatory efficiency.* This official should be empowered with broad responsibilities to manage and minimize regulatory burdens applicable to research universities and institutions. The Ombudsman would assist in harmonizing and streamlining Federal regulations and would also have responsibility for reviewing specific "simplification request." Under the auspices of the National Science and Technology Council (NSTC), the Ombudsman, along with a designated representative from the White House Office of Science and Technology Policy (OSTP), should lead an interagency group charged with regularly reviewing regulations affecting research universities. This interagency group could be organized as a new subcommittee or as part of the exiting Research Business Models Subcommittee. Through an application process, research universities or university associations could submit proposal to "fix" or eliminate rules that either add no value or promote inefficiency and excessive regulatory burden. The Ombudsman could be a critical point of contact to ensure frequent and effective contact between the federal government and the research university community.

4. *Establish protocols to address statutorily-mandated regulatory concerns.* When new laws are passed by Congress to achieve important public policy goals, unintended regulatory burden can be an unfortunate by-product. When statutorily-mandated requirements create unintended regulatory burdens for universities, a fast-track approach to amending the law would be a useful tool that could help to minimize burdensome regulations. Efforts to provide such an approach would assist with the ongoing partnership with the federal government for continuous improvement. Additionally, proposed new legislation could be provided to the Ombudsman (discussed above in recommendation 3) to assist in determining and developing financial impact statements with and on behalf of the research universities.

TOBIN L. SMITH
JOSH TRAPANI
ANTHONY DECRAPPEO
DAVID KENNEDY

Reforming Regulation of Research Universities

Regulatory and reporting requirements have become excessively burdensome. A more balanced approach is needed.

In recent years, research universities and their faculty have seen a steady stream of new federal regulations and reporting requirements imposed on them. These new requirements, in combination with other factors, have exacerbated already significant institutional financial stress and diverted faculty time from research and education.

The oversight of research that uses human subjects or animals, involves select agents, chemicals, or other potentially dangerous substances, or involves export-controlled technologies is necessary and important. Universities and researchers take seriously their responsibilities to comply with requirements and account for their use of federal resources. However, increasing regulatory and reporting requirements are not only costly in monetary terms; they also reduce faculty productivity and result in inefficient use of federal research dollars.

Quantifying the monetary and productivity costs of regulations is often difficult. Whereas the cost of each individual regulation may not appear to be significant, the real problem is the gradual, ever-increasing growth or stacking of regulations.

The fiscal situation of our universities requires a reexamination of regulatory and reporting requirements to ensure a proper balance between accountability and risk management and to ensure that federal and institutional resources, as well as researchers' time and effort, are being used effectively and efficiently.

The current climate of fiscal austerity has sparked a renewed interest in reforming and streamlining government regulations to eliminate waste and improve productivity. In January, President Obama released Executive Order 13563 ("Improving Regulation and Regulatory Review"), along with two presidential memoranda focused on regulation. These documents require federal agencies to develop plans for regulatory review to ensure that regulations become more effective and less burdensome.

Congress is also interested in regulatory reform. Rep.

Darrell Issa (R-CA), the chairman of the House Committee on Oversight and Government Reform, sent a letter to nearly 200 companies, trade associations, and other organizations, requesting information on existing and proposed regulations that have negatively affected job growth, and soliciting suggestions on reforming regulations and the rulemaking process. The committee received nearly 2,000 pages of responses.

Universities deserve attention

Higher education has largely been absent from recent governmental discussions of regulatory reform, despite evidence contained in a report prepared for the U.S. Commission on the Future of Higher Education that "there may already be more federal regulation of higher education than in most other industries." As documented by Catholic University of America's Office of General Counsel, more than 200 federal statutes affect higher education, and the list keeps growing. Sen. Lamar Alexander (R-TN) recognized this when he asked the National Research Council's (NRC's) Committee on Research Universities, at their November 2010 meeting, to identify ways to improve the health of U.S. research universities that would not cost the federal government money, pointing specifically at the problem of overregulation.

In addition to research, regulatory issues extend into universities' educational activities. For example, the Government Accountability Office said in a 2010 report that the Department of Education underestimated the burdens placed on universities associated with mandatory reporting for the Integrated Postsecondary Education System. A 2010 survey of financial aid administrators by the National Association of Student Financial Aid Administrators found that 85% of respondents at institutions with enrollments of more than 1,000 identified greater regulatory compliance workloads as a major cause of current resource shortages.

Increasing regulatory burdens are occurring during a period of severe financial pressure on universities. State educational appropriations per full-time student in 2010 constant dollars were 21% lower in 2010 than they were two decades earlier and 25% lower than a decade ago. Endowments have yet to recover from the substantial losses incurred in the recent financial crisis. Gifts and donations have declined. Raising tuition is not a realistic option for filling this gap, especially for public universities facing heightened scrutiny from state legislators or bound by state constitutions to minimize tuition rates.

At the same time that other funding sources have become constrained, the cost of performing research has become increasingly expensive for universities, in part because of the expanded costs of federal compliance. Between 1972 and 2009, the proportion of total academic R&D expenditures drawn from institutional funds nearly doubled from 11.6% to 20.4%. At the same time, the proportion funded by federal, state, and local governments decreased from 78.5% to 66%. Because of White House Office of Management and Budget (OMB) rules, universities are restricted in how much they can be reimbursed by the federal government to pay for compliance costs.

Heavy compliance burdens affect not only institutions, but also the morale and productivity of researchers within them. According to an often-cited and illustrative figure from the 2007 Federal Demonstration Partnership (FDP) Faculty Burden Survey, 42% of faculty time relating to the conduct of federally funded research is spent on administrative duties. Some of this additional time is the result of increased activities relating to compliance with federal regulations. In effect, at a time of limited resources, compliance requirements are taking researchers out of the laboratory and reducing their ability to perform the research that leads to the innovations that improve our quality of life.

Numerous research institutions provided us with data indicating that compliance costs have grown during the past decade. Recovery of these costs is determined by rules by set by OMB. Most of the research compliance costs are accumulated in a pool of costs classified by OMB as "sponsored projects administration" (SPA), and analysis of SPA can be insightful in measuring the growth of research compliance costs. One private institution in the midwest estimated that its SPA costs increased from $4.2 million in 2002 to $7.3 million in 2008. A prominent medical school in the southeast reported that its compliance and quality assurance costs increased from about $3 million in 2000 to $12.5 million in 2010.

More telling than the increases in SPA and associated research compliance costs are trends showing that these costs have increased more rapidly than the associated direct research expenditures, such as salaries, lab supplies, and research equipment. For example, the medical school mentioned above had a cumulative increase in compliance and quality-assurance costs of more than 300% between 2001 and 2010, whereas sponsored expenditures associated with the direct costs of research increased by only 125% during the same period. A private university in the south told us that its SPA-related costs associated with research increased by nearly 120% between fiscal year 2002 and 2010, whereas its direct research expenditures increased by less than 100%. No data that we received ran contrary to these trends.

It is important to note that this is not a case of adminis-

Heavy compliance burdens affect not only institutions, but also the morale and productivity of researchers within them.

trative inefficiency. University-wide administration and department and school-specific academic administration rates have fallen over the past decade, due mainly to drastic cuts in state appropriations and a strong emphasis on administrative efficiency and effective management. At the same time, SPA costs, which are closely linked to the cost of research compliance, have increased. The onslaught of research compliance regulation and unfunded mandates has overwhelmed the strong downward pressures of budget cuts and emphasis on administrative efficiency.

Precisely answering the seemingly simple question "How much does it cost universities to comply with any particular regulation?" is difficult. The cost of compliance frequently results from the time that faculty, staff, and administrators spend in fulfilling compliance and reporting responsibilities. This results in both monetary costs and the diversion of faculty time away from research and teaching, reducing productivity.

Productivity declines are a challenge to measure, with the 2007 FDP survey providing perhaps the best data. With regard to monetary costs, estimates of compliance for the same regulation or research area may range widely among different universities. This is not unexpected; the range reflects variability among universities in the size and nature of their research endeavors, as well as the differing degree to which institutional research engages in areas requiring compliance. For example, one university may conduct more human subjects studies, whereas another has more researchers working with hazardous materials or select agents.

Universities account for compliance costs in different ways. Compliance burdens are spread across many offices and units at an institution, and in many cases compliance costs are difficult to separate from other associated research operating costs. Finally, new compliance requirements, even when they seem small, can strain university systems. For instance, new regulations on export controls have added considerable burden to the usually one or two employees who deal with such matters, in some cases requiring the hiring of additional personnel. Proposed new National Institutes of Health (NIH) guidelines on conflict of interest are yet another example that will probably increase the workload.

A framework for evaluation and solutions

Although the ever-growing array of research regulations affecting universities can seem bewildering, solutions for problematic regulations fit within a relatively small number of categories:

- Eliminate outright or exempt universities from the regulation
- Harmonize the regulation across agencies to avoid duplication and redundancy
- Tier the regulation to levels of risk rather than assuming that one size fits all
- Refocus the regulation on performance-based goals rather than on process
- Adjust the regulation to better fit the academic research environment.

Table 1 is a matrix that associates examples of regulations with the solutions defined above. In most cases, regulatory relief does not mean simply eliminating a regulation. Solutions tend to fall within several categories (for example, harmonization and tiering to risk) rather than only one, and should be pursued carefully to ensure that they make sense and are not counterproductive. Below we discuss specific examples from the table in more detail:

Effort reporting. Effort reports show the percentage of total effort that individuals contribute to university activities. Faculty commit to devote a certain fraction of their work time to specific projects funded by the federal government, and must regularly certify that they are devoting this amount of time to those activities.

Effort reporting has been widely criticized for imposing significant cost without adding value. For example, according to FDP, "...effort reporting is based on effort which is difficult to measure, provides limited internal control value, is expensive, lacks timeliness, does not focus specifically on supporting direct charges, and is confusing when all forms of remuneration are considered."

Effort reporting can be eliminated without any detriment to the accountability or oversight of the research enterprise for five reasons. First, it is redundant. Requirements that faculty provide regular progress reports to funding agencies serve the same function as effort reporting, but do so more effectively because they better align with incentives for faculty performance such as research accomplishments, success on subsequent grant proposals, and ultimately promotion and tenure. Second, it is unnecessary. Faculty rarely spend less time than they initially commit to federally funded research. Indeed, as acknowledged by the OMB A-21 Clarification Memo of January 2001, faculty routinely spend more time than they committed to. Third, it lacks precision. It is incompatible with an academic research environment in which researchers do not work on billable hours and researcher responsibilities such as student supervision often cannot realistically be billed reliably to a single project. Fourth, it is expensive and wasteful of government funds. The federal government must spend money in the auditing of effort reports and associated administrative processes. Finally, effort reporting is responsible for adding considerably to universities' administrative costs and taking faculty away from research. Virtually every institution that responded to our request for information identified effort reporting as an area that has had significant cost and productivity implications.

The costs are significant. For example, one public university in the Midwest told us that nine employees spend about one quarter of their time each year monitoring certifications, at an estimated annual cost of $117,000. For many schools, effort reporting also requires the development or purchase and the continuing maintenance of specialized software systems. A public university in the midwest reported that the cost of the necessary software was more than $500,000, exclusive of implementation and training costs. Several universities reported that they spent in the range of $500,000 to $1 million annually on effort reporting.

Chemical Facilities Anti-Terrorism Standards (CFATS). The Department of Homeland Security (DHS) Appropriations Act of 2007 granted DHS the authority to regulate chemical facilities that present "high levels of security risk." Under this authority, DHS promulgated CFATS. Since 2007, the research community has urged DHS to reconsider the manner in which CFATS is applied to research laboratories located at universities.

The current regulations fail to recognize the differences between university research laboratories and major chemical manufacturing and production facilities, including how chemicals are used and stored for research purposes. Chemical plants often store large volumes of toxic substances; universities generally do not. Rather, they distribute regulated "chemicals of interest" in very small quantities, among laboratories in multiple buildings and generally in more than one geographic location. Given this distributed environment, research organizations present a low risk for serious toxic releases through theft, sabotage, or attack.

Nonproduction research laboratories with similar chemical use patterns located at noncommercial, nonprofit research organizations such as colleges and universities should be regulated differently. DHS should establish separate but robust standards, protocols, and procedures for assessing vulnerabilities and improving the security of chemicals of interest in a research setting. Several other federal agencies have established separate and successful standards for research laboratories; these standards include separate chemical safety regulations at the Occupational Safety and Health Administration and separate hazardous waste management regulations at the Environmental Protection Agency, both of which are distinct from those applied to industrial production and other facilities.

The current CFATS regulations take an inappropriately broad look at campuses, treating an entire campus as a single entity. Although CFATS allows some flexibility in defining the boundaries of facilities, site security plans or alternative security plans must be developed in the aggregate and may not be developed specifically for a lab or unit operation. DHS should take an approach in which the security requirements apply only to individual laboratories where chemicals of interest exist in quantities greater than the threshold planning quantity.

U.S. Citizenship and Immigration Services changes to Form I-129. In early 2011, the U.S. Citizenship and Immigration Service (USCIS) added a question about export control licenses to its Form I-129, which employers must complete when petitioning for a foreign worker to come to the United States temporarily to perform services. As a result, I-129 petitioners now have to complete a new certification for H-1B visas and certain other specialty occupation visa petitions. This new requirement puts substantial burdens on universities with questionable benefit for national security.

The value and purpose of Form I-129 remain unclear, especially considering that USCIS has no responsibility for export control enforcement or compliance and that other security checks are already incorporated into the existing visa process. Under the Visa Mantis program, for example, the State Department provides extra screening of visa applicants who are seeking to study or work in certain fields that are deemed to have national security implications. The change

TABLE 1

A framework for remedies for some regulatory burdens faced by research institutions

	Exempt universities or eliminate	*Harmonize/avoid duplication and redundancy*	*Tier to risk*	*Focus on performance, not process*	*Better synch with university R&D*
Human subjects		Harmonize human subjects protections between the Office of Human Research Protections (OHRP) and the Food and Drug Administration (FDA). Eliminate Health Insurance Portability and Accountability Act (HIPAA) from research, or harmonize HIPAA regulations with OHRP regulations.	Tier human subjects research for exemption from Institutional Review Board review (e.g., social science research vs. clinical trials).		
Animal research			Consult on whether the Animal Enterprise Terrorism Act provides sufficient protection for animal researchers.		
Export controls	Eliminate new regulations requiring deemed export certification for certain visa applications (I-129 form).	Harmonize International Traffic in Arms Regulation, Export Administration Regulations, and Office of Foreign Assets Control controls.	Tier export control lists to risk, removing much of what is currently on these lists or reclassify to lower their control levels.		For purposes of enforcement of deemed export control laws, require that individuals have knowledge or intent that controlled information will be exported or transmitted without proper authorization.
Effort reporting	Eliminate effort reporting.				
Financial reporting	Expanded Form 1099 Reporting Requirements will create an additional burden on financial reporting.		Sub-recipient monitoring: Modify requirement so that grantees would no longer be required to monitor sub-recipients who regularly receive Federal awards.		Federal Funding Accountability and Transparency Act (FFATA): Raise subreporting threshold from $25,000 to the simplified acquisition threshold, use OMB definition of "subcontract" (which eliminates procurements), and only report first tier. FFATA: Make reporting annual or eliminate more onerous requirements for universities. Change timing of Quarterly Cash Transaction Report.
Conflict of interest/ research integrity	Eliminate negative patent reports, which require form completion even when there are no intellectual property concerns.			Direct Office of Science and Technology Policy to convene agencies to develop a conflict of interest policy like the Misconduct in Science Policy, which articulates general goals and objectives.	
Select toxins and agents			Develop a tiered list and associated requirements, as has been documented by the American Society of Microbiology.		
Hazardous materials	CFATS: Wherever possible, create an exception for research laboratories.		CFATS: Tier chemicals of interest to risk when exemption isn't possible.		Examine and consider university facilities as different from large chemical facilities: Design alternative approaches in light of these differences.

140

Mechanisms should be developed to allow universities to be exempted from certain regulatory and reporting requirements, when appropriate, and if not exempted, to more easily be reimbursed for their associated costs.

to Form I-129 is therefore redundant and unnecessary.

Most research conducted by foreign nationals at U.S. research universities is fundamental research, which is excluded from export control requirements. Whether technology is subject to Export Administration Regulations is irrelevant if a foreign national is performing fundamental research. Because of this exclusion, there will probably be very few instances in which export control licenses will be required for foreign nationals employed at research universities on H-1B visas. However, universities must do significant additional review for I-129 submissions to confirm that this is indeed the case.

The inclusion of the "Deemed Export Acknowledgment" makes filling out Form I-129 and the H1-B application process much more complicated for visa petitioners and university employers. At research universities, international affairs and human resources offices typically complete and file the form for potential visa employees. However, to respond correctly to such a narrow question concerning exports licenses, other university officials from the office of sponsored programs and technology licensing, campus compliance officers, and sponsoring faculty must become involved in the petition to hire temporary employees. This has dramatically increased the time it takes university staff to complete Form I-129.

It is also unrealistic in a research environment to expect that export-control issues and technologies connected to a particular line of research in which a researcher is involved will remain static from the time Form I-129 is completed. Universities cannot predict where scientific inquiry will go, and many technologies involved in conducting research may change during the course of the research project as findings and discoveries progress. It is thus easy for universities to inadvertently respond to this question in a way that could eventually turn out to be inaccurate.

Other Examples. Several other examples of redundant and unnecessary research regulations exist. For example, many collaborative research projects involving investigators at different institutions require that subawards be made to other partnering institutions. In these instances, the prime award recipient is also required to "monitor" the business practices and internal controls at the subrecipient institution. Although there may be value to monitoring subrecipients that are not established recipients of federal funding, to monitor and report on other research universities that regularly receive federal awards is a wasteful exercise and should be eliminated.

Other examples involve tiering regulations to risk. In human subjects research, minimal-risk studies, such as many in the social sciences, should not require the same level of review as clinical trials. Similarly, not all research involving pathogens or biological toxins that pose potential risks to public health and safety pose the same level of risk. The requirements associated with the regulation of this "select agents" research should be tiered to risk, as documented by the American Society of Microbiology.

And finally, newly proposed conflict of interest guidelines from NIH that require public posting of faculty-industry relationships, even when potential conflicts are being effectively managed, will create public confusion and unnecessary work and have a potential chilling effect on university-industry interactions. The full impact of these regulatory changes should be carefully evaluated before they are implemented.

Steps toward reform

The specific regulations in Table 1 and discussed here are just a small sample of the regulatory issues facing research universities. Beyond the matrix we have laid out for addressing such issues, several other actions would help universities and the federal government work better together to reduce regulatory burden while still ensuring safety and accountability.

First, we need to improve understanding of the costs of regulation. As we have already discussed, quantifying the costs and burdens of regulations is difficult. The NRC and the Department of Education should conduct the study on regulation in higher education called for by Section 1106 of the Higher Education Opportunities Act (H. R. 4137), to

describe by agency the number of federal regulations and reporting requirements affecting institutions of higher education; the estimated time required and costs to institutions of higher education (disaggregated by types of institutions) to comply with these regulations; and recommendations for consolidating, streamlining, and eliminating redundant and burdensome federal regulations and reporting requirements affecting institutions of higher education.

In addition, OMB and the Office of Science and Technology Policy should jointly co-chair an interagency working group that regularly reviews regulations affecting research universities. This group could be organized as a new subcommittee of the National Science and Technology Council Committee on Science, or as part of the existing Research Business Models Subcommittee. Through an application process, research universities or university associations could submit proposals to fix or eliminate rules that add no value or promote inefficiency and excessive regulatory burden. Such a group would also be able to closely examine regulation costs.

Government flexibility and responsiveness must be increased. New or enhanced relationships and pathways of communication between universities and the government will help improve efforts to reduce regulatory burdens. The administration's EO 13563 provides an impetus for establishing these pathways. We should designate a high-level official within OMB's Office of Regulatory Affairs to serve as a federal ombudsman. This official would be responsible for addressing university regulatory concerns and seeking ways to increase efficiency and minimize regulatory burdens. The ombudsman would assist in harmonizing and streamlining federal regulations and would also have responsibility for reviewing specific simplification requests. The ombudsman should be OMB's co-chair on the interagency working group recommended above.

Protocols should be established to address statutorily mandated regulatory concerns. When new laws are passed by Congress to achieve important public policy goals, unintended regulatory burden can be an unfortunate byproduct. When requirements create unintended regulatory burdens for universities, a fast-track approach to amending the law would be a useful tool that could help to minimize burdensome regulations.

Mechanisms should be developed to allow universities to be exempted from certain regulatory and reporting requirements, when appropriate, and if not exempted, to more easily be reimbursed for their associated costs. There are three ways in which this can be done.

First, research universities should be given exemptions similar to those provided to small entities under the Regulatory Flexibility Act (RFA). The RFA requires agencies to prepare and publish a regulatory flexibility analysis describing the impact of a proposed rule on small entities. In addition, agencies are encouraged to facilitate participation of the affected entities by holding conferences and public hearings on the proposed rule. The RFA encourages tiering of government regulations or the identification of "significant alternatives" designed to make proposed rules less burdensome. The law should be amended to include organizations engaged in conducting federally sponsored research and education activities.

Second, coverage provided under the Unfunded Mandates Reform Act (UMRA) should be extended to research universities. It is often not a single regulation that creates compliance challenges, but the stacking of regulations over time. Agencies rarely reevaluate, eliminate, or redesign regulatory schemes to reduce the burden of compliance. The UMRA requires Congress and agencies to give special consideration to the costs and regulatory impact of new regulations on state and local governments, as well as on tribal entities. Extending coverage to public and private universities would result in research funding agencies being more responsive to the cost burdens of new requirements.

Third, institutions should be allowed to better account for new regulatory costs and to charge these costs to federal awards. The Paperwork Reduction Act requires that all proposed regulations be analyzed for the paperwork that they require and that paperwork be reduced to a minimum. Regulations creating new paperwork requirements must be cleared by OMB. Unfortunately, agency projections of paperwork burden are often underestimated and do not recognize how new reporting requirements will be paid for. The American Recovery and Reinvestment Act reporting requirements and the recently proposed NIH reporting requirements related to financial conflicts of interest are two notable examples. In cases in which new requirements are not effectively controlled to minimize the imposition of additional and sometimes substantial new costs, institutions should be allowed to establish a cost reimbursement mechanism in which the incremental costs can be recovered as a direct charge to the federal award.

Finally, cost sharing policies that are appropriate for the research community and that differentiate universities from for-profit entities should be developed. Although a cost sharing commitment between government agencies and industry partners may be appropriate, requiring the same commitment from university partners ignores universities' educational and public service roles and their nonprofit status.

The President's Council of Advisors on Science and Technology, in a 2010 report on energy R&D, recommended that universities be exempted from cost sharing requirements. The National Science Foundation (NSF) recently implemented a new policy that prohibits voluntary cost sharing on NSF programs, while also reaffirming its policy that mandatory cost sharing be required only in exceptional situations where it is necessary for long-term program success. Congress and other research funding agencies should follow NSF's lead and prohibit cost sharing policies that inappropriately impose additional costs on universities.

To better address regulatory issues at research universities, we need new and more timely and flexible mechanisms for universities and associations to work with federal officials. We have proposed a set of recommendations that would begin to establish these mechanisms. Only by working together can research universities and the federal government reach the shared goal of reducing undue regulatory requirements while maintaining safety and accountability. A more balanced regulatory load would help ease financial burdens on universities and improve the morale and productivity of the researchers whose discoveries and innovations will drive our nation's economy in this century.

Recommended reading

Association of American Universities, Association of Public and Land-Grant Universities, Council on Governmental Relations. 2011. Regulatory and Financial Reform of Federal Research Policy: Recommendations to the NRC Committee on Research Universities. http://www.aau.edu/WorkArea/DownloadAsset.aspx?id=11666

Council on Governmental Relations. 2008. Finances of Research Universities. www.cogr.edu/viewDoc.cfm?DocID=151534

Council on Governmental Relations. 2010. Federal Funding Agency Limitations on Cost Reimbursement. Paper: http://www.cogr.edu/viewDoc.cfm?DocID=151789. Appendix: http://www.cogr.edu/viewDoc.cfm?DocID=151790

Council on Governmental Relations. 2011. Federal Regulatory Changes Since 1991. http://www.cogr.edu/viewDoc.cfm?DocID=151793

Federal Demonstration Partnership. 2007. Faculty Burden Survey. http://sites.nationalacademies.org/PGA/fdp/index.htm

National Research Council. Study on Research Universities. http://sites.nationalacademies.org/PGA/bhew/researchuniversities/index.htm

National Science Board. 2009. Investing in the Future: NSF Cost Sharing Policies for a Robust Federal Research Enterprise. http://www.nsf.gov/pubs/2009/nsb0920/nsb0920.pdf

Parker, C.W. and O'Donnell, M.L. 2006. Some observations on the Federal regulation of higher education. http://www2.ed.gov/about/bdscomm/list/hiedfuture/reports/parker.pdf

President's Council of Advisors on Science & Technology. 2010. Report to the President on Accelerating the Pace of Change in Energy Technologies Through an Integrated Federal Energy Policy. http://www.whitehouse.gov/sites/default/files/microsites/ostp/pcast-energy-tech-report.pdf

The White House. 2011. Improving Regulation and Regulatory Review - Executive Order 13563. http://www.whitehouse.gov/the-press-office/2011/01/18/improving-regulation-and-regulatory-review-executive-order

The White House. 2011. 21st Century Government: A Simpler, Smarter Regulatory System. http://www.whitehouse.gov/21stcenturygov/actions/21st-century-regulatory-system

Tobin L. Smith (toby_smith@aau.edu) is vice president for policy and Josh Trapani (josh_trapani@aau.edu) is senior policy analyst at the Association of American Universities in Washington, DC. Anthony DeCrappeo (tdecrappeo@cogr.edu) is president and David Kennedy (dkennedy@cogr.edu) is director of costing policies at the Council on Governmental Relations in Washington, DC.

Responses to Questions for the Record Posed to Leslie P. Tolbert, Ph.D.
by
HOUSE COMMITTEE ON SCIENCE, SPACE, AND TECHNOLOGY
SUBCOMMITTEE ON RESEARCH AND SCIENCE EDUCATION

Relating to June 27, 2012 Hearing on
"The Role of Research Universities in Securing America's Future Prosperity: Challenges and Expectations"

Submitted by Leslie P. Tolbert, Ph.D.
Senior Vice President for Research, University of Arizona, Tucson, Arizona
August 1, 2012

1. ***The National Academies report identifies "national goals" that include advances in medicine and health care, energy security, improved standards of living, and education of children and adults. What are your thoughts on the national goals identified in the report? Do you believe this list is comprehensive or are there any areas you think may have been missed?***

The goals enunciated in the National Academies report are laudable. While no list can include everything that is important, this list includes goals that will find broad support, because they directly address our Nation's citizens' fundamental needs and desires for long-term health, well-being, and security. Especially significant among the goals is the focus on education at every level. Improvements in K-12 education are at least as important as ensuring the strength of research universities. Well prepared students can take full advantage of the research university system; and, in a virtuous cycle, our universities provide the teachers for K-12 and the doctors for our hospitals, as well as the research results that will inform their practices, for future generations. Ensuring the strength of U.S. research universities will help to ensure that we move in directions that provide long-term prosperity and security for our citizens.

2. ***Following the fourth report recommendation to improve university productivity, how challenging is it for research universities to eliminate redundant activities, programs, and structures? What does this type of introspection require from your university?***

Redundant, or unnecessarily duplicated, programs and structures were among the first targets for elimination during the budget cuts that universities have sustained in the last five years. To cut their costs, universities have implemented many actions to make their systems more efficient. These include streamlining business management and accounting, centralizing information technology (IT) services, and eliminating underperforming or undersubscribed academic programs.

The University of Arizona has instituted many changes for efficiency. For example:

- We hold our employees to high standards of performance. We continued and strengthened our process of regular, annual or multi-year, reviews of all academic units and began a process for regular review of senior leadership, as a basis for streamlining, building on strengths, and eliminating weaknesses.

- We simplified numerous administrative processes, through process mapping and subsequent elimination of any steps (and personnel) that were deemed not to be absolutely necessary.
- The University's central administration undertook organizational changes to eliminate historical complexity and better match the administration's structure with current needs.
- A number of small, department- or program-based business offices were consolidated to form fewer, larger offices that require fewer expensive managers.
- Campus-wide, we consolidated IT services, through the purchase or development of new software to perform many business and financial tasks and to provide oversight of sponsored (including federally sponsored) activities, and through the closure of department- and college-level computer servers that were legacies of a time when each large department had to have its own server. In the process of consolidation, we developed a new shared Research Data Center that will actually increase our computational capabilities.
- Some of our smaller degree-granting programs were closed, others that covered overlapping areas were merged, and some departments were corralled into larger "schools" that will enhance interaction and reduce redundancy in the future.
- The University has begun to implement Responsibility-Centered Management, a budgeting mechanism that is targeted at maximizing efficiency at every level in the institution.

All of this has cost money, but the savings are expected to far exceed the costs over the coming years. The ability to make further changes is becoming more and more difficult now, as we feel we have made most of the changes we can make without significantly eroding the quality of our research and education enterprises.

3. ***At the hearing, it was noted that while industry has dismantled its large corporate research labs they have not yet fully partnered with research universities to fill the gap. Has your university worked to partner with industry to fill this gap? If so, have those partnerships resulted in any positive outcomes? If not, why not and would your university consider industry partnerships in the future?***

Internationally, companies are increasing their overall spending on research and development (R&D), with more focus than ever before on development and less on foundational research. This leaves an increasing share of the research part of R&D to the universities. According to Battelle R&D Magazine's 2012 Projections report, companies throughout the world will spend a total of $1.4 Trillion on R&D in 2012, a 5% increase over the prior year. Although industry-sponsored research still only represents about 5-10% of a U.S. university's total research expenditures, it offers promising growth potential plus expanded relationships in other lucrative areas, including connections with students and alumni, economic development, commercialization, and philanthropy.

Partnering between universities and companies continues to present challenges, particularly in the areas of intellectual property (IP) ownership and in negotiating agreeable contracting terms, but the University of Arizona and others active in this realm have made considerable progress in these areas in recent years. The University of Arizona provides a single point-of-contact Corporate and Business Relations Director to simplify first-time connections with companies and a broad menu of engagement choices to transform simple, transactional relationships into broadly based, productive, and sustained strategic relationships. We are fully convinced that universities should commit to enhancing their industry partnerships because of the many mutual benefits they provide and because of the growth potential that private sector funding offers, and we are actively working toward those goals. Becoming

valued partners of industry has not only the obvious immediate effects on university programs, but also a more intangible, longer-term effect on "town-gown" relations.

The University of Arizona employs the following strategies for prospecting and developing new industry partners while also expanding existing company relationships:

- Providing a single point-of-contact portal supported by concierge-style customer servicing to all companies contacting the University.
- Focusing proactive business development activities and resources on building and sustaining strategic relationships with large global companies within the seven industry sectors that are relevant to us: Agriculture, Bioscience, Environmental Sustainability/Solar, Aerospace/Defense, Information Science and Technology, Space/Optical Sciences, and Advanced Materials.
- Leveraging and expanding existing company relationships campus wide, so that companies can engage in interdisciplinary research and can gain access to the many resources the University has to offer.
- Establishing an institutional strategy and approach for industry partnering and coordinating the many interests within the University community involved in these activities to ensure a seamless integration of services.
- Building a campus-wide network of responders to efficiently and effectively facilitate multi-unit/college engagements.
- Facilitating company interactions with contracting and technology transfer functions within the University.

For the future, the University of Arizona will continue to invest in expanding university-industry relationships and in developing mechanisms for measuring the holistic value of broadly based strategic relationships.

4. ***As I requested during the hearing, please provide a detailed list of specific regulations that Congress should consider amending or repealing due to their burdensome nature. Please explain each noted regulation, what it requires in order for implementation, and why you suggest amending or repeal.***

As a Federal grantee, we are conscientious stewards of public research investments. We understand the importance of compliance and regulatory oversight and we strongly support the objectives of accountability and transparency. The increasing numbers and complexity of federal regulations and reporting requirements, however, create a growing burden on both universities and federal agencies that sucks resources away from their primary target of supporting research. It should be possible to streamline and simplify those regulations so that they become less expensive in time and money while still maintaining essential accountability.

Many of the regulations come from the White House Office of Management and Budget, most particularly through OMB Circular A-21, which governs in detail how much universities can be reimbursed by the federal government for the common ("indirect") costs of providing the infrastructure for research. To OMB, we have suggested many changes that would significantly reduce the administrative burden. Among them are:

- Clarification of allowable charges for indirect costs, and allowing charges for administrative support that is directly allocable to a specific project as a direct cost to the project.

- Requiring all federal funding agencies to honor the full federally negotiated "Facilities and Administration" rate for coverage of the indirect costs of research.
- Elimination of effort-reporting and replacement with an outcomes-based system of Payroll Distribution.

To the Department of State and Department of Commerce in the Executive branch, we also would request:

- Streamlining and clarification of export control regulations in the International Traffic in Arms Regulations (State) and Export Administration Regulations (Commerce) that are protect national security interests but are complicated and sometimes unnecessarily limit university-based research.

Some of the growing regulatory burden is in statute that could be changed by Congressional action. In particular, we respectfully request that attention be paid to minimizing the regulatory burden that would be imposed by any new act of Congress, such as, for instance, the DATA Act. If and when particularly large new regulatory burdens are unavoidable, we request that explicit mechanisms be provided for covering those costs. It is critical to minimize so-called "unfunded mandates," which have increased the burden of oversight tremendously in recent years, distracting universities from the primary purposes of new programs.

A particular area of growing concern is the limitations imposed by the Defense Federal Acquisitions Regulations Supplement (DFARS). DFARS restricts the ability of university researchers on Department of Defense grants and contracts to publish their research results, even when they should be considered "fundamental research," and limiting the ability to have foreign nationals as participants in such research. University-based research, in general, should be open and its results available to others to build upon. Only under limited, specific conditions, for instance when it is deemed that the work must be export-controlled or Classified, should publication and foreign-national restrictions be imposed. Most of the research conducted in universities is truly fundamental and not specifically directed to military and other applications that must be kept secret, and in all those cases only the general FAR (and not DFARS) should apply. Direct engagement of the House Subcommittee on Research and Science Education with senior leadership in the U.S. Department of Defense on the subject of what can and should be considered fundamental research would be helpful.

5. ***You identified the challenging economic situation facing the Nation and your university. How have you prioritized programs or research areas at your institution? Do you feel you have lost anything significant to date?***

The University of Arizona is a comprehensive, land-grant, public research university with highly ranked programs that range from Dance and Philosophy to Astronomy and Optical Sciences. Approximately five years ago, the University developed a set of priorities for special, targeted investment in key research areas. A strategy was developed to focus a disproportionately large share of our limited resources on five areas of current excellence and/or of high possibility for growth. These areas include Space and Optical Sciences, where we are already outstanding; Energy research, where we have so much potential in solar energy and energy storage; and Biomedical and Clinical research, where we have scattered strengths that can form the basis for much more success and societal impact if we put in a focused investment to fill gaps in expertise. At the same time as we make these strategic, focused investments, we balance that focus with some broad coverage, so that we remain comprehensive for our students and so that critical interdisciplinary research is possible.

Currently, some significant programs at the University are under considerable threat. In many cases this is because the source of external support for those programs is itself being threatened and is unstable from year to year. For example, our plans for solar research and innovation have been jeopardized by large changes in the Federal and industry context for this area.

Besides setting priorities in our research investments, we also have listened to the workforce needs of the private sector regarding new educational programs. We have developed professional master's degrees, such as the Masters' of Science in Geographic Information Systems Technology, and new graduate certificates, for instance in Health Care Informatics, in response to those needs. We also are putting an emphasis on learning outcomes that are consistent with the way knowledge will be used in the future, and we are using internet technology to reduce the financial and human costs of traditional course delivery by offering on-line and hybrid (on-line and in-classroom) courses.

As strategic priorities are addressed, programs that are not given priority for internal investment are in many cases working harder to acquire external funding. A few have closed or merged with others, as described in answer to Question 2 above.

6. ***Your testimony notes the new Entrepreneurship minor being offered across the University of Arizona. Is this new opportunity being marketed to researchers and students pursuing STEM degrees? Has there been a great deal of interest form the University's science departments and programs for this type of minor?***

New minors in Entrepreneurship for undergraduate and Ph.D. students are aggressively marketed in the STEM disciplines. Neither minor is available to business students, so they are primarily populated with STEM students. The undergraduate minor is expected to be comprised of 60-75% STEM students, with the balance from arts and humanities. The doctoral minor has been comprised of over 90% STEM students over the three years since the inception of the program. Even before these two minors existed, 26% of our entrepreneurship students were from STEM fields. Overall, the new minor programs have been very well received by faculty, departments, and students across STEM areas.

7. ***The report recommends taking steps to grant residency for non-U.S. citizens who earn doctorates in areas of national need. There are some who may want to ensure caveats that help to guarantee the Nation's safety. Likewise, it is equally important that American students receiving these doctorates have priority on potential jobs. What are your thoughts on this recommendation?***

Our prosperity and security in the 21st century will depend on our ability to lead in an increasingly international and high-technology economy. Historically, many of our nation's most decorated and most impactful scientists and engineers have been foreign-born. To increase the size and quality of the workforce necessary to advance our economy, we must provide university opportunities to as many prepared students as possible. We should do what we can to attract the best STEM talent in the world, not just the U.S., to our universities, and then try to keep that talent that we have educated right here, in our nation's STEM workforce. Bills that were introduced in Congress this year to support the ability of foreign students who have earned advanced STEM degrees in the U.S. to obtain green cards should be considered seriously as a positive step forward on this issue.

Certainly, routine screening is prudent before issuing a green card or citizenship to any immigrant, to ensure that national security is not compromised; but that will exclude only a minor number of the foreign earners of Ph.D. degrees.

Interestingly, only about one quarter of people with doctoral degrees work in universities; most work in other fields, such as industry, government, healthcare, and law, where they bring skills in critical thinking, tackling complex problems, and understanding and communicating difficult ideas. Thus, those degrees prepare young people for a broad swath of careers of high responsibility. National Science Foundation statistics indicate that the unemployment rate of those people who hold a Ph.D. degree is very low, less than 2%. Thus, keeping foreign-born graduates who have earned doctoral degrees in the U.S. here will have a minimal, if any, negative impact on the competition of U.S. graduates for jobs. The jobs are there; we need more talent to fill them and make our nation's workforce the best in the world for decades to come.

8. ***Please comment on the function of your university's tech transfer office, entrepreneurial programs with regard to STEM disciplines, and any associations with research parks and centers. Please include their roles in assisting faculty and students with moving research from the lab to commercialization, including the pre-commercialization stage or proof-of-concept stage.***

The University of Arizona has a very substantial research park, the UA Tech Park, and is developing a new UA Bio Park that will focus on bioscience companies. The UA Tech Park plays an important role in our efforts to move technology from the laboratory to the marketplace. The park provides a business incubator to incubate student and faculty start-up companies and is a major site for the testing, evaluation, and demonstration of new technologies, especially in the fields of solar and other renewable energy; aerospace, defense, and border technologies; and optics and photonics. Of the 52 companies and other organizations in the park, 14 are university-related. The park hires 50-55 university interns or student assistants to work with park companies each semester. Outside of park activities, UA Tech Park management is working closely with local school districts, Pima Community College, and the University's branch campus, UA South, to promote STEM education and training.

Currently, the University is developing a second research park, the Arizona Bioscience Park (UA Bio Park), to promote technology development and commercialization in the life and biosciences and more tightly connect university-based research with R&D in the commercial sector.

The University has just started an exciting new venture, called Tech Launch Arizona, that is designed to integrate our existing Technology Transfer office, research parks and business accelerator, and Corporate and Business Relations office into a single, coordinated entity that will work closely with the entrepreneurship center in our College of Management. Tech Launch Arizona also will include a greatly expanded proof-of-concept center, for which philanthropic support is currently being sought. The goal of Tech Launch Arizona is to expand the culture of commercialization among faculty and students and to enhance our interaction with the innovation community. We will be adding programs and funding for inventors across the commercialization continuum so that there is support at each stage for qualified innovations to move forward. Expected outcomes include a greater entrepreneurial spirit among our faculty and students, quicker movement of new ideas and inventions into practical application and use, better relations with the private sector, and a more robust royalty revenue stream back to the University.

Questions for the Record
The Honorable Mo Brooks

HOUSE COMMITTEE ON SCIENCE, SPACE, AND TECHNOLOGY
SUBCOMMITTEE ON RESEARCH AND SCIENCE EDUCATION

The Role of Research Universities in Securing America's Future Prosperity: Challenges and Expectations

Wednesday, June 27, 2012
10:00 a.m.

QUESTIONS FOR DR. SIEDOW:

1. The National Academies report identifies "national goals" that include advances in medicine and health care, energy security, improved standards of living, and education of children and adults. What are your thoughts on the national goals identified in the report? Do you believe this list is comprehensive or are there any areas you think may have been missed?

   - The list of national goals identified in the National Academies report is generally comprehensive and highlights the most pressing challenges facing our Nation and the global community. That said, one item not mentioned that merits inclusion is the topic of "food and water security." This is particularly relevant given the current drought conditions underway in the Nation's midsection, but is also an underlying problem across the world. Additionally, IT and cyber security issues warrant special mention.

2. Following the report's fourth recommendation to improve university productivity, how challenging is it for research universities to eliminate redundant activities, programs and structures? What does this type of introspection require from your university?

   - The ability of universities to cut costs is challenging but doable. It is worth noting that public universities across the country have been going through this process for several years now in light of substantial and recurring cutbacks in State funding. They have become much more streamlined and efficient in their overall structures as a result.

     Looking specifically at Duke University, because it is a private institution, we are not dependent upon funding from the State of North Carolina. However, as a private institution we tend to be much more dependent, than are most public institutions, upon funding provided through our endowment and annual giving. In 2011, the value of our endowment was over $5.7 billion, but that number represented a substantial recovery from its value in 2009 when the economic downturn of 2008 decreased the endowment value to under $4.5 billion, almost 30% less than its value the year before. In response to the decrease in this major source of funding, the university

instituted cost-saving measures that ultimately equaled $125 million annually. This included personnel reductions, changes in service levels, programmatic adjustments, to name a few. Because some of the personnel affected by these measures were associated with research administration, these measures did affect the research enterprise to some extent.

In addition, the university has been working through an initiative over the past five years, Research Administration Continuous Improvement (RACI), to streamline all aspects of research administration across the board. To date these efforts have led to the institution of more automated procedures throughout the grants administration process and we anticipate major savings from the enhanced application of IT to all aspects of our research administration process. The current compliance and regulatory environment directly impacts the ability of faculty to focus on the conduct of research. The ultimate objective of RACI is improved service to research faculty through better support and reduced administrative burden that leads to better research outcomes.

3. At the hearing, it was noted that while industry has dismantled its large corporate research laboratories, they have not yet fully partnered with research universities to fill the gap. Has your university worked to partner with industry to fill this gap? If so, have those partnerships resulted in any positive outcomes? If not, why not and would your university consider industry partnerships in the future?

   - Duke has a long tradition of working with industry and has, in fact, led the annual National Science Foundation R&D indicators for twelve years running in the amount of R&D support derived from industry among all universities. Much of this is attributed to the success of the Duke Clinical Research Institute.

     On the non-medical side of the University we have worked hard to develop ties with industry in our research endeavors. While this has occasionally led to difficulties involved in reaching agreement between Duke and our potential industry partners over issue of who owns what IP (intellectual property), most of these negotiations have gone ahead without difficulty and have led to strong partnerships, particularly with faculty in our Pratt School of Engineering. We have every plan to continue to work to improved and enhance our interactions with industry in the future and will do what is needed to make such collaborations work.

4. As I requested during the hearing, please provide a detailed list of specific regulations that Congress should consider amending or repealing due to their burdensome nature. Please explain each noted regulation, what it requires in order for implementation and why you suggest amending or repeal.

   - Since 1990, sponsored research expenditures at Duke University have doubled and then doubled again. (Actual growth: 530%). In Fiscal Year 2010, sponsored research expenditures exceeded $826M. This significant growth has occurred at the same time that federal regulatory requirements and administrative cost restrictions have also

grown exponentially. In addition, there have been increasing limitations on generating sufficient institutional dollars to meet new regulatory requirements. This is a common scenario among almost all of Duke University's peer institutions, and like most of our peers, the University has taken steps to ensure compliance in spite of its growing price tag.

Duke University strongly supports the objectives of accountability and transparency, and firmly believes that compliance and regulatory oversight are essential to the conduct of federally- supported research. Duke University has developed a national model of compliance oversight and project management training designed to support compliance, while providing researchers with highly skilled support personnel to assist them in managing their federally funded projects. In the past five years Duke University has created a compliance management structure that includes over 70 dedicated compliance liaison officers, three new compliance offices, and multiple initiatives to address new and expanding federal regulations (e.g. ARRA, FISMA, Export Controls, COI, etc.).

These initiatives and responses are not without cost – costs that are not recoverable under current OMB A-21 language, but are very real to research universities which must absorb them. As an example, we estimate that improved systems for effort reporting alone cost the university $1.4 million in one-time costs and we spend upwards of $5 million annually in systems and personnel to manage and implement the certification process. Unfortunately, regulatory demands force institutions to implement systems that provide audit documentation but fall far short of appropriately equating researcher effort to sponsored project outcomes. The federal government must understand that research is never going to be measured as a standardized process. This aspect of the university-federal partnership is critical to reinforce because federal grants do not cover the full costs of the research; in most cases, faculty often spend far more "time" than is specifically accounted or budgeted for on the grant.

We thank you for the opportunity to offer our concerns and recommendations. We stand ready to discuss these recommendations at any time.

1. <u>Recommendation</u>: Reduce the burden of the effort certification process
Reduce or eliminate OMB A-21's effort certification requirement as it is currently structured in favor of a process that is more outcome based and less administratively burdensome.

<u>Proposed Actions</u>
Change OMB A-21 to allow a reporting option that relies on an assessment of the reasonableness of the effort expended/charged to the productivity/outcome of the project. This could be accomplished by modifying the Progress Report requirements and rely on the sponsor's review of progress made as the definitive measure. This recommendation is made on the basis of two important factors: 1. University payroll systems have matured significantly over the past several decades, making it possible to accurately readily allocate effort charged to specific projects and activities; 2. The current process does not align effort expended with outcomes in any meaningful manner. If this

recommendation is accepted, it is also imperative that auditors are aligned with revisions so that focus is on reasonable in support of project outcomes.

Burden/Cost
At Duke University, an extremely conservative estimate of the annual cost associated with the effort management process approximates 75 FTEs and $5.3M (other estimates, depending on the definition of effort reporting/management range from $10M - $15M in total annual cost). This estimate includes a proportion of FTEs that coordinate the collection of effort certifications, time associated with faculty and staff that are required to certify, personnel costs in central offices, and related technology costs. This estimate does not include associated space and other costs for staff to conduct these activities or the mandatory training and communication that is distributed to thousands of faculty and staff on an annual basis. Furthermore, Duke incurred a one-time initial implementation cost in FY09 of over $1.4 million. Note that the estimated $5.3M cost is for a process that is not directly correlated with improved research outcomes.

Lastly, it is important to mention that this cost is not reimbursable from sponsors as Duke University's F&A rate exceeds the 26% administrative cap.

This burden is particularly difficult in a complex academic medical center where:
a) there is significant interrelatedness between projects and
b) when one bedside interaction with a hospital patient is extremely difficult to capture accurately in an effort system. In this situation, the faculty member may simultaneously be exerting effort in support of clinical care, in support of the academic mission (because there may be a graduate accompanying the faculty member), and the research mission (because the patient may also be clinical trial subject).

Effort reporting is extremely burdensome and costly, and is not correlated to project outcome in a manner that justifies its cost.

2. Recommendation: Reduce Sub-recipient Monitoring burden
Eliminate the Subrecipient Monitoring requirement for universities that subcontract to other institutions that are subject to the OMB A-133 audit.

Proposed Actions
Universities that enter into subcontracting relationships with other domestic institutions subject to OMB A-133 should not be subject to expanded standards of accountability for the compliance actions of these subrecipients.

Burden/Cost
More than 60% of the Duke University 300 subcontractors are peer institutions that are subject to the OMB A-133 audit. This 60% represents more than 80% of our subcontract volume on an annual basis. Duke University therefore, expends most of its time monitoring subs that the federal government, by virtue of its direct grants to the institution, has deemed in a risk category that they feel is reasonable.

OMB A-133 and the associated annual supplement define audit guidelines, provide a framework for evaluation of risk and risk areas at prospective subrecipient institutions and even provide follow-up systems to determine if risk has been mitigated. Therefore, it seems logical to rely on these audits to provide a reliable, consistent framework for monitoring subrecipient compliance.

Duke University has developed a sophisticated business process and web-based system for gathering information on our potential subrecipients, evaluating this data, and adjusting contract terms and conditions as a result of this initial risk assessment. The university also monitors financial and programmatic compliance during the life of the funded project and conducts additional review at closeout. The Office of Sponsored Programs is responsible for reviewing OMB A-133 audits for all subrecipients, and ensures that updated information regarding risk is conveyed to the pre-award offices on a regular basis. Multiple forms, complex electronic workflow and three shared databases are required to support the current SRM process. The cost of developing the current assessment process and IT tools approximated 5 FTEs from central offices and the technology development group over a 15 month timeframe. In addition, at least three pre-award office staff members review, assess, and negotiate subrecipient agreements based on risk. The post-award office (OSP) issues formal letters advising each subrecipient of expected compliance requirements, and also issues an internal "rate of burn" letter to advise departments of financial progress at mid-point of each subaward. The Research Costing Compliance office provides extensive monitoring and training to ensure that subrecipient monitoring is appropriately applied. As stated above, this extensive effort would be appropriate only to a small subset of the university's subrecipient pool if those subject to OMB A-133 were removed from subrecipient monitoring. Duke could then adjust its process to focus on those at highest risk.

The new business process was designed to reduce burden by applying a technical solution but with federal auditors recent focus, we spend an inordinate amount of time documenting the process instead of focusing on those subrecipients that are not subject to the A-133, and therefore are likely at higher risk.

3. **<u>Recommendation</u>: Allow the direct charging of project management support staff.**

<u>Proposed Actions</u>
Communicate to the grant community that project management support activities are an allowable direct expense when those activities can be specifically identified to an individual project.

Rationale:
OMB A-21 current reference to "clerical and administrative" was developed over 20 years ago and was generally focused on "secretarial activities" that supported broad administrative functions and could not readily be allocated to a specific project. Examples might include typing correspondence, filing, purchasing basic supplies,

incidental travel arrangements, and general office duties. Although these functions remain essential to general administrative operational support, the nature of project management administrative responsibilities and their specific application to sponsored activities has dramatically changed.

Over the past four decades, a new profession of research support staff has emerged, with its own body of knowledge, professional credentials, professional associations, and professional standards. These skilled technicians may be found across the globe as professional project managers, and it is these individuals that form the project management support structure that is critical in effective management of sponsored activities. Their functions can be readily identified with project management support and their contributions are critical in relieving faculty of burdensome compliance and financial management duties. Unfortunately, current OMB A-21 language is often interpreted to prohibit the direct charging of these otherwise allocable compliance and project administration functions. We recommend that project management support activities be classified as an allowable direct expense when those activities can be specifically identified to an individual project.

Duke University faculty are frustrated by the competing demands of managing increasingly complex projects and the limitations on directly charging project management support to their funded projects. These activities include, but are not limited to, research protocol and compliance support, recruitment and hiring of staff, management of complex financial and programmatic reporting requirements and related project financial oversight. These are essential components of contemporary research projects and programs and in many instances, they are performed by researchers, or possibly by students and postdoctoral fellows, pulling these research personnel away from their research responsibilities.

Burden/Cost

The 2007 *Faculty Burden Survey*, conducted by the Federal Demonstration Partnership, reports that the significant growth of compliance requirements and commensurate project management responsibilities are overwhelming faculty, and having a measurable impact on their ability to focus on scientific productivity. The 2007 FDP *Faculty Burden Survey* revealed that, of the time that faculty committed to federal research, 42 percent was devoted to pre and post-award administrative activities – not to active research.

The recommended change would acknowledge the changing dynamic of project support functions, address the ever increasing regulatory and project management burden on faculty, and provide skilled technical support to enable researchers to become increasingly more productive and accountable. By funding personnel to perform project management tasks, sponsors will be paying a lower rate of pay than faculty researchers currently receive, thus leading to efficiencies in both science and administration.

Direct charging of allocable project management support personnel empowers support for individuals who would perform these functions in a much more cost effective manner than the PI.

4. Recommendation Elimination paper retention requirements for paper documents

Proposed Actions
a) Remove requirement that an institution get advance authorization before substituting electronic records for original (paper) records.
b) Remove requirement from all regulations, including the FAR (4.703), that require retention of paper documents after imaging to permit periodic validation of the imaging system.

Burden/Cost
Under the current regulations, many universities are required to maintain a massive amount of paper documentation in the unlikely possibility that it is related to a federal contract. One example, which is extremely costly, is the requirement when applied to the procurement cycle. To provide some high level numbers to this statement, although Duke University has less than $7 million dollars in contract procurement spend (excluding payroll, fringe and related F&A), we are required to maintain supporting documentation for more than $1.5 billion of procurement spend to ensure we were meeting the FAR requirement. This occurs because as an accounts payable invoice is received, the central office has no way of knowing whether the document is related to a federal contract, a student group, the health system, the football team, or any other unit within the university. Per FAR 4.703, we are required to retain the paper document for one year after scanning. This requires clerical support, filing cabinets, office supplies, rental space, etc. all to ensure that the ½% of potential contract related spend is retained in support of a potential audit.

As we expand the imaging solution to other business process cycles, such as travel and grants processing (proposal through closeout), we will continue to incur significant costs even though our contract volume ($20M) is small compared to the rest of our institutional business ($3B).

Background
Technology has improved over the recent years so that imaging solutions are full featured and searchable, secured, and add significant value to the business process while often reducing transaction cost. They allows an institution to workflow documents, share documents via corporate systems such as a general ledger, and most importantly maintain/retain the documents in an electronic format so that the original paper documents can be disposed of, as well as the associated file cabinets.

Many institutions have made progress in this area in the procurement cycle and are now considering an expansion of the use of technology, including the entire grant cycle from

proposal through closeout. Other opportunities include the travel/reimbursement business process, procurement card, check request, etc.

OMB A-110 (2 CFR 215.53, Para c) states that "Copies of original records may be substituted for the original records if authorized by the Federal awarding agency." DHHS has identified a process to transition to electronic records (OGAM AT 99-1), but very clearly states in the "Purpose and Background" section that institutions should *"be aware that Federal contract documents are subject to FAR 4.703(c)(3), which states, "the contractor or subcontractor retains the original records for a minimum of one year after imaging to permit periodic validation of the imaging systems.")* Recent discussions with cognizant officials at DHHS have confirmed this interpretation.

Institutions should be permitted to meet document retention guidelines in any manner they deem reasonable with the understanding that it is their ultimate responsibility to provide backup documentation as required to substantiate all expenditures, proposals, agreements, etc. This documentation, whether paper or electronic, must be available and legible for the appropriate retention period.

5. Recommendation: NIH should reconsider its May 13, 2010 notice that limits F&A recovery of Genomic Arrays.

Proposed Actions

a) NIH should rescind its May 13, 2010 Notice *(NOT-OD-10-097)* that limits F&A recovery on Genomic Arrays purchases. If this is not possible, then
b) NIH should clarify what the Notice does and does not apply to:
a. The *Notice* should not apply to "Sequencing Reagents", which are incredibly facility and administration intensive and often require facilities with specialized equipment, IT support, HVAC, and associated technicians.
c) NIH should raise the threshold.

Background/Burden/Cost

We endorse COGR's response dated May 27, 2010 and July 11, 2011.
Specifically focusing an F&A reimbursement policy to a single vendor purchased event is inconsistent with A-21 premise of an "averaging concept" and it is inconsistent with the reality for the true life cycle costs associated with Genomic Arrays. Because of the expedited implementation, multiple items associated with GA's were "swept" into this cap, including Sequencing Reagents that are facility and administratively intensive and require specialized equipment, HVAC, IT support, etc. With regard to the life cycle issue, the purchase is just one- step in the broader and very expensive continuum related to the processing. Furthermore, there are numerous cases where the university incurs far higher F&A costs than the negotiated rate for a particular purchase or grant, but no opportunity is presented to recover these costs. The 26% cap, cap on F&A for subcontracts, and artificial limitations by sponsors on reimbursement are but three examples.

Permitting NIH to arbitrary implement this cap opens the door to any situation where there is a real or perceived disproportionate administrative burden. Moreover, it does it in a manner than it extremely burdensome, operationally, for an institution to implement in a timeframe that a university could not realistically include in the F&A negotiation in an attempt to support equitable reimbursement.

6. <u>Recommendation</u>: Clarify the allowability of the direct charging of computers and similar technologies necessary for the effective conduct of research activities.

<u>Proposed Actions</u>
We endorse COGR's position and agree that OMB should write a "Memorandum to Agency Heads, Representatives from the Regulatory and Audit Community, and Research Universities and Institutions" that states research communications, tools, and similar equipment (and related supply items) that are necessary for the efficient and effective conduct of research activities are allowable as direct charges to Federally-sponsored research, service and educational programs, effective immediately. Furthermore, we agree that necessary adjustments to A-21, section J.18 should be made to support this communication and the audit community should be directed to utilize the proposed changes as the sole basis for determining allowability.

<u>Burden/Cost</u> *(paraphrased from COGR response)*
Technology, and how it is used in the conduct of research, has changed dramatically since Circular A-21 was introduced. Despite many changes to the Circular over the past two decades, text specific to current technology has not been updated in the Circular; in fact there is still reference to "telegrams" and other outdated modes of communication. Research communications equipment/devices and other "research tools" including laptop and desktop computers, printers, video equipment, cell phones, other equipment/devices that are used to conduct the research and to facilitate data processing/data transfers/etc. between research colleagues, and other "research tools" are necessary for the efficient and effective conduct of research activities.

The current requirement in Circular A-21, Section J.18, that requires these types of equipment and tools to be treated as "*general purpose*" and specifies them as "*unallowable as direct charges*" (Section J.18.b(1)) ignores the important and direct role they play in research. When research communications equipment/devices and other research tools can be supported as direct benefit to a federally sponsored program, they should be an allowable charge to the project, subject to cost allocability principles defined in Circular A-21. In the case where the item(s) do not meet the institution's threshold for capitalization, the same principle should be applied and the item(s) should be an allowable charge to the project.

Implementation of this change will provide faculty and investigators with easier access to the research communications, tools, and similar equipment (and related supply items) that are necessary to conducting their research activities.

regulations and policies among federal agencies. The protection of human research subjects' requirements has changed significantly by the accumulation of agency-specific specifications and suffers under duplicative conflicting reviews by federal agencies. The Department of Health and Human Services (HHS) human subject protection regulations at 45 CFR part 46 serves as the basis for all Federal human subject protection regulations and policies. This is accomplished through the implementation of Subpart A as the "Federal Policy for the Protection of Human Research Subjects," informally known as the "Common Rule." Adopted by 15 federal departments and agencies in 1991 the Common Rule is codified with identical language in the separate regulations of those departments and agencies. Some but not all agencies have adopted the other Subparts of 45 CFR 46 providing additional protections for specific subject groups. The Food and Drug Administration, has a separate set of regulations that regulate clinical investigations of products under its jurisdiction, such as drugs, biological products, and medical devices. In addition to meeting the basic regulations protecting human subjects, the Health Insurance Portability and Accountability Act of 1996 (HIPAA, recently amended by the Health Information Technology for Economic and Clinical Health Act, HITECH) requires additional reviews and approvals to ensure the privacy of individually identifiable health information in the conduct of research.

In implementing this Common Rule, agencies have taken strikingly different approaches. Research organizations are required to maintain a Federal-Wide Assurance (FWA) that demonstrates operational compliance with the current federal regulations. Nonetheless, agencies have inserted additional requirements in their implementation. The Department of Navy has recently expanded the training requirements for administrative personnel despite the training requirement that is part of the FWA process. The most time-consuming and redundant procedure is the requirement to submit for an additional review a research protocol describing the human subject research component that has been reviewed and approved by the applicant institution's IRB or, in some cases, by the peer review panels established to recommend the funding of research projects. This duplicate review delays awards and creates ambiguities over which institution or agency is ultimately responsible for the conduct of the human subject research. Agencies assure us that the institution retains responsibility and authority, but the agency will often require changes in the protocol that are inconsistent with institutional operations. Additional unique reporting, training, and operational requirements create confusion and occasional conflict in maintaining compliance with the regulation or policy.

The Council on Governmental Regulation (COGR) has identified a significant increase in the costs to institutions associated with the conduct of human subject research. During the period 1995 to 2000, costs related to human subjects' protection increased an average of 263% percent. The FY 2000 costs did not include mandatory training in human subjects protection – a new requirement in 2000 – estimated at that time by several large universities to be over $500,000. The COGR survey was repeated for AY2002 and AY2003, with average increases of more than 40%. COGR has recently polled a small group of large institutions with affiliated academic medical centers, and

they report costs from $400k to $1.2 million for their human subject protection programs.

Our belief is that the Common Rule requirement should be the standard for all research with human subjects. For institutions meeting the requirements of their approved FWA, research protocols for human subjects research should not undergo a full Federal agency review. Similarly, if institutions hold a current FWA which requires training of various members of the human research participate protection program, they should not have to meet additional unique training requirements. The additional requirement consumes researchers' time which is more productively spent in conducting research. Harmonization would allow researchers more time to devote to actual scientific work.

As proposed changes to the Common Rule are considered, the above concerns should be given full review and attention.

ARRA Reporting Expansion

In support of the American Recovery and Reinvestment Act of 2009 (ARRA) reporting and oversight, the University employed a specialized team composed of four experienced individuals to manage these awards, and developed a comprehensive in-house tracking and management IT system to support these efforts. If ARRA standards are applied to all federal awards, the resource demands on faculty and staff at Duke University would be exponentially increased.

Duke University endorses and supports the following statement issued by the Association of American Universities (AAU), the Association of Public and Land-grant Universities (APLU), and the Council on Governmental Relations (COGR) on H.R. 2146, the Digital Accountability and Transparency (DATA) Act of 2011.

Joint Statement from AAU, APLU and COGR: The nation's research university community is deeply concerned about the potential impact of HR 2146, the Digital Accountability and Transparency Act of 2011, on our nation's innovation capacity. This legislation would impose substantial new costs on universities' research enterprises, significantly reducing productivity with little benefit to the nation.

Scientific research is, by its nature and by already-existing laws, regulations, and reporting requirements, a transparent and accountable process. The Recovery Act imposed substantial added paperwork and other administrative burdens on scientists and administrators, with little evidence that they produced significant and useful information for the public or policymakers. The time and resources expended could have been devoted to actual research and education. Yet H.R. 2146 seeks to perpetuate these additional requirements.

In fact, preliminary data being collected by the Federal Demonstration Partnership suggests that the paperwork and other administrative costs of the Recovery Act reporting requirements for just under 100 research institutions alone were $87 million,

or about $7,900 per research award. If these costs are extended throughout the entire federal research enterprise, they could amount to hundreds of millions of dollars each year. The public rightfully demands that its tax dollars be spent usefully and wisely. Money is wasted, however, when researchers and administrators are forced to spend their time making needless calculations and filling out forms.

Both Congress and the Administration have been taking action to reduce the burden of unnecessary or unproductive regulation on the American economy. This legislation goes in exactly the opposite direction, and it should be rejected.

Federal Information Security Management Act (FISMA)

In October 29, 2008, the HHS CISO issued a memo to clarify FISMA application that stated, "FISMA (Federal Information Security Management Act) applies to grantees only when they collect, store, process, transmit or use information on behalf of HHS or any of its component organizations." A short time after this memo, FISMA terms appeared in RFPs for contracts from component organizations of the HHS. Duke, as well as many other universities across the country, has been negatively affected by these terms. The regulatory burdens include, but are not limited to, those summarized below:

Broad interpretation of a federal system -- Data associated with federally funded research generally resides on the same information systems as data associated with non-federally funded research. These systems are fully integrated into the existing computing infrastructure of the lab or unit performing the research. Yet, with the signing of a contract, these existing systems are transformed to "federal systems". They require different controls from that the rest of the computing environment. It is difficult to isolate these systems to apply these controls, as they must be used concurrently for non-federal contract research. The award of the contract forces two difficult choices: create a separate environment and duplicate systems, or apply a level of controls that is goes beyond what is required to meeting existing federal and state law, reducing the usability and flexibility of the systems to persons with no involvement in the work.

Decentralized nature of computing in academic setting – Persons with subject matter expertise reside in many different units within a university. . A researcher with a specific expertise may be awarded a contract. Her lab resides in one department and she uses expensive microscopes, systems and tools to perform that research. The next contract or subcontract will likely be awarded for a very different research purpose in a completely different lab. It is difficult to apply FISMA controls in a unit by unit basis, and it is equally difficult to consolidate computing resources (which much be shared with projects with no FISMA requirements). Applying a regulation that most appropriately pertains to the computing environment of an entire federal agency to disparate labs in a university setting is very difficult and costly.

Overlapping regulations – There has been an enormous effort to bring systems used in academia into compliance with HIPAA and HITECH due to the frequent use of PHI in human subjects' research. The contract does not change the nature of the data, yet the FISMA control requirements are significantly different and require much greater

expense to the research enterprise. This is undue regulatory burden. It is also important to note that the current effort to revise the "Common Rule" for human subjects research includes a proposal to create a uniform standard for the maintenance of PHI in the context of research. Those rules are being created to simplify the IRB review process, but FISMA has the potential to complicate it instead, if the institution needs to assure that both the new common rule and FISMA standards are met.

Small volume of contracts and subcontracts – unlike a federal agency which processes federal information as a standard business function, academic institutions process and maintain data associated with a relatively few federal contracts and subcontracts. Therefore, the cost of implementing controls cannot be offset with volume.

Lack of clarity – There is a lack of transparency in the determination of how the FISMA risk ratings are determined (High, Moderate, and Low). Contracts for similar types of research originating from different government receive different FISMA ratings. It is also difficult to determine what FISMA level should be flowed-down to subcontractors and on what basis the rating can be challenged.

The regulatory burdens come with significant costs. Because FISMA costs were not considered in the indirect rate funding negotiation, FISMA is an unfunded mandate. Some of the compliance costs, include, but are not limited to the following:

Certification and Accreditation costs – Certification and Accreditation (C & A) is a process that helps ensure that federal systems are meeting security requirements. If Duke has 25 different systems used in research which require FISMA controls the testing costs alone cost over $500,000 annually.

Subcontractor compliance costs – Subcontractors from other universities often provide subject area expertise to answer important research questions. Each time a subcontractor is employed, an evaluation of whether the subcontractor can meet the FISMA terms must be performed. In addition, the prime contractor is responsible for monitoring FISMA compliance for the subcontractors.

FISMA controls implementation – At a Low risk level, FISMA has over 140 control requirements. Although these controls are worthy, even at a low base-line, internal cost analysis show it would cost at least $1,000,000 to bring one single large unit into compliance. Smaller institutions without many contracts find these costs exorbitant.

Only large institutions can afford to employ these controls, which limits competition. In addition, unlike federal systems which are used to continually process data, federal contracts or subcontracts have an end date. Therefore the useful life of any hardware and software solutions used to implement controls would likely have to be recouped over the life of a single contract. Investment in such tools diverts money from research, and is not an efficient way to spend IT security dollars

5. You identified the challenging economic situation facing the Nation and your university. How have you prioritized programs or research areas at your institution? Do you feel you have lost anything significant to date?

   - To date the challenging economic situation facing the country has not affected Duke as much as it has many public institutions in terms of constricting specific research programs. As noted previously, the economic downturn did severely affect the size of our endowment and necessitated our cutting the University's annual budget by some $125M per year, roughly 10%. More specific to our research enterprise, we have not yet had to eliminate any significant areas of research because of reduced support from federal and other sources. That being said, our last two strategic planning exercises identified new interdisciplinary areas of research to focus our research efforts on. We are continuing to build in those areas of research but we have also been forced to cut back the amount of university funds provided to get several of those programs up and fully operational as a result of the budget-cutting measures referred to previously.

6. Can you tell me more about Duke's Program for Entrepreneurs? How did this begin? How is it connecting to students from STEM related disciplines?

   - Innovation and entrepreneurship have long been an integral part of Duke's culture. However, in 2010, the institution recognized a need to coordinate the many activities underway on campus through a centralize program. This gave rise to Duke Innovation and Entrepreneurship (Duke I&E). Duke I&E is committed to: 1) building a community and fostering a culture at Duke that supports innovation and entrepreneurship; 2) creating resources and infrastructure to support faculty, students and alumni in ideation, planning and launching of new enterprises; and 3) celebrating Duke entrepreneurs who are addressing the world's problems through the creation of new ventures. Through Duke I&E efforts to promote innovation and entrepreneurship permeate all levels of campus activity from formal academic programs for undergraduates, graduates, and professional students to informal working groups to competitions open to entrepreneurs of all types.

     Duke has a wide array of academic programs, at both the graduate and undergraduate level that focus on entrepreneurship. One in particular focused on students in STEM disciplines is Invention-to-Application, which is a year-long, experiential class for MBA, graduate biomedical engineering, engineering management, medical, and medical basic science students designed to integrate and expand their prior learning and draw on the experiences of teammates in order to understand and screen a group of real-world research projects based on their commercial potential. This is administered through the Program for Entrepreneurs (P4E) at the Fuqua School of Business

     There are many ways for students to get involved with entrepreneurship at Duke outside of the classroom setting. Graduate and undergraduate students can choose from a variety of student clubs and living groups. There are several networking

opportunities for students, faculty and alumni – including interest groups for social entrepreneurship, mobile applications, biotechnology and many more. The annual Duke Start-Up Challenge (founded in 1999) is open to all Duke students to compete for seed funding for their enterprise. The competition has seven independent "tracks", including undergraduate team, social venture, life sciences, and women-led teams.

For Duke students considering starting a new venture or joining an early venture that does not necessarily involve Duke intellectual property? There are a variety of programs to help them get started and assist them as the venture develops. These include: 1) the previously mentioned Duke Start-Up Challenge which encourages students to plan and launch their own businesses, receiving feedback from experienced professionals and a chance to win seed capital; 2) the Program for Entrepreneurs (P4E) which lets Duke students receive course credit for work towards starting a company. Students with projects can attempt to join the program by pitching their ideas at an Idea Pitch Event; and 3) DUHatch, which has a primary focus of assisting student entrepreneurs in creating viable business ventures.

7. The report recommends taking steps to grant residency for non-U.S. citizens who earn doctorates in areas of national need. There are some who may want to ensure caveats that help to guarantee the Nation's safety. Likewise, it is equally important that American students receiving these doctorates have priority on potential jobs. What are your thoughts on this recommendation?

   - Given the worldwide competition for students educated in STEM areas, the ability of the United States to attract foreign students trained in STEM subjects will be critical for allowing this country to maintain a competitive edge in science and technology in the future. To that end, the recommendation (#10) to streamline the process by which international students who want to study in the United States can obtain visas and doctoral students who obtain their degrees in this country can be allowed to remain here seems well justified and, within the constraints of national security considerations, worthy of relatively expeditious implementation.

8. Please comment on the function of your university's tech transfer office, entrepreneurial programs with regard to STEM disciplines, and any associations with research parks and centers. Please include their roles in assisting faculty and students with moving research from the laboratory to commercialization, including the pre-commercialization stage or proof-of-concept stage.

   - Research commercialization is the process of bringing research discoveries to market, so that they have a practical impact on people's lives. The Duke Office of Licensing & Ventures (OLV) is responsible for patents and technology licenses for Duke University and is the first stop for a faculty member, student or new venture team looking to commercialize technologies initially developed on campus. OLV is composed of a team of invention managers who have expertise in licensing, business development, marketing, and legal matters. The office reviews incoming invention

disclosures and works within its investor network to identify startup opportunities and to create new companies.

Duke University and OLV have a long-standing relationship with the nearby Research Triangle Park (RTP) which goes back to the time that the three area research intensive universities shared a common technology transfer office, the Triangle Universities Licensing Corporation (TULCO). While TULCO has since morphed into separate technology transfer offices at each of the three universities, collaborations between the universities and any number of entities within RTP, including the Research Triangle Institute, the North Carolina Biotechnology Center, the Triangle Universities Center for Advanced Studies Inc., (to name a few) remain to this day.

○