Innovation and Manufacturing: The National Institute of Standards and Technology in the 21st Century

Presented by

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Phillip Singerman – Professional Profile

- 30 years economic development experience at local, state, and federal levels, and in the private sector
- US Assistant Secretary of Commerce for Economic Development, 1995-1999 (Administration of Economic Development Administration)
- Founding CEO of Maryland Technology Development Corporation, and Philadelphia Ben Franklin Technology Center (rated #1 and #3 by Entrepreneur Magazine for seed funding)
- Managing Director of Toucan Capital, a $130 million private venture capital firm
- Consultant to local governments, economic development organizations, and universities on federal funding strategies
- Board of Directors, State Science & Technology Institute
- Selected as first NIST Associate Director for Innovation & Industry Services, 2011

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Outline

- What is NIST?
- How NIST Contributes to Ohio's Manufacturing Economy
- NIST Manufacturing Initiatives for FY 2012
- Innovation and Manufacturing

NIST's Role

"The Congress shall have Power To … fix the Standard of Weights and Measures"

U.S. Constitution, Article 1, Section 8

September 17, 1787

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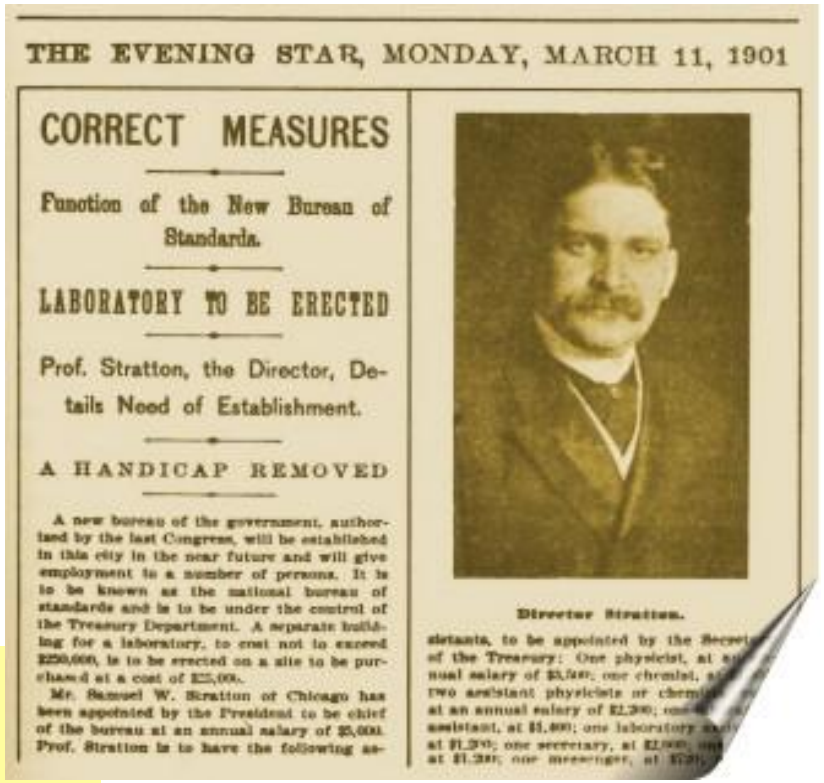
National Bureau of Standareds Established in 1901

"It is therefore the unanimous opinion of your committee that no more essential aid could be given to

- **manufacturing**
- **commerce**
- **the makers of scientific apparatus**
- **the scientific work of Government**
- **schools, colleges, and universities**

than by the establishment of the institution proposed in this bill."

House Committee on Coinage, Weights and Measures …
May 3, 1900
on the establishment of the National Bureau of Standards (now NIST)



THE EVENING STAR, MONDAY, MARCH 11, 1901

CORRECT MEASURES

Function of the New Bureau of Standards.

LABORATORY TO BE ERECTED

Prof. Stratton, the Director, Details Need of Establishment.

A HANDICAP REMOVED

A new bureau of the government, authorized by the last Congress, will be established in this city in the near future and will give employment to a number of persons. It is to be known as the national bureau of standards and is to be under the control of the Treasury Department. A separate building for a laboratory, to cost not to exceed $250,000, is to be erected on a site to be purchased at a cost of $25,000.

Mr. Samuel W. Stratton of Chicago has been appointed by the President to be chief of the bureau at an annual salary of $5,000. Prof. Stratton is to have the following as-

Director Stratton.

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The Congress finds and declares ...

- The future well-being of the United States economy depends on a strong manufacturing base and requires continual improvements in manufacturing technology, quality control, and techniques for ensuring product reliability and cost-effectiveness.
- Improvements in manufacturing and product technology depend on fundamental scientific and engineering research to develop
  a) the precise and accurate measurement methods and measurement standards needed to improve quality and reliability, and
  b) new technological processes by which such improved methods may be used in practice to improve manufacturing and to assist industry to transfer important laboratory discoveries into commercial products.

NIST Organic Act - 15 U.S.C 271, Section 1, 1988

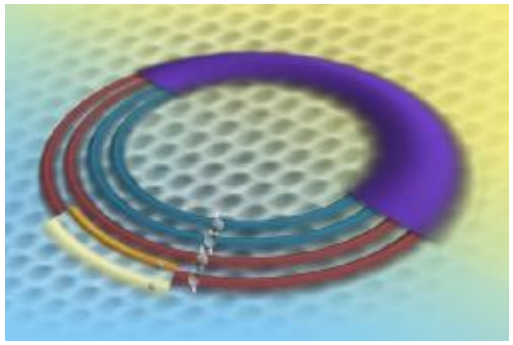
NIST – Targeting Investments to Advance U.S. Innovation and Boost Economic Recovery

NIST Mission

To promote U.S. innovation and industrial competitiveness by advancing measurement science, standards, and technology in ways that enhance economic security and improve our quality of life.

- Deep research expertise underpins technological innovation – e.g. lasers, memory, GPS, wireless
- Non-regulatory status enables important role as a convener that facilitates collaboration between industry and government

Cybersecurity: Improved response to cyber threats



Nanomanufacturing: New measurement tools for advanced materials manufacturing

Energy: Measurements and standards for energy security

Courtesy: techibuzz.com/GM Autos

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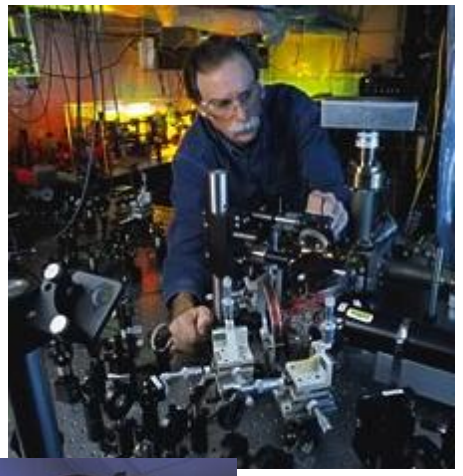
NIST At A Glance

Major Assets

- ~ 2,900 employees
- ~ 2600 associates and facilities users
- ~ 1,600 field staff in partner organizations
- ~ 400 NIST staff serving on 1,000 national and international standards committees
- 2 main campuses: Gaithersburg, MD and Boulder, CO
- 4 joint institutes with:
  - University of Colorado
  - University of Maryland Biotechnology Institute
  - University of Maryland Joint Quantum Institute
  - South Carolina Dept Natural Resources, College of Charleston, Medical University of South Carolina, NOAA



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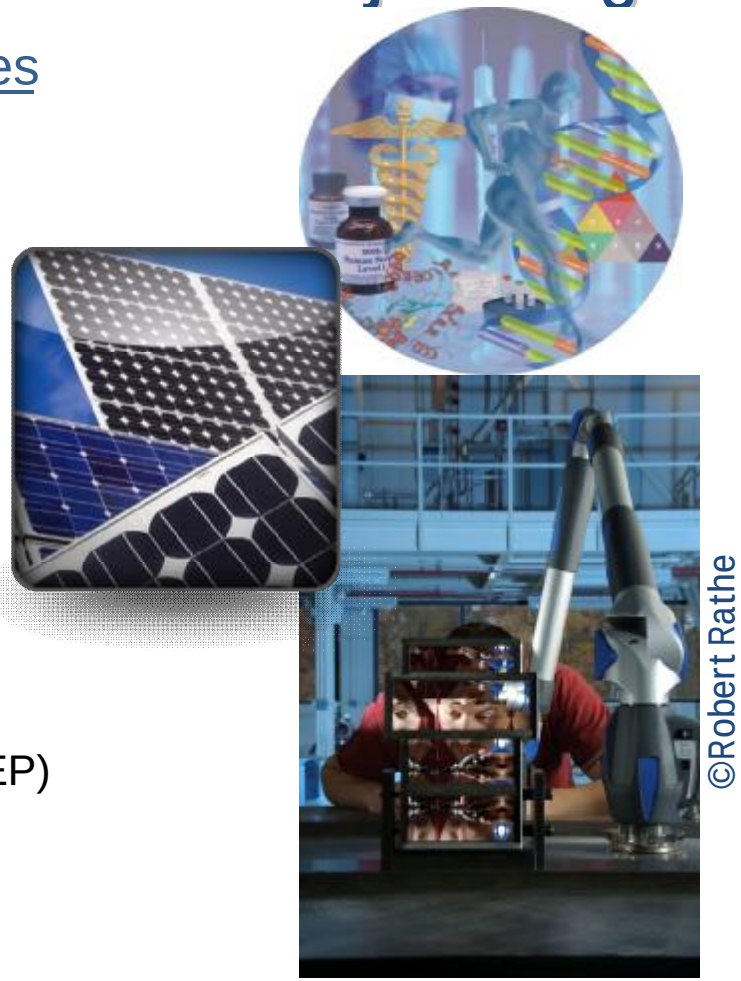
Laboratories and Major Programs

Scientifific & Technical Research Services (STRS) - Laboratories

- Center for Nanoscale Science and Technology
- NIST Center for Neutron Research
- Engineering
- Information Technology
- Material Measurement
- Physical Measurement

Innovation and Industry Services (IIS) Programs

- Hollings Manufacturing Extension Partnership (MEP)
- Technology Innovation Program (TIP)
- Baldrige Performance Excellence Program
- Technology Partnerships Office



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NIST FY 2012 Budget Request Compared to FY 2010 and FY 2011 Enacted (Dollars in millions)

	FY 2010 Enacted	FY 2011 Annual CR*	FY 2012 Request
Scientific Technical Research Services	**$ 505.4**	**$ 497.4**	**$ 678.9**
Laboratory Programs	494.9	497.4	630.2
Other	10.5	0.0	48.7
Innovation and Industry Services	**$ 204.2**	**$ 182.8**	**$ 237.6**
Hollings Manuf. Ext. Prg. (MEP)	124.7	128.4	142.6
Technology Innovation Prg. (TIP)	69.9	44.8	75.0
Baldrige Perf. Excellence Prg. 1/	9.6	9.6	7.7
Advanced Manu. Tech. Consort. (AMTech)	0.0	0.0	12.3
Construction	**$ 147.0**	**$ 69.9**	**$ 84.6**
Total NIST	**$ 856.6**	**$ 750.1**	**$1,001.1**

1/ Consistent with the NIST reorganization, the Baldrige Performance Excellence Program moved from STRS to IIS effective FY 2011.

* Includes 0.2% across-the-board recission

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Section

HOW NIST CONTRIBUTES TO OHIO'S MANUFACTURING ECONOMY

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NIST Helps Manufacturers of All Kinds

- Laboratory manufacturing research
- Measurement services
- National user facilities
- Nationwide network Hollings Manufacturing Extension Partnership (MEP) centers
- Early stage transformative Technology Innovation Program (TIP) funding

The international "Perception Challenge," jointly sponsored by NIST and Willow Garage, May 2011

Credit: Courtesy Willow Garage

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IIS Program for Competitive U.S. Manufacturing

Innovation and Industry Services (IIS)

- *Hollings Manufacturing Extension Partnership (MEP)*
- *Technology Innovation Program (TIP)*
- *Baldrige Performance Excellence Program (Baldrige)*
- *Technology Partnerships Office (TPO)*

Hollings Manufacturing Extension Partnership (MEP)

- Program started in 1988, with at least one center in all 50 states by 1996
- 60 centers with over 370 field locations
- System wide, Non-Federal staff is over 1,450
- Contracting with over 2,300 third party service providers
- Partnership Model – Federal/State/Industry
- MEP System budget ~ $300M
- 1/3 Federal, 2/3 State and Industry (fees for services)
- Started because of "market failures" in terms of access to information, technical expertise and cost
- Emphasis on performance – program and center – measured based upon impact of center services on client firms

The model for effective national networks for technology dissemination and adoption to drive economic growth

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MEP • MANUFACTURING EXTENSION PARTNERSHIP
NATIONAL INSTITUTE OF STANDARDS AND TECHNOLOGY

Hollings Manufacturing Extension Partnership (MEP)

800.MEP.4MFG
www.mep.nist.gov

60 MEP Centers
Over 1550 Field Staff
373 Service Locations

Ohio MEP (OHMEP)

Through and with the Ohio Thomas Edison Program …

Deliver programs to establish regional and statewide clusters of innovation that sustain Ohio's global competitive advantages for product development, company growth, manufacturing competitiveness, and job creation

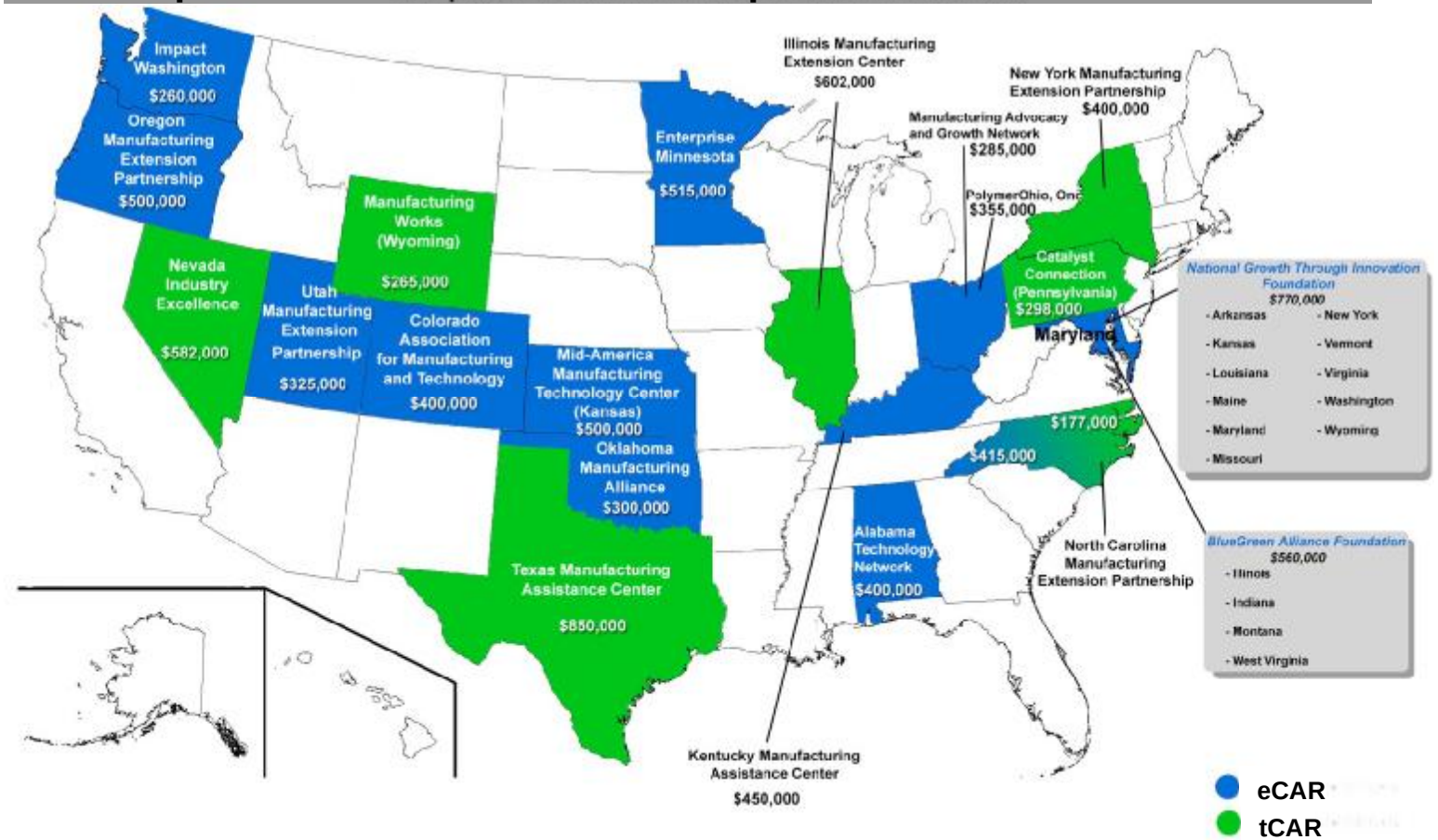
FY2006 – FY2012

- NIST funding of $27,426,031, matched by $70,409,472 in cost share from the state and partner organizations
- 7 field offices throughout Ohio, serving over 3000 Ohio manufacturers

Impacts (examples)

- $459 million in new and retained sales
- $32 million in new investments
- 4,163 jobs created or retained

2010 NIST Manufacturing Extension Partnership Awards
Development of Critical Tools and Expansion of Innovation Services



22 Projects
30 MEP Centers
$9.1 million NIST funding

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October 2010 MEP Awards

Ohio receives two recent MEP Awards, $640 K first-year Federal share for $1.36 M total project cost

- Manufacturing Advocacy and Growth Network (MAGNET)
  Stimulating Regional Manufacturing Growth through Sector Development
  Total multi-year project cost (est.): $631,771

- PolymerOhio, Inc.
  Advanced Modeling and Simulation for Manufacturing
  Total multi-year project cost (est.): $731,460

Technology Innovation Program (TIP)

TIP's Mission

- Assist United States businesses and institutions of higher education or other organizations, such as national laboratories and nonprofit research institutions
- Support, promote, and accelerate innovation in the United States through high-risk, high-reward research
- In areas of critical national need

America COMPETES Act (PL 110-69)
August 9, 2007

Funding Transformational Research for Critical National Needs

Funding Manufacturing Innovation Research

Advanced Technology Program (ATP) (1990 – 2007)

- In manufacturing: ~ 313 awards
  ~ $1.89 B in research
  ~ $1.0 B Federal share
- In Ohio (all technologies, all topics)
  - 26 ATP awards
  - $162.6 M in research, with $85.7 M Federal share
  - 70 instances of Ohio company and university participation

Technology Innovation Program (TIP) (2008 – present)

- In manufacturing: 21 awards
  $129.8 M in research
  $63.1 M Federal share

TIP Funding of Manufacturing Innovation

Manufacturing Portfolio Summary

- 2009 and 2010
- 21 awards
  - 17 single company awards
  - 4 joint ventures
- $129.8 million
  - $63.1 million Federal share
- 63 participating organizations
  (includes subrecipients and contractors)

- 2010 Manufacturing Competition
  - 110 proposals received
  - 158 single companies & JV members in submitted proposals
  - 9 awards issued
  - ~ 85% of recipient companies have <35 employees and <10 years old

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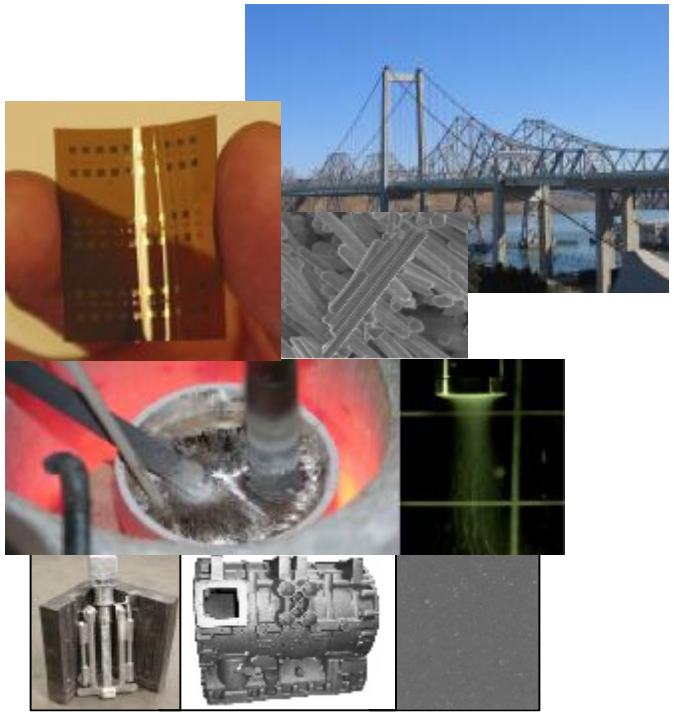
TIP in Ohio



- 4 TIP projects led by 5 Ohio organizations
  - 4 small/medium-sized businesses
  - 1 non-profit organization
- $19 M of high-risk, high-reward research
  - $9.3M TIP investment and $9.7M cost sharing

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TIP Awards in Ohio *(cont'd.)*

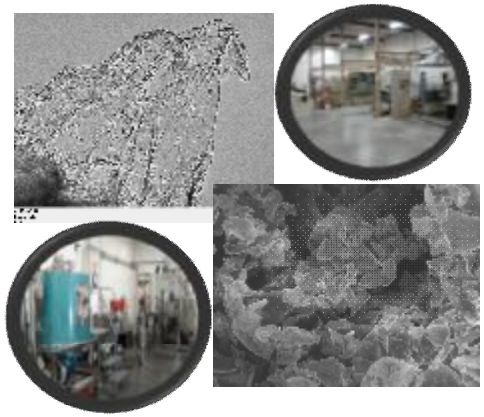
MesoCoat, Inc. (*Euclid, OH)* Civil Infrastructure

Advanced Coating Technology for Infrastructure

Other Project Members: EMTEC (Dayton, OH), Polythermics (Kirkland, WA)

Develop a novel coating technology using a high-intensity infrared light source to fuse and bond nanocomposite metal coatings and claddings to large steel structures such as bridges, oil rigs and pipelines.

Total project (est.): $3,956 K / Requested TIP funds: $1,792 K



Angstron Materials, LLC *(Dayton, OH)* Manufacturing

Functionalized Nano Graphene for Next-Generation Nano-Enhanced Products

Develop processes for mass-producing chemically modified ("functionalized") nano-graphene for next-generation products, particularly for the energy industries.

Total project (est.): $2,988 K / Requested TIP funds: $1,494 K

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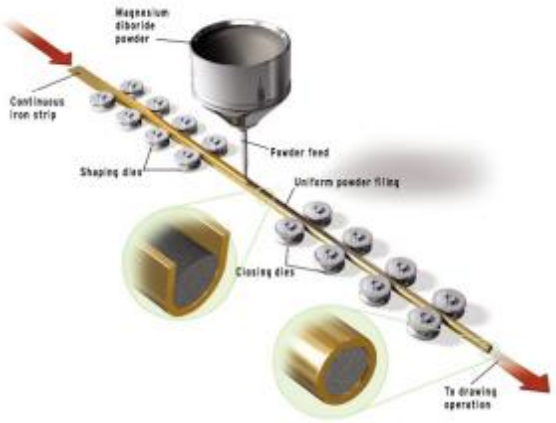
TIP Awards in Ohio *(cont'd.)*



Hyper Tech Research, Inc *(Columbus, OH)* Manufacturing

High-Speed, Continuous Manufacturing of Nano-Doped Magnesium Diboride Superconductors for Next-Generation MRI Systems

Develop a practical, industrial scale continuous manufacturing process for magnesium diboride superconducting wires and other wire products requiring a hollow metal tube around a powder-based core.

Total project (est.): $6,050 K / Requested TIP funds: $3,000 K

Kent Displays, Inc. *(Kent, OH)* Manufacturing

Process Innovation for High Technology Manufacturing of Flexible Liquid Crystal Displays -

Develop a suite of integrated processes for efficient, ¿roll-to-roll¿ manufacturing of flexible, reflective displays for high-volume product markets.

Total project (est.): $6,005 K / Requested TIP funds: $2,996 K

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Baldrige Performance Excellence Program

The nation's public-private partnership dedicated to performance excellence.

To improve the competitiveness and performance of U.S. organizations for the benefit of all U.S. residents, the Baldrige Performance Excellence Program is a customer-focused federal change agent that:

- Develops and disseminates evaluation criteria
- Manages the Malcolm Baldrige National Quality Award
- Promotes performance excellence
- Provides global leadership in the learning and sharing of successful strategies and performance practices, principles, and methodologies

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Baldrige in Ohio

- 19 Ohio Applicants for the Baldrige Award (2005-2010)
- 2 Award applicants in 2010 represent 8.270 jobs, 14 work locations, $1.05 billion in revenues/budgets, and an estimated 1.6 million customers served
- 17 Ohio Baldrige Examiners volunteered over $251k in services in 2010
- Ohio Partnership for Excellence and Award for Excellence built upon Baldrige program and criteria to improve organizational performance

Baldrige in Ohio *(cont'd)*

- 4 Ohio National Role Models in *Manufacturing, Service, and Small Business*
  - PRO-TEC Coating Co., small business, 2007 (Leipsic, OH)
  - Dana Corporation – Spicer Driveshaft Division, manufacturing, 2000 (Holland, OH)
  - Dana Commercial Credit Corporation, service, 1996 (Maumee, OH)
  - Globe Metallurgical Inc., small business, 1988 (Beverly, OH)

Technology Partnerships Office (TPO)

Facilitates technology transfer from NIST laboratories to accelerate economic growth by promoting the use of NIST developed technologies, cooperative research, guest scientists, and NIST's Small Business Innovation Research (SBIR) program

- Patent Licensing
- Cooperative Research
- Small Business Innovation Research funding

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Technology Partnerships with Ohio

Patent Licensing

- Three licenses issued to partners in Ohio (since 2005)
  - US Technology Aerospace Engineering Corp. - Canton, OH (small business)
  - Bailey Controls Company (Wickliffe, OH) (large business)
  - University of Dayton (Dayton, OH) (academia)

Small Business Innovation Research

- Five SBIR R&D awards made to three Ohio small businesses
  - Circuit Equipment Corp. (Mentor, OH)
  - Lake Shore Cryotronics, Inc. (Westerville, OH)
  - SRICO, Inc. (Columbus, OH)

Technology Partnerships with Ohio *(cont'd)*

Cooperative Research

- Twelve CRADAs issued to large & small businesses and universities in Ohio

  Examples include: Q-Lab Corporation (Westlake, OH)
  Sherwin-Williams Company (Cleveland, OH)

- 134 scientists and engineers were sponsored by 13 large & small businesses and universities to work on NIST campuses (since 2005)

  Examples include: Faraday Technology (Clayton, OH)
  Kent State University (Kent, OH)
  Proctor and Gamble (Cincinnati, OH)
  University of Akron (Akron, OH)

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Binational Industrial Research and Development: "BIRD Foundation" Innovation Partnerships

To stimulate, promote, and support joint (non-defense) industrial R&D of mutual benefit to Israel and the United States

- Established in 1977 as a joint fund/initiative between the US and Israeli governments
- Funds up to 50% of each company's R&D expenses associated with the joint project
- NIST participates on BIRD Committee and technical reviews

BIRD Foundation Awards to Ohio

- Procter & Gamble (OH) and ConTIPI (Israel), *Urinary Incontinence* (2006)
- Bird Technologies Group (OH) and Cellular Systems International Ltd (Israel), *Transmission Base Stations* (2007)

For additional information go to www.birdf.com

NIST Laboratory Programs in Manufacturing

- Energy
- Green Manufacturing
- Lean Manufacturing
- Metrology
- Nanomanufacturing
- Ontologies
- Process Improvement
- Product Data
- Robotics
- Simulation
- Supply Chain
- Sustainable Manufacturing
- Systems Integration

Center for Nanoscale Science and Technology (CNST)

Providing industry, academia, NIST, and other government agencies with access to world-class nanoscale measurement and fabrication methods and technology

- 6 Researchers
- 4 Research projects
  - Battelle Memorial Institute (Columbus, OH)
  - Honda Research Institute, USA Inc (Columbus, OH)
  - University of Akron (Akron, OH)
  - University of Toledo (Toledo, OH)

photo courtesy HDR Architecture, Inc./Steve Hall Copyright Hedrich Blessing

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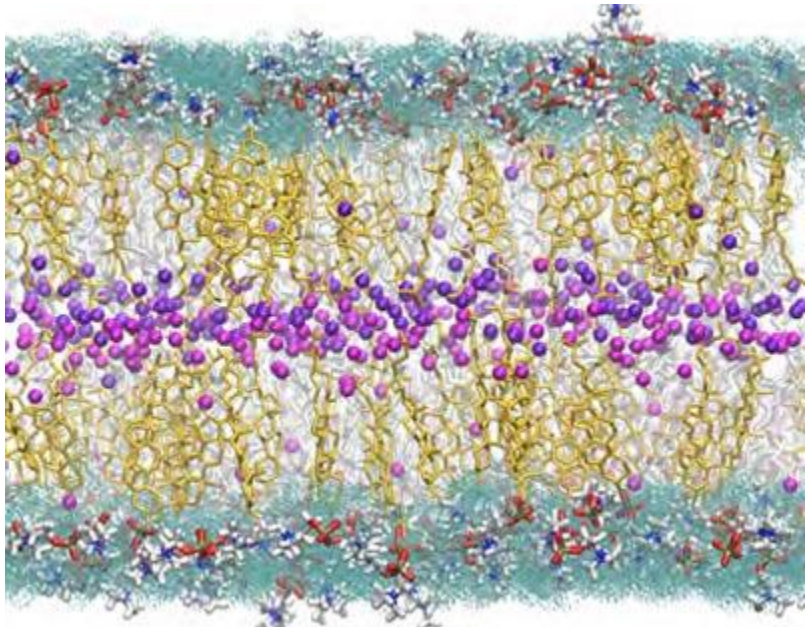
NIST Center for Neutron Research (NCNR)

A national resource for industry, universities, and government agencies



Closer Look at Cell Membrane Shows Cholesterol 'Keeping Order'

64 research participants from 13 Ohio organizations in FY 2010

Examples: Miami University
Oberlin College
Ohio Aerospace Institute
Procter & Gamble
RCB Hydrides, LLC
University of Akron

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Engineering Laboratory (EL)

Measurement science research, performance metrics, tools and methodologies for engineering applications, and critical technical contributions to standards and codes development for U.S. manufacturing and construction industries

- CRADAs and research agreements:
  - Youngstown State University (Youngstown, OH)
  - M-7 Technologies (Youngstown, OH)
  - TechSolve (Cincinnati, OH)
  - Tech4Imaging LLC (Cincinnati, OH)
- ~10 companies in standards related research
- Participation in NIST Consortia:
  - Edison Welding Institute (Columbus, OH)
  - Morris Technologies (Cincinnati, OH)
  - USAF Research Laboratory Wight-Patterson Air Force Base (Dayton, OH)

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Material Measurement Laboratory (MML)

Measurement research, standards, and data in the chemical, biological and materials sciences

- CRADAs with:
  - Center for Reliable Energy Systems (CRES) (Dublin, OH)
  - Dow Chemical Company (Dayton, OH)
  - Sierra Lobo, Inc. (Milan, OH)
- > 30 organizations rely on NIST standard reference databases
- > 150 organizations purchased NIST standard reference materials
- ~ 20 research agreements with ~ 11 organizations

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NIST MANUFACTURING INITIATIVES FOR FY 2012

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America COMPETES 2010: Department of Commerce / NIST - Manufacturing

- Directs DOC to analyzed the innovation capacity and economic competitiveness of the United States
- Directs creation of an interagency committee on technology under OSTP/NSTC to plan and coordinate Federal programs and activities in advanced manufacturing
- Directs NIST MEP to improve training at community colleges and evaluate barriers facing small-sized manufacturers
- Expands NIST MEP to support construction and green energy industries
- Directs DOC to create a program of Federal loan guarantees for small/medium sized manufacturers
- Directs DOC to study barriers to use of high-end computing by small/medium sized manufacturers

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NIST and Manufacturing for FY 2012

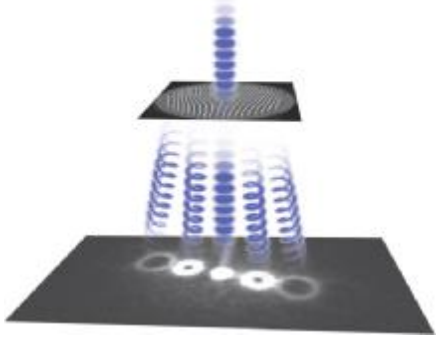
FY 2012 Budget Proposal - $120.5 million

Catalyze innovations, develop measurements, and provide technical resources to promote the global competitiveness of U.S. manufacturers and aspiring start-ups.

NIST will bolster and diversify needed research efforts and services that promote U.S. manufacturing

- Measurements and standards supporting Nanomanufacturing, Biomanufacturing, Additive Manufacturing, Sustainable Manufacturing, and Robotics (Laboratory programs)(+$85.4 M)
- Establishing the Advanced Manufacturing Technology (AMTech) Consortia (+$12.3 M)
- Supporting the Manufacturing Extension Partnership (+$17.6 M)
- Supporting the Technology Innovation Program(+5.2 M)

Courtesy: Heritage Global Partners



Credit: NIST

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NIST Laboratory Manufacturing Programs: New for FY 2012

FY 2012 Budget Proposal - $85.4 million

Tools for Manufacturing Competitiveness

- Strengthening Measurement Science and Standards in Support of Industry Needs (+$20 M)
- Advanced Materials for Industry (+$14.3 M)
- Innovations for 21st Century U.S. Manufacturing: Faster, Smarter and Cleaner (+$13.3 M)
- Measurement Services and Standards to Support Biomanufacturing (+$9.5 M)
- Measurements to Support the Manufacture and Production of Nanotechnology-based Products (+$28.3 M)

Photo by Kathie Koenig Simon

Courtesy: Inhabitat.com

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Advanced Manufacturing Technology Consortia (AMTech)

FY 2012 Budget Proposal - $12.3 million

Support R&D in advanced manufacturing and strengthen long term US leadership in critical technologies leading to sustainable economic growth and job creation

- Advanced Manufacturing Technology Consortia (AMTech) will receive grants to leverage existing consortia or establish critical new industry-led consortia
- Consortia will develop road-maps of critical long-term industrial research needs as well as fund facilities, equipment and research at leading universities and government laboratories
- Based on NIST's experience with the Nanoelectronics Research Initiative (NRI) partnership with the Nation's semiconductor industry

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INNOVATION AND MANUFACTURING

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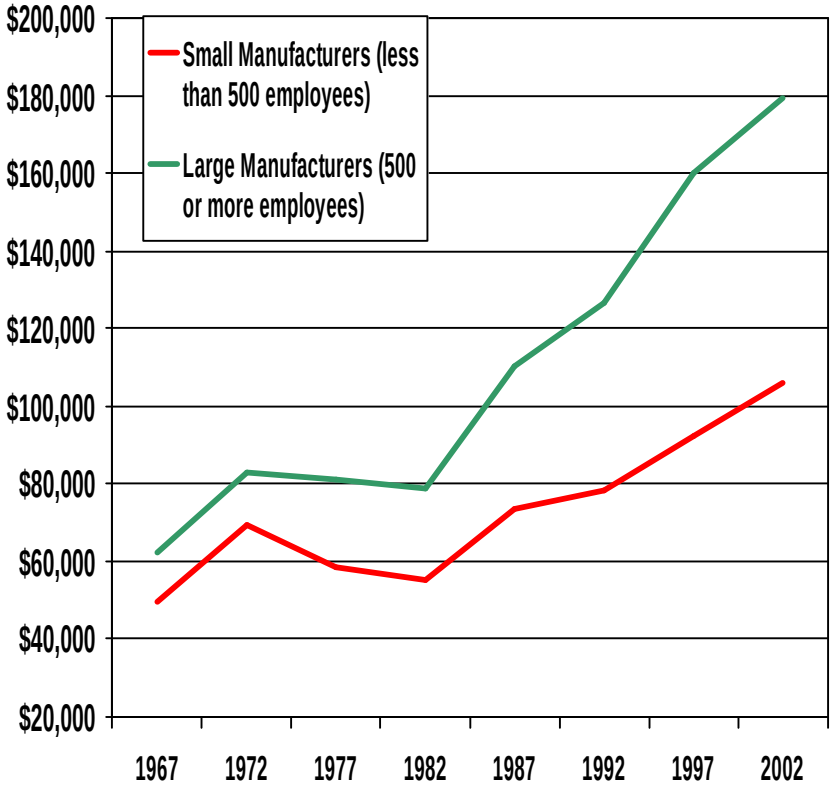
The Changing Face of Manufacturing: Getting Smaller – Need to Get Smarter

Facts about small manufacturers:

- 99 percent of all manufacturing establishments
- Employ 10.2 million people -- 70 percent of all manufacturing employment
- ~57 percent of the total value-added by all U.S. manufacturers

The Challenges for Small Manufacturers:

- Productivity among large firms continues to increase at a faster rate than small firms
- Market Failures in several dimensions: firm, inter-firm, consulting/services, public failure.



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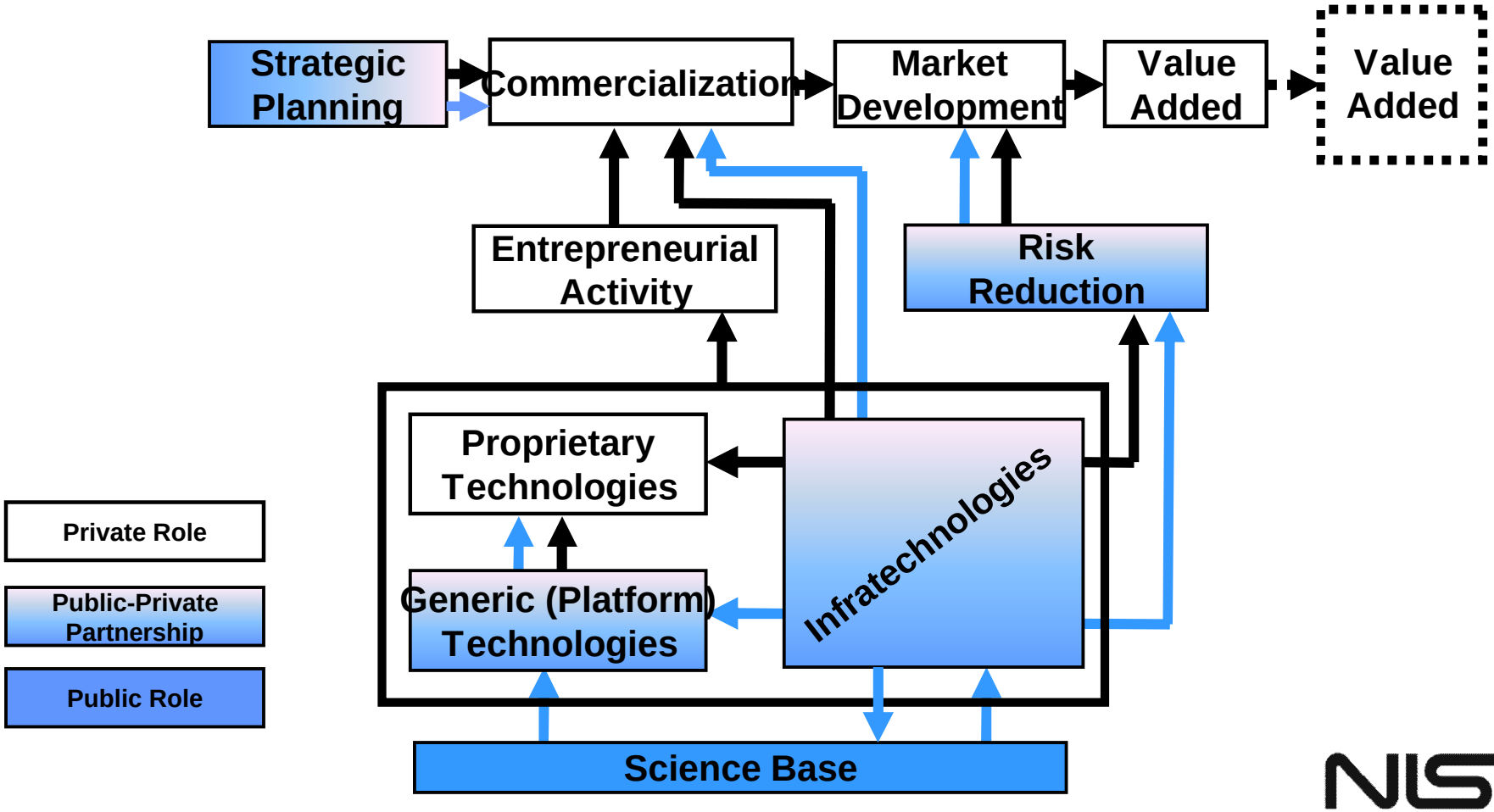
Technology-Element Model for Revitalizing Manufacturing Policy



G. Tassey, *The Technology Imperative*, Edward Elgar, 2007

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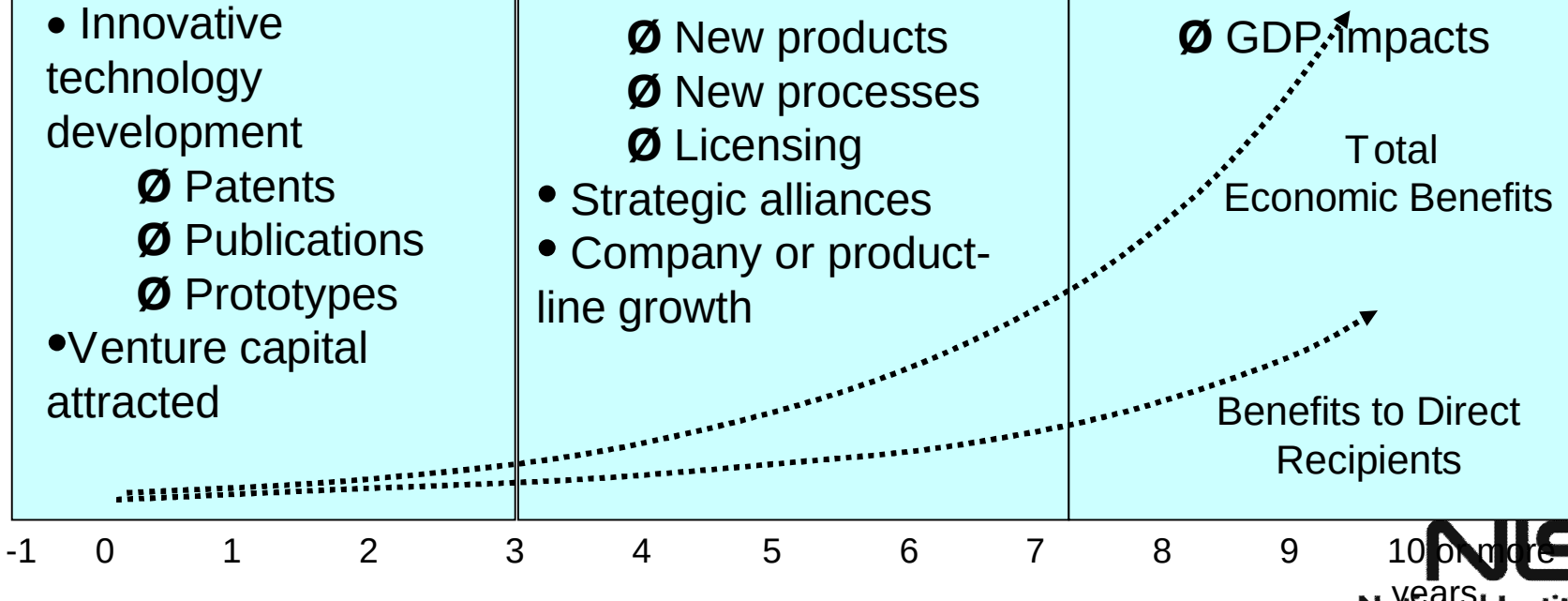
Timeline for Impact Assessment

Short-Term	Mid-Term	Long-Term
• Technical objectives met • Technology transfer • R&D Partnering • Acceleration of R&D • Innovative technology development Ø Patents Ø Publications Ø Prototypes •Venture capital attracted	• R&D and process productivity improvements • Transaction cost reductions • Commercialization Ø New products Ø New processes Ø Licensing • Strategic alliances • Company or product-line growth	• Broad industry or national economic benefits Ø Return on Investment Ø GDP impacts



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Thank you

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