

Written Testimony of  
Dr. Timothy L. Killeen  
President, The Research Foundation for The State University of New York and  
Vice Chancellor for Research, The State University of New York

Submitted to the  
Subcommittee on Research and Technology  
Committee on Science, Space, and Technology  
for the hearing  
Keeping America FIRST: Federal Investments in Research, Science, and Technology at NSF,  
NIST, OSTP and Interagency STEM Programs.

House of Representatives  
Washington, D.C.

November 13, 2013

I thank Chairman Bucshon, Ranking Member Lipinski, and honorable Members of the Subcommittee for the privilege of testifying at today's hearing, on a vitally important subject: that of securing the future of this Nation's research enterprise. My name is Timothy Killeen and I am the President of the Research Foundation for the State University of New York (SUNY) and the Vice Chancellor for Research for the 64-campus SUNY system.

I would like to begin by thanking the Committee members for the long-standing and steadfast support and stewardship of the Nation's research enterprise. I also thank you for releasing two different discussion drafts of reauthorization legislation, the primary purpose of which will be to provide adequate, sustained national investment in innovation through scientific research and development. In my opinion, this critically important legislation is needed to foster the economic security and the national security of the United States. These discussion drafts will stimulate a serious conversation in the Administration, the Congress, and in the scientific and engineering research and education community about the future health and well-being of the citizens of the United States as the 21<sup>st</sup> Century's knowledge economy unfolds.

At the outset, I would like to respectfully suggest that whatever legislative product this Committee ultimately produces should send a clear and unmistakable message to our international competitors that this Nation is committed to making the investments necessary to keep us at the cutting edge of the global knowledge economy. We compete to be first!

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The State University of New York (SUNY) is the Nation's largest comprehensive public university system. SUNY consists of 64 geographically dispersed campuses that bring educational opportunity within commuting distance of virtually all New Yorkers. SUNY has a total enrollment of over 450,000 students attending our research universities and medical schools, our comprehensive colleges, our technology colleges, and our community colleges. The SUNY Research Foundation is working to capitalize on the scope, scale, and diversity of SUNY as an engine for our state's innovation economy. The Research Foundation works with academic and business leaders to support research and discovery at SUNY through administration of sponsored projects and the transfer and sharing of intellectual property for public benefit and economic growth.

I want to take the Subcommittee back to just about one year ago when Hurricane Sandy slammed into the eastern seaboard. Now that the storm has come and gone – and we continue our efforts to recover from its impact – we might stop and ask what would have been the impact of Sandy on the mid-Atlantic region of this country if the storm had hit in October 1963 – 50 years earlier.

It might have played havoc with the New York Giants-Dallas Cowboys football game at Yankee Stadium (which, incidentally, the New York Giants won).

On the other hand – it just might have killed large numbers of people living on the eastern seaboard.

Fifty years ago, hurricane advisories extended only two days into the future, computer models and weather satellites were in their infancy, and forecasters might not have expected Sandy's late westward curve into New Jersey. We did not have the sophisticated weather information system that made it possible for the Nation's weather enterprise to make the call on Sandy as early and as accurately as was achieved, so that residents and businesses had sufficient warning to prepare and take shelter. While still not perfect, these modern forecasts undoubtedly made a profound difference for many, many people.

How did we acquire such a sophisticated and important weather forecast system?

The short answer is that we – society – continuously invested over decades in science, technology, engineering, mathematics, and education. These investments supported everything from basic research in mathematics and computer science to the development of satellites and parachute-borne instrument packages that could make the key observations. They enabled us to develop and run forecast models on advanced computing systems so that the large amounts of data could be turned into “actionable intelligence”.

But it was not just the investment in the physical and mathematical sciences or satellite technology that delivered this life-saving information. It was also our investment in interdisciplinary environmental sciences – including weather, climate, ocean and coastal research – as well as the social, behavioral and economic sciences that examine how people use storm-related information and respond to warnings. Together, this knowledge enabled state and local emergency managers and first responders to prepare and inform citizens in ways that saved lives and property. And it was a host of innovative technologies that allowed all of this information to be presented in a manner that most people—with or without smart phones—could understand. Finally, it was through investments in education that we had the talented human capital needed to put all this together and make it work.

The need for such multifaceted and creative research and education continues and we should not become complacent and feel that we have all the answers. We are, in some ways, even more vulnerable to severe storms today than we were in 1963. We now have many more people living in coastal areas. We are highly dependent on communication systems that can be disrupted by powerful storms. And we are more reliant on the power grid for everything from transportation to commerce and sophisticated medical care.

The Sandy example is just one of many such stories that speak directly to how specific investments in basic and applied research and education have supported the economic and national security of the United States and its citizens. The NSF Organic Act of 1950 is well worth re-reading in this context, calling for the NSF “to promote the progress of science, to advance the national health, prosperity and welfare, [and] to secure the national defense”. The Nation thus owes a debt of gratitude to this Subcommittee and the Congress for authorizing the resources over time that have led us to this point. The legislation the Subcommittee is now developing offers us the opportunity to continue this incredible – and, to our competitors, *enviable* - story of success, and to shape an even more vibrant, accountable, and transparent research and education enterprise for the future.

Unfortunately, however, it must be said that our Nation’s role as the world’s innovation leader is imperiled today. The combination of eroding federal buying power in research and education and the enormous resources other nations are pouring into these areas is creating a new kind of deficit for the United States: one that has been called an *innovation deficit*. It is troubling, for example, that we have fallen to 12<sup>th</sup> among developed countries in the proportion of young adults who hold college degrees. Closing the widening gap between needed and actual investments, while ensuring the health and vitality of the research enterprise, must be a national imperative.

If we fail to act boldly – and in the determined and united fashion of the past – we could face a less prepared, less highly skilled U.S. workforce, fewer U.S.-based scientific and technological breakthroughs, and fewer patents, startups, products, and jobs. These impacts may not be immediately obvious because the education and research that lead to advances do not happen overnight. But the consequences are inevitable if we do not respond to the innovation deficit.

The path forward for resolving the budget challenges facing the Nation is undeniably complicated and I fully appreciate that these challenges must be met resolutely and with realism. A strategic component of whatever answer we reach, however, should be sustained true growth of the federal investment in basic and applied research, and in education and student financial aid – a budgetary resolve that will bolster our Nation’s economic and national security for decades to come. Such growth will allow for fundamental new knowledge to be discovered at a pace consistent with the growing needs – here, by us, in the United States. It will allow for brilliant young scientists and engineers to contribute and innovate, and will, as in the past, enable economically significant, but often unanticipated, advances to occur to drive our economy forward. Such a budgetary component should be seen as an *investment* with returns of almost incalculable value in terms of economic prosperity, quality education, national security, and international standing and competitiveness.

The justification for this view is rooted in past success. More than half of the national economic growth since World War II has been a consequence of scientific and technological innovation, overwhelmingly stemming from federally funded research. Such groundbreaking research has led to life-saving vaccines and medical devices, lasers, MRI diagnostic devices, touchscreens, GPS, the Internet, and, yes, accurate life-saving predictions of severe storms. We are certainly proud of the track record of SUNY researchers in many of these areas. These and other advances have improved lives and generated entirely new sectors of our economy. And it must be stressed that many of the researchers making these discoveries and translating them into positive societal

outcomes would simply not have succeeded without the generous sustained federal support for research and education.

The onrushing international competition is real and we cannot coast and stay “first”. Having witnessed this Nation’s success at turning investments in research and higher education into innovation and economic growth, countries such as China, Singapore, India, and South Korea have dramatically increased their own investments in these areas. Over the past decade these other national investments have climbed at two to four times the rate of growth in our own research and development expenditures.

Part of any response to the innovation deficit should be to “turbo-charge” merit-based grant opportunities for proof-of-concept research and other innovative technology transfer activities at universities, research institutes and Federal laboratories, serving to accelerate the commercialization of federally-funded research outcomes and technologies. The TRANSFER Act that is under discussion represents a major step forward in this regard.

In New York, led by Governor Cuomo, we are leveraging our world-class SUNY system and other institutions of higher education in the state to partner with industry and new businesses as never before, providing them with direct access to advanced research capabilities, development resources, expertise in nanotechnology, biomedical, information technology and other fields, as well as to relevant human capital and expertise. And this new compact between the knowledge creation (research and education) and the job creation (private sector) communities will also directly enrich the educational experiences and job prospects of our students in a win-win partnership. I applaud the emphasis in both discussion drafts on enhancing technology transfer and commercialization through a major retooling and “tuning-up” of what is often called the *innovation ecosystem*.

I reiterate my belief that the legislation this Subcommittee is developing should send a very strong message to our international competitors that this Nation is committed to doing what is necessary to keep us at the cutting edge in today’s global knowledge economy. Both discussion drafts have important elements for this overall message. To further that end, I would like to suggest that the Subcommittee consider the following set of draft principles for its work towards the further development of the bill. These principles have been adapted from a set developed recently by a distinguished group of industry and academic leaders.

#### 1. Principles for the Funding of Science and Engineering

The National Academies’ report, *Rising Above the Gathering Storm*, and both the America COMPETES Acts of 2007 and 2010, set goals and established funding targets aimed at doubling funding for key federal research agencies within seven years. I fully recognize the difficulty of achieving the doubling goal in the current fiscal environment, but I believe that the reauthorization bill should:

- Make a strong statement that the United States sees robust funding across all disciplines of basic scientific and engineering research as a top national priority;

- Set targets that provide for steady and sustained real growth in funding for all of the major federal research agencies. The bill should specifically set such targets for the NSF, the Department of Energy (DOE) Office of Science and the National Institutes of Standards and Technology (NIST);
- Support funding pathways for competitive programs and core research that avoid detrimental tradeoffs between fields of science and engineering and that are based on utilization of well-managed peer review mechanisms designed to assess merit and avoid real and perceived conflicts of interest;
- Maintain a strong foundation of basic research across all scientific disciplines, from the physical, mathematical, environmental and life sciences, to engineering, to education research and the social, economic and behavioral sciences;
- Ensure that federal scientific agencies, guided by national needs and their scientific advisory committees and boards, continue to set and articulate clear priorities for funding within and among the full range of scientific disciplines – priorities that serve the advancement of scientific knowledge and are clearly in the national interest; and
- Commit to public accountability, transparency, and excellence in all aspects of the national research and education enterprise.

## 2. Principles for the Funding of Education Research and Workforce Development

Maintaining and promoting scientific literacy for all to prepare our young people for 21<sup>st</sup> century jobs and citizenship, and strengthening the pipeline of scientists and engineers who will propel science and innovation forward, were essential goals of *Rising Above the Gathering Storm* and of previous America COMPETES Acts. Maintaining and enhancing our science technology, engineering and mathematics (STEM) literacy and talent base is essential to continuing U.S. scientific, technological and economic global leadership. To this end, I believe that the reauthorization bill should:

- Support innovative and effective education programs to promote the broad-based scientific literacy necessary to equip all citizens with the scientific and technical knowledge required to meet future national and global challenges, as well as to train future generations of U.S. scientists and engineers;
- Support the NSF's mission of improving STEM education at all levels – and at a true national scale - by sustaining research critical to our understanding of how students learn STEM, how best to teach students in STEM fields, and how to increase participation of women and underrepresented minorities in STEM;
- Support proven STEM education programs at other federal research agencies aimed at ensuring an adequate STEM workforce in direct support of the fulfillment of their respective agency missions; and

- Support immigration reform for high-skilled workers and other policies to ensure that the United States has access to, and is fully able to take advantage of, the best and brightest talent in STEM fields from around the world.

### 3. Principles for Maintaining Research Excellence and Opportunity

The U.S. system of scientific research has been tremendously successful because it has remained broadly based and insulated from political pressures. The key evolving scientific focus areas have been determined by federal agencies, guided by the scientific community through a strong system of merit review and advisory committees; and research results have been widely distributed and made accessible. I suggest that the reauthorization bill take steps to:

- Support the “gold standard” system for research funding based upon competitive scientific merit, and broader impact, as evaluated through rigorous peer review. Peer review has been a critical factor in the success of America’s research system through its use of panels of scientific experts to evaluate the quality of proposals. In this competitive process, proposals compete for resources based on their scientific merit and potential for broader impacts. Peer review helps ensure that federal agencies support the best, cutting edge research, provides a self-correcting mechanism that works to help improve the quality of future research proposals, and provides public accountability by assuring that tax dollars are spent in the most effective manner;
- Preserve and support programs that seek to stimulate competitive research capabilities and opportunities in particular states and regions and for those institutions and populations currently under-represented in science and engineering;
- Reduce or eliminate unnecessary or duplicative federal regulations and reporting requirements that increase research costs, impede research productivity, and needlessly divert researchers’ time from directly conducting scientific research and mentoring students; and
- Ensure that any new programs, reporting requirements and/or other mandates that may be contained in the bill are provided with the funding necessary to carry them out and that they are accompanied by an analysis that details the cost of the new requirements.

### Concluding Thoughts

We are all aware of the serious budgetary challenges the Congress must confront and I recognize that such challenges will clearly impact this legislation. However, as you grapple with these difficult issues, it is important to keep our Nation on an innovation path that makes it possible for our economy to grow and our citizens to prosper. Public trust in the conduct of our scientific and educational research efforts must be gained – and retained - through appropriate accountability and transparency provisions, and - just as importantly - through a national commitment to vibrancy and excellence in the pursuit of new knowledge and in the development of human capital.

Throughout our history, this Nation has kept the promise of a better tomorrow for each new generation. This has been possible because of our economic prosperity is based in large part on America's role as global innovation leader. Failing to respond to today's challenges with sustained strategic investments in our research and education enterprise will pass to future generations the burdens of lost leadership in innovation, possible economic decline, and significantly more limited job opportunities for our youth. It is that important.

As the Congress moves to develop the Keeping America FIRST legislation that builds on efforts made via prior America COMPETES Acts, I hope the Subcommittee will find the principles I cited here helpful to gauge and assess specific ideas and elements for the legislation.

Thank you for the opportunity to present these views. I would be happy to answer any questions the Subcommittee and the Members may wish to raise.