"Can America Compete for Jobs?"

Statement of

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and

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Committee on Science, Engineering, and Public Policy
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The National Academies:
National Academy of Sciences, National Academy of Engineering,
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Mr. Chairman and members of the Committee.

I appreciate the opportunity to participate in this hearing which addresses one of the most significant challenges facing America today: our nation's ability to preserve, and hopefully enhance, the standard of living and quality of life enjoyed by America's citizens. Unfortunately, absent decisive action on the part of our nation's leaders, there is a very real likelihood that today's adult generation will leave to its children, for the first time in our nation's history, a sustained, substantially lower standard of living than it enjoyed.

I would like to begin my testimony by thanking you, Mr. Chairman, for your courageous leadership in placing science and engineering on the nation's agenda. I believe that there has been a broad awakening in America as to the impact of science and technology and the consequences of its neglect. You and the members of this committee were among the first to sound the alarm.

As you may be aware, it was my privilege to serve as chair of the National Academies' assessment of our nation's future competitiveness. This committee, whose report became known as the "Gathering Storm" report, has completed its assigned task and, in keeping with the Academies' policies, been disbanded. Given that circumstance, the views I express today will be my own, speaking as a private citizen. However, I believe that my remarks are generally reflective of the views of my colleagues on the National Academies' committee. The committee's 20-person membership consisted of former presidential appointees, CEO's, Nobel Laureates, a State Superintendent of Schools, and several university presidents … one of whom has recently found new employment as Secretary of Defense. I should note that many other individuals and organizations have devoted enormous talent and energy to helping address the competitiveness challenges our nation faces, including the Council on Competitiveness, the Business Roundtable, the National Association of Manufacturers, the American Association of University Presidents, the Chamber of Commerce, the National Association of State Universities and Land-Grant Colleges, the American Physical

Society, the American Association for the Advancement of Science, and numerous others.

It was through the encouragement of members of the Senate and House of Representatives that the National Academies' project was initiated, and in particular Senators Alexander and Bingaman and Representatives Boehlert and you, Mr. Chairman, requested that an assessment be conducted. It would be difficult to cite a finer example of bi-partisan cooperation in addressing a problem of critical importance to America's citizenry than that which took place following the release of the National Academies' "Gathering Storm" report and involving the White House and Cabinet Officers, the House of Representatives, and the Senate. The initial legislation to implement the Academies' recommendations had 70 co-sponsors in the Senate – 35 Democrats and 35 Republicans. Similar support has been found in the House.

I have with me a collection of editorials and op/eds from newspapers in all 50 states. Virtually all indicate support for the Academies' findings and recommendations. I will, because of the document's length, not request that it be included in the record, but if any of the Members would like a copy I would be pleased to have one delivered to your office.

Having examined a great deal of evidence, the committee concluded that America's ability to compete for jobs in the years ahead will depend heavily upon our ability to maintain a strong position in the fields of science and engineering. It will be these fields that will underpin the innovation that in turn will create quality jobs for Americans. And to fill those jobs, *all* our citizens will need the basic tools required to function in a high-tech world. Eight different studies conducted in recent decades indicate that public investments in science and technology have produced societal returns that range from 20 to 67 percent per year. Various other studies have concluded that between 50 and 85 percent of the nation's growth in GDP per capita during the last half-century can be attributed to science and engineering progress. In fact, one would be hard-pressed to find a better investment than research and education.

While a great deal has been accomplished, much remains to be done. The Academies' estimate of the incremental cost, at the federal level, of putting the nation in a position to compete, will grow from $9B per year to $19B per year over the next five years. This is not a one-year competition in which we find ourselves – it is a seismic change, comparable to that the nation underwent when it encountered a shift from 84 percent of its workers being involved in agriculture in the early 1800's to about one percent today. The transition to a globalized economy will, however, be markedly faster, with three billion would-be capitalists having entered the global job market in the past two decades alone and the number of nations actively participating in that market suddenly increasing from 25 to 66. These job candidates are highly motivated, willing to work for a fraction of the compensation U.S. workers receive, and are increasingly well educated. Furthermore, they span the employment spectrum from laborers and assembly workers to medical doctors, accountants and engineers.

It has been 17 months since the Academies' report was issued and while substantial preparatory work is now in place, including the FY07 continuing resolution, little impact of this effort has yet to be felt where it matters: in America's factories, schools, and research laboratories. The year ahead will be decisive in this regard, a period that one day may be looked back upon as a "tipping point" – one way or the other. The question is whether we have the staying-power to sustain the efforts which have now been initiated.

During the months since the Academies' report was issued the world has, unfortunately, not been standing still waiting for us: An entire new generation of semiconductor integrated circuits, the mortar of the modern electronics revolution, has been introduced; Toyota now has eight times the market capitalization of General Motors and Ford, *combined*; the remnants of what was once the world's greatest industrial research lab, the legendary Bell Labs, the home of the transistor and the laser and numerous Nobel Laureates, has now been sold to a French firm; for the first time the most capable high-energy particle accelerator in the world does not reside in the United

States; another $650 billion has been spent on our public schools which, according to recent standardized tests in science, was accompanied by a moderate improvement in performance in the lower grades and further deterioration in the 12th grade – suggesting that the longer our children are exposed to our schools, the worse they fare. In addition, U.S. investors put more new money into foreign stock funds than U.S. funds; 77 percent of the new research laboratories currently planned to be built in the world will reside in just two countries – neither of which is the United States; American firms once again spent more on litigation than on research and development; U.S. undergraduate engineering enrollment remained generally flat according to the latest data; nearly all the major Initial Public Offerings in the world during the period took place outside the United States; the German firm which not long ago purchased one of America's Big Three automakers, Chrysler, has now, upon closer inspection, decided it doesn't want it after all; the Academies' recommendation to add $9 billion to the federal budget was debated as U.S. citizens gambled $7 billion on the Super Bowl; our children continued to spend more time watching television than in the classroom; and the World Economic Forum in Geneva precipitously lowered its rating of U.S. competitiveness from first place to sixth.

A particularly troublesome aspect of the challenge we face is that there has been and will be no sudden wake-up call – no Sputnik, no 9/11, no Pearl Harbor – rather, the situation is much more analogous to the proverbial frog being slowly boiled. The economy is of course doing quite well, and it has to be considered a major positive that other nations are prospering. The challenge for America is to continue to be among those nations that prosper – and in this regard virtually all the warning trends are headed in the wrong direction.

As Tom Friedman concluded in *The World is Flat*, globalization has "accidentally made Beijing, Bangalore and Bethesda next door neighbors" – a neighborhood wherein able candidates for jobs which have traditionally resided in the United States are now just a mouse-click away.

It should be noted that while the Academies' committee focused on creating and sustaining jobs, the impact of the competitiveness race on our nation's physical security could be even more profound. Several years ago it was my privilege to serve on the bipartisan Hart-Rudman Commission on National Security, one of the two primary findings of the group being, ". . . the inadequacies of our system of research and education pose a greater threat to U.S. national security over the next quarter century than any potential conventional war that we might imagine." Indeed, the consequences of current trends are particularly acute for defense firms, which must rely upon U.S. citizens for much of their engineering force and cannot simply shift work overseas as does much of the commercial sector.

The National Academies' report offers four recommendations and 20 specific implementing actions to begin the process of assuring America's future competitiveness and security. The four recommendations address strengthening our K-12 public schools, significantly increasing the nation's investment in basic research, encouraging more of the nation's "best and brightest" to become engineers and scientists; and reconstituting the nation's innovation ecosystem in such areas as patent policy, tax policy, litigation policy, and immigration policy. The Academies' report proposes undertaking these tasks within an overall framework that focuses upon reducing the nation's energy dependence, since that is a task of the utmost importance and is closely coupled to the attainment of advancements in science and engineering.

The two highest priorities cited in the National Academies' report are, first, to increase the number of K-12 teachers with university degrees in the physical sciences, math or engineering, and, second, to substantially increase the basic research budget in math, engineering and the physical sciences while, at a very minimum, preserving the purchasing power of the nation's on-going investment in the biosciences. The growth in recent years in funding of the health sciences is already paying significant dividends.

The Academies' specific recommendations with regard to science were presented in "The Gathering Storm" report under the heading, "Sowing the Seeds" and focused on strengthening the nation's traditional commitment to long-term *basic* research through:

- Increasing federal investment in research by 10 percent per year (real growth) over the next seven years, with primary attention devoted to the physical sciences, engineering, mathematics, and information sciences—without *dis*investing in the biological sciences.
- Providing research grants to early career researchers
- Instituting 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.
- Allocating at least 8% of the existing budgets of federal research agencies to discretionary funding under the control of local laboratory directors.
- Creating 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 on a competitive basis the conduct of long-term "out-of-the-box," transformational, generic, energy research by universities, industry and government laboratories.
- Establishing a Presidential *Innovation* Award to recognize and stimulate scientific and engineering advances in the national interest.

It is critical that we assure the existence of a long-term talent base to pursue the needed science and engineering activity, which together comprises the underpinning of much of America's innovation enterprise. Warranting particular emphasis is the matter of encouraging women and minorities, now widely underrepresented in the science and engineering community, to pursue careers in these fields. America, already handicapped in this global competition by its wage scale, cannot afford to fail to avail itself of the talents of over half its citizenry. The committee recommended, under the heading, "Best and Brightest":

- Establishing 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.
- Providing a federal tax credit to employers to encourage their support of continuing education of their employees.
- Providing 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 the opportunity for expedited residence status if these students are offered employment in the US.
- Instituting a skill-based, preferential immigration option
- Reforming the current system of "deemed exports" so that international students and researchers have access to necessary non-classified information and research equipment while studying and working in the US.

Absent decisive steps, America's business base is almost certain to migrate to other, more competitive countries in the years ahead – in fact, it is already doing so. Under such a circumstance our nation could find itself with some of the world's richest investors living in a sea of unemployment. The consequences of this for stability and prosperity are evident.

Fortunately, it is not yet too late … but it *is* getting late. With the strong involvement of our nation's leaders, including the continuing support of the members of this committee, we can assure that our science base remains vigorous, our K-12 educational system is rebuilt, our innovation infrastructure once again becomes the most attractive in the world – and our children are assured of an opportunity for a life even better than most of us have enjoyed.

Thank you again for permitting me to address this important topic. I would of course be pleased to answer any questions you might have.

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.

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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.

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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.

*subsequently became Secretary of Defense

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 then 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, he served as Chairman and CEO from 1988 and 1987, respectively, until 1995, having previously been President and COO. He served as President of Lockheed Martin Corporation upon the formation of that firm in 1995, and became its CEO in January 1996, and later Chairman. Upon retiring from Lockheed Martin in August 1997, he joined the faculty of the Princeton University School of Engineering and Applied Science where he served as Lecturer with the Rank of Professor 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, Procter & Gamble, of which he is Presiding Director, and Lockheed Martin and is a member of the Board of Trustees of Colonial Williamsburg, a 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 21 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.