

**U.S. HOUSE OF REPRESENTATIVES
COMMITTEE ON SCIENCE AND TECHNOLOGY**

HEARING CHARTER

Science and Technology Leadership in a 21st Century Global Economy

**Tuesday, March 13, 2007
1:00 p.m. - 3:30 p.m.
2318 Rayburn House Office Building**

1. Purpose

On Tuesday, March 13, 2007, the House Committee on Science and Technology will hold a hearing to receive testimony on the critical importance of science and technology to our nation's prosperity. The focus is on the provisions of the National Academies report entitled *Rising Above the Gathering Storm: Energizing and Employing America for a Brighter Economic Future*. Witnesses have been asked to address the reasoning behind the education and research recommendations enunciated in that report.

2. Witnesses

Mr. Norman R. Augustine, Retired Chairman and CEO of the Lockheed Martin Corporation. Mr. Augustine chaired the National Academies committee that wrote the *Gathering Storm* report.

Mr. Harold McGraw, III, Chairman, President, and CEO of the McGraw-Hill Companies. Mr. McGraw is the chairman of the Business Roundtable.

Dr. Robert Dynes, President of the University of California. Dr. Dynes is Professor of Physics and Materials Science and a member of the National Academy of Sciences.

Dr. Craig Barrett, Chairman of the Board of Intel Corporation. Dr. Barrett served on the National Academies committee that wrote the *Gathering Storm* report.

Dr. Neal Lane, Malcolm Gillis University Professor at Rice University and Senior Fellow at the James Baker III Institute for Public Policy. Dr. Lane was the Director of the National Science Foundation from 1993 to 1998 and Director of the White House Office of Science and Technology Policy from 1998 to 2001.

Ms. Deborah Wince-Smith, President of the Council on Competitiveness. Ms. Wince-Smith served as an Assistant Director at the Office of Science and Technology Policy and as Assistant Secretary for Technology Policy in the Department of Commerce.

3. Overarching Questions

- Why is the promotion of science and technology so critical to America's prosperity? Where do we stand today, and where do we need to be in the future?
- What should the federal government's role be in advancing the science and technology agenda? What should be the top priorities in science education and research? Do H.R. 362 and H.R. 363 address the most critical needs?

4. Brief Overview

Henry Luce, publisher of Time Magazine, coined the term "the American century" in 1941 to describe his vision of the 20th century. Indeed, after World War II, the US economy grew substantially, and economists estimate that about half of US economic growth was the result of technological innovation. Indeed, during the 20th century, the United States became a world leader in science and technology education and research and in innovation, and economic indicators demonstrated that the United States offered a high standard of living to its citizens.

In the 1990's however, during a period in which the United States was known as the world's lone "superpower", a number of indicators suggested that US prosperity was diminishing. The United States trade surplus in high-technology products that was \$54 billion in 1990 turned into a trade deficit of \$50 billion in 2004. A number of iconic American companies moved assets, jobs, and ownership overseas. And American students performed poorly in several international assessments of math and science achievement.

In May of 2005, Senators Lamar Alexander and Jeff Bingaman asked the National Academies to conduct a study of "the most urgent challenges the United States faces in maintaining leadership in key areas of science and technology." In June, Congressmen Sherwood Boehlert and Bart Gordon wrote to the National Academies to endorse the Senate request for a study and to suggest some additional specific questions. The National Academies assembled a Committee on Prospering in the Global Economy of the 21st Century, and on October 12, 2005, that committee issued a report entitled *Rising Above the Gathering Storm: Energizing and Employing America for a Brighter Economic Future*.

That report, whose title we abbreviate to *Gathering Storm*, offered four recommendations:

- Recommendation A: Increase America's talent pool by vastly improving K-12 science and mathematics education.
- Recommendation B: Sustain and strengthen the nation's traditional commitment to long-term basic research that has the potential to be transformational to maintain the flow of new ideas that fuel the economy, provide security, and enhance the quality of life.
- Recommendation C: Make the United States the most attractive setting in which to study and perform research so that we can develop, recruit, and retain the best and brightest students, scientists, and engineers from within the United States and throughout the world.

- Recommendation D: Ensure that the United States is the premier place in the world to innovate; invest in downstream activities such as manufacturing and marketing; and create high-paying jobs based on innovation by such actions as modernizing the patent system, realigning tax policies to encourage innovation, and ensuring affordable broadband access.

Along with each recommendation, the report spelled out several specific action items to pursue in order to implement the recommendation.

On October 20, 2005, the Committee on Science of the 109th Congress held a hearing, entitled *Science, Technology, and Global Economic Competitiveness*. The witnesses at that hearing were Norm Augustine, retired Chairman and CEO of Lockheed Martin Corporation and chair of the *Gathering Storm* report committee; Roy Vagelos, retired Chairman and CEO of Merck & Co. and member of the *Gathering Storm* report committee; and William Wulf, President of the National Academy of Engineering. In their testimony, these witnesses promoted the recommendations of the report and argued that the action items were critical and urgent.

The *Gathering Storm* report quickly became influential in promoting a national agenda on innovation and competitiveness. In the 109th Congress, the House Committee on Science reported two pieces of legislation implementing a number of the *Gathering Storm* action items. The first of these bills was H.R. 5356, the Research for Competitiveness Act. The second was H.R. 5358, the Science and Mathematics Education for Competitiveness Act. Together, these bills addressed many of the action items related to Recommendations A and B. The bills were never brought to the floor of the House.

In the 110th Congress, Chairman Bart Gordon introduced three competitiveness bills, again attempting to implement the *Gathering Storm* recommendations that address science and technology. The first of these, H.R. 362, entitled “10,000 Teachers, 10,000,000 Minds Science and Math Scholarship Act”, parallels in large part H.R. 5358 from the 109th Congress. The second of these, H.R. 363, entitled “Sowing the Seeds Through Science and Engineering Research Act”, parallels in large part H.R. 5356 from the 109th Congress. (The third bill, H.R. 364, is to provide for an Advanced Research Projects Agency for Energy and is not the focus of the present hearing.)

On February 28, 2007, the Committee on Science and Technology marked up H.R. 363 and passed an amended version of the introduced bill. A summary of that bill as reported, along with a summary of H.R. 362, appears below.

5. Specific Questions for the Witnesses

Each witness received a letter of invitation to testify at the hearing. In that letter, the witnesses were asked to address the overarching questions related to the hearing. In addition, the witnesses were each asked to address an aspect of the hearing focus that relates to their realm of expertise.

Mr. Augustine was asked to describe the reasoning behind the priorities that resulted in the recommendations in *Gathering Storm* report. Dr. Barrett was asked the same question, and in

addition was asked about his thoughts on what changes are needed in Science, Technology, Engineering, and Mathematics (STEM) education in order for the nation to meet the future workforce needs of industry.

Mr. McGraw and Ms. Wince-Smith were asked what changes are needed in STEM education in order to meet the future workforce needs of business and industry. The Business Roundtable and the Council on Competitiveness both represent broad coalitions of business interests.

Dr. Dynes was asked to describe the California Teach program: how the Cal Teach model came into being; what the challenges are to putting it in place; what we are learning from the program about recruiting and preparing science, math, and engineering college majors to become STEM teachers; and what factors are important for emulating similar programs on a national scale.

Dr. Lane was asked to comment on the appropriateness of the proposed role of NSF in administering the STEM education programs contained in H.R. 362. In particular, Dr. Lane was asked to address how these NSF programs interact with STEM education activities at the Department of Education.

6. The Provisions of the Bills

H.R. 362 — The “10,000 Teachers, 10 Million Minds” Science and Math Scholarships Act

The bill implements most of the K–12 science education recommendations of the *Gathering Storm* report. It establishes a teacher education program at the National Science Foundation (NSF) to encourage math, science and engineering faculty to work with education faculty to improve the education of science and math teachers and to provide scholarships to science, math and engineering students who commit to becoming science or math teachers at elementary and secondary schools; authorizes summer teacher training institutes at NSF and DOE to improve the content knowledge and pedagogical skills of in-service science and math teachers, including preparing them to teach Advanced Placement and International Baccalaureate courses in science and math; requires that NSF include support for master’s degree programs for in-service science and mathematics teachers within the NSF Math and Science Partnerships; and authorizes funding for the NSF STEM Talent Expansion program and expands the program to include centers for improving undergraduate STEM education.

Sectional Summary of Bill

Section 1 is the Table of Contents.

Section 2 reports findings on the role of NSF in K–12 and undergraduate STEM education.

Section 3 spells out definitions used in the bill.

Title I – Science Scholarships

Section 101 is the short title of the bill.

Section 102 reports findings relating the bill to the National Academies report recommendations.

Section 103 describes the policy objective of the bill — to increase by 10,000 annually the number of capable K-12 science and math teachers.

Section 104 amends the NSF Noyce Scholarship program, established by the NSF Authorization Act of 2002, to create incentives for colleges and universities to improve the training of STEM teachers and increases the size and duration of the scholarships provided for science, math, and engineering majors who pursue teaching credentials:

- Provides competitive awards to institutions of higher education (or consortia of such institutions) that (1) establish cross-department faculty teams (science, math and engineering faculty along with education faculty) to develop courses of instruction leading to baccalaureate degrees in fields of science, math and/or engineering and also preparing graduates to become certified or licensed to teach in a K-12 classroom, and (2) administer scholarships for students during their sophomore through senior years and summer internships during their freshman years.
- Requires early field teaching experiences for student teachers in the program under the supervision of highly experienced and effective teachers.
- Requires awardees to provide professional development and mentoring support to scholarship recipients, after matriculation.
- Sets scholarship amounts at the cost of attendance at particular institutions, not to exceed \$10,000 per year, and provides up to 3 years of scholarship support for any individual.
- Requires scholarship recipients to commit to teaching for up to 6 years following graduation (the period of teaching commitment is based on the number of years of scholarship support), reduces the commitment by one year for individuals who teach at high-need schools, and converts the scholarships to loans if the teaching commitment is not met.
- Authorizes the NSF to accept donations from the private sector to help support scholarships and internships.
- Authorizes \$70 million for NSF for FY 2008, \$101 million for FY 2009, \$133 million for FY 2010, \$164 million for FY 2011, and \$196 million for FY 2012.

Title II – Mathematics and Science Education Improvement

Section 201 amends the NSF Math and Science Education Partnerships program established by the NSF Authorization Act of 2002:

- Specifies that priority for awards under the program be given to applications that include teacher training activities as a main focus.
- Authorizes teacher training activities to prepare teachers to teach Advanced Placement and International Baccalaureate science or math courses and provides for mentoring by professional scientists, mathematicians and engineers.
- Authorizes the development of master's degree programs for in-service science and math teachers.

Section 202 addresses teacher institute programs at NSF and DOE:

- NSF is directed to establish a grant program to support summer or academic year teacher institutes and authorizes summer teacher institutes as a component of the NSF 21st Century program. Such summer institutes are required to include teacher training activities to prepare teachers to teach Advanced Placement and International Baccalaureate science or math courses.
- Authorizes \$32 million for NSF for FY 2008, \$35.2 million for FY 2009, and \$38.7 million for FY 2010, \$42.6 million for FY 2011, and \$46.8 million for FY 2012.
- The following amounts are authorized for the existing Laboratory Science Teacher Professional Development program at DOE: \$3 million for FY 2008, \$8 million for FY 2009, and \$10 million for each year FY 2010 through FY 2012.

Section 203 requires NSF to ensure that, under the Math and Science Partnership program, master's degree programs are developed and implemented for in-service math and science teachers, who attend on a part-time basis and who will be able to complete the degree requirements within two years. The programs have the following features:

- Provide stipends to defray the cost of attendance for teachers in the program.
- Allow for support for the development of the courses of instruction and related educational materials and equipment (offering of online learning is an option).
- Require the distribution of awards among institutions of different sizes and geographic locations.

Authorizes for this program \$46 million for NSF for FY 2008, \$50.6 million for FY 2009, \$55.7 million for FY 2010, \$61.2 million for FY 2011, and \$67.3 million for FY 2012.

Section 204 establishes a national panel of experts to identify and collect K–12 science and mathematics teaching materials that have been demonstrated to be effective and to recommend the development of new materials in areas where effective materials do not exist; and directs NSF and the Department of Education to develop ways to disseminate effective materials and

support efforts to develop new materials, in accordance with the recommendations of the national panel.

Section 205 amends the NSF STEM Talent Expansion program established under the NSF Authorization Act of 2002 to create centers for improvement of undergraduate education in STEM fields, including:

- Development of undergraduate curriculum and teaching methods and training for faculty and teaching assistants in effective pedagogical practices.
- Assessment of the effectiveness of the centers and dissemination of information about materials and methods developed.

Authorizes \$44 million for NSF for the STEM Talent Expansion program for FY 2008, of which \$4 million is available for centers; \$55 million for FY 2009, of which \$10 million is available for centers; and \$60 million for each year of FY 2010 through FY 2012, of which \$10 million is available in each year for centers.

H.R. 363 — Sowing the Seeds through Science and Engineering Research Act

The bill implements recommendations related to strengthening long-term basic research contained in the *Gathering Storm* report. It supports outstanding researchers in the early stages of their careers through grants at the National Science Foundation (NSF) and the Department of Energy (DOE) of \$80,000 per year for 5 years; establishes a floor of 1.5% of research funding appropriated for NSF for an existing program supporting graduate students in multidisciplinary fields of national importance; establishes a presidential innovation award to stimulate scientific and engineering advances in the national interest; establishes a national coordination office to identify and prioritize research infrastructure needs at universities and national laboratories and to help guide the investments of new infrastructure funds authorized for NSF and DOE; authorizes NSF to support research on innovation; directs the National Institute of Standards and Technology (NIST) and DOE to report on efforts to recruit and retain early-career scientists and engineers; and expresses the sense of Congress that a balanced science program at the National Aeronautics and Space Administration (NASA) contributes significantly to innovation and competitiveness.

Sectional Summary of Bill

Section 1 is the short title of the bill.

Section 2 authorizes NSF to carry out a grant program for awards to scientists and engineers at the early stage of their careers in academia or in nonprofit research organizations. The NSF's existing Faculty Early Career Development (CAREER) program may be designated as the mechanism for awarding these grants. The awards will go to outstanding researchers at the beginning of their careers and are intended for individuals from a variety of types of institutions, including minority serving institutions. The grants provide 5 years of research funding support at a minimum of \$80,000 per year per award.

NSF is required to designate at least 3.5% of funds appropriated for Research and Related Activities to the grant program for each of FY 2008 through FY 2012.

Section 3 authorizes DOE to carry out a grant program for awards to scientists and engineers at the early stage of their careers in academia or in nonprofit research organizations to conduct research in fields relevant to the mission of DOE. The awards will go to outstanding researchers at the beginning of their careers and are intended for individuals from a variety of types of institutions, including minority serving institutions. The grants provide 5 years of research funding support at a minimum of \$80,000 per year per award, and priority shall go to proposals involving collaborations with researchers at DOE national laboratories. The bill authorizes to DOE \$25 million for each year for FY 2008 through FY 2012.

Section 4 directs NSF to allocate at least 1.5% of the amounts appropriated for Research and Related Activities to the Integrative Graduate Education and Research Traineeship (IGERT) program, which provides support for graduate students in fields relevant to national needs. It requires NSF to coordinate with other agencies to expand the interdisciplinary nature of the IGERT program and authorizes NSF to accept funds from other agencies to carry out the program.

Section 5 establishes the Presidential Innovation Award presented periodically, on the basis of recommendations from the Director of the Office of Science and Technology Policy, to citizens or permanent residents of the U.S. who develop unique scientific or engineering ideas judged to stimulate scientific and engineering advances in the national interest, to illustrate the linkage between science and engineering and national needs, and to provide an example to excite the interest of students in science or engineering professions.

Section 6 establishes a National Coordination Office for Research Infrastructure under the Office of Science and Technology Policy to identify and prioritize deficiencies in research facilities and instrumentation in academic institutions and national laboratories and to make recommendations for use of funding authorized. The Office is directed to report to Congress annually at the time of the administration's budget proposal.

Section 7 authorizes NSF, in carrying out its research programs on science policy and the science of learning, to support research on the process of innovation and the teaching of inventiveness.

Section 8 directs NIST to transmit to the House Committee on Science and Technology and the Senate Committee on Commerce, Science, and Transportation, not later than 3 months following enactment of the bill, a report on efforts to recruit and retain early-career scientists and engineers at NIST.

Section 9 expresses the sense of Congress that a balanced and robust program in science, aeronautics, exploration, and human space flight at NASA contributes significantly to national innovation and competitiveness. It also directs the NASA administrator to participate fully in interagency efforts to promote innovation and economic competitiveness through scientific research and development.

Appendix A: Executive Summary of National Academies Report, [*Rising Above the Gathering Storm: Energizing and Employing America for a Brighter Economic Future.*](#)

The executive summary may be downloaded and viewed for free at the National Academy of Sciences site [here](#).