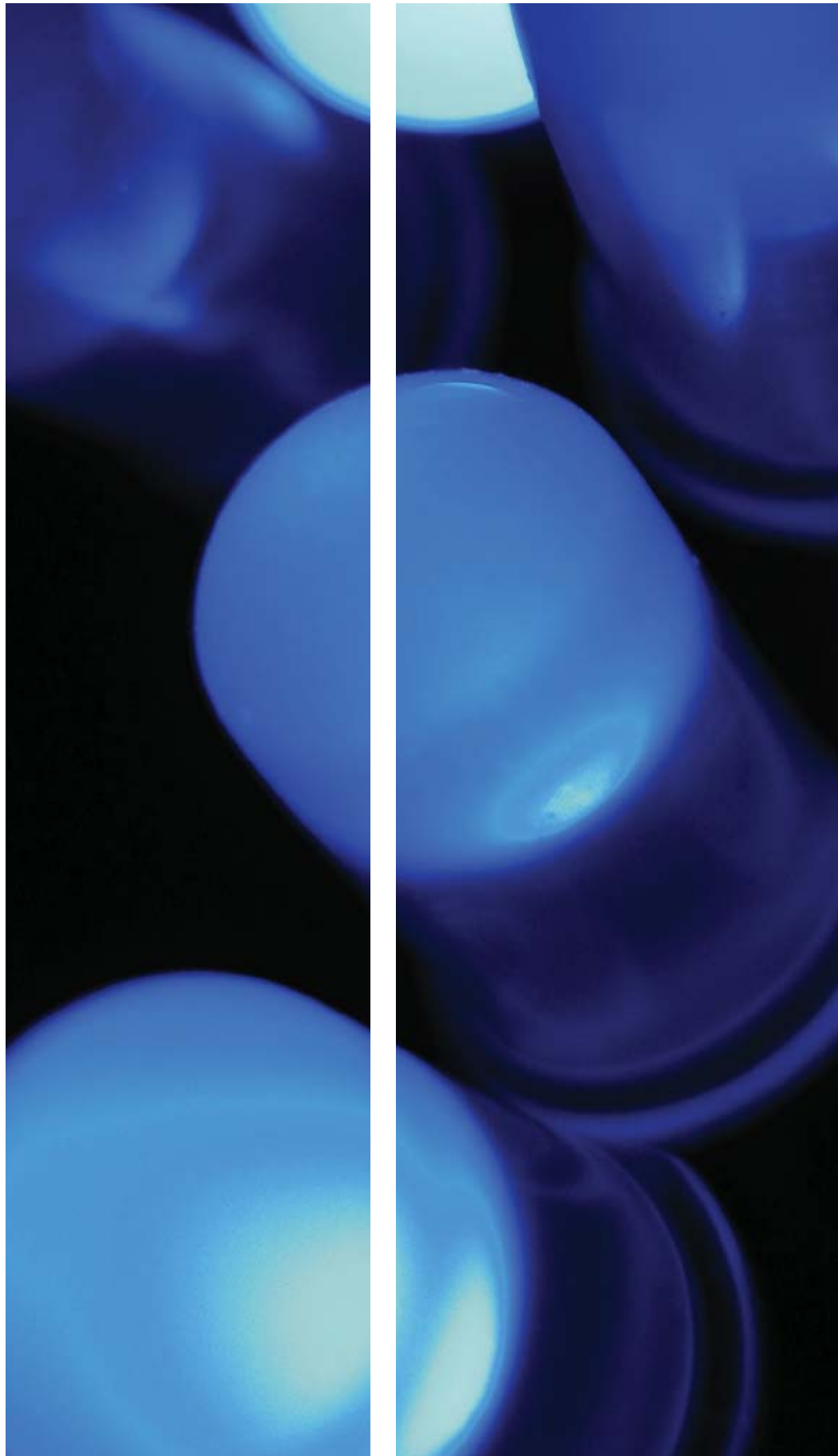




2008 STRATEGIC PLAN

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EXECUTIVE SUMMARY



Executive Director's Welcome

Speaking for myself and the governing board of the Pennsylvania NanoMaterials Commercialization Center, welcome to the Center's first strategic plan. We are very pleased that you are interested in learning more about the Center's key role in assisting the formation and growth of high technology companies in Pennsylvania. We are very proud of the Center's accomplishments to date. This plan outlines the aggressive goals and objectives in the future to grow the Center's impact in commercializing innovative nanotechnologies for new products and processes for the Commonwealth.

Alan G. Brown, Ph.D.
Executive Director

The Pennsylvania Nanomaterials Commercialization Center is a non-profit technology-based economic development organization focused on bringing nanotechnology research into the marketplace. The Center has three critical objectives:

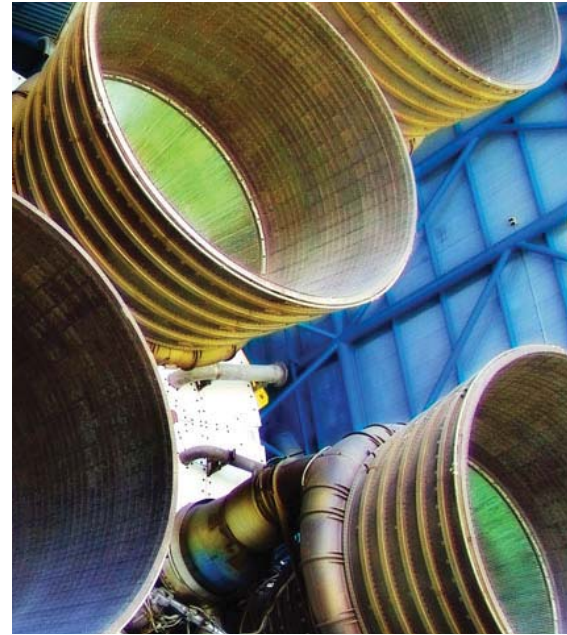
- Accelerating the transition of new nanomaterials technologies to the defense and commercial markets
- Meeting the needs of the Center's diverse stakeholders with value-added services
- Operating a lean business model to ensure maximum benefit to its stakeholders

The Center accomplishes these objectives by supporting two areas of activity:

- Creating value-added partnerships between universities, small and large companies to commercialize nanomaterials research
- Provide grants to support new product development projects using nanomaterials research

The Center is supported by the Department of Community and Economic Development of the Commonwealth of Pennsylvania, the Federal Air Force Research Lab, the Heinz Endowments and its private sector partners.

ABOUT THE CENTER



Nanomaterials Defined

The term nanotechnology refers to the creation and manipulation of matter at the nanoscale. The nanoscale is defined as a unit of measure between 1 and 100 nanometers, where a nanometer is one billionth of a meter. The reason why nanotechnology is becoming increasingly important is that matter at the nanoscale exhibits unique new properties due to the fact that nanoscale particles behave differently compared to matter at the bulk scale.

In the coming years, nanotechnology will revolutionize many fields, such as medicine, pharmaceuticals, electronics, energy, aerospace, as well as many consumer products areas. Industry studies have shown that the impact of nanotechnology in each of these areas will occur at various times in the future. Whereas the introduction of nanotechnology into drugs, tumor imaging and disease treatment is still decades away, the use of nanotechnology in basic materials will occur over the next five years. The field of nano-materials encompasses the use of existing and new materials at the nanoscale to make new products and enhance the performance and add new features to existing products. Some examples are stain-resistant clothing, anti-bacterial surfaces, stronger steel and alloys and more energy-efficient lighting.

Overview

The Center was founded by a consortium of leading materials companies with major operations in the Pittsburgh region including, Alcoa, Bayer MaterialScience, PPG Industries and U.S. Steel Corporation. The organization was created as an industry-driven model designed to revitalize the product portfolios of the founding members along with encouraging the formation of small, start-up companies using advanced nanomaterials technologies. The Center addresses the critical commercialization gap in the market between the nationally recognized advanced materials research at Pennsylvania universities and the development of new products and processes from those technologies. The Center is a 501(c)3 non-profit organization and receives, or has received, support, both financial and in-kind, to fund its operations from the Commonwealth of Pennsylvania, the Department of Defense, its founding companies, universities and other organizations in the state.

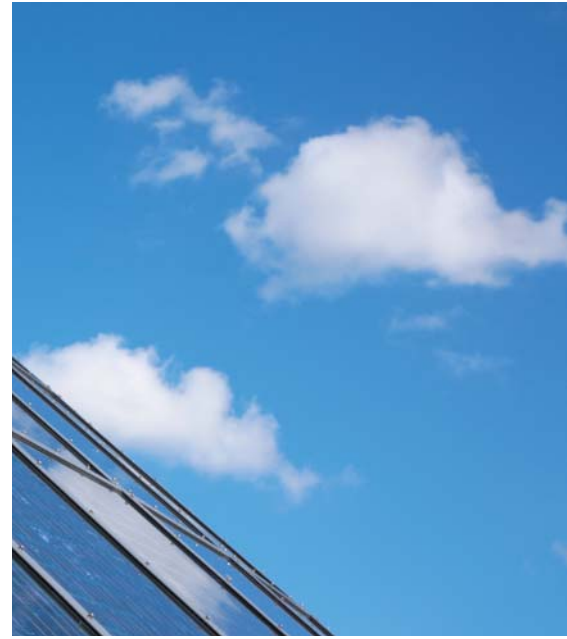
Mission

The Pennsylvania NanoMaterials Commercialization Center accelerates the commercialization of nanomaterials research for new and enhanced products critical to the U.S. economy and manufacturing base.

Vision

The Pennsylvania NanoMaterials Commercialization Center is a worldwide leader in facilitating the commercialization of nanomaterials technologies, and builds upon Pennsylvania's excellence in advanced materials research, development and manufacturing. The Center uses a unique model to proactively create partnerships between government organizations, universities, entrepreneurs, small and large companies to match nanotechnology research with innovative new ideas, and then accelerates the development of those ideas into new products, new companies and growth for the region.

CENTER STAKEHOLDERS



Impact of the Center

In the first full year of operation, the Center has achieved the following impact:

6
Jobs

\$876,000
Leveraged Investment

\$998,176
Company-Matched Investment

1
Company-Filed Patents

Relationships of the Nano Center

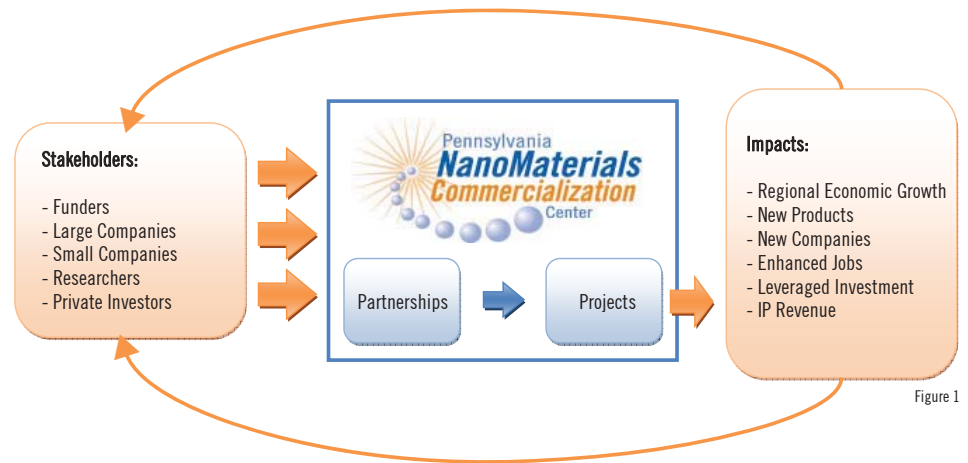


Figure 1

Stakeholders

The Center's major stakeholders are large and small companies, universities, State and Federal funders and private investors. The Center balances the needs of these stakeholders with a unique business model, shown in Figure 1. This model effectively integrates the needs of all the public and market participants to enhance innovation at the early stage of the new product development cycle. For large companies, the center strives to revitalize their new product strategies through partnerships with small, start-up companies and universities. For small companies, the Center assists with funding support, project management and access to Angel and VC investment. The Center partners with universities to accelerate technology transfer of promising nanotechnologies developed from their research. For public funders, the Center increases economic development through the formation of new high-technology companies, jobs and leveraged investment.

Table 1 on the next two pages provides a detailed view of how each stakeholder group benefits from and supports the Center.

CENTER STAKEHOLDERS



Table 1

Stakeholder Category	Stakeholder(s)	How the Center Benefits this Stakeholder
Industry	Large companies, such as founders (Alcoa, Bayer, PPG, U.S. Steel)	<ul style="list-style-type: none"> • Provides visibility of emerging nanotechnology research • Provides potential licensing or partnering opportunities • Reduces risk for possible future investment in start-up nano companies • Acts as a conduit for non-dilutive capital to fund research and development
Industry	Small start-up companies	<ul style="list-style-type: none"> • Provides partnering opportunities and connections through the network • Validates the market by working with academic and industry partners • Funds product development • Mentors who can assist bringing a product to the market
Academia	Founding academic institutions (Carnegie Mellon, Univ. of Pittsburgh, Penn State University)	<ul style="list-style-type: none"> • Assists technology transfer offices identify technologies having market potential • Assists industrial research offices identify corporate partners to conduct nanomaterials research and utilize facilities
Pennsylvania	Department of Community and Economic Development (Ben Franklin Technology Development Authority)	<ul style="list-style-type: none"> • Acts as a major part of the Pennsylvania's Investment in Nanotechnology (PIN) strategy • Provides a central focus for nanomaterials support • Works to increase start-up activity rate • Assists the agency create jobs and new companies • Assists in the retention of jobs through the reinvention of some companies
Pennsylvania	Legislature	<ul style="list-style-type: none"> • Maintains and broadens Pennsylvania's economic base by leveraging public and private partnerships • Creates jobs • Diversifies the economic base
Federal	Air Force Research Lab (AFRL)	<ul style="list-style-type: none"> • Allows the AFRL to identify needs and solicit ideas indirectly • Allows for speed-to-market • Adds a tool beyond the SBIR process to find new technology applications • Encourages young companies to apply for an SBIR
Federal	Congress, Pennsylvania Delegation	<ul style="list-style-type: none"> • Works to create a national model for technology commercialization • Creates jobs in Pennsylvania • Assists Pennsylvania and national manufacturing companies by providing a hub of nanotechnology activity
Federal	Other Federal Agencies	<ul style="list-style-type: none"> • The model currently being developed between the Center and AFRL can be replicated in other areas • The technology transfer process and the problems associated with it requires new tools – the Center is seeking to demonstrate how to make the process more efficient

CENTER STAKEHOLDERS



Table 1 - continued

Stakeholder Category	Stakeholder(s)	Unique Value Proposition for this Stakeholder	Role that Stakeholder can Play in Future
Industry	Large companies, such as founders (Alcoa, Bayer, PPG, U.S. Steel)	<ul style="list-style-type: none"> Center is an integrator between academic and private sector 	<ul style="list-style-type: none"> Provide financial support to the Center for value-added services (e.g. finding partners) Assist in discussions with other stakeholders / funders
Industry	Small start-up companies	<ul style="list-style-type: none"> Focuses on the critical stage of technology to product process Provides credibility for future funding opportunities 	<ul style="list-style-type: none"> Identify SBIR / STTR and other research that they would like to pursue and ask for the Center assistance in facilitating academic / industry partnerships
Academia	Founding academic institutions (Carnegie Mellon, Univ. of Pittsburgh, Penn State University)	<ul style="list-style-type: none"> Creates a pool of state and federal funding that can support research Accelerates university IP licensing revenue 	<ul style="list-style-type: none"> Work with the Center to increase licensing of nano-related intellectual property Work with the Center to increase the number of startups
Pennsylvania	Department of Community and Economic Development (Ben Franklin Technology Development Authority)	<ul style="list-style-type: none"> As an industry-led economic development initiative, the Center is closely aligned with industry perspectives 	<ul style="list-style-type: none"> Increase and / or maintain funding support for programs
Pennsylvania	Legislature	<ul style="list-style-type: none"> Provides a critical resource for nanomaterials companies in all legislative districts 	<ul style="list-style-type: none"> Support the Center through a legislative line item
Federal	Air Force Research Lab (AFRL)	<ul style="list-style-type: none"> The Center is state and federally supported to allow for a balanced approach to operations and investment into projects 	<ul style="list-style-type: none"> Assist in identifying / introducing the Center to other agencies in need of similar resources
Federal	Congress, Pennsylvania Delegation	<ul style="list-style-type: none"> Only federally funded center solely focused on nanomaterials commercialization 	<ul style="list-style-type: none"> Assist in introducing the Center to other agencies – such as the Department of Energy
Federal	Other Federal Agencies	<ul style="list-style-type: none"> Provides alternative models to SBIR and STTR 	

A UNIQUE REGIONAL & NATIONAL ASSET



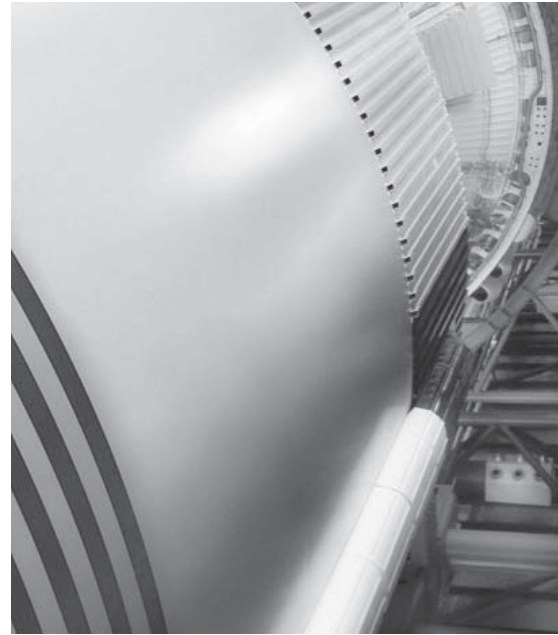
Pennsylvania has recognized the importance of nanotechnology as an enabler for high-technology company and job growth in the Commonwealth. The state has translated this recognition into a long-term investment in nanotechnology research and commercialization, outlined by its Pennsylvania Initiative in Nanotechnology or PIN. PIN outlines three core strategies to achieve economic growth through nanotechnology. These are: (1) consortia-drive education and workforce development, (2) increased commercialization of nanotechnology applications and processes through collaboration, and (3) increased technology transfer and enhancement of university-based resources and skills.

The Center directly addresses two of the core strategies (2 and 3) in the PIN initiative through a unique commercialization model, which maximizes the impact of Pennsylvania's Technology Based Economic Development investment by accelerating the formation and growth of new and existing high- technology companies in the state. In addition, the Center leverages the significant federal nanotechnology research investment in Pennsylvania's universities to transition that research into new products and processes.

The Center's commercialization model has several unique elements. First, the Center creates and supports the optimum partnerships between universities, small and large companies focused on a specific nano-based new product demonstrating a market need. Second, the Center provides funding investment and project management support for projects focused on a specific new product. Many small and start-up companies tend to fail because they feel that their technology will produce a wide range of products in many markets. The Center's projects provide the necessary product focus to improve the likelihood of success. Third, if the company with the new idea or technology does not have commercialization experience, the Center assists that company in finding and partnering with a company, which has that experience. All these factors help to reduce the risk for small and start-up companies attempting to commercialize advanced technologies.

The Center plays a critical role in the market, bridging a "valley of death" that exists between basic research and market adoption of a new technology, (see Figure 2). This early phase of the new product development cycle is particularly risky. For this reason, small company start-ups have a high failure rate. The first "S" curve shows how the Center bridges the gap between research and prototype development in the start-up phase of the new company. The Center helps reduce this risk through

A UNIQUE REGIONAL & NATIONAL ASSET



its rigorous proposal review process, project management support and seed funding support. This benefits small companies making them more attractive to private investors.

Similarly, existing companies developing new high technology products to revitalize their product lines also face significant risks of success, shown in the second “S” curve. Risk is reduced for large companies in that they can obtain information on new product concepts developed in small companies using emerging nanotechnologies and then make investment decisions based on that knowledge.

New Company / New Product Life Cycle

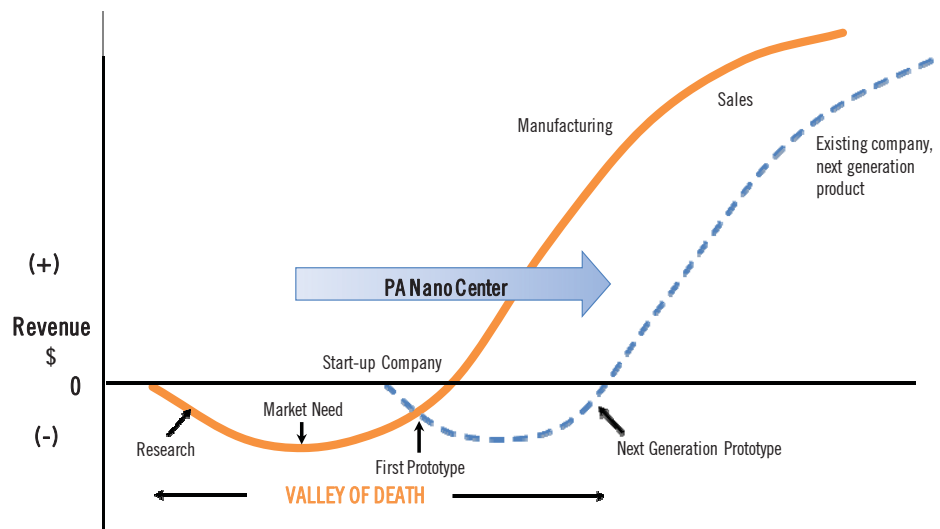


Figure 2

PA Nano Center Projects focus on formation and growth of new nano companies, as well as new nano-based products for existing companies.

A UNIQUE REGIONAL & NATIONAL ASSET



The Center's model is also a unique national model for Technology Based Economic Development Organizations. First it is one of the first public-private organizations in the nation focused on commercializing the exciting field of nanotechnology. Second, it is industry-driven, resulting in developing new products based on market need rather than attempting to license laboratory research directly from universities. Lastly, it utilizes the strengths of all its partners to improve the probability of successful outcomes – new products, new companies, increased university technology commercialization.

The Center will continue to market this unique integrative commercialization model to all the federal government agencies supporting nanotechnology research, and hopefully gain their support. This in turn will enable the nation to continue its world leadership in developing innovative new products and industries using the exciting new field of nanotechnology.

CENTER MARKET REACH

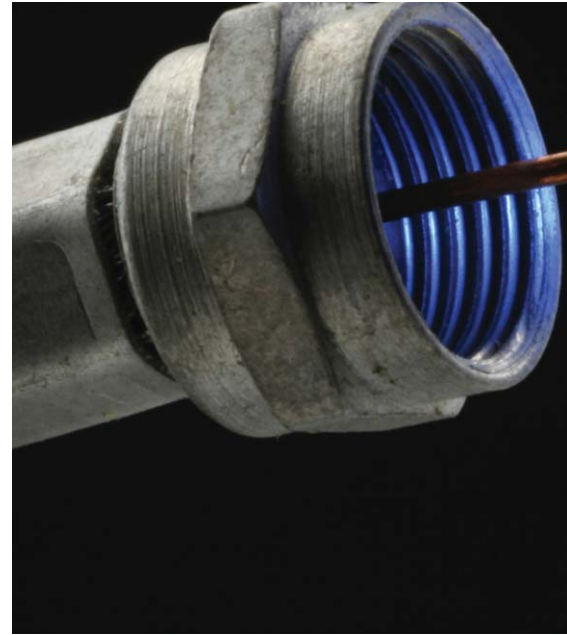


The Center serves the Commonwealth of Pennsylvania as well as a national audience by linking Federal and State resources together. To date, financial support has been provided by the Center to the companies shown in Table 2.

Table 2

Company	Primary Focus	Technology Cluster	Company Location
Illuminex Corporation	Novel device using Nanowire arrays to develop a new generation of heat pipes that are more efficient in removing heat from microprocessor chips used in computer servers and desktops.	Cleantech – computing	Lancaster, PA
Plextronics, Inc.	Commercialize new, high-performing active layer technology for organic photovoltaic solar cells. The initiative is utilizing novel organic semiconductors to develop a new generation of polymer-based inks that will increase solar conversion efficiency, while extending the lifetime of existing devices.	Cleantech – energy	Pittsburgh, PA
Crystalplex Corporation	To commercialize innovative new Quantum Dot technology. Quantum Dots are nano-sized semiconductor crystals which have unique optical properties. This project will utilize these nano-sized devices to improve the efficiency while reducing the costs of light emitting diodes (LED) used in energy saving lighting, and electronic displays	Cleantech – energy	Pittsburgh, PA
Integran Technologies USA, Inc.	To develop a novel new nanomaterials coaxial wire technology. This project will help establish this new wire technology as a fully proven, mass production-ready process, and create a new technology and market support center in Pittsburgh to serve the wiring industry across the U.S.	Materials	Pittsburgh, PA
HydroGen LLC	To develop and manufacture enhanced performance hydrogen fuel cell electrodes. The new electrodes will utilize novel carbon nanotubes to improve the performance and lifetime of the electrodes, and thereby reduce downtime and overall costs for fuel cell operation	Cleantech – energy	Versailles, PA
NanoRDC LLC	To develop and commercialize a novel chemical method for functionalizing carbon nanotubes (CNT's). Polymers using these treated CNT's will have enhanced antistatic and electrical conductivity, resulting in the expanded use of new rubber and plastic materials for the automotive, electronics, aerospace and defense industries.	Chemicals	Akron, Ohio (federal)

GOVERNANCE & STRATEGY



Governance

The Center, by design, is a lean organization with only two full-time employees. The Center's strategy calls for partnering with key resources rather than building significant overhead. This allows the Center to more effectively deploy capital and programs for the benefit of its industry and academic stakeholders.

The center has strong, active support from its governing board and Technical Advisory Committee (TAC). Both of these groups have representation from the center's major stakeholders. Together, the board and TAC contribute more than 1,000 hours a year of donated time to help the Center successfully accomplish its mission.

Implementation of the Strategy

The investment "gap" between the large infusion of capital in fundamental research and later stage financing provides a unique opportunity for the Center. By providing "seed" grants for promising advanced nanomaterials technologies which have commercial applications, the Center can leverage relatively small investments into significant economic growth of high technology companies in the Commonwealth.

To implement the strategy, the Center ensures a balance between its economic development mission and its value-added business model for its target customers. It strives to maintain and grow its public funding to provide viable seed investments. Finally, the Center creates value-added services and markets itself to all its diverse stakeholders, which in turn, creates new nano-based products, processes and companies in Pennsylvania. This document outlines four key goals, with supporting objectives to achieve its mission.

GOALS & OBJECTIVES



Goal 1

Demonstrate impact of the Center's activities to public stakeholders.

Objectives:

- a) Increase the number and quality of proposals and projects.
- b) Increase the number of successful project outcomes.
- c) Publish and disseminate successful outcomes "Report Card" annually to the AFRL, state legislators, and congressional stakeholders.

Goal 2

Develop and implement more value-added services provided by the Center to companies, universities and investors.

Objectives:

- a) Perform an in-depth market analysis of the advanced materials sector in Pennsylvania. Show how the Center fills a critical need for commercializing nanomaterials research. Disseminate this report to key stakeholders.
- b) Develop and implement the University-Industry Product Innovation Workshops with four universities and company partners. Successful outcomes from these workshops will produce more innovative proposal ideas for the Center.
- c) Engage VCs and Angel investor groups to promote the Center's project portfolio and facilitate follow-on funding opportunities for these companies.

GOALS & OBJECTIVES



Goal 3

Expand the visibility and awareness of the Center across Pennsylvania and the nation.

Objectives:

- a) Increase the number of university partners in the Center's activities, e.g., Lehigh, University of Pennsylvania, Drexel, Penn State - Erie.
- b) Promote the Center through presentations at national conferences, articles and informal meetings.
- c) Partner with other nanotechnology organizations across the U.S. to help increase national recognition.
- d) Expand the readership of the *NanoMaterials Quarterly* eNewsletter across U.S.

Goal 4

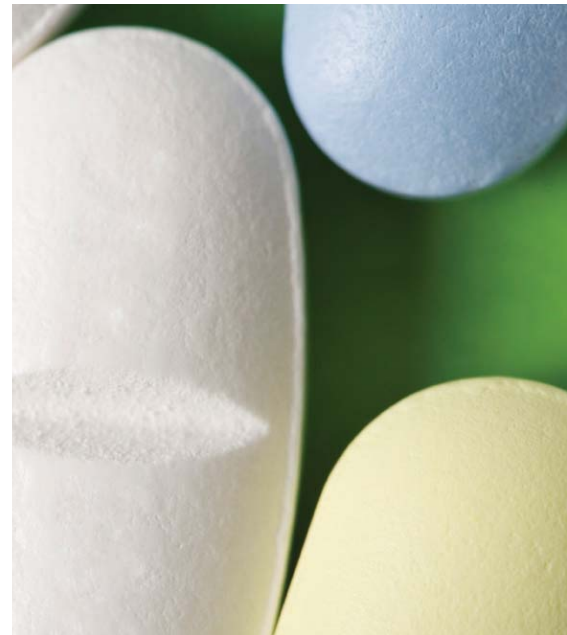
Increase and diversify revenue sources for the Center.

Objectives:

- a) Through Goal 1 activities, increase state and federal support.
- b) Through Goal 2 activities, develop and implement a plan to increase private revenue sources. This could be an annual dues membership model for stakeholders and / or fees for workshops, matchmaking services, etc.
- c) Develop funding support from other federal agencies and departments, such as DOE, of other armed services.



FINANCIAL PLAN



Revenues

The Center received its initial funding and support, beginning in late 2005, from the Department of Community and Economic Development (DCED) of the Commonwealth of Pennsylvania, the Heinz Foundation, the Pittsburgh Technology Council and the four founding member companies. It hired its full-time Director, Dr. Alan Brown, in January of 2006.

Currently, the Center has two major funding sources -- the Department of Defense and the Commonwealth of Pennsylvania. The federal funding is provided from the Air Force Research Laboratory (AFRL) at Wright Patterson Air Force Base. This funding has been obtained through congressional appropriations obtained by Representative Mike Doyle. To date, the total funding from this source is \$2 M.

The second source of public funding was received in late 2005 and August 2006 from the Ben Franklin Technology Development Authority through the Department of Community and Economic Development (DCED), Pennsylvania. This funding was part of the Commonwealth's long-term investment in nanotechnology as outlined in the Pennsylvania Initiative in Nanotechnology (PIN). To date, the total funding from this source is \$1.2 M. Overall, the Center has received total funding in the amount of \$3.6 M to support its activities. In addition to the cash support from its funders, the Center receives significant in-kind support from its governing board and Technical Advisory Committee as described above.

Expenditures

The Center has used this support to establish its operational processes, define a Technology Roadmap and form a Technical Advisory Committee. From late 2006 through 2007, this committee has reviewed 53 white papers and 26 final proposals submitted to the Center, and recommended six for funding. These six projects currently form the Center's project portfolio. The details of this portfolio are shown in Table 2.

The current portfolio of projects comprises a total investment by the Center of \$1.25 M, with matching amounts from the project companies of \$750 K.



GOVERNING BOARD

Appendix A



Robert J. Kumpf Ph.D.
Chairman
Bayer MaterialScience LLC

Luis Fanor Vega Ph.D.
Vice Chairman
Alcoa Technology

Daniel E. Rardon Ph.D.
Secretary / Treasurer
PPG Industries

Larry E. Pfister
Director
U.S. Steel Corporation

Andrew W. Hannah
Director
Plextronics Inc.

Carlo G. Pantano Ph.D.
Director*
The Pennsylvania State University

Patrick B. Stewart
Director
GSP Consulting

Audrey Russo
(Ex Officio member)
Pittsburgh Technology Council

* Annually rotating seat among Carnegie Mellon University, Penn State University and the University of Pittsburgh



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