

**Supporting Innovation in the 21<sup>st</sup> Century Economy:  
Perspectives on the Carnegie Mellon Experience  
Testimony submitted by  
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Committee on Science and Technology  
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**Introduction**

Thank you Chairman Wu, Ranking Member Smith, and Members of the Committee for the opportunity to speak to you today and to share perspectives on strategies to maintain and reinvigorate the leadership of the United States in innovation-led job and business growth. My name is Mark Kamlet. I am the Provost and Executive Vice President of Carnegie Mellon University. I serve as the chief academic officer of CMU but I have also been very engaged in our tech transfer policies and directly involved in a number of university spin-out companies. I also serve on the National Academy of Sciences panel on intellectual property – though my remarks today reflect only my views and not those of the panel.

My comments will focus on two key areas. First, I will share briefly with you Carnegie Mellon’s experience in seeking to create a culture that accelerates the path from basic research to commercialization. Second, my remarks will seek to discern lessons from these experiences that may be of value as you assess policy options to ensure that the U.S. remains the world leader in innovation and, particularly, the capacity for innovation to stimulate broad-based economic opportunity.

However, it is important that I first begin by thanking you and the members of this Committee for your tireless support of the advancement of science and technology. This Committee has been a steadfast proponent of policies to maintain U.S. science excellence and an “incubator” of the kinds of creative ideas needed to refresh and rejuvenate our leadership for a changing world. I have witnessed the impact of this leadership directly in labs within Carnegie Mellon and I am grateful for your efforts.

**Recognizing Our Strengths: The Vitality of the American Research University Partnership**

An effort to assess future directions for U.S. innovation policy must begin with recognition of the core vision and values that have been at the heart of our success to date. The fundamental partnership between the federal government and American higher education in the post-war period to create the modern research university has been the greatest catalyst to economic growth in the last half century. While the U.S. faces intense competition in the global economy it is worth noting that we possess one asset that no other nation has yet duplicated –

the capacity of university based research to launch high growth companies. There is virtually no equivalent of “Google” emerging from dorm rooms in universities in Europe or Asia. This is an asset we must seek to nurture for the future.

The power of this partnership in creating the modern research university was in my view greatly enhanced by the passage of the Bayh–Dole Act. Bayh–Dole extended this partnership by fully engaging universities in technology transfer and spin-out development. At its essence, the Bayh-Dole Act created a vehicle for leveraging U.S. investment in basic research into a stronger engine for commercialization.

Bayh-Dole was enacted at a time when the U.S. economy faced economic challenges nearly as severe as those we currently confront. In 1980 the U.S. economy was beset by double digit unemployment and double digit inflation. The rise of international competition had brought the phrase “rust belt” into the popular lexicon for the first time. In Pittsburgh, America’s epicenter of economic dislocation in the early 1980’s, over 100,000 jobs were lost in the steel industry in less than three years.

The Bayh-Dole Act created the foundation for the innovation-led recovery of the 1980’s and the growth of the 1990’s. Since the enactment of Bayh-Dole the university community’s commitment to technology transfer has skyrocketed. The number of university tech transfer programs increased from 30 to over 300. Over 5,000 new companies have been created and university- based patents and product introductions have also risen dramatically.

Without question I believe that the U.S. investment in science and basic research would never have produced the commercial and job dividends so vital over the last two decades without the Bayh-Dole Act and its impact on energizing universities to become partners and advocates for commercialization.

But while a recognition of those historic strengths is vital to charting a course forward, past achievements are no guarantee for a future where we face fundamental new challenges from increasing international competition, a critical need to overcome a period of stagnation in federal support for basic research, some evidence of a plateauing in university-based patenting trends and unmistakable indications that the vital link between basic research and innovation-led job growth has weakened if not broken completely. I will seek to identify lessons from Carnegie Mellon’s experiences that may hold promise for writing a new chapter in the innovation compact between the federal government and American universities.

### **Searching for Strategies to Rejuvenate Innovation: Lessons from Carnegie Mellon’s Experiences**

Carnegie Mellon University brings perspectives on these challenges from a relatively unique history among leading American research universities. Created in 1900 to be a technical trade school for the sons and daughters of steelworkers, the University is the youngest Top 25 research institution in the U.S. Our roots have instilled a focus on practical problem solving

and a culture of interdisciplinary research that have been critical to our capacity to stimulate innovation.

Nevertheless, we have faced the challenge of having to forge policies and a cultural environment capable of generating significant results. Upon becoming provost in 2000, I confronted the strong findings of a University committee convened to guide the search for my position that concluded that Carnegie Mellon's tech transfer process was broken. The Committee found that the policies and processes in place at that time instilled conflict between the University and our faculty and choked off both commercialization and start-up creation.

Our response was an overhaul of Carnegie Mellon's tech transfer process and the creation of what we call the "5% go in peace" approach. This approach creates a streamlined, common template for faculty based start-ups that limits university equity to 5% capped at a \$2 million dilution event, establishes clear royalty guidelines with a three year delay in payments and ensures virtually no University interference in start-up operations. This streamlined template has been augmented by supportive policies that allow faculty to incubate companies in University labs for short periods and that also allow faculty to hold C-level positions in the companies they create.

The 5% go in peace program has also been bolstered by the establishment of a supportive innovation ecosystem across the University. This ecosystem consists of aggressive entrepreneurial training and outreach that engages over 10% of the student population each year. It also includes the strategic placement of entrepreneurs in residence in key areas to jump start the development of ideas for new companies. In addition, a new initiative in computer science, known as Project Olympus, is bringing focused assistance on entrepreneurship to researchers in the earliest phases of research. One Project Olympus supported start-up was recently acquired by Google. Finally, we augment our streamlined processes for start-up creation with intense collaboration with regional economic development organizations to ensure that our companies have fertile ground for growth after leaving the University.

The 5% go in peace approach has been a catalyst to innovation. The rate of university spin-outs has doubled since the implementation of this policy in 2004. Since 2007, Carnegie Mellon has ranked number #1 among all U.S. universities without a medical school in the number of start companies created per research dollar spent and ranked number two in the nation among all universities in 2008 (source: AUTM, the Association of University Technology Managers).

On average the University creates 10 to 20 new companies each year. These start-ups range from robotics firms launching new applications for manufacturing and services, to video game companies, to a new battery storage company and a recent start-up that has developed a technology to utilize a person's blood to engineer plastics for plates to be used in medical procedures in order to reduce rejection rates. While most of these start-ups focus on leading edge technologies nearly one-third involve the manufacturing of products. University-based innovation is capable of far reaching impacts.

This focus on creating an ecosystem to support start-ups has been mirrored by a University-wide commitment to economic development by Carnegie Mellon's President, Jared Cohon. This commitment has resulted in the creation of an on campus facility to ease the ability of companies to launch operations in Pittsburgh. The facility is currently home to Apple, Intel and Google. Carnegie Mellon has also helped to attract Caterpillar, Disney Research and Rand to Pittsburgh. Other major tech leaders such as Network Appliance, Foster Miller and Cadence Design Systems have entered the Pittsburgh market by purchasing CMU- related companies.

This focus on economic development has done more than simply contribute to the nearly 9,000 jobs created by Carnegie Mellon related companies in the Pittsburgh region that are central to the area's recovery from the collapse of the 1980's. A University wide commitment to economic development has helped to establish entirely new models for industry/university research collaboration – the second core component of the innovation equation. While each company tends to pursue its own unique model of collaboration ranging on a spectrum from open source research to highly proprietary engagements, our experience demonstrates that a commitment to economic development is a vital catalyst to building the strong faculty/company relationships that are essential to stimulating innovation.

### **Challenges and Potential Strategies for the Road Ahead**

The Carnegie Mellon experience demonstrates that a focus on accelerating start-ups and a commitment to regional economic development as a core university mission can help establish a culture of innovation that produces tangible commercialization outcomes. At the same time we confront clear challenges that illustrate the difficulties the nation faces in accelerating innovation-led job growth.

These challenges fall into two major areas. First, at a time when universities and the federal government face enormous fiscal challenges, the resources needed to advance basic research outcomes to the point where a determination can be made as to whether they provide the basis for licensing or start-up creation are virtually non-existent.

The scale of resources required is not large. An investment of \$100,000 in a promising area for example can often enable a researcher to make the leap from concept to commercial potential. But currently, universities must rely on either internal sources or foundations for these funds and the net result is a lower return on U.S. investment in basic research.

The federal effort most applicable to meeting this gap is the SBIR program. However, the need for pre-commercial prototyping is often greatest before a researcher would be ready to start a firm and be SBIR eligible.

The second challenge is the need to fundamentally reevaluate strategies to encourage stronger partnerships between universities and new industry. While Carnegie Mellon's focus on economic development has fostered important collaborations, the overall climate created by key tax policies is having a chilling effect on the capacity to stimulate a stronger research

partnership with companies. I believe that this climate is hindering our capacity to link university research to capturing manufacturing opportunities in the U.S.

Recognizing these two main challenges I would offer the following three recommendations for consideration.

**(1) Create funding sources to close the gap between basic research and commercialization.**

I would strongly encourage Committee consideration of experimental approaches to enhance investment in moving basic research outcomes closer to commercialization. The President has proposed one approach to fill this gap by including \$12 million in the proposed FY2011 NSF budget for Innovation Ecosystem grants. The goal of this proposal is to provide support for programs that link researchers to resources that can evaluate the potential for new business creation or commercial licensing earlier in the research process.

Secretary Locke has also discussed the potential creation of regional “prototype development centers” that would also facilitate pre-commercialization refinement of research activities. A national pilot program in efforts such as these could both test their effectiveness and foster the creative development of strategies.

This funding should come with clear requirements however to ensure a federal return. I would propose for example that to be eligible universities must demonstrate that they have in place policies conducive to start-ups and commercialization and have created the economic development partnerships vital to foster innovation. Where applicable these programs should also enhance collaboration among universities in the commercialization process.

**(2) Invest in Targeted Research Initiatives that have the Potential to Dynamically Link Fundamental Research and Commercialization**

The ability to stimulate innovation would also be enhanced by exploring opportunities to target investments towards areas where a strong synergy exists between advancements in basic research and near term commercial growth.

For example, over the last two years researchers at Carnegie Mellon have joined their colleagues at ten other universities and a number of major companies to develop a roadmap for the future of U.S. commercial robotics. Funded by the Computing Community Consortium, the roadmapping process focused on identifying near term, medium range and long term application and research needs.

The outcome of this work is an integrated vision for linking continued progress in fundamental research areas vital to breakthrough advances with near term technology gaps that can accelerate new product innovations in manufacturing, health care, education and service applications. This approach harnesses the best strengths of U.S.

research universities but creates a framework for collaborations on near term innovations that can stimulate new companies and technology transfer. I believe similar initiatives in areas such as the science of learning or the brain sciences where major breakthroughs in fundamental research have recently been made could also be fertile ground for this type of approach.

### **(3) Establish a National Focus on Rejuvenating Industry-University Collaboration**

Just as the Bayh-Dole Act ushered in a boom in university based start-ups, the U.S. is in need of an overall strategy or policy framework for increasing collaboration among companies and universities. Such a framework should assess both current barriers and opportunities for new incentives.

One starting point for developing this framework would be an examination of the U.S. Tax code and Revenue Procedure 97-14 which places restrictions on the ability of universities to effectively engage companies. This procedure precludes companies sponsoring research projects from receiving preferential treatment in licensing. In effect, it requires universities to essentially stipulate that companies cannot own the IP coming from research they fund. It is a barrier unique to the U.S. and a major competitive disadvantage.

Efforts were made in Revenue Procedure 2007-47 to mitigate the impact of these provisions. But these changes still largely preclude the ability of companies to readily obtain exclusive licenses for research that they fund in buildings financed with tax exempt bonds.

Arguments can be made that altering these provisions would foster unfair competition with private sector research or undermine the basic mission of universities. I believe these issues can be addressed and that the competitive challenges facing the U.S. demand that we try.

A second starting point for this initiative would be to continue to explore modifications to the R & D tax credit that would incentivize university collaboration. At a time when companies are increasingly off-shoring research operations, tax incentives for university collaborations could be a valuable tool for retaining innovation capacity in the U.S.

Finally, an initiative to rejuvenate university/industry collaborations should focus specifically on opportunities to more closely link basic research to manufacturing. Carnegie Mellon is launching a campus-wide initiative called the Manufacturing Accelerator to create more direct pathways between leading edge basic engineering and computer science research and manufacturing.

The Accelerator will leverage a network of over 200 small and medium sized Pennsylvania firms to focus basic research on industry defined product and process

opportunities. Any effort to stimulate stronger university/industry collaboration must include strategies for extending that partnership to production.

## **Conclusion**

Thank you again for your commitment to American leadership in science and the opportunity to share Carnegie Mellon's experiences in seeking to ensure that the federal investment in basic research stimulates innovation. The U.S. confronts the challenges from a unique position of strength. The American research university is an asset not yet matched anywhere in the world.

But the times demand that we evaluate strategies that can insure that this asset fosters broad-based economic opportunities in the future. Carnegie Mellon has worked to foster a culture of innovation that has accelerated new business creation and commercialization research partnerships with companies. Our experiences suggest that strategic policy initiatives could serve to reinvigorate the overall climate for university-based innovation.

These strategic initiatives should include new funding sources that bridge the gap between basic research and commercialization anchored in strict requirements for universities to put in place and maintain start-up supportive policies. Second, focusing some segment of basic research funding on targeted areas where close collaboration to foster synergy between fundamental science breakthroughs and barriers to commercial applications, such as robotics, would be a critical step to accelerate research-based innovation. Finally, a broad-based effort to explore means of enhancing the environment for industry/university collaboration is clearly needed. A focus on tax code and tax credit actions as well as an assessment of opportunities that create closer linkages between university research and manufacturing activities could provide a starting point for establishing a policy framework as bold as the Bayh-Dole Act proved to be in launching an era of start-up creation.

In closing, let me pass on the observation that one cannot spend time on the campus of an American university without coming away with a renewed belief that our best times are ahead of us. Carnegie Mellon and the entire university community stand ready to join you in advancing ideas and policies that will match the vigor and creativity of our students.