

The “Gathering Storm:” Three Years Later

Statement of

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and

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Committee on Science, Engineering, and Public Policy
Division on Policy and Global Affairs
The National Academies:
National Academy of Sciences, National Academy of Engineering,
Institute of Medicine**

Before the

**Subcommittee on Commerce, Justice and Science
Committee on Appropriations
U.S. House of Representatives**

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Mr. Chairman and members of the Committee:

Thank you for this opportunity to appear before you to discuss what has taken place since the national Academies first released the document which has come to be known as the “Gathering Storm” report, after the first line in its title. It was my privilege to appear before your committee previously to provide a “One Year Later” update as to the impact of that report; hence, my comments today are in effect a “*Three Years Later*” update.

The National Academies—the Academy of Science, the Academy of Engineering and the Institute of Medicine—trace their origins to the establishment of the National Academy of Science by President Lincoln and the Congress with the objective of providing independent advice to the nation and its leaders on matters within the Academies’ fields of expertise. The Gathering Storm committee was created by the Academies in response to a bipartisan request by members of both the House of Representatives and the Senate. Our committee consisted of twenty members including university presidents, corporate CEO’s, Nobel Laureates, K-12 educators and former Presidential appointees. We are proud that two of our members are now serving in President Obama’s Cabinet.

As you are aware, the overall findings of the Gathering Storm committee were given strong bipartisan support in both the House and Senate and by President Bush and now by President Obama. I suppose I could report that much was accomplished during the first two years after the Gathering Storm report was published. A new research university was established with an opening day endowment equal to MIT’s after 142 years. Each year, over 200,000 students studied abroad, mostly pursuing science or engineering degrees, often under government-provided scholarships. Government investment in R&D began a 25 percent increase. An initiative was funded to make the country a global nanotechnology hub. An additional \$10 billion was budgeted for K-12 education, with emphasis on math and science. And a \$3 billion add-on to the nation’s research budget was announced.

These actions took place in Saudi Arabia, China, the United Kingdom, India, Brazil, and Russia, respectively.

What about the United States? After Congress overwhelmingly authorized many of *The Gathering Storm’s* recommendations, the needed funds to implement them were not appropriated. As a result, one leading national laboratory began to impose mandatory two-day-per-month “unpaid holidays” on its science staff; several laboratories began laying off researchers, the U.S. portion of the international program to develop plentiful energy through nuclear fusion was reduced to “survival mode,” America’s firms continued to spend three times more on litigation than research; and many young would-be scientists presumably began reconsidering their careers. Fortunately, some of these adverse consequences were later curtailed by budgetary actions in the Supplemental Legislation, but few steps forward were taken.

Were today’s hearing to have taken place two months ago I am afraid that what I have just reported would have been the essence of what I had to say—although it should be noted that a number of states have initiated “Gathering Storm efforts” of their own—albeit at a much smaller scale than is ultimately going to be needed at the national level.

With the recent passage of the stimulus package the so-called “shovel ready” rebuilding of the nation’s physical infrastructure was accompanied by funding to begin the repair of a number of structural problems in our nation’s economy—most notably in education and scientific research. While the National Academies has not, to the best of my knowledge, undertaken any specific studies of the impact of the near-term investments in the nation’s physical infrastructure, the investments in science and education generally reflect Gathering Storm proposals and, properly executed, can be expected to have a very positive and lasting effect.

But three major challenges still remain insofar as the Gathering Storm recommendations are concerned. First, if the nation’s K-12 education system is to be repaired and our basic research program is to be productive, *sustained* funding will be required—not simply a one-time injection. In fact, were the latter to be the case, the result might even prove to be counterproductive. Second, the shortage of K-12 science and mathematics teachers with primary degrees in the fields they teach remains to be adequately addressed. And third, the nation’s science and engineering cadre and its education community must now produce results that justify the funds which are being entrusted to them.

It is perhaps appropriate at this point to note why the Gathering Storm committee placed such great emphasis on science and engineering, including the related endeavors of research and education. The reason is that while scientists and engineers comprise only four percent of the nation’s workforce, they disproportionately create jobs for the other 96 percent...and *jobs* for all citizens is what the Academies report was really about. Numerous other studies have shown that over the last half-century between 50 and 85 percent of the growth in the Gross Domestic Product is attributable to advancements in science and engineering. In the current century, the Knowledge Century, this effect is likely to be even more prominent.

Other witnesses have, I understand, been requested to provide an assessment of the health of our nation’s science and engineering enterprise. In this regard I would simply note that it was the unanimous view of the members of the national Academies Gathering Storm committee that the United States is perilously close to falling decisively behind other nations in key areas of science and engineering.. U.S. industry, generally reluctantly, has found a means of avoiding the consequences of such a trend; namely, establishing its research centers *outside* the United States. It is to be expected that engineering, prototyping, pre-production and production activities—and the jobs that accompany them—will then follow this pattern unless specific actions are taken to the contrary.

In closing I believe it is appropriate to take note of what are perhaps the two most recent studies bearing on America’s evolving position with regard to the key ingredients of 21st century competitiveness: education and innovation. With respect to the former, America of course has some outstanding schools, teachers, administrators, and students—but overall, by global standards, we are failing our children...and failing them abysmally. In international tests in math and science, U.S. students invariably rank near the very bottom of the global class. *The Washington Post* summarized the results of the most recent 30-nation International Program for Student Assessment, observing that achievement in science is essentially stagnating, but that there is one bright spot: fourth grade math—where America “jumped” ahead. Unfortunately,

most firms do not hire fourth graders, but were the media a bit more adept at math itself it would have calculated that at our rate of “jumping ahead” we will catch up with the students of Hong Kong in a mere 85 years...assuming, of course, that the children of Hong Kong don’t get any better in the meantime.

Turning to innovation, the Information Technology and Innovation Foundation just released its most recent assessment of innovation and competitiveness in which it dropped the U.S. to sixth place among the 40 nations considered in its assessment. As if to punctuate the observation, it concluded that in terms of progress over the most recent decade, America is in last place.

In summary, the recent legislative steps affecting the funding of science and education are very constructive indeed...but as I have noted, much remains to be accomplished. When it comes to competitiveness for 21st century jobs, we are engaged not in a sprint but in an endurance race.

Thank you for permitting me to appear before you today.

NORMAN R. AUGUSTINE was raised in Colorado and attended Princeton University where he graduated with a BSE in Aeronautical Engineering, magna cum laude, and an MSE. He was elected to Phi Beta Kappa, Tau Beta Pi and Sigma Xi.

In 1958 he joined the Douglas Aircraft Company in California where he worked as a Research Engineer, Program Manager and Chief Engineer. Beginning in 1965, he served in the Office of the Secretary of Defense as Assistant Director of Defense Research and Engineering. He joined LTV Missiles and Space Company in 1970, serving as Vice President, Advanced Programs and Marketing. In 1973 he returned to the government as Assistant Secretary of the Army and in 1975 became Under Secretary of the Army, and later Acting Secretary of the Army. Joining Martin Marietta Corporation in 1977 as Vice President of Technical Operations, he was elected as CEO in 1987 and chairman in 1988, having previously been President and COO. He served as president of Lockheed Martin Corporation upon the formation of that company in 1995, and became CEO later that year. He retired as chairman and CEO of Lockheed Martin in August 1997, at which time he became a Lecturer with the Rank of Professor on the faculty of Princeton University where he served until July 1999.

Mr. Augustine was Chairman and Principal Officer of the American Red Cross for nine years, Chairman of the National Academy of Engineering, President and Chairman of the Association of the United States Army, Chairman of the Aerospace Industries Association, and Chairman of the Defense Science Board. He is a former President of the American Institute of Aeronautics and Astronautics and the Boy Scouts of America. He is a current or former member of the Board of Directors of ConocoPhillips, Black & Decker, Proctor & Gamble and Lockheed Martin, and was a member of the Board of Trustees of Colonial Williamsburg. He is a Regent of the University System of Maryland, Trustee Emeritus of Johns Hopkins and a former member of the Board of Trustees of Princeton and MIT. He is a member of the Advisory Board to the Department of Homeland Security, was a member of the Hart/Rudman Commission on National Security, and has served for 16 years on the President's Council of Advisors on Science and Technology. He is a member of the American Philosophical Society and the Council on Foreign Affairs, and is a Fellow of the National Academy of Arts and Sciences and the Explorers Club.

Mr. Augustine has been presented the National Medal of Technology by the President of the United States and received the Joint Chiefs of Staff Distinguished Public Service Award. He has five times received the Department of Defense's highest civilian decoration, the Distinguished Service Medal. He is co-author of *The Defense Revolution* and *Shakespeare In Charge* and author of *Augustine's Laws* and *Augustine's Travels*. He holds 23 honorary degrees and was selected by Who's Who in America and the Library of Congress as one of "Fifty Great Americans" on the occasion of Who's Who's fiftieth anniversary. He has traveled in over 100 countries and stood on both the North and South Poles of the earth.

(Rev: July 2008)

NATIONAL ACADEMIES “GATHERING STORM” COMMITTEE BIOGRAPHIC INFORMATION*

NORMAN R. AUGUSTINE [NAE*] (Chair) is the retired chairman and CEO of the Lockheed Martin Corporation. He serves on the President’s Council of Advisors on Science and Technology and has served as undersecretary of the Army. He is a recipient of the National Medal of Technology.

CRAIG BARRETT [NAE] is chairman of the Board of the Intel Corporation.

GAIL CASSELL [IOM*] is vice president for scientific affairs and a Distinguished Lilly Research Scholar for Infectious Diseases at Eli Lilly and Company.

STEVEN CHU [NAS*] is the director of the E.O. Lawrence Berkeley National Laboratory. He was a cowinner of the Nobel prize in physics in 1997.

ROBERT GATES is the president of Texas A&M University and served as Director of Central Intelligence.

NANCY GRASMICK is the Maryland state superintendent of schools.

CHARLES HOLLIDAY JR. [NAE] is chairman of the Board and CEO of DuPont.

SHIRLEY ANN JACKSON [NAE] is president of Rensselaer Polytechnic Institute. She is the immediate past president of the American Association for the Advancement of Science and was chairman of the US Nuclear Regulatory Commission.

ANITA K. JONES [NAE] is the Lawrence R. Quarles Professor of Engineering and Applied Science at the University of Virginia. She served as director of defense research and engineering at the US Department of Defense and was vice-chair of the National Science Board.

JOSHUA LEDERBERG [NAS/IOM] is the Sackler Foundation Scholar at Rockefeller University in New York. He was a cowinner of the Nobel prize in physiology or medicine in 1958.

RICHARD LEVIN is president of Yale University and the Frederick William Beinecke Professor of Economics.

C. D. (DAN) MOTE JR. [NAE] is president of the University of Maryland and the Glenn L. Martin Institute Professor of Engineering.

CHERRY MURRAY [NAS/NAE] is the deputy director for science and technology at Lawrence Livermore National Laboratory. She was formerly the senior vice president at Bell Labs, Lucent Technologies.

PETER O’DONNELL JR. is president of the O’Donnell Foundation of Dallas, a private foundation that develops and funds model programs designed to strengthen engineering and science education and research.

LEE R. RAYMOND [NAE] is the chairman of the Board and CEO of Exxon Mobil Corporation.

ROBERT C. RICHARDSON [NAS] is the F. R. Newman Professor of Physics and the vice provost for research at Cornell University. He was a cowinner of the Nobel prize in physics in 1996.

P. ROY VAGELOS [NAS/IOM] is the retired chairman and CEO of Merck & Co., Inc.

CHARLES M. VEST [NAE] is president emeritus of MIT and a professor of mechanical engineering. He serves on the President's Council of Advisors on Science and Technology and is the immediate past chair of the Association of American Universities.

GEORGE M. WHITESIDES [NAS/NAE] is the Woodford L. & Ann A. Flowers University Professor at Harvard University. He has served as an adviser for the National Science Foundation and the Defense Advanced Research Projects Agency.

RICHARD N. ZARE [NAS] is the Marguerite Blake Wilbur Professor of Natural Science at Stanford University. He was chair of the National Science Board from 1996 to 1998.

GATHERING STORM RECOMMENDATIONS

Science

- Increase federal investment in research by 10 percent per year over the next seven years, with primary attention devoted to the physical sciences, engineering, mathematics, and information sciences—without *disinvesting* in the biological sciences.
- Provide research grants to early career researchers
- Institute a National Coordination Office for Research Infrastructure to oversee the investment of an additional \$500M per year for five years for advanced research facilities and equipment.
- Allocate at least 8% of the existing budgets of federal research agencies to discretionary funding under the control of local laboratory directors.
- Create of an Advanced Research Projects Agency—Energy (ARPA-E), modeled after DARPA in the Department of Defense, reporting to the Department of Energy Undersecretary for Science. The purpose of this entity would be to support the conduct of long-term “out-of-the-box,” transformational, generic, energy research by universities, industry and government laboratories.

Education

- Establish 25,000 competitive science, mathematics, engineering, and technology undergraduate scholarships and 5,000 graduate fellowships in areas of national need for US citizens pursuing study at US universities.
- Establish a Presidential *Innovation Award* to recognize and stimulate scientific and engineering advances in the national interest.
- Provide a federal tax credit to employers to encourage their support of continuing education.
- Provide a one-year automatic visa extension to international students who receive a science or engineering doctorate at a U.S. university and meet normal security requirements, and providing automatic work permits and expedited residence status if these students are offered employment in the US.
- Institute a skill-based, preferential immigration option
- Reform the current system of “deemed exports” so that international students and researchers have access to necessary non-classified information or research equipment while studying and working in the US.

VIEWS ON COMPETITIVENESS

- “We’re standing pat while the rest of the world is passing us by. If we continue on this path, our chances of being the leader in the knowledge economy in the decades to come are between slim and none.”
William E. Kirwan – Chancellor, University System of Maryland
- Writing about attending graduation at Rensselaer: “The foreign names kept coming—‘Hong Lu, Ku Xie, Tao Yuan, Fu Tang’—I thought the entire class of doctoral students in physics were going to be Chinese, until ‘Paul Shane Morrow’ saved the day...my complaint...was that there wasn’t someone from the Immigration and Naturalization Service (there) stapling green cards to the diplomas of each of the foreign-born PhDs.”
Thomas L. Friedman – Author, “The World Is Flat...”
- “If the U.S. doesn’t get its act together, DuPont is going to go to the countries that do.”
Chad Holliday – CEO, DuPont
- “If companies were run like many (K-12) education systems, they wouldn’t last a week.”
Thomas Donohue – President, U.S. Chamber of Commerce
- “We’re well on our way to becoming America, the land of the free and the home of the unemployed.”
Norman R. Augustine – Retired Chairman & CEO, Lockheed Martin Corp.
- “When I compare our high schools to what I see when I’m traveling abroad, I’m terrified for our workforce of tomorrow.”
Bill Gates – Founder, Microsoft Corp.
- “If you don’t solve (the K-12 education problem), nothing else is going to matter all that much.”
Alan Greenspan – Chairman, Federal Reserve
- “We go where the smart people are. Now our business operations are two-thirds in the U.S. and one-third overseas. But that ratio will flip over (in) the next ten years.”
Howard High – Spokesperson, Intel Corp.

- “We had more sports exercise majors graduate than electrical engineering grads last year. If you want to be the massage capital of the world you’re well on the way.”
*Jeffrey R. Immelt – Chairman, CEO, General Electric
(Speaking in Washington, DC)*
- “Where nations once measured their strength by the size of their armies and arsenals, in the world of the future knowledge will matter most.”
Bill Clinton – President of the United States
- “We as a country have chosen not to compete...we’ve killed investment banking and now we are killing engineering...it’s our future and we are throwing it down the drain.”
Craig Barrett –CEO, Intel Corp.
- “...in today’s integrated and digitized global market, where knowledge and innovation tools are so widely distributed...: Whatever can be done, will be done. The only question is will it be done by you or to you.”
Thomas L. Friedman – Author, “The World Is Flat...”
- “It’s not just that kids need to go to school, they need to learn in school.”
Emiliana Vegas – World Bank
- “Where is Sputnik when we need it?”
Bill Gates – Founder, Microsoft Corp.
- “Will America lead...and reap the rewards? Or will we surrender that advantage to other countries with clearer vision?”
Susan Hockfield – President, MIT
- “...our present crisis is not just a financial meltdown crying out for a cash injection. We are in much deeper trouble. In fact, we as a country have become General Motors—as a result of our national drift. Look in the mirror: G.M. is us.”
Thomas L. Friedman – Author, “The World Is Flat...”
- (The way to move forward is) “through science, science, science, and science, with science and technology to rebuild our infrastructure, make it green and reduce our dependence on foreign oil, to use science for innovation, to grow our economy, creating good paying jobs, educating people to be competitive, science to make America healthy, and science to preserve the planet by stopping global warming, and science to protect the American people.”
Nancy Pelosi – Speaker of the House of Representatives

- “If we spend one trillion dollars on a stimulus and just get better highways and bridges—and not a new Google, Apple, Intel or Microsoft—your kids will thank you for making it so much easier for them to commute to the unemployment office ... “

Thomas L. Friedman – Author, “The World Is Flat...”

- “The future of our nation and people depends not on just how well we educate our children generally, but on how well we educate them in mathematics and science specifically.”

Senator John Glenn

- “Technology has been paying the bills in this country...we’re killing the goose that laid the golden eggs.”

Stan Williams, Senior Fellow, HP

- “It must gall them to see bright, aspiring scientists starved of funding while Detroit gets rewarded for its stupidity.”

Daniel Lyons, Newsweek

- “Providing short-term rescue packages to the economy without simultaneously fixing its fundamental problems, such as education and investment in research, is like feeding a candy bar to a diabetic.”

Norman R. Augustine, Chairman, National Academies Competitiveness Study

- SEE NEXT PAGE

- “Every day, our economy gets sicker—and the time for a remedy that puts Americans back to work, jump-starts our economy and invests in lasting growth is now.”

Barack Obama, President of the United States