Testimony of Michael Borrus, Founding General Partner, X/Seed Capital
before the U.S. Congress, House of Representatives, Committee on Science and Technology, Subcommittee on Technology and Innovation

February 15, 2007

Summary Testimony of Michael Borrus

Distinguished members of Congress:

I am Michael Borrus, founding General Partner of X/Seed Capital, a seed-focused early stage venture fund based in California's Silicon Valley. I have been asked to give my views on the Advanced Technology Program (ATP) at NIST, a program that, since its inception, I have studied closely -- first as a UC Berkeley faculty member focused on emerging technologies, technology markets and policy, then as an entrepreneur at an innovative start-up, and now as a very early-stage (so-called "seed-stage") venture capital investor focused on breakthrough innovation. Those experiences provide an informed perspective on ATP and color this testimony. You should also note that I currently serve on the external industry Advisory Committee to ATP and that I previously served on the National Academies' steering Committee on Government-Industry Partnerships, chaired by Intel founder Gordon Moore, which issued two detailed evaluations of the ATP program in 1999 and 2001.[1]

Summary Conclusions

- Significant changes over the last 15 years in early stage capital markets in the US – in particular, an institutional drift away from very risky, seed stage funding by private venture capital investors – create an urgent need for the ATP to be continued, for substantial funding to be restored so that ATP can run new competitions, and for it to be *stably* funded for the foreseeable future.

- The ATP is quite likely the most intensively studied, rigorously scrutinized and carefully assessed US technology program of the past 50 years. The overwhelming consensus of such painstaking analysis, as of the prior NRC reviews, is easily summarized: ATP is an extremely well run program that works and works very well.[2] Indeed, ATP boosts several unique features that permit it to set the standard among federal technology programs. It is, for example, the only federal technology program that actually measures its economic return to the Nation.[3]

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[1] National Research Council, Committee on Government-Industry Partnerships *Review of ATP*, Washington, D.C.: National Academy Press, 2001. In addition to the papers and proceedings in that volume, the Committee issued National Research Council, *The Advanced Technology Program: Challenges and Opportunities*, Washington, D.C.: National Academy Press, 1999.

[2] In addition to the NRC studies, *Ibid*., see the numerous evaluations referenced therein.

[3] See the discussion at http://www.atp.nist.gov/factsheets/1-a-1.htm and the source cited there, suggesting at least $18 billion in present value social benefits from 40 ATP projects (over 8X ATP's total investment over the full life of the program).

- As an especially well-run federal technology program targeted at areas of market failure and long-term national needs, a restored ATP has a vital role to play and can be an essential element in the broader American response to global changes in technology markets, in climate, in energy security, and in the U.S. competitive position in the global economy. Indeed, given the stakes, a restored ATP with increased, stable funding is in fact the most prudent, cautious and conservative approach for it risks the least: By contrast, failing to fund ATP risks sacrificing American opportunities for technical advance and the long-term economic growth and productivity gains it produces.

- For all of these reasons, I believe that Congress should re-authorize the ATP program, provide sufficient funding for ATP to run several competitions focused around areas of acute need or promise in such areas as carbon-neutral alternative energies and energy storage, and consider ways that ATP might be stably and predictably funded over the next several years to maximize its contribution to the Nation.

Let me now touch on key aspects of these summary points.

Seed financing.

There is a paradox in today's venture capital markets: There is simultaneously too much venture capital and too little. There is too much venture capital available once early stage risk has been reduced and start-ups seek capital for expansion. However, there is too little venture capital available for the riskiest, de novo start-up phase of a new venture's life. That 'seed' stage -- when an entrepreneur may have a good idea, some scientific validation and at best only a rudimentary technology – is typically when potential innovations are transitioned out of the lab and toward the commercial marketplace. It is when they must navigate the gap in seed-stage funding dubbed by many analysts as the 'valley of death' – a classic market failure in early stage innovation.[4]

The two parts of this paradox are actually halves of a single explanation: In the last 15 years, as the venture capital industry has grown in size, venture firms have put more capital under management. *Managing* more capital typically requires *deploying* more capital in each investment, that is, in far larger increments than can be consumed at the seed stage by start-ups. The bulk of the venture capital industry has consequently drifted away from seed and very early stage financing to invest later in more mature stages of a start-up's life when more capital is required to expand operations. Data compiled for the National Venture Capital Association confirm all of these trends.[5]

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[4] See, e.g., NIST head and IBM chief scientist, now Harvard Professor, Lewis M. Branscomb and Philip E. Auerswald, "Valleys of Death and Darwinian Seas: Financing the Invention to Innovation Transition in the United States," The Journal of Technology Transfer, Volume 28, Numbers 3-4 / August, 2003, and sources cited there.

[5] See the last five years of the annual PricewaterhouseCoopers/National Venture Capital Association *MoneyTree™ Report*; in addition, the testimony by Jonathan Cohen, founder and CEO of 20/20 GeneSystems, at the House Science Committee Hearing on "Small Business Innovation Research: What is

The consequence of these trends is a need for additional sources of capital at the seed stage. That is why my fund exists. And that is one of the reasons there is a greater need than ever before for ATP, which has always focused on filling the seed-stage gap, helping to cross the 'valley of death'. The need is sufficiently large that there is plenty of room for both government and private money – crowding out is just not an issue.

Unique ATP features

One of the reasons ATP works well is that it boosts several unique features that ought to be more widely adopted across the broad ecosystem of federal technology programs. ATP competitions are peer-reviewed, pork-free and merit based. The program's public-private cost-sharing, its demonstrated ability to run multiple competitions, both general and focused in areas of acute need, and to run them fast and on budget, its detailed, economically sound self-assessment, its measured return on investment, its explicit mission to enhance US competitiveness through innovation – all set it quite apart from almost every other federal technology program.

So effective are these attributes, that at the same time the Bush Administration has sought to kill ATP, it has been widely taken as an ideal model and copied by foreign governments from Asia to Eastern Europe. These same attributes are one of the reasons the program has so effectively played a key role in providing early capital to the companies like Affymetrix and SunPower responsible for a wealth of valuable new innovation from gene chips, rapid DNA sequencers and cheap digital mammography to fuel cells, high-efficiency solar photovoltaic cells and novel engineered materials.[6]

ATP is sometimes labeled with the profoundly misleading and profoundly misinformed characterization of 'picking winners and losers': That is, frankly, flat wrong. No investor, private or public, picks winners and losers in technology innovation. Rather, it is the market (customers) that does the picking. By contrast, with ATP and other federal technology programs, the government is really helping to plant long-term technology seeds in areas of private market failure or acute public need. Some of those technology seeds will sprout, others will not. But the planting, the activity as a whole, must go forward if long-term economic gains are to be effectively harvested.

Global challenges and U.S. innovation

The U.S. faces numerous competitive challenges globally – among then, the rapid technological rise of China, India, and parts of Eastern Europe and Latin America, the need to respond to global climate change and the concomitant shift to carbon neutral

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the Optimal Role of Venture Capital," July 28, 2005; Generally, the last 10 years has seen a decline in the percentage of venture investments going to seed and early stage and a concomitant shift away from higher-risk early-stage funding. See the discussion in the introduction in National Research Council, *SBIR and the Phase III Commercialization Challenge*, Charles W. Wessner, ed., Washington, D.C.: The National Academies Press, 2007.

[6] For more detail see the descriptions on the ATP web site at http://www.atp.nist.gov/gems/listgems.htm

energy sources, declining competitive position in certain technologically intensive industries.[7] The only enduring answer to all of these challenges that can sustain U.S. leadership and a growing standard of living for future Americans, is increased long-term innovation leading to wholly new industries and to the transformation of existing industries.[8] In turn, substantial domestic U.S. investment in research and development -- both public and private -- is the prerequisite for that kind of innovation.[9]

For a variety of reasons – enormous uncertainty, the impossibility of accurate risk assessment, extreme volatility, appropriability problems, among others, very early stage technology capital markets are especially prone to numerous market imperfections including herd behavior, strategic gaming, information asymmetries, institutional structures focused on early liquidity, and the exercise of market power. These problems are especially severe for especially risky new technical approaches, when intensive collaboration across multiple technical disciplines may be essential for technical progress (therefore requiring the coordination of disparate technical and market actors), and wherever a clear, reasonably short-term path is lacking for private market actors to reap sufficient returns from their private investment. In those cases, federal technology funding mechanisms have historically played an essential role in fostering technical innovation to the point where private capital markets can then sustain development.

That is the sweet spot that ATP very effectively addresses. Indeed, for reasons described earlier, ATP is uniquely positioned to respond to the competitive challenges identified above. It is my strong recommendation that Congress re-authorize the ATP program and provide sufficient funding for ATP to run several competitions, both general competitions and focused competitions in areas of acute need or promise such as carbon-neutral alternative energies and energy storage. Given the importance of funding stability and predictability to technological progress, Congress should also seriously consider ways that ATP might be stably and predictably funded over the next decade to maximize its contribution to the Nation.

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[7] On some of these and other challenges see, the National Research Council, Rising Above The Gathering Storm, Washington DC: National Academies Press, 2006.

[8] See Michael Borrus and Jay Stowsky, "Technology Policy and Economic Growth," in Lewis Branscomb and James Keller, editors, *Investing in Innovation: Creating a Research and Innovation Policy*, Cambridge, MA: MIT Press, 1998. The contribution of technology to economic growth is now well recognized. See P. Romer, "Endogenous Technological Change," *Journal of Political Economy*, 98(5):71-102, 1990. See also G. Grossman and E. Helpman, *Innovation and Growth in the Global Economy*, Cambridge, MA: MIT Press, 1993.

[9] Romer, "Endogenous Technological Change," *op. cit.*; Borrus and Stowsky, "Technology Policy and Economic Growth," *op. cit*. See also National Research Council, *Allocating Federal Funds for Science and Technology*, Washington, D.C.: National Academy Press, 1995. The report notes that federal investments in R&D have produced enormous benefits for the nation's economy, national defense, health, and social well-being. *Ibid*, p. 3.