II.I. Major Research and Public Service Activities

R&D EXPENDITURES : Fiscal Year 2008

Institution: New Jersey Institute of Technology

	Amount ($)
Federally Financed Academic R&D Expenditures	40,287,000
Institutionally Financed Academic R&D Expenditures	30,871,000
State, Industry & Other Financed R&D Expenditures	18,599,000
Total Academic R&D Expenditures	89,757,000

Note: Dollar amount as reported to the National Science Foundation (NSF) on Form #411 (*Survey of Research and Development Expenditures at Colleges and Universities*).

Research and development is a fundamental component of the NJIT mission. NJIT is one of only three public research universities within the state system – that is, mission directed to offer a comprehensive array of Ph.D. programs – and of the three the only one specifically oriented towards professional studies including engineering, the physical sciences, computing sciences, architecture, and management. It is "New Jersey's Science and Technology University".

While *research* activity may be viewed as end unto itself, it is also a powerful enabler for all of the university's mission elements. Faculty members engaged in research bring real-world application and a contagious enthusiasm to the classroom, and in some cases even advance the technologies used in *instructional* activities. The competency built through independent scientific research allows the university to assist the state in a wide variety of *public service* activities that range from community planning and transportation policy to child-safe hand gun technology development. With strong roots in the application of scientific discovery to practical purpose that comes from a 125 year-long heritage in engineering, the university recognizes the importance of contributing to the local, regional and national *economic development*. The university fosters an intimate connection between its faculty and student researchers and the business community in the form of formal partnerships with companies ranging from incubator start-ups to global OEMs.

NJIT research is "at the edge of knowledge". By that we mean that our researchers are at the forefront of their professions and proactively working to connect scientific discovery to practical application. Some examples follow that are organized around thematic areas

of particular significance to new Jersey – healthcare, homeland security, information and communication technology, nanotechnology and sustainable systems.

II.I.1. Healthcare Systems

Amazing progress is occurring in the life sciences as improved understanding of the molecular origins of life move medicine from heuristic and statistical approaches to predictive models. This is the province of engineering, math, physics chemistry and computing that are the defining disciplines of NJIT. From miniaturized, implantable sensors and advanced imaging through new bio-inspired materials to biological and pharmaceutical drug discovery NJIT has the disciplinary tools to break new ground. Some examples of NJIT research at the edge of healthcare systems follow.

NJIT was designated as the host institution for a research collaboration designed to advance **stem cell therapies**. The Newark Institute for Regenerative Healthcare is dedicated to creating technologies to translate basic research on stem cell science into practical and deliverable therapies for patients. The Institute's program will create a stem cell industry from stem cell science, integrating efforts from across the state, the nation and the globe to accelerate the translation of research into cures. New medical equipment, sensor, control system, information technology and service industries will be defined by these activities and will create a new stem-cell economy with the potential for extraordinary economic benefit to the State of New Jersey. A comprehensive pilot scale production center will be the central element that supports the research, serves as a supplier of stem cell lines for basic research and clinical trials, and provides a test-bed for a wide variety of custom equipment manufacturers that will be drawn to the Newark Innovation Zone to gain regular access to the showcase operation. The Institute has been approved to receive a $50M construction grant from EDA as part of a statewide bond initiative supporting stem cell research facilities and equipment.

Treena Livingston Arizneh, assistant professor of biomedical engineering, winner of an NSF Presidential Early Career Award for Scientists and Engineers (PECASE) award, the highest national honor for young scientists and engineers, for her **research with adult stem cells** received a $700,000 grant from the New Jersey Commission on Spinal Cord Research, a state agency that funds spinal cord research. She will use the grant to build a laboratory to test if stem cells taken from adult bone marrow can be made to turn into neurons. If her research shows that the cells can turn into neurons -- the nerve cells in the body that control brain and spinal cord function -- patients with spinal cord injuries could be healed with injections of stem cells. Arinzeh's second $300,000 grant, from the New Jersey Commission on Science and Technology, will allow her to apply her stem cell techniques to help patients who have cartilage damage. She and Jaffe will spur **cartilage regeneration** by combing stem cells with bio-degradable scaffolds that mimic fibers found in human cartilage tissue. They will test different scaffolds

and determine which biomaterial is the best catalyst for stem cell differentiation. Again, their hope is that stem cells can soon be used to treat patients with damaged cartilage.

NJIT researchers Iqbal Zafar, PhD, research professor and Somenath Mitra, PhD, acting chair and professor, department of chemistry and environmental sciences have developed the concept for a **biologically powered fuel cell** that would utilize sugars in the blood steam as a renewable energy source for implanted medical devices. The approach integrates micro- and nano-fluidic platforms, electrodes and membrane/electrolyte separator into a biologically compatible, encapsulated biomedical device. It utilizes aligned single wall carbon nanotubes with high ballistic electrical conductivity, and rapid, green microwave-assisted enzyme covalent functionalization of nanotube tips or sidewalls to provide for stable long term performance.

Tara Alvarez, assistant professor of biomedical engineering, received a prestigious Faculty Early Career Development Award from the NSF to support her work in **neural engineering and vision research** and to enhance the Vision and Neural Engineering Laboratory. The grants support the early career development of teacher-scholars who integrate research and education. Her research focuses on how the brain learns when visually locating objects in three dimensional space to gain a better understanding of basic motor control and motor learning. She also plans to offer courses for undergraduates and to develop educational programs for pre-college girls to attract them to the field of neural engineering.

Michael Jaffe, research professor of biomedical engineering and chemistry directs **collagen research** at the Medical Device Concept Laboratory (MDCL). MDCL projects focus on reconstituted collagen fiber formation, collagen characterization -- both as a "material" and as tissue engineering substrate, collagen mechanical properties and transport of small molecules through skin. One project of special interest is a collaboration among Treena Arinzeh and Sam Hessami (OB/GYN) and Fred Silver (pathology) of UMDNJ, aimed at understanding the collagenous failure that leads to uterine prolapse, a major problem in women's health.

Biomedical engineers at NJIT will use new technology to **help children with cerebral palsy** improve their movements, reduce stiffness in their joints and live fuller and more independent lives. Small robots mounted on wheelchairs, interactive video games and a robotic arm that can be programmed to guide and aid human motion – these are just a few of the technologies the engineers will use to help these children improve their muscular control and movements. The program led by BME Professor Richard Foulds is part of a the newly formed **Rehabilitation Engineering Research Center** (RERC) at NJIT, funded by a $4.75 million grant from the National Institute on Disability and Rehabilitation Research, in Washington, D.C. The institute supports research for the

rehabilitation of people with disabilities. The grant, awarded on Nov. 1, 2005, will run for five years.

A $1 million, three-year grant from the Howard Hughes Medical Institute awarded jointly to NJIT, Rutgers-Newark and UMDNJ-New Jersey Medical School will be used to develop a novel doctoral program designed to **train future neuroscientists** who can integrate approaches used in mathematics, biomedical sciences and computation. "With their physical proximity and close ties among the faculty, these three institutions will create a unique environment unparalleled in interdisciplinary neuroscience training," said Robert Miura, professor and acting chair of the department of mathematical sciences at NJIT.

New Jersey Institute of Technology (NJIT) computer scientist Yehoshua Perl, PhD, creates elegant logical structures to track **down errant or misplaced medical terms**. The errors creep into documents and databases developed by corporations, government agencies, hospitals and academic institutions that design, maintain and use terminologies throughout a variety of systems. Perl's research is funded by a three-year **$1.43-million grant from the National Library of Medicine** (NLM), a branch of the National Institutes of Health.

Interactions among neuropeptides and microglial cells in the brain are the research focus of G. Miller Jonakait, dean of the College of Science and Liberal Arts and professor of biological sciences. With grant support from the National Science Foundation, she is looking at how neurons and glia interact both in the normal brain and in the damaged or diseased brain. Several specific neuropeptides seem to play a role **in regulating microglial responsiveness**, particularly in dampening the inflammatory response. Dr. Jonakait is exploring this neuronal/glial cross-talk hoping to understand the ways in which neurons affect glia and glia affect neurons.

Associate Professor Sheldon Wang has two new NSF grants — a project to study manufacturing processes for **biocompatible implant materials**, and a study to develop new computational models for **normal and sickle red blood cells** in an aqueous environment with the goal of developing a better understanding of sickle cell diseases and their treatments

II.I.2. Homeland Security

The threat to national security represents a fundamental change to a society that has been built around the concept of invulnerability of our borders, and defense against an enemy that shares the same hierarchical power structure and basic assumptions of self preservation as we do. Responding to the new challenge requires a systemic re-engineering of physical and social infrastructure based on the new modality of threat. Technology is not a panacea, but it will be the key

productivity gain that elevates our response to the level required without draining our human and financial resources and constraining our way of life to unacceptable limits. NJIT is in the field driving this process and in turn bringing back to the university and its incubator firms issues that demand new thinking and a structure of performance and interoperability standards that encourage competition and innovation. Some examples of NJIT research at the edge of homeland security follow.

One of the most significant spurs to the growth of NJIT's research program has been the university's emphasis on technologies to assist in homeland security. NJIT is home to **New Jersey's Homeland Security Technology Systems Center.** The center works to identify faculty expertise as well as technologies under study within the university that have potential to assist in the nation's security programs and to facilitate partnerships with local, state and federal agencies for homeland security initiatives. One of the first projects undertaken by the Homeland Security Technology Systems Center was smart camera surveillance system at the **Garden State Plaza Mall** in Paramus, directed by Donald H. Sebastian, the university's senior vice president for research and development. The system, developed as a national prototype, uses mall security cameras in combination with special software designed to search for suspicious objects or behavior and alert local authorities. With special funding from Acting Governor Richard Cody, a similar model system has been installed at the **Beatrice Gilmore School in West Paterson**. NJIT has funding from the N.J. Department of Law and Public Safety to protect schools and shopping malls.

In one of the most promising homeland security initiatives, university researchers continue to develop applications that utilize terahertz (THz) electromagnetic radiation to detect and **identify explosives and biological agents**. A team of researchers led by John Federici, professor of physics, received a patent for a terahertz imaging system that could be used in airports to detect potentially harmful materials even if they are concealed in clothing, sealed packages, or suitcases. The team also has funding from the Army Research Office, and their industrial collaborator, Picometrix, Inc., of Ann Arbor, Mich., a manufacturer of high-speed optical receivers and ultrafast instrumentation, has a Phase II Small Business Innovative Research (SBIR) grant to develop the system. Above, Federici displays one of the homodyne modules developed by Picometrix that will collect data for the system. Other projects related to homeland security include: • With NSF funding, Haim Grebel, professor of electrical and computer engineering, is developing new concepts for producing infrared filters based on intergrated circuit microstructure technology. His group plans to develop and test filters for all types of spectral sensors applied to a broad range of monitoring and detection systems from the visible to the THz region.

NJIT is partnering with Iowa State University (ISU) to develop the **Center for Information Protection** (CIP), an NSF-supported Cooperative Research Center in Information Assurance. Constantine Manikopoulos, associate professor of

electrical and computer engineering, will head the NJIT component that will focus on research in intrusion detection, network security, privacy, and attack-tolerant systems. The center is designed to improve the security of the nation's **cyber infrastructure**. The CIP will partner with industries that provide security solutions as well as industries that use these solutions in the creation of an overall security perimeter designed to protect data and information assets critical to their industry.

A new technology that can verify a person's identity using facial images is the goal of research by Chengjun Liu, assistant professor of computer science. He has developed a **face recognition system** that improves on previous technology by taking into account such factors as lighting and facial expressions. The system has tested 100 percent effective in matching videotaped images to those stored in government databases by comparing 62 features or facial landmarks. Such a technology can be used as a security system with facial identification replacing a physical key or a password. An effective face recognition system could also assist law enforcement officials in locating fugitives by means of video cameras strategically placed in public places such as airports. Liu recently received funding from the Department of Defense to support his research as part of the government's effort for combating terrorism using face recognition technologies.

The development of a portable MEMS (micro-electromechanical systems) device as part of a biological detection system is the focus of a joint research project between NJIT and Sandia National Laboratories in Albuquerque, N.M., the government facility charged with developing technologies to support national security. The device -- known as a trigger -- is the key component in a system for the rapid and accurate **identification of harmful biological agents** in field and urban environments. The team includes Boris Khusid, professor of mechanical engineering, and his doctoral students in mechanical engineering from NJIT along with Sandia researchers.

A biometric identification system based on **Dynamic Grip Recognition** developed in NJIT's personalized weapons project could also be effective in preventing skyjackers from taking control of aircraft. The research team is developing a prototype "smart gun" using silicon-based piezo-electric pressure sensors embedded in the gun grip. The system can identify the user based on the unique "signature" of the individual hand during the first instant of trigger pull. On-board decision electronics and micro-mechanical systems-based actuators then react to either enable or block the firing mechanism. Biometrics expert, Michael Recce, professor of information systems, has also applied for a patent to adapt his hand grip technology for use by airplane pilots. Since operation of modern aircraft frequently shifts between the pilot and ground controllers, Recce reasoned that the installation of his grip sensors in the cockpit controls could be achieved with relative ease because only the authenticated grips of the pilot or copilot could be programmed to operate the plane. When the pilot releases his or her grip, control of the plane would revert to the ground. The concept of dynamic

biometrics is also being extended to other devices such as keypad entry systems where the rhythmic pattern of data entry reveals an underlying structure that is unique to the individual, reproducible and detectable.

M. Ala Saadeghvaziri, professor of civil and environmental engineering, has received start-up funding from the Multidisciplinary Center for Earthquake and Engineering Research at the University of Buffalo to develop proof of concept for an innovative water-based protective technology that could be used to **mitigate the effects of explosions** or earthquakes on public buildings such as schools and hospitals.

David Mendonca, assistant professor of information systems, is investigating how training in improvisation can help **improve the tactical response to large-scale emergencies** like the 2001 World Trade Center attack. With a prestigious NSF Faculty Early Career Development award, he hopes to develop software that can help emergency response personnel to make the right decisions under pressure.

The work of Associate Professor Eliza Michalopoulou in ocean acoustics has a compelling and timely bottom line — national defense. With expertise in both mathematical analysis and signal processing, she studies how sounds move in the ocean and how they are affected by factors like temperature, ocean depth, seafloor composition and currents. The main goal is to help the U.S. Navy, which supports her research through the Office of Naval Research, to identify better techniques for **detecting underwater vehicles**, particularly along the nation's seacoasts. The end products of her work are algorithms that can be used in developing next-generation security systems.

Dr. Michael Chumer of the Information Systems department is working on a variety of advanced software architectures to **support emergency response and homeland security** applications. By developing interoperability standards these architectures facilitate rapid integration of high performance software applications into a virtual command and control support system. With direct support from the US Army, some of these concepts are being demonstrated in conjunction with combat unmanned systems management.

II.I.3. Information and Communication Technology

The mass-impact of computing technology and the ultimate delivery on the promise of digital convergence will only come when information is available anywhere, anytime and for anyone (or anything!). The development of ubiquitous broadband connectivity will in turn drive transformational products based on distributed intelligence and novel human interface concepts. Some examples of NJIT research at the edge of information and communications technology follow.

Envisioning a future in which wearable computers help students locate their friends on campus and even facilitate introductions to new acquaintances with similar interests, a team of researchers led by Constantine Manikopoulos, associate professor of electrical and computer engineering, and Quentin Jones, assistant professor of information systems, are working to make NJIT a national prototype **SmartCampus**. The project is supported by funding from the National Science Foundation and Hewlett-Packard. The team will develop a mobile, wireless NJIT campus community system along with the software and protocols to support a wide range of location-based computing services. The team will create privacy-sensitive applications that make use of contextual factors — the properties of people and places and the relationships between them — that are unique to people to people to places, or P3 systems such as SmartCampus. The project will also enrich the curriculum — the team foresees the development of masters programs in human-computer interaction and information assurance and new courses in such areas as wireless security and wearable computing.

Technologies to enable the **next generation of wireless digital communications** are the focus of research at the Center for Wireless Communications and Signal Processing. Yeheskel Bar-Ness, distinguished professor of electrical and computer engineering and director of the center, leads a team of researchers working to develop the infrastructure needed to support the burgeoning demand for wireless communication. The group addresses issues such as privacy and security, interference and jamming, ever heavier user traffic, and rapid transmission of data through wireless networks. Dr. Bar-Ness recently filed for patents on next-generation devices with two of his doctoral students. One, a parallel decoding algorithm of Turbo Codes provides scalable decoding delay without any additional computation or performance degradation. Another, creates a new phase noise suppression method for high speed wireless data communications.

Alex Haimovich, professor of electrical engineering, is developing a new type of network using multiple antennas that could accommodate both a **high-speed information link** and a sensor network for security or medical monitoring within the same frequency space. With NSF funding, his research team is seeking to develop solutions that can support a wide variety of applications simultaneously within a home or business. The team's goal is a new type of network characterized by multiple antennas and multiple appliances (MAMA).

Roberto Rojas-Cessa, assistant professor of electrical and computer engineering, is leading a team of researchers who are developing a **new service model concept**, called service vector, as a solution for providing quality of service support for a large variety of traffic classes — Internet, video, audio, business and data services — that challenge the next-generation information networks. The study has NSF funding.

Data watermarking, intrusion alarm systems and distortionless data hiding are some of the techniques under study at the **Center for Wireless Networking and Internet Security**. A partnership between NJIT's Department of Electrical and Computer Engineering and Princeton University, the center was supported by a $2.6 million R&D Excellence Grant from New Jersey Commission on Science and Technology.

Michael Bieber, associate professor of information systems, is leading a project to develop a Digital Library Service Integration (DLSI) infrastructure. Supported by the National Science Foundation under its National Science, Technology, Engineering, and Mathematics Education Digital Library (NSDL) program, the project aims to provide a systematic approach **for integrating digital library collections** and services. Digital library services are emerging, such as classification, searching, and peer review, as well as hypermedia functionality such as annotation and guided tours. Using the Dynamic Hypermedia Engine (DHE) developed at NJIT's Collaborative Hypermedia Research Laboratory, the DLSI program will integrate relatively simple services that may be used without modification. The research team believes that DLSI can form the core of vibrant virtual educational communities by supporting a broad range of community support services.

II.I.4. Nanotechnology

Nanotechnology is neither a passing fad of the scientific community nor clever repackaging of existing disciplinary knowledge. It is a disruptive technology that will influence product design and manufacture across the spectrum of every imaginable application. The projected impact of nanotechnology may have been an article of faith several years ago, but there is now evidence that “nano” has gone from frontier science to a practicable technology. The most notable accomplishments have come in the limited field of carbon nanotube (CNT) based systems. At NJIT, alone, our researchers have developed reliable technology to produce molecular scale “wires”, solar cells, and biologically fueled power cells based on CNT. This has wide reaching implications for applications ranging from alternative energy to revolutionary, implanted medical devices. Some examples of NJIT research at the edge of nanotechnology follow.

A team led by Iqbal Zafar, PhD, research professor and Somenath Mitra, PhD, acting chair and professor, department of chemistry and environmental sciences, has developed a quick and simple method to **produce water-soluble carbon nanotubes**. This is something that has never been done before. The new nanotubes are 125 times more water soluble than existing ones. In addition, the new nanotubes, following a short heat treatment, can conduct electricity as well as the non-soluble ones. There are many benefits, the most obvious ones are their value in electronic coatings and films or plastic or polymer composites. The former are used in electronic manufacturing to create lead-free, less toxic,

conductive and soldering materials. The computer industry uses these coatings and films to remove heat, because they do that well.

In less than 20 minutes, NJIT researchers can now seed, heat and **grow carbon nanotubes** in 10-foot-long, hollow thin steel tubing. The ground-breaking method will lead to improvements in cleaner gasoline, better food processing and faster, cheaper ways to clean air and water. The discovery was recently described in the Journal of Material Chemistry, June 14, 2006, by lead researcher Somenath Mitra, PhD, professor and acting chair of NJIT's Department of Chemistry and Environmental Science and his team in "Selective Self-assembly of Single Walled Carbon Nanotubes in Long Steel Tubing for Chemical Separation." Other journals featuring their work are Chemical Physics Letters and Carbon and Analytical Chemistry.

Functional nanostructures for novel electron devices are the focus of the Integrated Nanostructures Laboratory, headed by Leonid Tsybeskov, associate professor of electrical and computer engineering. In one project supported by the National Science Foundation, the team is investigating links between structural and optical properties in **three-dimensional nanostructures** made of silicon and germanium, the most common materials for semiconductors. Visible photo luminescence from Si nanocrystals and different forms of organization in Ge nanocrystals grown on a Si substrate are recent discoveries, and Dr. Tsybeskov is exploring the feasibility of novel devices that make use of efficient light emission in these nanostructures. Hewlett-Packard and IBM are partners on the project.

The team is also continuing its work on **silicon quantum dots** -- molecule-sized crystals of silicon that could allow a new generation of computer chips just a few atoms across in size. Dr. Tsybeskov's group has invented a novel fabrication technique for these silicon nanostructures and demonstrated how these structures can be used in non-volatile memories and other electronic devices. Supported by the National Science Foundation and the French National Center for Scientific Research, the research is continuing with in an international collaboration with the Material Technology Laboratory at Motorola, the Institute for Electronic and Microelectronic Research in Lille, France, and the University of Rochester.

New techniques for **processing nanostructured powders** are the research focus of Robert Pfeffer, distinguished professor of chemical engineering. Although the unique properties of nanostructured materials can greatly benefit many industries, such as, food, pharmaceutical, petroleum, chemical, agricultural and ceramics, little attention has been paid to flow around nanoparticles and flow in nanodomains. With funding from the National Science Foundation, Dr. Pfeffer's research team at the New Jersey Center for Engineered Particulates, together with researchers from the Illinois Institute of Technology, is seeking to solve the challenging problem of understanding the physics of fluidization and transport of nanoparticles. The goal is to be able to process nanoparticles to produce nanomixtures and nanocomposites with tailored properties.

II.I.5. Sustainable Systems Technology

New Jersey is prototypical of many areas where the co-location of dense population centers and industrial systems needs to be successfully managed to maintain quality of life while promoting economic development. Preservation of air, water and land quality; efficient transportation systems for goods and people; affordable, environmentally benign housing and office space; disaster resistant infrastructure; are all empowered through the technological developments at NJIT. The combustion of petroleum-based fuels is the least thermodynamically efficient technique for powering the global demands for energy. The oil crisis of the 70's, repeated now, and the recognition that global warming due to the accumulation of the products of combustion has at least some scientific merit makes it clear that disruptive technology is required. Alternative energy research is actively underway at NJIT. Some examples of NJIT research at the edge of sustainable systems technology follow.

Chemical engineer Kamalesh Sirkar, PhD, a distinguished professor and an expert in membrane separation technology, is leading a team of researchers to develop a **breakthrough method to desalinate water**. Sirkar holds more than 20 patents in the field of membrane separation. Using his technology, engineers will be able to recover water from brines with the highest salt concentrations. The process will work especially well with brines holding salt concentrations above 5.5 percent. Currently, 5.5 percent is the highest percentage of salt in brine that can be treated using reverse osmosis. The Bureau of Reclamation in the Department of Interior is funding the project.

Michael Jaffe, research professor of biomedical engineering and director of the Medical Device Concept Laboratory has teamed with the Iowa Corn Promotion Board to identify polymer opportunities based on monomers derived from corn. The study will look at the potential of **corn derivatives** as readily available and inexpensive sources of new polymeric materials. Materials to be investigated range from new, bio-erodible polymers for medical applications to improved, bio-compatible coatings and plastics.

Microscopic sensors that will **prevent disruptions in electrical power** are the focus of a project led by Ken Chin, professor of physics. A joint effort between the NJIT and Public Service Enterprise Group, the project is developing fiber optical MEMS "microphones" that will alert utilities of irregularities or deterioration within the power grid that may signal a system failure. The first device in development targets a condition known as partial discharge (PD) activity that occur in high voltage cables as a result of defects such as voids or contaminants. This device is currently in field tests and a PSEG field station. Another novel MEMS device monitors the integrity of cable splices so as to provide early detection of incipient failure before it results in an outage of service.

Organic photovoltaics (OPVs) are a promising low-cost **alternative to silicon solar cells** and thus a great deal of effort is being devoted, in both academic and industrial laboratories to increase the power conversion efficiency and scale-up production processes. An attractive feature of the OVPs is that they can fabricate by a coating process (e.g., spin coating) to cover large areas and may be formed on flexible plastic substrates. Iqbal Zafar, PhD, research professor and Somenath Mitra, PhD, acting chair and professor, department of chemistry and environmental sciences are developing the science and the technology for the next generation OPVs to overcome the limitations of existing photovoltaics through the preparation and investigation of new types of photoactive nanocomposites of derivatized single-wall carbon nanotubes. This research is made possible by the unique expertise of the PIs' in synthesis of fully dispersed SWNTs in any solvent using microwave processing and their functionalization.

A better understanding of the **solar flares that can interfere with wireless communication** and damage satellites in Earth's orbit is the focus of research by the Center for Solar-Terrestrial Research. Professor Phil Goode directs the Big Bear Solar Observatory on a mountaintop in California. In the fall of 2007 he will complete a multi-year, multi-million dollar, federally financed construction project that will result in the **world's largest optical solar telescope**. CSTR research will lead to new understandings of the sun's complex behavior and its effect on our own environment. Dale Gary, professor of physics and specialist in radio solar physics, is leading a design study for the Frequency Agile Solar Radiotelescope (FASR). The project, supported by the National Science Foundation, will construct a **new radio telescope capable of making high-resolution images of the solar corona**. The telescope, which will consist of 100 receiving dishes, will allow scientists to study the birth of coronal mass ejections, violent phenomena associated with the Sun's magnetic fields that can cause sudden, intense fluctuations in the solar wind and serious consequences on Earth. The high-energy particles that characterize these ejections have the potential to destroy satellites. The satellites in turn may impact television viewing, pagers, cellular phones and other wireless devices. With the ability to observe these phenomena, especially those on the near face of the sun that most affect Earth, researchers will be able to provide better information on the space environment to airlines, power companies and satellite operators. Eventually, solar researchers may be able to predict the severity of such incidents and when they will occur.

Establishing remote sensing as an operational management tool in assessing the **quality of New Jersey's nearshore waters** is the focus of research by Sima Bagheri, professor of civil and environmental engineering. Under a NASA Faculty Fellowship, she participated in the NASA Airborne Oceanographic LIDAR (light detection and ranging) remote sensing data acquisition over the East Coast. The program remotely measures biological and chemical substances in the world's oceans and coastal zones, using sensors that are flown in aircraft to make

measurements. The research supports satellite measurements of water quality parameters important in global warming, carbon flux and climate change research.

The New Jersey Applied Water Research Center, directed by Taha Marhaba, associate professor of environmental engineering, has been established by NJIT in partnership with the American Water Works Association to unite industry, government and academia in a common effort to research and **improve the state's drinking water**. Researchers from NJIT and the Water Works Association, a non-profit group dedicated to providing the state with safe drinking water, expect to have a significant impact on the state's water infrastructure. The center's emphasis on applied research specific to New Jersey will fill in the gaps that national research programs have not addressed. Researchers will also work to assure that the region's water supply is safe from bio-terrorist attacks, developing monitoring systems to identify biological agents deposited in the water infrastructure.

Transportation planners from Houston, Texas recently commended researchers at New Jersey Institute of Technology for enabling them to make better use of a technology product developed to assist in the transportation project funding process known as the Transportation, Economic and Land-Use System or TELUS. TELUS is a fully integrated data-management and decision-support system designed to **help Metropolitan Planning Organizations** (MPOs) and state departments of transportation prepare Transportation Improvement Programs – better known in the industry under the acronym TIP Researchers at NJIT led by Lazar Spasovic, PhD, professor in the civil engineering department at NJIT developed TELUS under a federal grant, and recently spent time helping the planners in Houston customize the system.

NJIT has been designated as the **Liberty Corridor Planning Institute**. In this capacity, NJIT researchers are engaged in creating the framework under which over $100M in federal funds will be invested to improve New Jersey's transportation infrastructure to support the ten-fold growth in containerized shipping that is projected as part of the Port Newark expansion. The objective is to facilitate the movement of import and export goods within the already congested Port district to facilitate job growth and economic development in the associated trades.

II.I.6. Research Centers and Specialized Labs

NJIT's research program focuses on applied research in the most promising of emerging technologies, with emphasis on technology transfer and commercialization. Research at NJIT is organized around multi-disciplinary centers of excellence that encourage partnerships among various disciplines, as well as with other educational institutions, private enterprise and government agencies.

APPLIED LIFE SCIENCES

- Newark Institute for Regenerative Healthcare develops process technology to bring stem cell – based therapies to practical, reproducible, commercial scale..
- Biomedical Engineering: Stem cell applications in tissue regeneration, vision and neural engineering, bioMEMS, motion analysis and rehabilitation engineering, biomaterials and biopolymers.
- Center for Applied Genomics: Development and application of DNA microarray technology.
- The Medical Device Concept Laboratory : Synthetic materials in biomedicine.
- Membrane and Separation Technologies: Micro- and nanoporous filters for medicine and pharmaceutical manufacture.
- ProjectFusion: Technologies to support SmartCampus, a mobile, wireless NJIT campus community system with applications to protect privacy and maintain security..
- The Vision and Neural Engineering Lab: Oculomotor dynamics, vergeance eye movements.

ARCHITECTURE AND BUILDING SCIENCES

- Center for Architecture and Building Science Research: Educational facilities, health care and aging environments, developmental disablilities planning, historic preservation, housing and community development.
- Concrete Testing Laboratory: Reinforced and high-strength concretes.
- Imaging Laboratory: Computer-aided design in architecture.

COMPUTING, MATHEMATICS AND TELECOMMUNICATIONS

- Center for Applied Mathematics and Statistics: Mathematical biology, fluid dynamics, wave propagation.
- Center for Wireless Communications and Signal Processing Research: Multi-carrier systems, Turbo Coding techniques, ultra-wideband communications, MIMO systems.
- Collaborative Hypermedia Laboratory: Asynchronous learning systems, online communities, digital libraries.
- Cryptography & Telecommunication Laboratory: Cryptography, computer security and telecommunications networks.
- Data and Knowledge Engineering Laboratory: Data mining, bioinformations, computational biology.
- electronic Arts Habitat (eArtH): Multimedia, social computing, human-computer interaction.

- New Jersey Center for Wireless Networking and Internet Security: Intrusion detection, watermarking, mobile networks.

ENVIRONMENTAL SCIENCE AND ENGINEERING

- York Center for Environmental Engineering and Science: Hazardous substance management, pollution remediation and prevention, sustainable manufacturing.
- Northeast Hazardous Substance Research Center: Hazardous substance handling, reduction, assessment and management.
- Geoenvironmental Engineering Laboratory: Solid waste management and disposal, environmental systems, waste water treatment, site remediation.
- Laboratory for Process and Field Analytical Chemistry: On-line process analysis, environmental monitoring, portable instruments for on-sire environmental measurement. .

MATERIALS SCIENCE AND MANUFACTURING

- Bearings and Bearing Lubrications Laboratory: Hydrodynamic, hydrostatic, rolling element bearings and novel designs of unique bearings.
- Computational Fluid Dynamics: Particulate flows, mixing enhancement, suppression/enhancement of turbulence, drag minimization, thermal management.
- Electro-hydrodynamics Laboratory: Sensors and separation devices for a wide variety of systems for environment monitoring, health care, and medical diagnostics
- Electronic Imaging Center: Infrared filters, sensors and detectors utilizing terahertz radiation, carbon nanotubes.
- W.M. Keck Laboratory: Manipulation of liquid flows and the small particles/microorganisms they transport in biological and biomedical technologies.
- Materials Characterization Laboratory: Elemental. organic and structural analysis
- Metal Combustion Laboratory: Propellants, explosives, pyrotechnics, and incendiaries.
- Microelectronics Fabrication Center: Application-specific integrated circuits, optical switches, pressure sensors, and MEMS for biomedical, biometrics, and microfluidics application.
- Microgravity Research Laboratory: High energy density additives to propellants and explosives, gas sensors, fuel cells, and ultra-hard material coatings
- New Jersey Center for Engineered Particulates: Tailored particle coatings for pharmaceuticals, food, cosmetics, ceramics, defense, electronics and specialty chemicals.

- New Jersey Center for Microflow Control: Fluidic devices, with a focus on miniaturized flows, and miniaturized sensors and actuators.
- Optical Science and Engineering: optoelectronics, environmental monitoring, industrial process monitoring and position control, and ultrafast optical and optoelectronic phenomena.
- Polymer Processing Institute: Modification of polymers processing into special property products for the medical, health care, automotive, electronics, construction, and packaging industries
- Waterjet Technology Lab: Waterjet machining and cleaning applications.

SOLAR PHYSICS

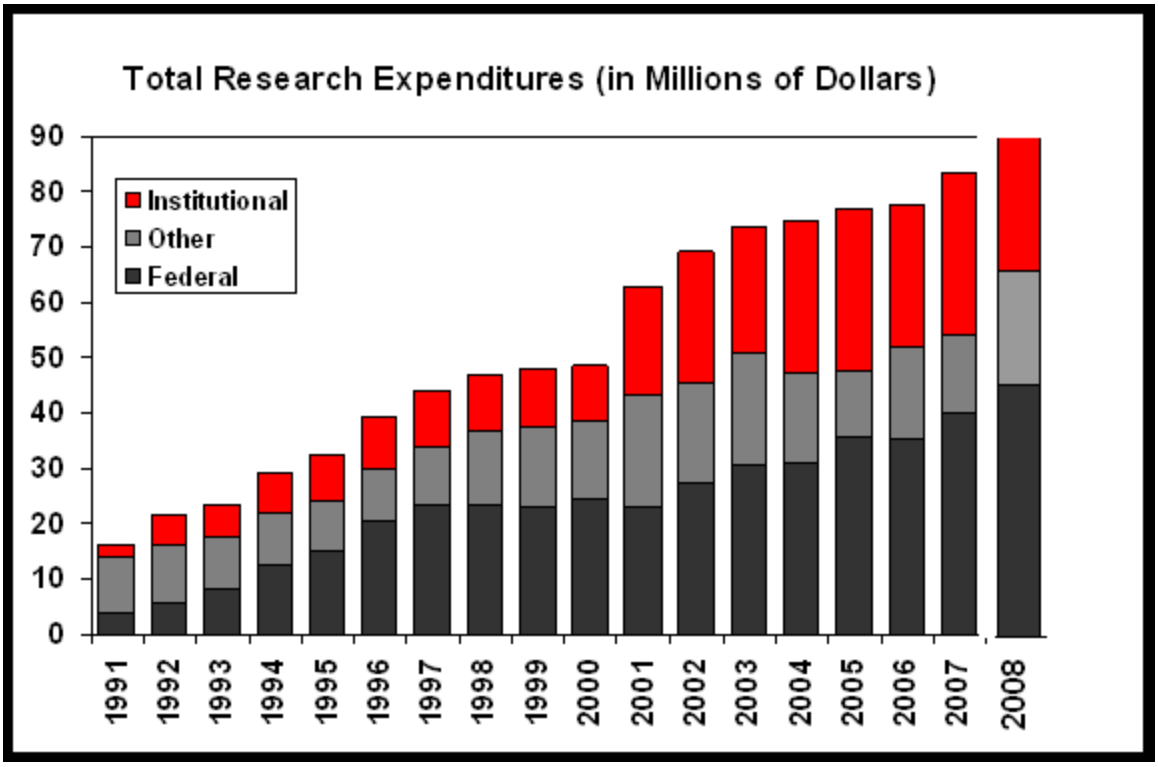
- Center for Solar-Terrestrial Research: Solar optical astronomy, solar radiophysics, terrestrial science.
- Big Bear Solar Observatory: Solar observation, helioseismology.
- Owens Valley Solar Array: Transient energetic phenomena, coronal magnetic fields.
- The Frequency-Agile Solar Radiotelescope (FASR) Project: Nature and evolution of coronal magnetic fields, physics of solar flares, drivers of space weather, the quiet Sun.
- Global High-Resolution H-Alpha Network: Round-the-clock solar observation.
- Space Weather Project: Monitoring and forecasting solar activity that may affect Earth's climate and technologies.

TRANSPORTATION

- Liberty Corridor Planning Institute: Port Newark, Elizabeth, Bayonne redevelopment; Freight transportation, brownfields and passenger transportation
- National Center for Transportation and Industrial Productivity: Freight movement at domestic and international gateways, global competitiveness, intermodal passenger and freight transportation systems.
- North Jersey Transportation Planning Authority: Maintaining and improving transportation systems.
- Transportation, Economic and Land Use System (TELUS): Computerized transportation planning and programming.

II.I.7. NJIT Research Expenditures

NJIT research expenditures since 1991 have grown six-fold and Federally funded research expenditures have grown even more dramatically – more than ten fold in seventeen years.



II.I.8. Incubator Expansion

The opening of a third Enterprise Development Center (EDC III) in 2002 makes NJIT's small business incubation program one of the largest in the nation. With 80,000 square feet in five stories, EDC III doubles the previous incubation space. Three floors in the new structure are earmarked for technology start-up businesses, while the remaining two floors will provide "graduation" space for companies that have outgrown an incubation program.

EDC, founded in 1988 by NJIT, with assistance along the way from Prudential, the New Jersey Commission on Science and Technology, the New Jersey Economic Development Authority, and the U.S. Economic Development Administration, is the oldest and largest incubator facility in New Jersey, with the capacity for serving more than 60 client businesses. EDC provides a broad base of support and acts as a "proving ground" for new and developing high-tech products. Many client companies are developing commercial enterprises that reflect the university's major thrusts in information technology, health sciences, environmental science and engineering, and materials science and engineering.

The university provides the latest technical information, including access to the university's specialized equipment, faculty experts and students. The success rate for EDC businesses is higher than 85 percent; more than 50 businesses have graduated from the incubator facility.

Based on its experience in high-tech business incubation, NJIT has placed a focus on increasing the depth and breadth of services that these incubators can offer to resident firms. In particular, the objective should be to promote **business acceleration** – growing companies more rapidly from business concept to fledgling business. On the technological front, underwriting the expense of access to university based personnel and equipment assets and facilitating the ability to compete for federal and foundation grant funding will more rapidly move companies to critical "proof of concept" and reduce the inherent risk to investors. In addition, adding new professional services liked shared support for marketing, information technology infrastructure, management team building and other critical growth items will increase the flow of successful businesses from existing incubators. NJIT has won several grants from the NJCS&T and has application spending with the National Science Foundation to further enhance its concepts for new business acceleration – and these are viewed as critical competitive advantages for the NJ-EDA led **Innovation Zone** program in Newark.

II.I.9. Helping Businesses Get Lean

More that 100 New Jersey manufacturing firms benefited this year from the technical assistance programs of the Center for Manufacturing Systems (CMS). The center, directed by Wayne Chaneski, offers services that range from identifying short-term productivity improvement opportunities to long-term engagements geared toward streamlining entire operations. CMS also assisted companies with product design and prototyping, process development, plant layout, machining of complex parts, and training in modern manufacturing concepts.

Training in lean manufacturing is one of the center's most popular services. Lean techniques -- inventory reduction, reduced lead time, continuous flow, increased flexibility -- are critical to the small and mid-sized manufacturing businesses that are the center's clients. One project for Purepac Pharmaceutical, an Elizabeth-based manufacturer of generic drugs, focused on reducing setup time -- the time a machine is out of service for changeover between the end of one run and the beginning of another. The CMS team videotaped an actual machine setup, then helped employees to review the process and identify solutions to problems. One department also got 5S training (Sort, Set-in-Order, Shine, Standardize, and Sustain) for improving efficiency by reorganizing workspace.

II.I.10. New Jersey Immunization Information System and the New Jersey Local Information Network & Communications System

NJIT has put into production for statewide use the New Jersey Immunization Information System (NJIIS) and the New Jersey Local Information Network and Communications System (NJLINCS) for the New Jersey Department of Health and Senior Services (NJDHSS).

NJIIS is an on-line immunization registry capable of enrolling all New Jersey children at birth and recording and evaluating their immunization histories for completeness under the Center for Disease Control and Prevention's current guidelines. Over 150,000 children are currently in the registry and more than 150 health departments, clinics and private physician's offices are currently participating via dial in modems or the Internet. NJIT installs client software at user sites, operates the servers and provides administrative and technical support for the NJIIS.

NJLINCS is an Internet based communications system that will link all local health departments with the NJDHSS in Trenton. NJLINCS provides rapid, two-way communication between state health officials and local health officers for dissemination and collection of health related information and data. NJIT operates the servers and provides administrative and technical support for the NJLINCS.

II.I.11. Assistance to Business

NJIT offers direct assistance to business through several services to small- and medium-sized businesses to encourage their growth and success. These services are delivered primarily through NJIT's six-business assistance centers:

- Technology Extension Program in Manufacturing Engineering (a component of the New Jersey Manufacturing Extension Partnership – NJMEP): a statewide manufacturing extension program to help small- and medium-sized manufacturing businesses to modernize and become more competitive
- Center for Information Age Technology (CIAT): integrates computer technology into the operations of New Jersey business, government, non-profit and educational organizations
- Center for Manufacturing Systems: assists manufacturers with prototype product development, process improvement and modernization with high speed machining center, advanced CAD/CAM and rapid prototyping facilities.
- Defense Procurement Technical Assistance Center: helps New Jersey small businesses obtain defense and other federal contracts

- Enterprise Development Center I, II and III: small business incubators that help new and developing enterprises survive the typically difficult start-up stages;
- New Jersey Technical Assistance Program (NJTAP): helps New Jersey small- and medium-sized businesses comply with state and federal pollution prevention regulations;
- Micro-fabrication Center: serves to assist businesses with design and fabrication services related to silicon processing technologies in the university's clean room for MEMS and CMOS processing;
- Polymer Processing Institute: provides assistance to small businesses in processing of polymers and plastics.

NJIT also provides assistance to business through workforce development activities, research activities, economic development activities, and public service activities.

II.I.12. Workforce Development

Almost all NJIT activities are related to workforce development. These activities include, but are not limited to:

- Undergraduate and graduate degree programs – as of June 2006 NJIT has granted 870 bachelor's degrees, 917 masters degrees, and 75 doctoral degrees
- Continuing professional education programs
- Weekend University Program
- Cooperative education program
- Community and Public Service program
- Career Planning and Placement programs
- Programs designed to recruit and retain under-represented groups in NJIT's technology oriented degree fields (e.g., women and minorities are nationally under-represented in the engineering profession)
- Assessment of the skills and knowledge needed by the workforce
- Continual curriculum review to ensure that NJIT students develop the needed skills and knowledge
- Development of additional ways to develop needed skills and knowledge (e.g., Distance Learning, blended/hybrid courses, and courses offered in either a two semester or three semester format)
- Business Incubation programs
- Manufacturing Extension program

As an educational institution, NJIT has always tried to develop in its students the knowledge and skills they need to meet the needs of the New Jersey economy. In addition, NJIT has always designed and conducted programs which serve "cradle to gray" educational needs. That is, at the one end, there are programs for K-12

students which build the pipeline of future professionals; at the middle end, our undergraduate and graduate programs for traditionally aged college students emphasize relevant learning both inside and outside the classroom and are conducted in ways which overcome obstacles of socio-economic class and geography so as to enable access to higher education goals; and, at the other end, there are programs for incumbent and dislocated professionals which upgrade skills and knowledge and combat obsolesce. Together these programs produce the human capital that helps the economy of New Jersey resist and respond to the accelerating pressures of globalization and business restructuring. As workforce needs change, so does NJIT.

In response to changing workforce needs, for example, NJIT has introduced more than 10 new degree programs over the last two decades; introduced a Weekend University Program in 2005 for adults 24 years and older; and launched an activity in 2006 to provide advanced education at the workplace to professionals in industrial sectors important to the NJ economy. These programs include pharmaceutical engineering, homeland security, physical and digital counter-terrorism; emergency response management; biomedical engineering, biological computational biology, environmental engineering, engineering management, and environmental science.

Effective in 2002, the NJIT College of Computing Sciences introduced a completely re-designed senior project Capstone course, utilizing projects from industry, faculty and students as the basis for team-oriented projects. In these projects, student teams analyze, diagnose and model system requirements to produce well-engineered and well-documented software products. The capstone program was able to establish project-based relationships with sponsors in which more than 50 are external business or organizations to NJIT.

Long recognized for it prowess in quality distance learning, NJIT continued to make select distance-based undergraduate and graduate degrees and high employment demand graduate certificates available both to full and part-time students and to youthful and older learners. By permitting access to learning through a means which overcomes barriers of time and geography, NJIT helps to build the capacity of New Jersey's professional workforce.

The University Research Experience (URE), University Learning Center (ULC), and McNair grant program provided a range of technical assistance to Educational Opportunity Program (EOP) and minority students who historically have been under-represented in masters and Ph.D. degree programs. URE enables undergraduates, as early as the freshman year, to work with faculty on research projects and McNair takes their work into graduate degrees. }

Career Development Services (CDS) contributes to the university's and the state's economic and workforce development priorities by assisting New Jersey employers to become more productive and therefore more profitable. During

2008, over 4,400 companies used CDS as a source of prospective candidates for their organizations. Experiential education programs such as cooperative education and internships help organizations to greatly reduce the learning curve for new college graduates. Each year the university graduates a significantly greater percentage of students who enter the workplace at a more advanced knowledge and skill level. The conversion of cooperative education and internship assignments to full-time employment for students at or near graduation is a regular occurrence at NJIT. In many cases companies create positions within their organizations for purpose of retaining their valued student employees. Actual examples of where co-op conversion to full time positions occurred include: Mercedes-Benz USA; Eric Mullen Architect; Citigroup; Johnson & Johnson; Boston Scientific; and Bristol Myers.

Each year at NJIT over 1,000 students participate in some form of experiential education in such high demand fields of information technology, biomedical engineering and informatics, telecommunications and construction. One employer, Michael Smith, founder and president of General Devices, in Ridgefield, New Jersey, states, "All but a few of the 20 employees at General Devices have joined the company through student experiential education at NJIT. They design and manufacture advanced telemedicine and communications products for emergency medical services, hospital emergency rooms and public safety departments. We now depend on NJIT as our prime source of technical talent. As a small firm competing in a high-tech field, it's the talented, enthusiastic people coming to us at entry level who make it possible for us to succeed."

NJIT's expertise in workforce development has been widely recognized in many other ways. Recognizing that NJ is an under-producer of Science, Math, Engineering and Technology (SMET) undergraduate majors (less than 6% of NJ high school graduates intend to study engineering compared to the national average of 9%), NJIT has forged extensive partnerships with the math, science and technology high school "academies" of the county vocational-technical schools to deliver joint admissions, pre-engineering and college-level courses, articulated curricula, and advanced standing, thus enabling numerous students to enter NJIT in the last two years directly as sophomores. Similar initiatives exist between NJIT and the community colleges for students to progress seamlessly toward the completion of their BS degrees. In 2006, an innovative program of this nature was launched with Camden County College in Blackwood, NJ to permit their alumni to complete an NJIT BSIT degree in less than two years of full time study in courses offered on an accelerated basis. At the graduate level, there is a shortage of domestic students receiving SMET-related masters and PhD degrees. NJIT offers graduate certificates and executive master's degrees in subject areas of specific importance to New Jersey's economy at corporate extension sites (e.g.; Strkyer Orthopaedics and Verizon Wireless) and through distance learning. Showcased subject areas include: biomedical engineering, pharmaceutical manufacturing, homeland security, and engineering management.

As another example of an initiative to address this shortage, in 2006, NJIT formed separate agreements for accelerated programs with both New Jersey City University and William Paterson University. These programs permit these colleges' undergraduates in their senior year to progress seamlessly to NJIT MS degrees in computer science, information systems, applied mathematics and applied statistics in just one more year of full-time study.

In addition, NJIT has a well established network of business incubators with locations throughout the State, with NJIT currently housing New Jersey's largest concentration of incubator activity. Realizing the benefit to shifting the focus from merely adding capacity to a system for increasing the depth and breadth of services that incubators offer to resident firms, during this period, NJIT initiated a business acceleration program in order to facilitate the growth of companies more rapidly from business concept to fledgling business. Critical catalysts to growth made available to resident firms included underwriting the expense of access to NJIT-based personnel and equipment assets, strengthening the ability of resident firms to compete for federal and foundation grant funding, and providing shared support for marketing, and information technology infrastructure.

New Jersey Manufacturing Extension Partnership (NJMEP) is another example of a business acceleration program which is geared, in particular, to small- and medium-sized manufacturers. Effective in 1995, NJIT became part of a national program of manufacturing technical assistance run by the National Institute of Standards and Technology (NIST) of the U.S. Department of Commerce. The NJMEP incorporates a number of existing NJIT resources. Five manufacturing sub-sectors were identified as both critical to the growth of the regional economy and at-risk in the absence of assistance: metalworking and machinery, electronics and instrumentation, rubber and plastics, food processing, and textiles and apparel. A staff of 15 MEP field engineers is responsible for assisting small- and medium-sized businesses to adapt to changing regulations and business conditions by bringing them into contact with existing sources of aid, and for refining the state's understanding of their needs.

Continuing Professional Education (CPE) at NJIT has long been recognized as a leader in industry training and workforce development, as exemplified by the NJ Department of Labor and Workforce Development's Office of Customized Training. For example, during the last two years, NJIT conducted tailored in-house training for 3,400 NJ employees at their places of work. Other training partnerships were forged with NJ AFL-CIO for petro-chemical counter-terrorism security awareness, with the NJ State Police for counter-terrorism training and with several NJ Workforce Investment Boards (i.e. Newark and Altantic/Cape May) and community colleges for training in specific skill set areas. Alone and in partnership with the NJ Community College Workforce Consortium, CPE continued to use a distributed system of training at company sites and community colleges; and to select and oversee flexible teams of trainers who adeptly utilize selected teaching tools so as to accommodate adult learning styles and needs.

During the past two years NJIT has received substantial state grants to fund additional technology oriented workforce development projects. The Workforce Development Instructional and Outreach Program (PrE-IOP) is one example of such project which was concluded during this time period. It was created to enlarge the pool of qualified high-tech workers, including those who have been historically under-represented. The grant helped create standards-based engineering curricula for secondary schools and provided training for nearly 450 educators representing 147 New Jersey Schools. Evaluation results indicated that high school student attitudes towards engineers and engineering as a career increased from the beginning to the end of the school year following teachers' attendance in a PreE-IOP program.

Over the past two years, because of its successful track record with cutting edge academic curricula, customized contract training, distance learning technology utilization, business incubation, and manufacturing extension, among others, the institutional infrastructure of NJIT has been significantly strengthened to be poised to lead the development of workforce capacity building in the NJ higher education sector.

II.I.13. Culture/Cultural Events

NJIT provides a variety of cultural events. For example, NJIT collaborates with Rutgers-Newark to present four plays each year attended by a total of approximately 1200 people. There are also guest musicians and acting workshops. A co-curricular activity with both the "Musical Theater" and "Living Theater" courses at NJIT are student scripted and presented plays called "Stories from Home." To date, more than 150 stories have been told and approximately 50 have been scripted and performed.

In collaboration with Rutgers Newark and Essex County College, all special months are celebrated (Black History, Hispanic Heritage, Asian Pacific and Women's History). NJIT also celebrates World Week. In addition, on-going programs and activities are sponsored throughout the year. These include evening and weekend events with jazz bands and open mikes. Trips to diverse plays and events off-campus are also sponsored.

Student groups and the Office of the Dean of Student Services also present a variety of cultural events. NJIT is a co-sponsor of the annual Black film festival together with the Newark Museum and Rutgers University and the sponsor of the Black Maria Film Festival for young film makers.

II.I.14. Sports/Sport Events

The 2007-08 academic year set the stage for increased visibility for NJIT's athletic department in the seasons to come. Highlighting the changes was the completion of a plan to reclassify the men's soccer program into NCAA Division I. In fall 2004, the team, in its second year of the reclassification process, played a Division I schedule for the first time. The following year, they became members of the NCAA's highest-profile division. The university also anticipates full reclassification of its athletics program within the next year.

The university's athletic facilities were also improved. Lubetkin Field, home to the soccer teams, underwent a $1.2 million renovation which provided a new artificial grass surface, a walking track and improved landscaping. The main gymnasium floor and the four tennis courts were also resurfaced. For the baseball team, NJIT came to an agreement with the Newark Bears for the Highlanders to play all of their home games at Bears & Eagles Riverfront Stadium. The team responded by setting a school record for wins and having five all-conference performers, plus the Player of the Year and Coach of the Year. In total, nine athletes earned all-conference recognition and four were academic all-conference selections. NJIT continued its membership in the Central Atlantic Collegiate Conference, joining such local schools as Felician, Caldwell, and Bloomfield, which has significantly cut down on travel time and costs while affording NJIT the opportunity to foster local rivalries.

A total of 180 students received athletic scholarships in AY 2007-2008, used to supplement the unmet tuition need of student athletes identified by the athletic administration. The total amount awarded in AY 2007-08 was nearly $800,000. These students are all highly qualified student athletes whose academic and athletic skills will benefit the university as NJIT moves fully into Division I sports. During 2007-2008, NJIT honored 99 scholar-athletes who participated in varsity sports and earned a GPA of at least 3.0 for either Spring 2006 or Fall 2007. In 2007-08, the university will once again offer 15 intercollegiate varsity sports: baseball, M/W basketball, M/W cross country, M/W fencing, M/W soccer, M/W swimming, M/W tennis, and M/W volleyball.

II.I.15. Public Service, Charitable Efforts, Volunteerism

NJIT has produced numerous studies for the development of state policies, particularly for projects involving technology, transportation, alternative energy, and technology infrastructure. Most recently, NJIT has taken a leading role in the development of a security plan following the events of September 11 and in response to the need for greater homeland security. NJIT also has established a substantial level of outreach to the K-12 educational community in providing teacher development and special opportunities for children in science, math,

technology, and engineering education. Outstanding among NJIT's public service initiatives are:

- Activities related to University Heights Science Park (expected to generate 3000 jobs)
- Activities of the Center for Pre-College Programs – a national model for K-12 students and teachers in the sciences, mathematics and engineering. The program now serves over 3500 teachers, students, administrators, and parents.
- Activities of the Office of Community and Public Service which links classroom theory and concepts with practical applications in the community.

These practical applications include:

- Community Service Work-Study: More than twenty NJIT students worked for a dozen Newark area non-profit organizations during AYOl. Agencies sites included Newark Center for Families, Community in Schools-NJ, Community Agency Corporation, St Phillips Academy, Newark Emergency Services for Families, and the Historical Society. "

- NJIT Literacy Corps: Through collaboration with the Newark, America Reads Partnership, 40 NJlT work-study students tutored over 350 elementary age school children at 15 schools & organizations throughout the area.

- Service Learning: Over 350 NJIT students partnered with 75 non-profit agencies to complete over 10,000 hours of volunteer service linking their academic learning with practical experience. This year, EOP and Athletics Department incorporated service-learning activities into their programs to promote civic engagement opportunities for participants. Recent projects included: a group of CIS students who designed and constructed a major volunteer database for the United Way of Essex and West Hudson; for the Clifton Public Library and an EOP student, interested in oral communication, who interviewed senior citizens and developed a video documentary of community historical information for the Newark West Ward Neighborhood Association.

- Volunteer Clearinghouse: Collaborative volunteer activities were sponsored during the year with IFSC, Health Services, DOS, Residence Life, etc. Over 200 NJIT students volunteered for activities such as NJIT/Prudential Global Volunteer Day", NESF Community Tech Network ", United Way "Celebrity Reads" project, Newark Do Something "Give Back Day" and the annual IFSC "Blood Drive".

II.I.16. Special Recognition Projects

The *New Jersey Inventors Hall of Fame*, established in 1987, recognizes the state's inventing heritage and provides a permanent tribute to the individuals and corporations who have worked to advance technology. Outstanding New Jersey inventors are inducted into the Hall of Fame at an annual banquet held during the second week of February. A the same time, a select group of New Jersey inventors holding current patents are awarded *Inventor of the Year* citations and one corporation is named to the *Corporate Invention Hall of Fame*.

The *New Jersey Literary Hall of Fame* is dedicated to remembering and perpetuating the work of New Jersey authors. This recognition was started in 1976 to bring attention to the state's writers past and present. Each year, writers, known nationally and internationally, have been inducted. Books and other memorabilia of New Jersey's major writers have also been collected.

NJIT Archives now houses the collections of Dr. Herman Estrin and Edward Weston long time faculty member and founder of the New Jersey Literary Hall of Fame and the New Jersey Writers Conference. The NJIT Archives also includes the Edward Weston Collection. Edward Weston, one of the founders of the Newark Technical School, is known for his research and development in the fields of electroplating, lighting, and electronic measurements. The NJIT Archives now has many of his papers, including patent litigation, hundreds of mechanical drawings of his equipment, and museum displays of his equipment. The NJIT archives have also begun to digitize and make accessible over the web, NJIT theses and dissertations as well as some yearbooks and other university materials of interest to researchers and alumni.