

Converting Research into Innovation & Growth:

SBIR, the University, and the Park



Investing in Innovation:
Promoting New Opportunities in the
United Nations Economic Council for Europe Region
Geneva, Switzerland
April 10, 2008

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The National Academies



- National Academy of Sciences
 - Chartered by Congress in 1863
 - A self-perpetuating Honorary Society
- National Research Council (1916)
 - The Operating Arm of the National Academies
- National Academy of Engineering (1964)
- Institute of Medicine (1970)

Today's Presentation

- The Innovation Imperative
 - The Global Innovation Challenge
 - The Role of Small Businesses
- Policy Myths about Innovation
 - The Linear Innovation Myth
 - The Perfect Market Myth
 - The VC Solution Myth
- The SBIR Program
 - Program Advantages
 - The National Academies' Assessment
 - The University Connection
- Conclusions
 - Responding to the Global Innovation Challenge
 - Learning from Each Other

Today's Policy Challenge is A Global Challenge

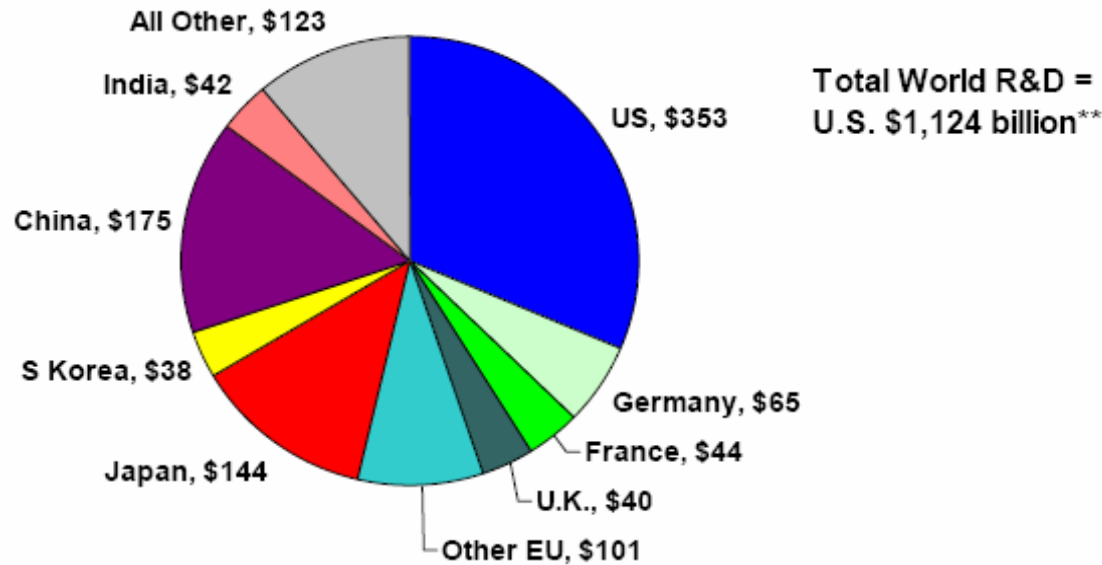
All Countries want to know
how to sustain Growth
and Competitiveness

Innovation is Recognized as a Key Strategy for Growth & Competitiveness

- **China** brings scale advantages, national focus and resources
 - National Goal to become a Global Manufacturing & Leading Edge R&D Center
 - Intense Focus on Innovation & Institutional Change
- **India's** Policy Liberalization now unleashing growth
 - Emerging as a center for high-end R&D
- **Japan** is Restructuring its Innovation System
 - High level policy focus and major investments
- **Finland, Netherlands,** and **Germany** are renewing & funding tech programs

Global R&D Competition is Accelerating

Shares of Total World R&D, 2007



China has passed Japan as the World's No. 2 Investor in R&D

India has passed the UK

Source: Battelle, Global R&D Report, 2007, from Battelle, OECD, and R&D Magazine data. Projections for 2007, by performer nation. ** - calculated using purchasing power parities, in millions of dollars.
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France's Recent Innovation Initiatives

- New Research and Innovation Bills to Reform the French Public Research System
- SME pact to Build Bridges Between Innovative SMEs and Large Companies
- Pôles de Compétitivité €1.5 billion (2006-2008)
- Agency for Industrial Innovation for Large Industry-led R&D Programs €2 billion —Now Ending
- National Agency for Research €1 billion
- Institute of High Studies in S&T
- Carnot Institutes to Encourage Public-private Innovation Partnerships
- Oséo to Support Innovative SMEs ~€1 billion
- New University Reform of Governance & Finance



The Innovation Imperative

- 3 Key Points
 - Innovation is Key to Maintaining a Country's Competitive Position in the Global Economy
 - Small Businesses and Universities Play a Key Role in the Innovation Process
 - Institutional Change is Necessary to Compete Successfully—New Incentives are Required to change

A Recipe for Success

- Focused, Proven Programs
 - Well funded by a patient government
- Positive Framework Conditions to support Growth
- Dynamic Small Business Entrepreneurs
- 21st Century Universities
- New Institutions—e.g., S&T Parks

U.S. Framework Conditions

- A large and integrated domestic market
- Key Advantage: A society open to innovation
 - Trust in Science & Scientific Institutions
- An economic and institutional infrastructure that quickly re-deploys resources to their most efficient use
 - Strong & diverse higher educational system
 - Deep and flexible capital and labor markets
 - Strong S&T institutions
 - Entrepreneurial Culture
 - Ability to grow new Large Firms

Dynamic Small Businesses

A Key Source of
Knowledge-based Growth

Small Companies Drive High-Technology Innovation

- Large Returns to National Economic Capability Can Result from Relatively Small National Investments
- Innovations can become Commercial Products driving Growth—with the Right Policy Support
- Developing Incentives to spur Innovative Ideas for New Products is a Central Policy Challenge
- **Small Companies are Key Players in Bringing New Technologies to Market**
 - Audretsch & Acs

The Small Businesses Advantage

- U.S. Small Businesses generated 60 to 80 percent of net new jobs annually over the last decade
- Employed 39 percent of high tech workers, such as scientists, engineers, and computer workers
- Produced 13 to 14 times more patents per employee than large patenting firms
 - Patents are of High Quality
 - Twice as likely as large firm patents to be among the one percent most cited
- Small Companies are a Key source of Innovation by themselves and for Large Companies

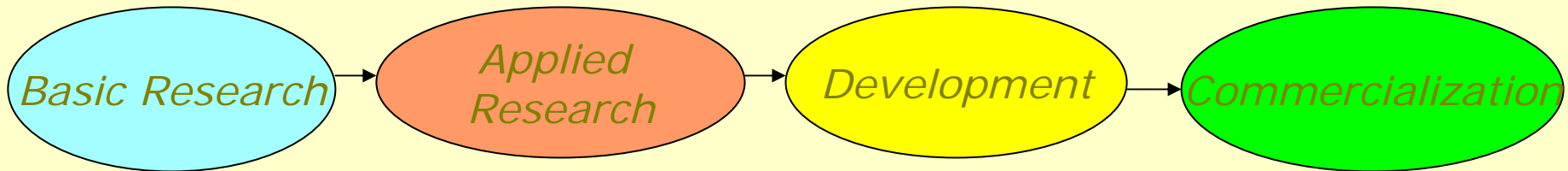
Sources: SBA Office of Advocacy (2005) data drawn from U.S. Bureau of the Census; Advocacy-funded research by Joel Popkin and Company (Research Summary #211); Federal Procurement Data System; Advocacy-funded research by CHI Research, nc. (Research Summary #225); Bureau of Labor Statistics, Current Population Survey; U.S. Department of Commerce, International Trade Administration

However, Common Policy Myths about Innovation have Real Impacts

Myths Matter when they Impact Policy

The Myth of the Linear Model of Innovation

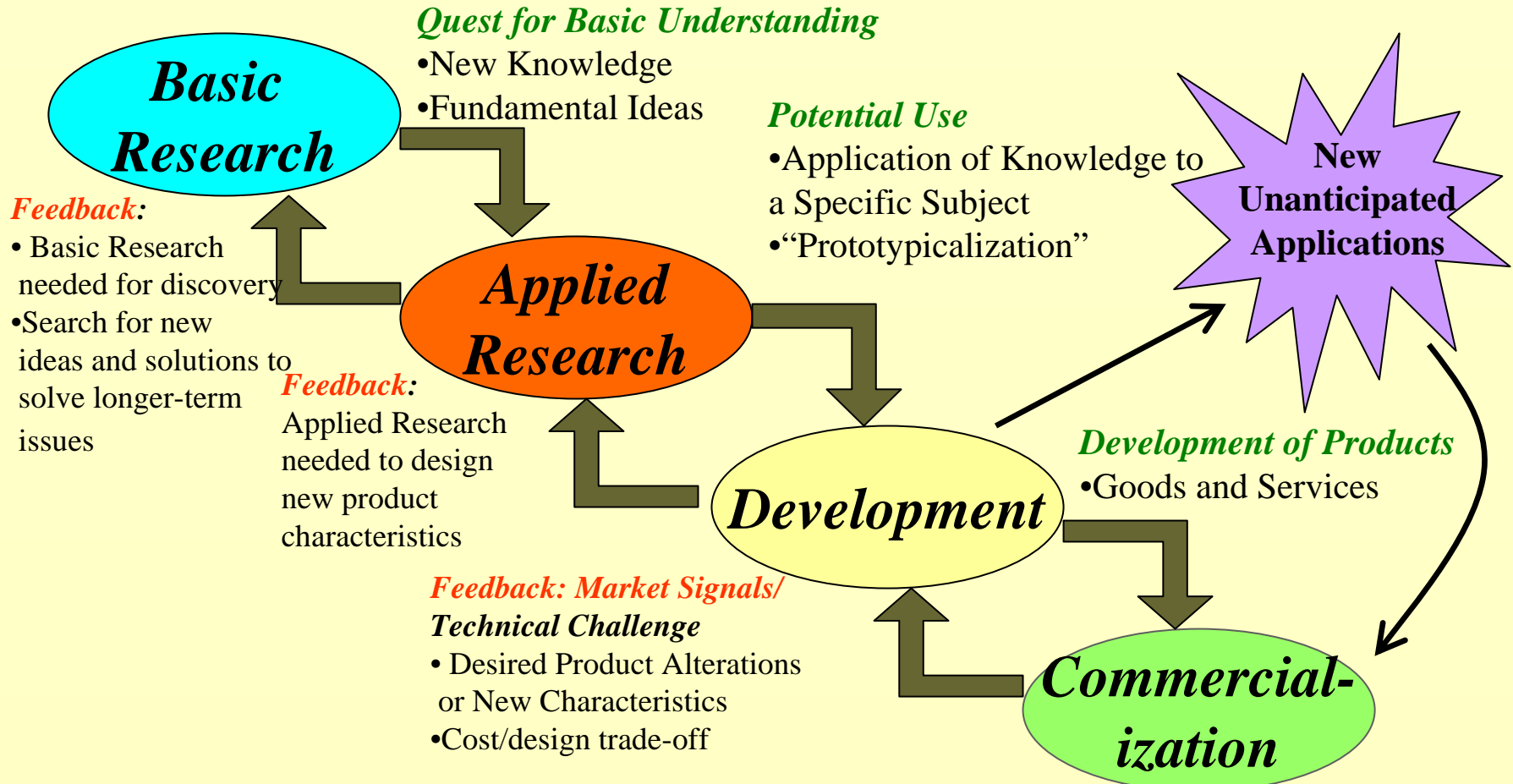
- Global Myth: Innovation is a Linear Process



- Reality: Innovation is a Complex Process
 - Major overlap between Basic and Applied Research, as well as between Development and Commercialization
 - Principal Investigators and/or Patents and Processes are Mobile, i.e., not firm-dependent
 - Many Unexpected Outcomes
 - Technological breakthroughs may precede, as well as stem from, basic research
 - Clustering of Innovation is non-linear

Non-Linear Model of Innovation

Technology Development & Commercialization are Complex



The Myth of American Exceptionalism

- Myth: American innovation is based on extraordinary qualities of Americans
- Reality: Incentives found in the US motivate individuals from all over the world to innovate by combining ideas with capital, know-how, and talent
 - Gentle Bankruptcy Laws permit rapid recovery
 - Forgiving Social Norms allow more than one try
 - High Social Value on Commercial Success
- Strong Clusters with Specialized Services, Markets Open to Competition, and the Prospect of Substantial Rewards all encourage Innovation

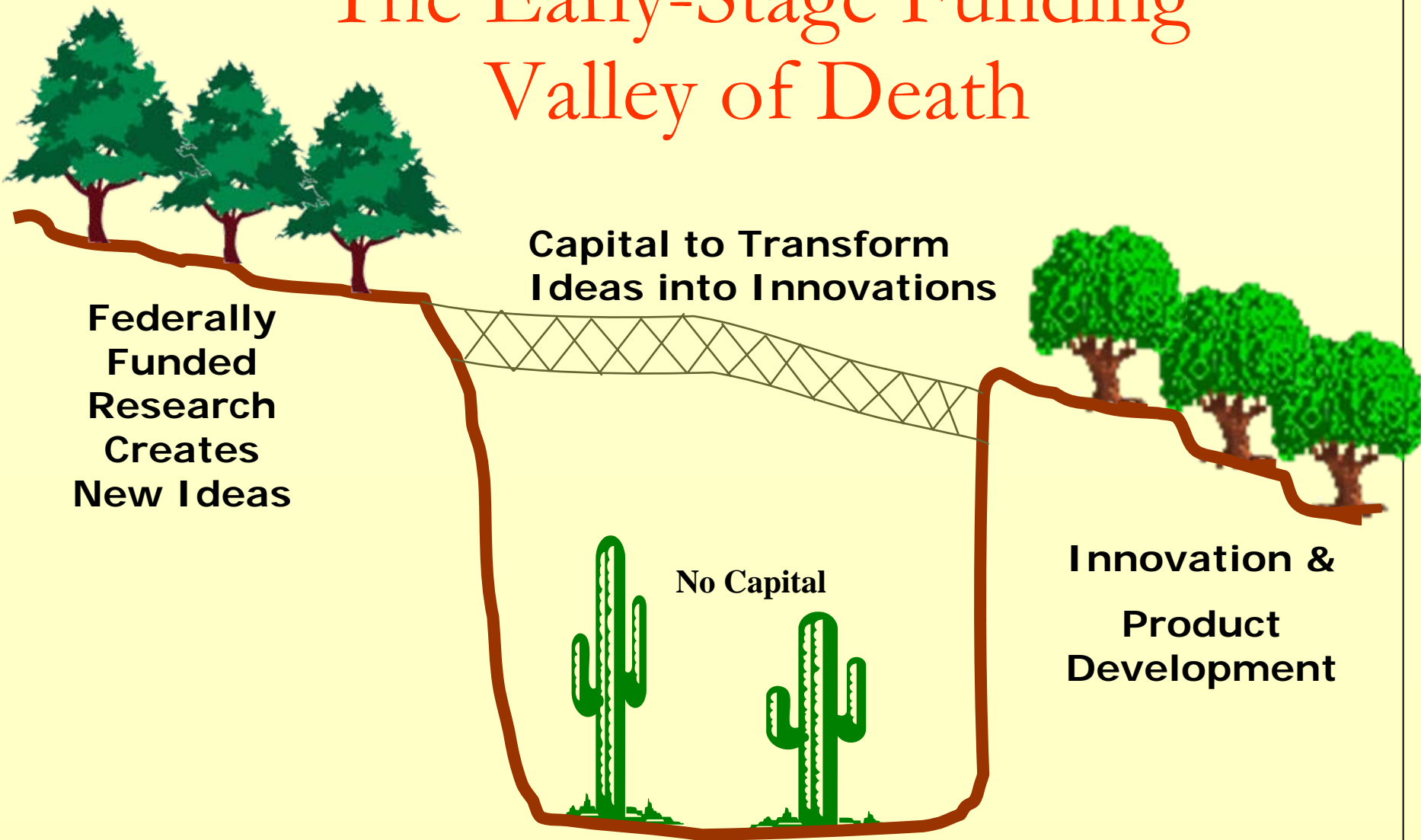
The U.S. Myth about Perfect Markets

A Hurdle for Small Innovative
Businesses

The U.S. Myth of Perfect Markets

- Strong U.S. Myth: “If it is a good idea, the market will fund it.”
- Reality:
 - Potential Investors have less than perfect knowledge, especially about innovative new ideas
 - “Asymmetric Information” leads to suboptimal investments
 - This means that it is hard for small firms to obtain funding for new ideas
 - George Akerlof, Michael Spence and Joseph Stiglitz received the Nobel Prize in 2001, “for their analyses of markets with asymmetric information”

The Early-Stage Funding Valley of Death





***"I call my invention 'The Wheel,' but so far I've
been unable to attract any venture capital."***

36 FORBES ■ November 1, 2004

What about
Venture
Capital?

The Myth of U.S. Venture Capital Markets

- Myth: “U.S. VC Markets are broad & deep, thus there is no role for government awards”
- Reality: Large U.S. Venture Capital Market is Not Focused on Early-Stage Firms
 - Risk is too high & information on potential product is limited
 - Proof of concept/prototype often absent or not yet achieved
 - Even Angel investors need more information
 - Small Investments have High Overhead Costs
 - Most Early Stage firms need investments in the \$100K to \$700K range
 - Most VC firms do not want to manage numerous small investments
- This is the gap that innovation awards address

The Venture Capital Constraint

Large U.S. Venture Capital Market is Not Focused on Seed/Early-Stage Firms

U.S. Venture Capital by Stage of Investment 2007

Total: \$29.4 Billion

Later Stage
\$12.2 billion
1168 Deals

Expansion Stage
\$10.8 billion
1235 Deals

41%

37%

Early Stage:
\$5.2 billion
995 Deals

18%

4%

Seed Stage: \$1.2 billion
415 Deals

Bridging the Valley of Death

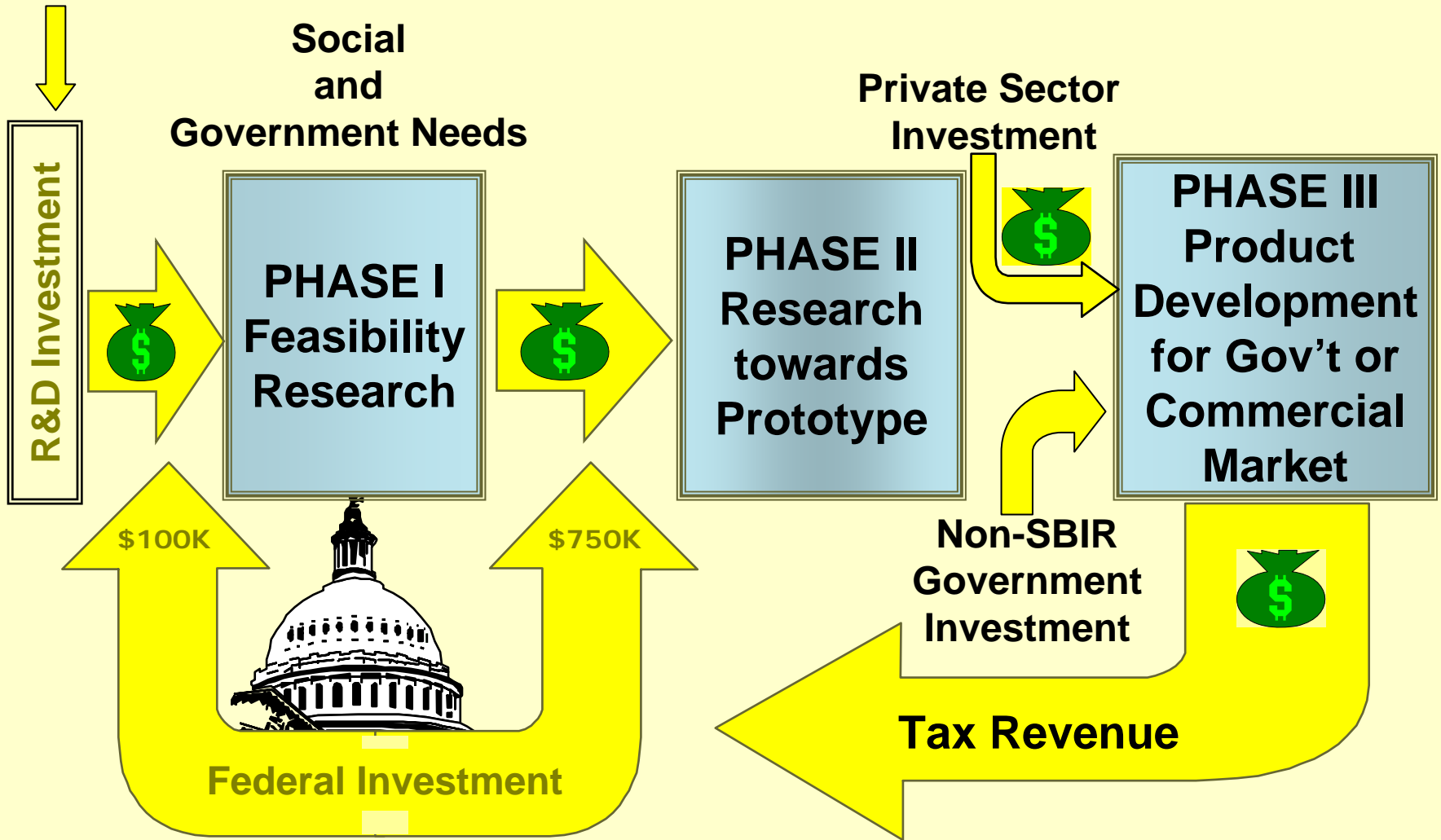
The Small Business Innovation
Research (SBIR) Program

The SBIR Program

- Created by the Small Business Innovation Act of 1982 & renewed in 1992 & 2001
- Participation by all federal agencies with \$100 million R&D budget
 - Agencies must allocate 2.5% of their R&D budgets for small business awards
- Currently a \$2.3 billion per year program
 - Largest U.S. Partnership Program
 - Active for 25 years!

\$138 billion

The SBIR “Open Innovation” Model



SBIR Concept Advantages

- The Government identifies Societal needs in health, security, environment, & energy
- But the actual proposals are Industry-Initiated, screened by a 2-Phase Filter
 - Phase I: Proof of Concept
 - Phase II: Prototype
- Program ownership rests with many agencies, not a single “tech agency”
- No new money, hence politically viable
- Changes incentives within Organizations for those who wish to change
 - University Professors can apply their knowledge
 - Companies can propose promising applications

SBIR's Win-Win-Win Proposition

- Why do Entrepreneurs like SBIR?
 - Grants mean no dilution of ownership
 - Awards are a signal of quality to private capital market
- Why do Governments like SBIR?
 - SBIR helps Government Agencies Solve their Problems
 - Private Sector Ingenuity helps address Public needs
- Why do Universities Increasingly Like SBIR?
 - Helps Universities to diversify & grow the regional job base
 - Cooperation validates Research Funding

The National Academies' Assessment of SBIR

- A \$5 million, Large Scale Study with 20 researchers
 - Based on request from the U.S. Congress
 - Study covers 96% of the program
 - 5 agencies, each with unique missions
 - SBIR is administered separately by multiple institutes, centers, laboratories, and agencies.
 - NIH alone has 23 separate institutes & centers using SBIR
- The Study Goals are to Assess SBIR's Contributions & Improve its Operations
 - A Ten Volume Study

NRC Study of SBIR involves Unprecedented Large Scale Original Field Research

- Surveys: Over 7000 Projects Surveyed
 - Phase I Award Survey targeted 3000 firms
 - Survey on Phase II Awards (1992-2002) involved over 4000 firms
 - Program Manager Survey
 - Technical Manager Surveys (TPOCs and COTRs)
- Case Studies
 - Approximately 100 case studies conducted
 - Case Study selection reflects program diversity
- Surveys & Case Studies Developed in Consultation with Agencies & SBIR users

SBIR Contributes to the Development of Scientific & Technological Knowledge

- SBIR Generates Knowledge
 - As embodied in data, publications, patents, licenses, models, algorithms, equipment, new firms, etc.
- SBIR Broadens Scope & Speed of Research
 - Helps firms initiate new high-risk research
 - Helps broaden the scope of existing research
- SBIR Disseminates Intellectual Capital
 - Suggested by presence of extensive Licensing agreements by Phase II awardees
- SBIR Builds Networks between Universities & Firms
 - Faculty and students draw on SBIR to establish businesses, start projects, drive towards commercialization

New NRC Research Reveals SBIR Impact on Firm Formation and Growth

- SBIR Awards Have a Substantial Impact on Participating Companies.
 - **Company Creation:** 20% of responding companies said they were founded as a result of a prospective SBIR award
 - **Research Initiation:** SBIR awards played a key role in the decision to pursue a research project (70% claimed as cause)
 - **Company Growth:** Significant part of firm growth resulted from award
 - **Partnering:** SBIR funding is often used to bring in Academic Consultants & to partner with other firms

SBIR and the University:

A Mechanism to Transfer Knowledge

- SBIR Innovation Awards Directly Cause Researchers to create New Firms
 - Faculty does not have to give up University post
 - Cooperation creates High-Tech Jobs
- Universities can diversify & grow the job base
 - Increasingly universities are the largest regional employer for all types of employment
- Cooperation validates Research Funding
 - Returns to Society in Health, Wealth, & Taxes
 - SBIR is a proven mechanism in an uncertain game

The 21st Century University

- For the Knowledge Economy, the University needs to
 - Teach the next generation
 - With up to date laboratories on real market questions
 - About the sciences needed to address current and future questions (e.g., nuclear waste, stem cell research, genetically modified food)
 - Conduct Research
 - “Curiosity-driven Research,” certainly but
 - the University also needs to bring Science to bear on Social Problems and Industry Needs
 - Commercialize
 - New Science-led solutions to societal problems
 - New Products, Processes
 - Market-ready students

Commercializing University Research ...

- Provides a Return to Public Investments in Research
 - Ensures that new & promising ideas are not trapped in the University laboratory
- Provides a source of New Firms & Jobs
 - Needed for Economic renewal & competitiveness
- Justifies New Research Allocations
 - Creates tangible outputs from public investments
- Provides Services to Firms within the Innovation Ecosystem
 - Fosters skill pools needed for innovation clusters
- S&T Parks are increasingly seen as a key tool to help commercialize university research

The Roles of S&T Research Parks

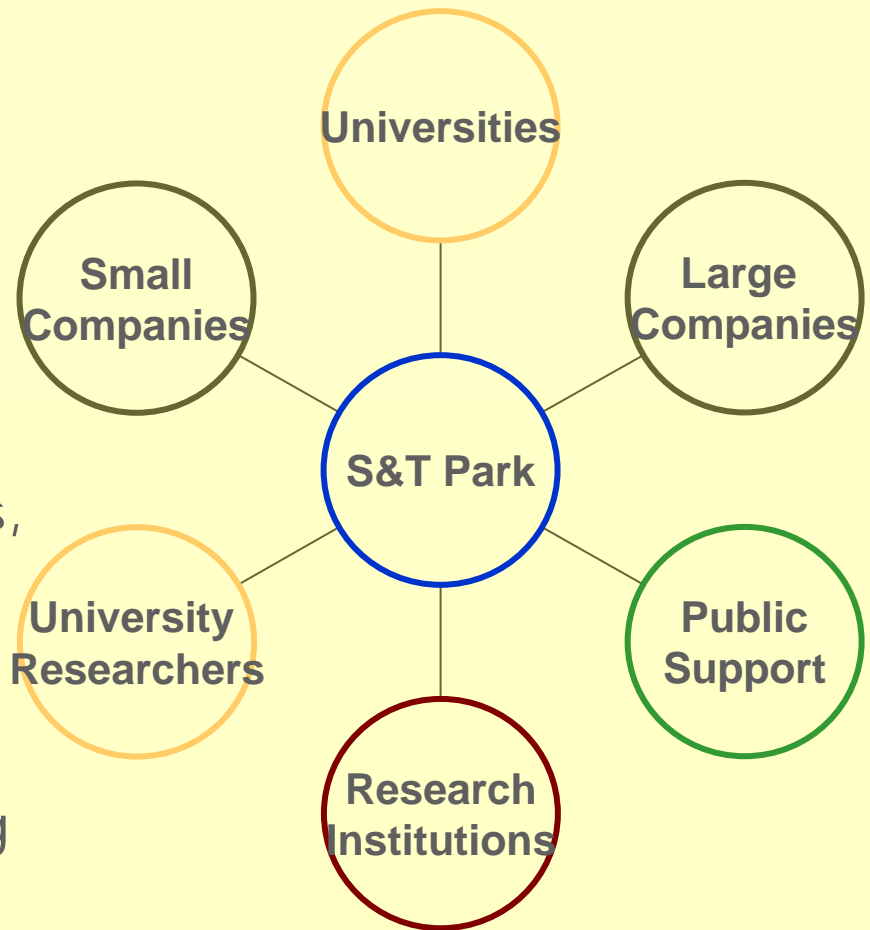
The National Academies held a major
conference on S&T Research Parks
on March 13, 2008

What are some of the take-away
points?

S&T Parks can Spur University-Industry Cooperation

Well-conceived and regularly assessed S&T Parks can

- Help advance university missions
- Build partnerships among researchers, small companies, and large companies
- Generate tangible outcomes from university research through increasing public support for university funding



S&T Parks: Success Factors

- ✓ Involvement of Major Research Universities and/or Laboratories
 - Provides access to critical knowledge resources
 - Facilitates knowledge transfer through collaboration
- ✓ Proximity: They must be close together
- ✓ Access to a pool of High-tech Talent
- ✓ Presence of Long-term Project Funding
 - Stability and commitment to resources is needed

S&T Parks: Success Factors

- ✓ Creation of Physical Infrastructure and Amenities
- ✓ Need to Encourage Entrepreneurial Culture
 - Willingness to commercialize knowledge by starting a firm
- ✓ Ability to Attract Industry and Researchers
- ✓ Goals-based Assessment is needed

Appropriately Designed S&T Parks can be a Catalyst for Innovation

- Encourage Research Cooperation
 - S&T Parks encourage cooperation among university researchers, companies, and research institutions to develop new ideas
- Promote Regional Development
 - Facilitate Firm Creation
 - Generate Critical Mass for a Regional Economy
 - Encourage New and Existing Firms and the New Jobs and Growth they bring
- Build Public Support for Research
 - Help laboratories justify further R&D support
 - Have concrete impacts on jobs and growth that build support in the Community and the State

Conclusions

Innovation Awards like SBIR can
be an Important Policy Tool to
Meet the Globalization Challenge

SBIR Program: Leveraging Higher Returns on R&D Investments

- SBIR Capitalizes on Existing R&D Investments and Procurement Funds
- Focus on Valley of Death—Key Point of Vulnerability for Firms and Products
- National Program to Meet National Needs with National Firms
- Bottom-up Approach to Tech Transfer
 - Contributes to Innovative Solutions as well as Growth and Job Creation

SBIR can help Drive the Growth of a Knowledge Economy

- A tool to lift productivity growth & build a more modern knowledge-based economy
 - Helps government provide services at lower cost
 - Capitalizes on National R&D Investments
 - Catalyzes the Development of New Ideas and New Technologies
 - Addresses Gaps in Early-Stage Funding for Promising Technologies
 - Generates Jobs, Growth, & Effective Innovation

SBIR is Recognized Internationally as Best Practice

- Finland has adopted a 3-Phase SBIR Program
 - Sweden & Russia have adopted an SBIR-Type program
 - UK SIRI program is similar in concept; now being upgraded
 - The Netherlands government has recently adopted SBIR, following a pilot program
 - Japan, Korea, & Taiwan have adopted SBIR concept
 - India has launched a SBIR Initiative for the biotechnology sector
- All had consultations with the NAS

Our Common Challenge

- National Innovation Systems are Different in Scale and Flexibility
 - Flexibility is a differentiator
 - It is less how much is spent but *how well it can be used by the private sector*
- All Systems Have Common Challenges
 - Need to justify R&D expenditures by creating new jobs & new wealth
 - Need to try new mechanisms that shift innovation incentives in a positive way
- Learning from Each Other is the Pathway to Progress