PITA Mission

The Pennsylvania Infrastructure Technology Alliance (PITA) is collaboration among the Pennsylvania Department of Community and Economic Development (DCED), the Center for Advanced Technology for Large Structural Systems (ATLSS) at Lehigh University, and the Institute for Complex Engineered Systems (ICES) at Carnegie Mellon University. The mission of the PITA Program is to assist the Commonwealth of Pennsylvania and its companies in increasing operating efficiency and enhancing economic development by: 1) conducting technology development projects with PA companies; 2) developing technology leading to new PA companies; 3) conducting educational outreach programs for the benefit of PA companies and students; 4) seed funding and technology development projects that attract funding from other sources; 5) creating an environment linking PA companies, agencies and students to increase the creation and retention of high paying jobs in the Commonwealth; and 6) enabling PA universities to remain at the forefront of engineering research and education.

Alliance Principals

The Institute for Complex Engineered Systems (ICES) at Carnegie Mellon University pursues multi-disciplinary research and education both within the College of Engineering and across colleges at Carnegie Mellon University. Primary goals of ICES are to identify, seed, and grow multi-disciplinary research projects within designated strategic areas and to foster vibrant research relationships between industry and the College of Engineering. Technical foci currently being investigated through ICES include: Bioengineering Technologies; Engineering Design Research; Interactive Real-Time Computer Systems; Microsystems; the Center for Sensing Critical Infrastructure Research (CenSCIR); and the Center for Nano-enabled Devices and Energy Technology (CNXT). Through these activities, ICES promotes collaboration across Carnegie Mellon University while creating sustainable multi-disciplinary research infrastructure.

The Center for Advanced Technology for Large Structural Systems (ATLSS) at Lehigh University is a national center for research that, in partnership with industry and public agencies, provides technological innovations leading to cost effective, high-performance large structural systems for bridges, buildings, ships, power plants, and other major structures. Activities focus on developing new structural systems and advanced materials applications, and on structural performance and durability issues for both new and existing structures. The performance of our infrastructure strongly influences the international competitive position of our Commonwealth and the safety and quality of life for our people.

Technology Development Program

The PITA Technology Development Program is designed to produce technological developments that significantly improve both the communications and the physical infrastructure of the Commonwealth and/or to sponsor technology projects which address a combination of short-term and long-term needs of Commonwealth agencies and businesses. PITA also serves to plan, conduct and manage research and technology development on a systematic, cross-disciplinary and sustained basis to achieve the PA DCED mission. PITA currently supports the following seven research and education Technology Areas:

1) Innovative Infrastructure Systems (IIS) - The objectives of this area are to: a) develop and implement innovative structural materials, components, connections, assemblages, and systems that are cost effective, durable and easily maintained, b) establish methods to evaluate and predict the future condition of structural elements and their protective coatings and advance in methods for the rehabilitation, repair, and strengthening of damaged or deteriorated structural components, c) to evaluate, develop and implement new materials and methods to protect the general infrastructure (transportation, buildings, water supply, wastewater treatment, and public utilities) from natural and man-made effects including earthquakes, wind, fire, flood and blast. Examples of important technologies encompassed by this research area include:

- Innovative infrastructure designs and materials
- High-performance steel and concrete bridge systems
- Rehabilitation of structures using innovative materials
- Systems for sensing and monitoring of structures
- Advanced fire dynamics in large structures
- Multimodal security networks
- Software and networking technologies which guarantee infrastructure security
2) **Information and Systems Technology (IST)** - The goal of this technology area is to develop and exploit information technologies that will lead to providing the right information to the right person at the right time. This will lead to more efficient, reliable, and robust data storage and information systems. The technologies developed in this would have diverse applications in industrial operations, e-commerce, public safety, training, security and utilities. Important technologies in this research area include:

- Agent-based technologies for secure information retrieval
- Mobile computing and sensor-based control methods for surveillance
- Novel data-mining techniques
- Innovative data analysis, signal processing and presentation techniques

3) **Product and Process Design and Optimization (PPDO)** - The goals of this technology area are a) to develop information driven design and manufacturing systems as well as tools to optimize the development of products and processes, and b) to drive innovation in products and processes that are of interest to Pennsylvania based companies. Systems research and optimization research explore untapped synergies at the interface of cyberinfrastructure, process systems engineering and operations research to develop novel computational models for improving the operation of large enterprises such as the petroleum, chemical and pharmaceutical industries. Research on new design and manufacturing technologies, spanning the component to the systems level, create and improve downstream product offerings and in some cases spawn startup companies. Industry and government participants include: design firms, manufacturers, computing/communications infrastructure companies, chemical companies and the Department of Community and Economic Development. Examples of key technologies in this area:

- Enterprise-wide optimization for industries with complex process, supply and distribution interdependencies
- Optimization or innovations in manufacturing processes.
- Multi-scale modeling for predictive design for manufacturability
- Design and manufacturing of new electronics circuits and chips
- Microsystems technologies leading to new product and process improvements
- Robotic systems for process and product improvement

4) **Biomedical and Health Engineering (BHE)** - The objective of this technology area is to bring together multidisciplinary research teams from universities, hospitals and companies to develop technologies in the emerging fields of artificial organs, biosensing, medical robotics and engineered tissues. The area will also prioritize assisted-living technology in response to the needs of the Pennsylvania’s aging population. This technology area will support the future growth in the development, design and manufacture of biomedical techniques and systems that will improve the quality of life for citizens of the Commonwealth. This area is of interest to Pennsylvania based companies involved in engineering design, manufacturing, health care, hospitals, medical centers and computing/communications infrastructure. Government participants include, NSF, NIH and Departments of Community and Economic Development. Examples of important technologies in this research area include:

- Engineered tissues, endovascular grafts and artificial organs
- Implantable medical microsystems
- Computer aided surgery
- Coatings and microparticles for drug delivery
- Robotically assisted living.

5) **Environmental and Energy Technology (EET)** - The objective of this technology area is to implement comprehensive, systematic models, which treat all stages of life of a constructed facility or manufactured product as part of an integrated process of evaluation. Focus will be placed on a) advanced material, chemical, and biological environmental remediation technology, assisting the growing environmental remediation industry, b) methods and tools to assist in the effective allocation of funds on projects designed to preserve and enhance natural resources, c) waste minimization technologies, d) energy resource management and usage technologies e) and alternative energy storage and production systems. Industry and government participants include: owners and operators of facilities, engineering design firms, constructors, Department of Environmental Protection, Department of Transportation, and the Department of General Services. Examples of important technologies in this research area are:

- Process design optimization for waste minimization at the source

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- Alternative energy and green energy research
- Information technology for analyzing the release of chemicals to air
- Extruding CO₂ from the air to mitigate global climate change
- Technologies for evaluating biological and chemical effects in water supplies

6) Nanotechnology (NANO) - The objective of this technology area is to combine engineering design, material science, electrical, computer and mechanical engineering expertise to create innovative nanotechnology-based materials, devices and systems for sensing, energy generation and power storage capabilities. The emphasis is to support and enable the creation of a dynamic nanotechnology manufacturing capability in Pennsylvania by providing product alternatives and techniques to reinvigorate the state’s declining commodities-dependent manufacturing sector. In 2004, nanotechnology was a $13 billion dollar global industry. By 2014, that figure is forecast to reach $2.6 trillion, about 10 times the projected value of the biotech sector and about 15 percent of the world's manufacturing output. Industry and government participants include manufacturing companies, energy companies, PA DCED and other PA economic development groups. Examples of important technologies in this research area are:
  - Development of novel nanocomposite photocatalysts
  - Nanodevices for environmental monitoring
  - Nanoscale transport modeling for fuel cells
  - Development of nanostructured electrolytes for fuel cells
  - Nanowires and nanoparticles for biomedical, sensor, and electronic applications.

7) Courses and Outreach Programs (COP) - The current portfolio of PITA courses and outreach activities will be broadened to address engineering education over a wide range of educational levels from pre-college students to post-graduate engineering professionals, including:
  - Outreach programs, jointly sponsored with Pennsylvania companies, local school districts and education consortia, to help educate pre-college students in math, science, engineering, and technology.
  - Project courses that link Pennsylvania companies with teams of undergraduate and graduate students working on engineering projects aimed at improving the products and/or processes of these companies. These courses are part of the student’s undergraduate or graduate curriculum.
  - Individual courses and possibly groups of courses developed specifically for post-graduate engineering professionals.

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