

NEW JERSEY INSTITUTE OF TECHNOLOGY FY2005 BUDGET REQUEST

PRIORITY PACKAGES INTRODUCTION

The following pages relate to the University's priority packages. The programs described are consistent with the ongoing university strategic activities permitting a clear linkage between planning and budgeting activities, as well as reflecting external economic factors. The Priority Packages are fully consistent with fulfilling NJIT's mission.

Strategic Plan for NJIT

NJIT is completing an updated Strategic Plan; a focused, actionable plan with resources behind implementation. The Planning Committee of the Board of Overseers, working with the NJIT administration, has developed a planning process, **ViSTa** - A Strategic Planning Process for NJIT: Vision - Strategy - Tactics, which has been followed as appropriate in the planning effort.

The **ViSTa** Steering Committee developed a Draft Strategic Plan, through the Strategic Priority and Strategic Objective level. A Strategic Priority is a fundamental issue an organization addresses to deliver on its value proposition and achieve its mission. Strategic Objectives specify the milestones the organization will work toward to address its Strategic Priorities and are specific, measurable, imply action, challenging yet attainable, and have a completion date. Priorities and Objectives may change over time.

Vision: Purpose / Principles / Mission

Mission

NJIT is the *state's technological research university*, committed to the pursuit of excellence ----

- in undergraduate, graduate, and continuing professional *education*, preparing students for productive careers and amplifying their potential for lifelong personal and professional growth;
- in the conduct of *research* with emphasis on applied, interdisciplinary efforts encompassing architecture, the sciences, including the health sciences, engineering, mathematics, transportation and infrastructure systems, information and communications technologies;
- in contributing to the state's *economic development* through the state's largest business incubator system, workforce development, joint ventures with government and the business community, and through the development of intellectual property;
- in *service* to both its urban environment and the broader society of the state and nation by conducting public policy studies, making educational opportunities widely available, and initiating community-building projects.

NJIT prepares its graduates for positions of leadership as professionals and as citizens; provides educational opportunities for a broadly diverse student body; responds to needs of large and small businesses, state and local governmental agencies, and civic organizations; partners with educational institutions at all levels to accomplish its mission; and advances the uses of technology as a means of improving the quality of life.

Vision

A preeminent technological research university known for innovation, entrepreneurship, and engagement.

Core Values

Our core values reflect our beliefs, guide our behavior, shape our culture, and in so doing establish a sense of community and common purpose.

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- **Excellence** - We pursue excellence in all that we do and will be satisfied with nothing less than meeting and sustaining the highest standards of performance.
- **Integrity** – We are honest and ethical in all we do, keep our promises, and acknowledge our mistakes.
- **Student-Centered** – We care for our students as individuals and make every effort to build enduring relationships by responding to their needs.
- **Civility** – We treat each other with respect and with dignity and communicate frequently and with candor.
- **Diversity** – We celebrate the diversity of our university community and are sensitive to cultural and personal differences. We do not tolerate discrimination of any form.

Strategy: Core Competencies / Value proposition / Strategic Priorities and Objectives

Value Proposition

NJIT provides accessible, affordable education for the technological professions to a diverse student body, delivers practical research results to its sponsors, and is an active participant in the life of the community in which it lives.

Goals

NJIT's goals are to:

- enhance our educational programs,
- enhance and focus our research efforts,
- strengthen our sense of community,
- enhance our revenue base,
- impact the economy, and
- strengthen our efforts in civic engagement.

Five Strategic Priorities

- Enhance and enrich the quality of life of the university community and ensure a focus on the student.
- Increase revenue from private sources.
- Develop a core of nationally recognized programs.
- Improve national rankings in research and intellectual property development.
- Become nationally recognized for attracting high achieving students from diverse national and international populations.

Strategic Objectives and Tactics: Action Plan

In order to make the plan actionable, a number of Strategic Objectives around which ten campus-wide Task Forces have been created to establish Tactics to achieve the Objectives. Tactics describe the actual actions that will be taken. The task forces are as follows:

Priority: Enhance and enrich the quality of life of the university community and ensure a focus on the student.

Task Force #1

Develop and implement a landscaping/campus appearance enhancement plan, including improvement of the interior condition of buildings, by 2005 followed by completion of a facilities and infrastructure master plan by 2006.

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Task Force #2

Systematically reengineer administrative and academic processes to improve customer and student satisfaction over the next five years.

Task Force #3

Move the men's soccer program to NCAA Division I status by spring 2005 as an integral part of the move of the university's intercollegiate athletics program from NCAA Division II to Division I.

Task Force #4

Implement high-profile, intellectually stimulating on-campus events by 2005.

Priority: Increase revenue from private sources.

Task Force #5

- Increase the percentage of alumni donors from 16% to 21%, the mean for Tier II National Doctoral institutions, in three years.
- Increase gift revenue from private sources, exclusive of gifts-in-kind, by 5% annually for the next three years.
- Successfully launch and complete two focused capital campaigns within the next three years.
- Launch the quiet phase of a comprehensive capital campaign in three years.

Priority: Develop a core of nationally recognized programs.

Task Force #6

- Build three programs to national prominence by 2008.
- Strengthen by 2005 three niche areas with high potential for NJIT and the State of New Jersey.

Task Force #7

Develop and implement a marketing program by 2005 that impacts constituents and local, regional, and national media.

Priority: Improve national rankings in research and intellectual property development.

Task Force #8

- Double externally sponsored research and development expenditures over the next 5 years.
- Increase number of faculty awards to at least the average of a select set of benchmark peer institutions within five years.
- Reach and maintain a three-year average of 60 PhD graduates per year in 15 disciplines within five years.

Task Force #9

Increase the number of licenses from university held intellectual property to at least the average of a select set of benchmark peer institutions within five years.

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Priority: Become nationally recognized for attracting high achieving students from diverse national and international populations.

Task Force #10

- Increase enrollment by fall of 2008 in the Albert Dorman Honors College to 1 of 5 freshmen, of newly admitted undergraduate students, excluding undeclared, to 25% women, 15% African-American and 15% Hispanic.
- Increase the mean SAT score by 20 points for an incoming freshman class of at least 750 by 2005.
- Increase the graduation rate of first-time, full-time freshmen (FTFTF) to 55% by fall 2010.

The FY2005 budget request identifies **\$18.4** million in university priorities, which are detailed in the following narratives. These funds would complement approximately \$2 million initially allocated to support development of these priorities. Funding of the priorities identified will stabilize existing university programs and provide for implementation of the Strategic Plan as well as offer expanded, quality education to the citizens of the State.

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DEVELOP A CORE OF NATIONALLY RECOGNIZED PROGRAMS

NJIT's *Vision Statement* clearly describes the University's goal of reaching new levels of institutional excellence in service to the people within the community, state and nation. Degree programs and curricula will prepare students to assume positions of leadership as professionals and entrepreneurs. NJIT graduates will be engineers, scientists, architects, technologists, managers, social scientists, and policy-makers with a broad understanding of economic, social and organizational issues; with excellent communication skills as well as specialized technical competence; with the interpersonal skills needed to work well in teams; with social awareness, ethical values, and moral integrity as underpinnings for personal growth and responsible citizenship; and with a record of both practical work experience and community service as components of their education.

NJIT's academic fabric is defined by the presence of a research faculty engaged in undergraduate instruction, continuing professional education, and graduate education leading to the research doctorate, the Ph.D. NJIT has made spectacular progress in recent years in attracting the faculty members who created and strengthened this kind of environment. They generate a high and increasing level of federal and corporate research funding. They integrate what they have learned from their own research into the material they teach. And they routinely expect each Ph.D. student to initiate or participate in a substantial program of original research. The unity of the teaching and research functions is a way of life at NJIT.

FY2005 proposed programs are consistent with the university's teaching and learning goals, which are:

To ensure that the curriculum remains congruent with the realities of a demographically and technologically dynamic world and to modify curricula and teaching and learning modalities with a view toward educating for leadership in a global economy,

- To enhance student awareness of an increasingly complex, diverse and interdependent world,
- To continue to expand the use of computing hardware and software and other advanced technologies,
- To expand links between what students and faculty do on campus and their experiences in industry and other professional settings,
- To strengthen and enhance student analytical and communications skills,
- To improve undergraduate and graduate teaching skills,
- To support programs that foster teaching excellence and the use of effective teaching techniques,
- To assess more effectively the quality of teaching as part of the promotion and tenure process,
- To create a learning environment that better serves and supports underrepresented student groups such as women and minorities,
- To improve retention across all student populations,
- To implement a planned increase in outcomes assessment activities,
- To link study in the major to a system of outcomes assessment,

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- To review academic programs on a regular basis
- To improve the integration of the university's various assessment-related activities, and
- To embrace quality improvement as a major objective in both academic and administrative functions.

Build Three Programs to National Prominence By 2008

1. Wireless Communications and Networking
2. Department of Mathematical Sciences
3. New Jersey School of Architecture

1. Wireless Communications and Networking

Wireless Communications and Networking combines two research focus areas in the Department of Electrical and Computer Engineering (ECE). There is already a significant strength in the areas of wireless communications and signal processing and networking that is recognized at the national level and supported through a number of federal grants including grants from NSF, US Army, AFOSR. In addition, there are substantial grants and contracts from industry through direct and SBIR contracts. The total external funding in this research program area exceeds \$3 million per year. The overall research in this strategic area also provides the foundation of interdisciplinary research with Computer Architecture and Digital Systems, and Solid-State, VLSI and Electro-Optics Systems.

The applications of wireless communications, networking and security system technologies include a wide spectrum of priority and strategic areas defined by the national federal funding agencies (NSF, US Army, DoD, NSA, NIH) and leading industries (AT&T-Bell Labs, Lucent Technologies, Telecordia, Lockheed Martin, Mitsubishi, MITRE Corp, Northrup Grumman and SAIC). The application areas include mobile communications, e-commerce, health care, medical telemetry, military, and homeland security. These activities in developing core and application technologies link several faculty members from ECE and other Departments (Computer Science, Information Systems and Physics) at NJIT.

The proposed initiative will strengthen and enhance work on important research problems currently pursued by members of the Center for Communications and Signal Processing Research. These topics have been also been recently identified by the international 4G forum as some of the key technologies for future standards: packet data communication over coded CDMA with hybrid ARQ: multi-carrier systems and OFDM systems: ultra-wideband (UWB) communications including low SNR systems, UWB transceivers, UWB antenna design, channel modeling, and experiments: MIMO systems including MIMO_OFDM techniques for 4G wide-area networks.

The systems and infrastructure of the next generation wireless will have to handle a much expanded volume of information, new applications that will require faster data rates as well as a mix of data rates, improved quality of service, and vastly improved security. Ubiquitous services and global mobility will require solutions that allow for seamless transition between network infrastructures. It is clear that to address the challenging problems of the next generation wireless systems will require

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the cross collaboration among researchers at the physical layer, networking layer, and security protocols. This initiative will provide the platform for researchers in ECE in wireless techniques, networking, and security along with strengths in hardware RF transceivers, antenna systems, and signal processing to link together, collaborate and attract future funds from major funding agencies and industry partnerships.

The synergy described above with strategic program enhancement focused on wireless communications, networking and security will provide the ECE Department necessary and critical enhancement of strength to establish a nationally recognized and ranked Program of Excellence. This reputation is much needed to improve the collaborative research funding by at least 50% and to attract domestic and international high quality Ph.D. students to pursue research at the cutting edge. This will directly impact the growth in student enrollment and graduation. Further, the goal is to graduate 15-20 Ph.D. students per year in the Electrical and Computer Engineering Department.

Wireless communications, networking and security are major areas of future industrial growth with significant opportunities for commercialization. New Jersey is a leading location in the country that has attracted major national and international communication industries. The knowledge base developed through this initiative will impact NJ industries on developing new network communication and security technologies through technology transfer and its commercialization and hiring of trained researchers. The proposed industry collaborations and partnerships would provide students with a rewarding industry-based perspective in education and research. The collaborative effort will be valuable in training a future workforce as well as help future product development and commercialization. The proposed program will also help in establishing small-scale industries through NJIT incubator facilities for creating new companies and jobs. For example, new 4th Generation communications system technology is of strategic interest to industry and academic research community. The implementation of 4G wireless communication technology along with networking application in home, community and business environment is expected to open new job markets and industrial growth.

The overall goal for the proposed initiative is to elevate the ECE Department into the top 50 in the nation, according to the U.S. News and World Report graduate ranking. The following key performance indicators are listed for outcome assessment:

1. Increase in external research funding by 100 percent by 2008.
2. More than 10 Ph.D. graduates per year from the proposed research program (the Department goal is 15-20 Ph.D. per year for the ECE Department).
3. 100 percent increase in referred journal and conference publications.
4. 100 percent increase in citation of research papers by the faculty and students in the program area.
5. Enhancement in national and international recognition of the program.

Strategic investment in Wireless Communications and Networking consists of strategic hiring in key areas and enhancing the infrastructure support and facilities. This program focus provides the best opportunity for further enhancement of national and international recognition. In order to strengthen this program, the following investment plan is proposed.

- 1. New faculty in key areas to strengthen the research focus of the program.**
 - (i) A senior faculty member in networking with emphasis on higher layers, applications, and security. This is a senior level position with a demonstrated track record of successful leadership and collaborative research to strengthen and synergize the research productivity in

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this area for national recognition.

- (ii) A junior/mid level faculty member in signal processing theory and applications.
 - (iii) A junior/mid level faculty member in sensor networks/communications for strengthening the communications and networking research with the new spectrum of emerging applications such as home networking and medical telemetry.
2. **Establish start-up funds for the senior and junior level positions.** The senior-level position requires a start-up package and matching support to accelerate the growth of collaborative synergy for bringing the funding and reputation among the top-ranked programs in the nation.
 3. **Enhance research infrastructure support and national and international research scholar exchange programs** with top-ranked national and international universities. This initiative would provide matching financial support for Post-Docs and Visiting Research Scholars from internationally known institutions to stimulate and explore new research domains.
 4. **Establish liaison and enhance exposure to the targeted funding agencies and industry** including NSF, US Army, DARPA, Sarnoff, MITRE, TASC, CISCO, Mitsubishi, Panasonic and IBM through visits, briefings and seminars. Fall 2003-08.
 5. **Work with incubator companies to develop key projects** targeted at intellectual property development and technology transfer. Spring 2003-08.
 6. **Work with NJIT Research Office, US Army CECOM and participating industries and institutions** for submission of partnership based proposals for block and federal appropriated funding. Fall 2003-08.
 7. **Organize workshops and seminars to enhance visibility and peer interaction.** Fall 2003.
 8. **Develop research fellowships** to attract high-quality domestic Ph.D. students. Fall 2004.
 9. **Provide much-needed space for research operations for faculty, students and visitors.** The space is much limited in the ECE Department to support the growth in grants and Ph.D. student enrollment. With additional research active faculty, it will be critically important to provide additional space for research operations in this program. The expansion of the ECE building to put up 4th and 5th floors has been approved for many years but has been postponed due to budget cuts. One entire floor is proposed to house various research laboratories, students and visiting scholars in the area of Wireless Communications, Networking and Security. It is expected that such proximity and synergy will be a catalyst in accelerating the growth and research productivity of the proposed program for regional, national and international recognition.
 10. **Strengthen existing research center.** The NJIT Foundation Center for Communications and Signal Processing Research founded in 1986, has established a national and international reputation. The Center currently supports research in the amount of \$700K per year. The goal is to increase the funded research by at least 100 percent by 2008. That requires an investment to upgrade the Center's equipment to the level required for cutting edge research in 4G wireless technologies. Fall 2003-Fall 2004.

Budget Summary Wireless Communications and Networking:

Faculty (3)	\$260,000
Research Administrator (1)	\$65,000
Visiting Scholar Program	\$200,000
Workshops / Seminars / Conferences	\$50,000
Research Fellowships	\$150,000
Start-up Packages	<u>\$550,000</u>
Total Identified Needs:	\$1,275,000

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Total Identified Needs (\$000's) Wireless Communications and Networking				
FTE #	Salary	Start-Up	Equipment/Gen. Operating	Grand Total
4	\$325	\$550	\$400	\$1,275

2. Department of Mathematical Sciences

Summary: It is proposed to leverage and build upon existing strengths in the Department of Mathematical Sciences (DMS) in the areas of (1) Mathematical Biology and (2) Mathematical Fluid Dynamics in order to elevate the Department to national prominence within five years. In addition to enhancing research productivity in these areas, major efforts will be directed at exploiting natural synergistic research opportunities with other active groups within and outside NJIT in order to increase significantly research funding. The organization of conferences/workshops and other activities with the larger mathematical communities will lead to the recognition of NJIT as a center of research and programmatic excellence in these two disciplines.

National prominence will be attained by the DMS by focusing on two of its strongest research components - Mathematical Biology and Mathematical Fluid Dynamics. Success in this proposed program will propel the DMS into national prominence.

2. Departmental Initiatives

In seeking a path for the Department of Mathematical Sciences to achieve national prominence, there are a number of Departmental activities planned to achieve this goal. Over the past decade, the DMS has worked hard to establish itself as one of the best programs at NJIT. These efforts have resulted in some limited national recognition, but to achieve national prominence will require considerable expansion of Departmental activities. There are several strategies that are envisioned that will support the proposed activities of these focus groups, namely the Mathematical Biology Group (MBG) and the Mathematical Fluid Dynamics Group (MFDG), as well as other researchers in the Department, and will contribute substantially to efforts to attain national prominence. These supporting activities are:

2.1. Hire an additional faculty member. This is needed to bring fresh research perspectives to the DMS and to support the envisaged expansions in research and in undergraduate and graduate activities.

2.2. Establish a Distinguished Visiting Professor Program. Each year we will select one (or two) internationally recognized leaders in Mathematical Biology and Mathematical Fluid Dynamics to spend a year (or semester) at NJIT. This could be accomplished by having these visitors spend their sabbatical year at NJIT. This program will raise the visibility of the DMS and enhance our research efforts. There are many outstanding mathematical scientists that may be interested in such positions, and we shall work closely with nearby institutions, such as the Courant Institute at NYU, to share support for these distinguished visitors.

2.3. Establish NJIT Postdoctoral Fellowships in the Mathematical Sciences. Each year we shall invite applications to fill NJIT Postdoctoral Fellowship positions in the Mathematical Sciences with a stated preference for experts in mathematical biology and mathematical fluid dynamics. We shall offer an attractive salary in order to recruit the best applicants. The visibility of these fellowships will increase our stature, and the outstanding postdocs will increase our research productivity. The successful training and professional placement of our postdoctoral fellows will relay the prominence

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of our program to the community.

2.4. Establish NJIT Doctoral Fellowships in the Mathematical Sciences. Each year we shall support outstanding Ph.D. students with NJIT Doctoral Fellowships that pay a competitive annual stipend. We expect these to be highly competitive and to attract outstanding students into our Ph.D. Program. Concomitant with this initiative to increase the number of excellent graduate students in our doctoral program, the number of Ph.D. graduates should increase from 3-5 per year to 5-7 per year.

2.5 Research Experience for Undergraduates (REU). The quality of our best undergraduate students has improved to a standard where they can be involved in high-level research. This will be achieved through academic year and summer research opportunities.

2.6. Renovate our facilities and upgrade equipment. A top tier department typically has modern, comfortable facilities that make a very positive impression on visitors and encourage faculty members and students to interact within the department. As our space demands have changed over the past decade, and continue to change, we need to make renovations consistent with our goal of national prominence. We also plan to upgrade our computers that are used by faculty and students in their research and teaching.

2.7. Provide additional travel support for faculty, postdocs, and students. In order to achieve national prominence, we need to send faculty, students, and postdocs in the focus areas to more conferences to give oral and poster presentations on their research.

2.8. Establish a named lecture series to bring prominent applied mathematicians in Mathematical Biology and in Mathematical Fluid Dynamics to NJIT. This lecture series could be called the NJIT or CAMS Lecture Series in Applied Mathematics, and the speakers will be predominantly Mathematical Biologists and Mathematical Fluid Dynamicists. The lecturer will give one technical talk and another talk for a more general audience. In addition to highlighting research in these two areas, our researchers will be exposed to different points of view and to a wider range of research topics. Such visits will facilitate useful research connections and could lead to collaborations.

2.9. Organize and host regional biennial workshops/conferences on Computational Neuroscience and Mathematical Fluid Dynamics. There will be an annual regional workshop/conference alternating between Computational Neuroscience and Mathematical Fluid Dynamics. There are large concentrations of Computational Neuroscientists and Mathematical Fluid Dynamicists in the Northeast and along the Atlantic coast to Washington, DC. Workshops centrally located in Newark would attract a large number of participants. These workshops will aid us in keeping abreast of the latest work in these fields, and provide opportunities for making potentially useful connections with leaders in these fields. Efforts will be made to enlist nearby research groups to help in the organization of these workshops.

2.10. Organize more mini-symposia in Mathematical Biology and in Mathematical Fluid Dynamics at major conferences. Members of the MBG and MFDG have organized full-scale conferences (e.g., an AMS-IMA-SIAM Summer Research Conference in the Mathematical Sciences, 1995; Pacific Rim Conference on Mathematics, 2001) as well as several mini-symposia on special topics at national and international conferences. Members of these groups have been invited to give plenary lectures at leading national and international conferences. We plan to increase these activities in order to underscore our leadership in certain research areas and strengthen our ties with other leaders in these fields.

2.11. Hire a research administrator. The activities aimed at achieving national prominence are extensive and require additional dedicated staff support. Therefore, we propose to hire a research administrator whose sole duties will be to provide support for the infrastructure of our plans, such as advertising, conference and workshop organization, keeping abreast of national research initiatives, and administrative requirements associated with postdoctoral, lecture series, and visiting professor positions. In addition, he or she would be responsible for all financial and administrative aspects of

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research grants and maintaining websites for the focus groups. We will seek a person who has at least an MS in the mathematical sciences and is keenly interested in being part of our plans to achieve national prominence.

2.12. Nominate faculty for prizes and awards. National and international awards are effective in advertising the strengths of the awardees and their departments. Such awards serve to boost morale and establish higher standards.

2.13. Review the teaching loads of faculty in our focus groups relative to their research productivity.

2.14. Submit a VIGRE proposal. Our activities in submitting RTG and MCTP proposals have convinced us that we can submit a very competitive Vertical Integration of Research and Education in the Mathematical Sciences (VIGRE) proposal to NSF. If we succeed, we will be in the same league as the top tier departments.

2.15. Improve our advertising material. We have several flyers for advertising our programs and research groups. These flyers need updates and improvements to recruit more and better students and postdocs.

2.16. Host the Industrial Mathematics Summer Workshop. Delaware and RPI have been organizing and hosting the Industrial Workshop for several years, and have benefited in terms of their reputations and collaborative research activities with industry. We now have the critical mass of faculty to serve as the host of this Workshop, and we plan to pursue this. In addition to increasing our visibility in industrial research in mathematical biology and fluid dynamics, the industrial contacts made as a result of these efforts should help in obtaining summer internships for our students and positions in industry for our graduates.

2.17. Nominate members in the focus areas to editorial boards of leading journals. Presently, faculty members of DMS serve on over a dozen editorial boards of research journals in Applied Mathematics, including two Co-Editors-in-Chief and Vice President for Publications of the Society for Industrial and Applied Mathematics. When opportunities arise to add to these and other journal editorial boards, we shall use our influence to place DMS members on these boards. Memberships on these boards are an important measure of the stature of the DMS.

2.18. Create a quarterly newsletter on Applied Mathematics at NJIT. This will be an excellent vehicle for advertising our local activities to potential students and the professional community of applied mathematicians.

3. Mathematical Biology

The Mathematical Biology Group has ten very active and productive faculty members and an Associate Research Professor in Mathematical Biology – with particular strengths in Mathematical Neuroscience and Computational Biology. The MBG is one of the largest research Mathematical Biology Groups in the country and can be established as one of the premier groups with the addition of activities and resources that will expand, highlight, and advertise our strengths in this area. The MBG is a prolific research group with eight grants from major funding agencies such as the NIH, NSF, and the Whitaker Foundation.

Research highlights. The members of the MBG are pursuing a variety of research projects in mathematical physiology, and, in particular, in mathematical and computational neuroscience. These include:

- Determining the uses or roles for short-term synaptic plasticity in neuronal networks and its role in creating multiple rhythms as well as how it mediates transitions between these rhythms.
- Study of mechanisms of short-term synaptic facilitation and other calcium-dependent processes involved in neurotransmitter secretion, and modeling of presynaptic calcium diffusion and buffering.
- Determining how neurons in the visual cortex process elementary features of the visual scene

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and how recurrent networks perform computations.

- Explaining the cellular mechanisms in the long-term homeostatic regulation of the pyloric network underlying the transitions between two modes of the rhythmic neural activity.
- Biological pathway modeling to describe quantitatively sub-cellular networks of biochemical reactions and signal transduction pathways.
- Quantification of the time course of drugs and metabolites in various tissue and fluid compartments of the body with extrapolation across species.
- A Research Coordination Networks grant to combine research from several laboratories at different universities on an extensively studied small neuronal network to produce a comprehensive model.
- Modeling and computational analysis of cell communication in *Drosophila* oogenesis to develop mechanistic models of cell-cell communication in developing epithelial layers.
- Combining experimental and modeling approaches to analyze short-term synaptic dynamics within a small network in the crustacean central nervous system.
- Examining the effects of chemical actions of neuromodulators in a small rhythmic neuronal network.
- Developing ion diffusion models of spatial buffering and spreading cortical depression, a slow wave phenomenon observed in the cortex of the brain.
- Modeling of the immunocolloid labeling process using deterministic models to learn how to choose conditions rationally so as to optimize labeling of target molecules.

With the wealth of talent and expertise residing in the MBG, national prominence is well within reach, and can be achieved in five years by taking the following additional steps:

3.1. Identify and encourage research synergies. The MBG's strengths make it ideally positioned to serve as a catalyst and provide leadership in multidisciplinary research with UMDNJ and active groups at NJIT and Rutgers-Newark in such areas as biology, biomedical engineering, and computational biology. The extensive breadth and depth in mathematical neuroscience in the MBG at NJIT provide the potential for collaborations with the members of the Center for Molecular and Behavioral Neuroscience at Rutgers-Newark. There already exists collaboration within the group between mathematical and experimental researchers. Two members of the MBG have joint appointments in Biomedical Engineering, and another two are also in the Federated Department of Biological Sciences. This will foster further collaborations in research and funding with investigators in those programs.

3.2. Organize and host the Annual Meeting of the Society for Mathematical Biology and/or the SIAM Life Sciences Conference at least once at NJIT during the next five years. The Society for Mathematical Biology is the only national society devoted exclusively to Mathematical Biology. Its annual meetings are held in locations as far away as Hawaii, Mexico City, and Dundee, UK. The Society for Industrial and Applied Mathematics (SIAM) is the nation's largest organization for Applied Mathematics, which now has an Activity Group on Life Sciences. The SIAM Conferences on Life Sciences began last year and covered all aspects of the life sciences. These important SIAM conferences are organized by researchers from prominent and influential Mathematical Biology groups. Organizing one of these conferences would establish us as major players in the field.

4. Mathematical Fluid Dynamics

The Mathematical Fluid Dynamics Group has a critical mass of ten research faculty, two research professors in mathematical sciences, and three faculty members from Mechanical Engineering, several of whom have national and international reputations in Mathematical Sciences. The group should achieve national prominence within five years given the necessary resources. The MFDG already is one of the better Mathematical Fluid Dynamics Groups in the country. Members of the

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MFDG have carved out some significant niche areas in analytical and computational fluid dynamics research, with specialties in interfacial fluids and microfluidics, and some related activities in fluid/particulate flows, chaotic flows, combustion, and biofluids. The MFDG has eight research grants from major funding agencies such as the NSF, AFOSR, and NASA, and makes a significant contribution to the overall research profile of the DMS with many journal publications and presentations at prestigious conferences and workshops. More than half of all Ph.D.s produced by the DMS have been in the area of fluid dynamics. MFDG members also played key roles in the RTG and MCTP proposals that the DMS submitted to the NSF for support of research, education, and mentoring. If these multi-million dollar proposals are funded, this will give us greater visibility and move us closer to achieving our goal of national prominence. A member of the Mathematical Fluid Dynamics Group is also competing for the highly prestigious FRG (Focused Research Group) grant from NSF.

The DMS will expand efforts to take advantage of several natural synergies with groups of active researchers in Newark College of Engineering (NCE), thereby enhancing the standing of the MFDG and the groups with which it interacts. In particular, the following steps will be taken to advance the MFDG to national prominence within the next five years:

4.1. Collaborations to obtain multidisciplinary grants. There are ample opportunities for obtaining large-scale multidisciplinary grants in fluids-related areas by collaborating with teams in NCE. These will be fully pursued.

4.2. Joint research with Mechanical Engineering. The MFDG has ongoing collaborations with the fluids group in Mechanical Engineering (ME) headed by Nadine Aubry. Our collaborative efforts with ME also extend to teaching, course development, and research activities in the fluids area. The MFDG is playing a leadership role in the niche effort proposed by ME in "Advanced Fluidics for Biological Applications and Technologies," with particular contributions in the areas of control of microjet breakup, multiphase dispersive jets for biological arrays, and microjet fabrication. Our theoretical expertise along with that in ME will be combined with experimental investigations within the niche to produce prominent research that will raise the NJIT profile in this special niche to national prominence.

4.3. Joint research with other departments in NCE. Previous productive joint research efforts with researchers in the Department of Chemical Engineering possibly can be reinvigorated. Also, some joint work in suspended particle segregation with J. Meegoda of the Department of Civil and Environmental Engineering appears to have considerable potential for funding.

5. Timetable and Milestones

The major milestones to be achieved over the proposed five-year duration can be measured by a steady increase in quality publications, a continual growth in research funding, and an expansion of multidisciplinary research activities. It is expected that a 25% increase in all of these areas will occur. Similarly, a 25% growth in the number of high quality undergraduate students and graduate students is expected. Lecture Series, Visiting Professor, and Postdoctoral Fellowship Programs will have to attract truly outstanding scholars in order to be deemed successful. In fact, there will be a marked improvement in the faculty, students, and visitors in the DMS consistent with being among the top ten applied mathematics departments in the country. This will be further confirmed by a significant improvement in the employment profiles of our graduates.

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Budget Summary Dept. of Mathematical Sciences:

Faculty (1)	\$60,000
Research Administrator(1)	\$65,000
Distinguished Visiting Professor (1)	\$75,000
Postdoctoral Fellows (3)	\$150,000
Conferences / Workshops / Travel	\$120,000
REU Activities	\$46,000
Equipment (computers and software)	\$20,000
Recruitment and Advertising	\$20,000
Facilities Renovation	<u>\$200,000</u>

Total Identified Needs: \$756,000

Total Identified Needs (\$000's) Department of Mathematical Sciences				
FTE #	Salary	Start-Up	Equipment/Gen. Operating	Grand Total
6	\$350	\$200	\$206	\$756

3. The New Jersey School of Architecture

The New Jersey School of Architecture (NJSOA) can maintain and increase its national visibility by recalibrating its two major foci and by instigating fundamental revisions to the curriculum.

- Computer-aided design (CAD) would be expanded to include computer-aided manufacturing (CAM). The inclusion of CAM responds to a changing manufacturing capability in the building industry which allows the production of customized products through flexible manufacturing techniques in limited quantities at a small premium. Architects, therefore, will be capable of designing and prototyping building components which could then be manufactured.
- Large-scale planning and community design will become mandatory and be included as a core course. Because the community design projects are real rather than hypothetical, they expose students to the real life parameters that inform the design process. Students will work in teams and gain an appreciation for the processes and methods which shape our communities.
- Curricular changes will reflect the impending transformation of professional services in architecture. In the future, professional services will have as an integral component, outsourced or out shared services. Different skill sets as well as differing attitudes will require a realignment of some key pedagogical objectives. The ability to think laterally, to invent, to take risks and to re-examine the present building delivery processes will become increasingly important.
- The establishment of an NJSOA Fabrication Laboratory (FAB) located in the Civil Engineering space in our building. The FAB LAB will house some of the CAM equipment.
- Position NJSOA in the top 10% of architecture schools nationally in terms of research volume and

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to establish a national profile, especially through the center for High Performance Schools and the Housing Design Advisor.

- Development of an Industrial Design Program will be a logical outgrowth of the foray into CAD/CAM. Not only will this potentially enlarge the professional role of architects by including product design in the range of services, but it offers NJIT a first-mover advantage in relation to and licensable intellectual property development in this emerging field.

The present faculty has the pedagogical skills necessary to develop and implement a reconstituted curriculum. They also have the capacity to redirect the two foci that have elevated the School to national prominence, provided that there are judicious additions to the faculty, and further provided that necessary network, hardware and software resources are made available.

- The shift from CAD to CAD/CAM will require an expansion of our present CAD faculty by two, as well as two network managers/technicians.
- The expansion of community planning as an integral and mandatory component of the curriculum will require at least one additional full time faculty member; this number will be further augmented by additional part-time faculty.
- The investment in CAM equipment will be limited because some equipment already exists elsewhere at NJIT.
- Introduction of additional knowledge and research based studios will prepare students to expand the traditional role of the profession of Architecture and provide the skills needed to participate and compete in a new line of inquiry.
- NJSOA has a rapidly increasing profile in research as applied to large-scale planning and infrastructure design. It is anticipated that through these educational shifts, NJSOA will be able to more than double the external support for community design studios from approximately \$100,000 dollars a year to approximately \$250,000 dollars a year.

Enrollment Projections (does not include Ph.D)

<u>Year</u>	<u>2000</u>	<u>2001</u>	<u>2002</u>	<u>2003</u>	<u>2004</u>	<u>2005</u>	<u>2006</u>	<u>2007</u>	<u>2008</u>
Undergraduate	486	505	569	634	650	670	700	700	700
SAT Average	1142	1152	1173	1182	1190	1195	1200	1205	1210
Graduate	100	100	100	100	100	105	110	115	120
Total	586	605	669	734	750	775	810	815	820

Projected Number of Graduates

	<u>2000</u>	<u>2001</u>	<u>2002</u>	<u>2003</u>	<u>2004</u>	<u>2005</u>	<u>2006</u>	<u>2007</u>	<u>2008</u>
Undergraduate	84	79	67	88	80	101	105	135	140
Graduate	24	25	30	26	25	24	26	26	26
Total	108	104	97	114	105	125	131	161	166

Instructional and research facilities are currently fully utilized. The proposed enrollment growth will require future facility funding to adequately meet program needs.

The present NJSOA research funding is on a positive trajectory. The research volume has almost doubled in the last three years. However, in order to keep at this present rate of growth, additional resources are required. In the area of large scale planning and infrastructure design, NJSOA is only limited by the number of qualified faculty members. Future growth in research funding will be directly proportional to the number of qualified faculty members.

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In the area of CAD/CAM, NJSOA could qualify for both Federal and State funding, provided necessary expertise is identified. At present, NJSOA has some depth in the area of CAD but an insufficient number of people with a specific track record in this specialized area. This could be an area of future development which would attract attention from industry as well as federal sources. The particular area of exploration will be the application of flexible manufacturing efforts to limited run products. This is an important emerging issue in the building industry.

Research Volume Projections For NJSOA / CABS (\$000's)

<u>Year</u>	<u>2000</u>	<u>2001</u>	<u>2002</u>	<u>2003</u>	<u>2004</u>	<u>2005</u>	<u>2006</u>	<u>2007</u>	<u>2008</u>
	406	994	562	1,250	1,500	1,750	2,000	2,250	2,500

The proposed plan has a three-fold impact on the local economy:

- The major impact will be to produce people skilled to compete in a rapidly changing professional climate. The special attributes and skills needed to take advantage of the profound restructuring of professional services will require a significant redirection of the existing curriculum. The State has a great deal to gain from the training of a professional labor force able to compete in a business climate which tends to commodify and out shore significant segments of professional services.
- The large-scale planning efforts revolve around real projects. These community building efforts have proven to be highly effective and have been instrumental in helping to structure revitalization efforts in many New Jersey Communities. The expansion of our capability will allow us to address a greater number of these projects simultaneously and thereby geometrically increase the impact of community design as an engine for growth. Such projects also contributed to developing the kinds of communities to which professionals will be willing to relocate in response to business needs for skilled personnel.
- CAD/CAM will help establish a bridge between design professions and New Jersey's waning manufacturing base. An emphasis on quick prototyping and production of components using flexible manufacturing techniques will allow New Jersey's businesses to compete effectively on a national and global scale. The training of design professionals versed in CAD/CAM will be an important ingredient in this endeavor.
- The expanded role of the center for High Performance Schools will include the use of schools as catalysts for revitalization.

Budget Summary New Jersey School of Architecture:

CAM Faculty 2 @ \$75,000	\$150,000
2 Network managers/technicians @ \$50,000	\$100,000
Community Design Faculty @ \$85,000	\$85,000
Special Lecturers (Clinical Prof.) (3) @ \$65,000	\$195,000
Start-Up Equipment:	
Fabrication laboratory Phase I	\$137,000
Fabrication laboratory Phase II	<u>\$114,000</u>
Subtotal – Start Up	<u>\$251,000</u>
 Total Identified Needs:	 \$781,000

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Total Identified Needs (\$000's) The New Jersey School of Architecture				
FTE #	Salary	Start-Up	Equipment/Gen. Operating	Grand Total
8	\$530	\$251	\$0	\$781

**Strengthen By 2005, Three Niche Areas with High Potential
For NJIT and the State of New Jersey**

1. Neural Engineering at NJIT
2. Nanoscale Technologies
3. Advanced Engineering Particulate Materials

1. Neural Engineering at NJIT

Neural Engineering is an important emerging area. In particular, development of therapies that utilize neural plasticity to overcome clinical and educational deficits is a niche area that is just becoming recognized. This area is widely envisioned to develop into a major component of modern neurological therapy and rehabilitation. Neural engineering applies concepts and tools from engineering to basic and clinical problems in neural function.

With a modest investment, NJIT can reasonably be expected to become the dominant research center for neural engineering in the NY-NJ metro area, and likely throughout the Mid-Atlantic region. This would also establish NJIT as a nationally recognized center for neural engineering.

The neural engineering research at NJIT would provide tools for new clinical and educational therapies. From this, entrepreneurial businesses would be expected to emerge and would contribute to the NJ economy. Moreover, expansion of neural engineering at NJIT would also support planned synergistic research growth at RU-Newark and Kessler Institute for Rehabilitation.

This proposal focuses NJIT's effort on a specific and also emerging area within neural engineering: techniques that utilize neural plasticity to accomplish therapy. Neural plasticity is the ability of the brain to remap its internal neuronal (synaptic) connections. For instance, neural plasticity would provide one way to treat localized damage within the brain (eg, from stroke) by remapping neural pathways to avoid the damaged region. Neural plasticity would also be important in education (one might call this cognitive engineering) -- to remap neural connections to accomplish a developmentally impaired task in a more effective manner (eg, to counter a learning disability¹). Neural plasticity has long been recognized in children. Recent findings that neural plasticity remains

¹ One company (with some Newark roots at RU-Newark) markets an engineered therapy that has been fairly successful in helping children overcome a learning disability. This company utilized the expertise of a neural engineer (X. Wang), who is now Assoc. Prof. of BME at Johns Hopkins.

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significant in older adults have set the stage for increased neural engineering applications. For example, after trauma to the brain, properly designed and engineered stimulus regimes would induce and enhance transfer of neural functions away from damaged regions to cortical regions that remain intact. Neural engineering would thus provide the “mold” for neural plasticity.

There are substantial strengths that NJIT has to establish a research niche in neural engineering – specifically in engineered neural plasticity. Many of these strengths are internal to NJIT; many are also conferred by leveraging associations with local colleagues.

NJIT has itself considerable assets to focus on neural engineering:

BME Department: Current faculty who would play **primary** roles in Neural Engineering:

- Foulds (neuromuscular rehabilitation)
- Alvarez (oculomotor adaptation),
- Adamovich (neuromuscular rehabilitation - *to be hired, Nov '03*)

BME Department: Current faculty who would play **supportive** roles for Neural Engineering:

- Lacker (musculoskeletal biomechanic consequences of neural reprogramming)
- Greene (ophthalmology)
- Arinzeh (regenerative engineering of neural tissue from adult stem cells)
- Reisman (signal processing to identify status of autonomic nervous system)
- Hunter (striated muscle physiology)
- Mantilla (neurosurgeon, special lecturer)

Applied Math Department: Current faculty working in computational neuroscience

- Nadim (experimental and computational neuroscience of neural networks)
- Bose (computational neuroscience)
- Miura (computational neuroscience)
- Tao (computational neuroscience)

Federated Biology Department: Current faculty in computational and experimental neuroscience

- Golowasch (experimental neuroscience)
- Jonakait (neuroimmunology)

ECE Department: Current faculty working on technologies supportive of neural engineering

- Dhawan (image processing of functional MRI images that locate neural activity)

Chemistry Department.: Current faculty working with molecular aspects of neuroscience

- Venanzi (models of neural drug docking)

BioMEMS: microfabrication facility

- Ivanov (development of implantable microelectrode arrays)

Local research partners provide substantial further assets for neural engineering

NJIT is poised to leverage off considerable neuroscience strength in its neighboring institutions:

➤ **Center for Molecular and Behavioral Neuroscience at Rutgers-Newark**

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- World-class research center and one of the leaders in studying neural plasticity.
 - Annual research budget on the order of \$10M.
 - Following BME's lead, this center chose to focus on neural plasticity for their recent proposal to the Governor's Commission on Job Growth and Economic Development (BME is included in that proposal).
- **3Tesla functional MRI imaging unit at UMDNJ**
- This unit has twice the normal magnetic field strength of typical human MRI.
 - Only such 3T units are capable of accurate mapping of neural function sites.
 - Provides critical data demonstrating re-mapping (i.e., re-locating) neural function.
- **Integrated Biomedical Engineering PhD Training Program between NJIT and UMDNJ-N**
- **Integrated Neuroscience Training Program between RU-N and UMDNJ-N**
- **Kessler Rehabilitation Institute**
This is the 5-th best nationally ranked rehabilitation institute in the US. BME and Kessler researchers have worked together successfully in the past. Partnering would provide a clinical research site for testing engineered neural plasticity in patients.
- **VA Medical Center (S. Orange)**
Strong links to BME. Would also be clinical research site for neural plasticity.
- **Expected Growth in Enrollment and External Research Funding**

The growth in enrollment that would support Neural Engineering is already in the pipeline. (In fact, much of it is already here, ahead of schedule.) That is, neural engineering would tap into the strong growth of both undergraduate and graduate enrollment in biomedical engineering at NJIT.

When the BME department was being formed, the target was eventually to reach a steady-state undergraduate enrollment of 200 students. Presently, after only two brief years of existence, the undergraduate enrollment is ~230 students. Foreseeable upward trends would carry that to 300 students. It should also be noted that these BME students are – on average – the best undergraduates who are drawn to NJIT. Similarly, the MS program in BME has grown from ~20 students before the department was formed to ~70 master's students presently.

These trends in student enrollment will probably occur, whether or not a neural engineering niche is supported. Nevertheless, NJIT will likely be forced to recruit tenured faculty to meet this student demand in any case. By tying one of the expanded BME faculty to neural engineering, NJIT would be able to leverage student interest in BME to help develop a rewarding research program for the Institute.

External research funding in neural engineering is expected to expand from \$0.14M now to at least \$2.0M annual total research expenditure by academic year 2006-2007. Because engineering neural plasticity will lead to therapies that are clinically applicable, a number of new businesses are expected to be born out of this research endeavor.

To focus and lead an outstanding research enhancement in neural engineering, one that will bring NJIT to the national table in the area, NJIT should recruit a "rising star" (within Biomedical

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Engineering) to advance research capabilities and national reputation in neural engineering. Such a tenured faculty member would be recruited at the Associate Professor level. He/she would likely be someone who has recently been promoted to the Associate level, and has recently developed a national recognition.

In addition, it's estimated that it would require approximately \$400K in start up costs to attract a new faculty member of the desired stature to move to NJIT. In addition, \$100K in specialized equipment would be needed to enhance the work of the present faculty for applications in neural plasticity.

Budget Summary Neural Engineering:

Faculty (1)	\$120,000
Equipment	\$100,000
Start-Up Package	<u>\$400,000</u>
Total Identified Needs:	\$620,000

Total Identified Needs (\$000's) Neural Engineering				
FTE #	Salary	Start-Up	Equipment/Gen. Operating	Grand Total
1	\$120	\$100	\$400	\$620

2. Nanoscale Technologies

The proposed Advanced Nanoscale Technologies initiative is focused on the fundamental understanding and exploitation of new physical, chemical and biological properties of nano-systems. The initiative's mission is the creation and utilization of functional devices and systems that are achieved through the control of matter on the atomic, molecular, or the macromolecular level.

Nanotechnology is the single, fastest growing research and development area in the nation. The scientific and engineering scope of the program will be based on the ongoing work at NJIT for the last decade. NJIT has built a strong record and developed the recognized leadership in nanoscience and nanotechnology. The Nano -Initiative at NJIT is funded by more than \$1 million per year through federal grants and contracts. In the past 5 years, the above research has generated more than 40 publications in the area of nanotechnology. NJIT possesses a Scanning Electron Microscope a Transmission Electron Microscope, an Atomic Force Microscope, and a Near-Field Optical Microscope, all geared to assess nano-size structures. In addition to our capabilities and expertise, the proposed program will be built on the strong collaboration with New Jersey Nano-Consortium and will employ the world-best capabilities of the Murray Hill facilities for manufacturing at the nanoscale.

In fiscal year 2002, the federal budget effectively spent \$697 million for research and development in Nanoscience and Technology (NST), with \$204 million channeled through NSF. In fiscal year 2003, the federal government requested \$774 million, including \$221 million for NSF. In fiscal year 2004, the federal request totals \$849 million, with \$249 million for NSF. Other agencies supporting nanotechnology include the Departments of Agriculture, Commerce, Defense, Energy, Homeland Security and Justice; the Environmental Protection Agency; the National Institutes of Health; and

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NASA. Due to its high profile development, many other institutions have formed NST-oriented research centers.

NJIT can compete, and succeed, by stressing and building upon its established strengths in NST. The goal would be to develop national stature in selected areas of NST from within the vast areas encompassed by this emerging field. The proposed initiative and synergy will attract more funding from federal agencies (NSF, DoD, US Army, NIH, EPA) and industries to increase domestic and international student enrollment. This is a very effective growth area with synergies within many disciplines and application areas.

Students, both graduate and undergraduate, tend to gravitate towards emerging fields with economic and career benefits. Nanotechnology is such a field. *One can use this interdisciplinary trend as a vehicle to redefine Engineering and Science curricula and in particular, in engineering oriented universities, such as NJIT.* This proposal includes four major initiatives: (a) formation of a interdisciplinary undergraduate program in nano-optics and nano-bio (b) funding through NSF grants of a Research Experience for Undergraduates program at NJIT (c) provide mentoring of undergraduates in the existing programs, such as Senior Design Project in ECE (d) reaching out to regional and national nanotechnology companies to discuss their research and development programs as well as recruiting NJIT students. Expenditure in the undergraduate level should mainly be in establishing laboratories and setting up small undergraduate research funds. The outcome should be examined in light of an increased enrollment, broader area impact (e.g. its usefulness beyond an immediate classroom size) and national recognition.

At the graduate level, the increase in faculty funding in nano-optics and nano-bio will fund Research Assistant students. In addition, the program will use its funds to fund one exceptional incoming graduate student a year as an Advanced Nanoscale Technologies Research Fellow. These funds will allow the program's faculty to recruit aggressively the best domestic and foreign graduate students. A goal of this program is to have 15 Ph.D. students, graduating 5-6 Ph.D.'s per year.

In terms of institutional strength to carry out these undergraduate and graduate initiatives, two of the PIs (Grebel/Federici) have successfully (~\$600,000 in NSF grants) developed innovative combined research and development curriculum for an interdisciplinary photonic program. Building on such success, it's proposed to initiate a new nanotechnology program at NJIT.

Nanotechnology is a very effective growth area with synergies in many disciplines and application areas. At present, the multi-disciplinary niche area in nanotechnology is in the development phase. A goal is to become one of the leading programs in the nation. With the establishment of nationally recognized Center of Excellence, the rating of both the program and Departments will be significantly improved, as was the case with the Optical Science and Engineering Program. The success of efforts will be measured in terms of overall ranking in the nation, number of Ph.D. graduates per year, number of refereed publications, number of faculty and student awards, number, quality and amount of grants and the participation of the faculty in national and international professional activities.

With the prospect of trillions of transistors on a single nanotechnology chip, many new applications will emerge. This will give rise to new industries. The effect of nanotechnologies will be dramatic not just on general-purpose computing, but on embedded systems as well. This is a two-way street where the industry needs are defining our education strategy and our projects define the future economy and job market. However, commercial challenges posed by nanotechnologies should be first met. These challenges include the development of both fabrication and design tools. One such opportunity is design, analysis and simulation tools for nanotechnology systems. The aim of this

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program is precisely to develop such tools and methodologies. We believe that technology transfer of such tools to local companies will provide a significant boost to New Jersey economy. The program should also initiate many SBIR and STTR proposals from small companies to support the innovative aspect of New Jersey small-scale industries.

The core of the program is with its personnel, namely, its researchers and educators. In order to strengthen this aspect, six additional junior-to-mid level faculty members with considerable amount of start-up funds and laboratory resources are required. *Such start-up funds are typically assessed at \$300K/person and should include laboratory space and supporting infrastructure.* These researchers will be interfacing with each other through their activities in the program. Other program administrative costs are estimated at the level of \$50K/year.

Budget Summary Nanoscale Technologies:

Faculty (6)	\$450,000
Lab Technician	\$50,000
Start-Up Funds	<u>\$1,800,000</u>
Total Identified Needs:	<u>\$2,300,000</u>

Total Identified Needs (\$000's) Nanoscale Technologies				
FTE #	Salary	Start-Up	Equipment/Gen. Operating	Grand Total
7	\$500	\$1,800	\$0	\$2,300

3. Advanced Engineered Particulate Materials

Engineered particulate materials are particles that involve chemical or physical manipulations at a small cluster level in the size range between 10 nanometers and 100 microns. They are often dormant but become active upon exposure to a different physico-chemical environment. Examples include; polymer-film-coated drug particles, composites of active and excipients for improved drug uniformity, micro-granules of pharmaceuticals & nutraceuticals, improved hydroxyapatite (HAP) as a bone replacement material, nano-silver coated polystyrene beads for anti-bacterial cosmetics, mechano-alloyed meta-stable metallic powders as high-energy density fuels, and nano-platinum based composites as catalysts.

Nano-scale technologies are complex structures. They involve controlled functionalities for the purpose of multi-tasking at the molecular level. Their output therefore, depends on the input as well as control signals. These signals may be electrical, biological or chemicals. Examples for functional nanotechnology structures are single electron transistors with channel width (on the order of 20 nm), transistors based on a single, single-wall carbon nano-tube, memory devices which are based on quantum dots (on the order of a few nanometers) and electronic circuitry which is made uniquely or, in part with small ensembles of organic molecules. On the biological front, specific examples include molecular sensors, which are attached to carbon nanotubes, nano-twizzers, nano-electrodes for

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monitoring and manipulating cell functions etc.

Even carbon-nano-tubes may be utilized in engineered particulates, but the intent is to exploit their mechanical and chemical properties in a manner that is static and not dynamic, as would be the case for nano-devices. While these two fields can also converge in cases such as advanced targeted drug delivery methods, in general they are distinctly different. Thus, functional powder made out of carbon nanotubes constitutes engineered particulate. A controlled growth of carbon nanotube at specific points of an electronic circuit constitutes a nanotechnology element.

Particulate products generate well over one trillion dollars annually to the US economy. New Jersey deals with a significant portion of this amount, because it is home to many diverse industries dealing with conventional as well as advanced particulate materials. These industries include large and small companies in pharmaceuticals, food, cosmetics, specialty chemicals, defense, electronics and ceramics, utilizing powder-based materials such as, drugs, biomaterials, piezoelectric-ceramics, magnetic materials, optical materials, energetic materials, etc. As a specific example, NJ is home to nearly 80 % of the US pharmaceutical companies, which captured nearly 38% of the total *worldwide* pharmaceutical market of \$337 billion in 1999².

A careful scrutiny of the current economic and technological landscape of these industries immediately points to the fact that in the vital area of ***Advanced Engineered Particulate Materials***, there is a serious lack of (1) *A Strong Scientific Knowledge Base*, and (2) *Personnel with Cross-disciplinary Skills*. This provides a unique opportunity for NJIT not only to develop an internationally esteemed research program that attracts highly competitive federal funding, but also generates intellectual property and makes a significant economic impact, thereby advancing and sustaining US competitiveness in a field where Europe and Japan have a significant edge. An investment in this niche area will also result in feeding the workforce with well-trained graduates with cross-disciplinary skills, highly crucial to this area, because, many of the problems faced by US industries dealing with particulate processes and products are attributed largely to the lack of such talent.

Vision and Scope

As the size of particles becomes smaller and smaller, down to nanosize, the properties at the particle scale can change drastically and significantly to affect the bulk properties, resulting in unique added value to all kinds of particulate-based materials. The proposed *niche area* will suggest, develop, engineer and seek out new applications for these value-added particles, also called the *Advanced Engineered Particulate Materials*. With strategic investments, NJIT *can and will* become a significant leader in this area, capitalizing on its current capabilities in creating and modifying particulate materials with tailored properties through particle engineering that exploits the unique properties of nano, submicron and micron sized particles.

The goal of this proposal is to establish an ***International Center of Excellence*** in *Advanced Engineered Particulate Materials*. The proposed core activities of this program will include (1) processing and modification of particulate materials, (2) achieving a sound scientific understanding of particulate processes, (3) developing innovative applications and new products in collaboration with industrial partners, and (4) developing a multipurpose, multifunctional particulate characterization facility, which will be used by NJ companies and help support the program's core activities. In five years, we expect to have achieved an international reputation for:

- A strong scientific knowledge base of experimental, computational and theoretical studies for the

² NJ is home to 8 out of top 10 companies worldwide (July 2003 data)

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scaleable synthesis/modification of engineered particles including:

- nano-structured composites and nano-patterned particulates,
 - ultra-fine (including nano) powders with discrete or continuous functional coatings, and
 - particles having a prescribed size, shape, and morphology.
- A state-of-the-art infrastructure for particle characterization and experimental and computational research laboratories serving as a resource for the solution of specific industrial problems.
 - A significant amount of intellectual property generated and proactive technology transfer activities to transform the IP into commercially viable processes and products. These will include pharmaceuticals, vitamins, food, health-care and personal-care products, micro-materials, pigments, coatings, multifunctional particles, advanced fillers, particles for "smart" materials, sensors and catalysts, polishing materials, minerals, energetic materials, ceramics, and biomaterials.
 - A group of high quality graduates/postdocs with a strong background and research capabilities in advanced particle engineering and characterization.

The major expected outcomes of the long-term investment are significantly increased federal and industrial funding and the building of an international reputation in advanced engineered particulates. Currently, there are about 17 faculty members, spanning across the colleges, participating in research that has direct relevance to the area of advanced particulate materials, much of this particularly relevant to pharmaceuticals. However, a careful analysis of the available expertise shows that several key areas need to be strengthened, for example, multi-scale modeling (molecular, nano, and micro), crystallization and thermodynamics, particle-molecular and/or particle/cellular interface science, surfactant thermodynamics, drug delivery, nano-scale fluid-particle interactions, nano-tribology, and smart nano-materials and sensors. By adding four new faculty members with expertise in four of the areas listed above, we will not only highly complement the present 17 core and associated faculty, but will help bring existing NJIT resources from computational chemistry, bio-medical engineering, and mathematical sciences, into the pool of researchers, attaining the critical mass³ necessary for attracting very large federally funded competitive programs, such as a NSF-ERC, NSF- Nanoscale Science and Engineering Centers, or Instrumentation Awards. It is emphasized that this group would be highly competitive in materials areas such as pharmaceuticals, health-care, and personal-care and cosmetics (relevant to life sciences). This group will also become stronger in the areas of specialty chemicals, electronic materials, and energetic materials. The federal agencies that could be targeted include NSF, NIH, NIST, FDA, DARPA, ONR, DoD and DoE. It is noted that most of these agencies require two additional (apart from faculty expertise) components to be competitive (1) endorsements from industry, and (2) a strong educational component.

The necessary immediate support includes the addition of some key support staff: a post-doctoral research associate, a technician, and a business plan administrator, and some new instrumentation. The cost of these support staff and instrumentation is estimated at \$300K. *The benefit of this investment will be significant*; specifically, (1) industrially sponsored projects should increase by \$200K/yr; (2) proposal submitting activity should increase by at least \$1M/yr; (3) NJIT will host annual mini-symposia with workshops and short-courses, attracting over 200 participants, increasing our visibility, and generating a revenue stream of \$15K/yr; (4) company usage of our instrumentation facility should increase by at least \$20K/yr; (5) journal papers should increase by 5/yr, and new invention disclosures by 3/yr; and (6) strategic initiatives will be made for technology transfer and IP-based revenue seeking. These positive outcomes will be made possible since the core and associated faculty will have more time to spend on research and scholarly activities and less on

³ This will result in a total of 25 faculty, 12 core faculty and 13 associated.

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DEVELOP A CORE OF NATIONALLY RECOGNIZED PROGRAMS

administrative tasks.

In summary, the funding strategy of the program will be three-fold: (1) One or more PIs attracting competitive federal funding; (2) Larger groups working on multi-PI, multi-disciplinary federally funded programs; and (3) Individual or small groups of PIs working with industrial partners for industrial funding as well as joint ventures such as SBIR and larger federal-industry partnerships. It is anticipated that funding will easily rise to about \$5M per year within the next 5 years, doubling to \$10M in 10 years. Along with the increase in funded research, and increased visibility, several related interdisciplinary areas, such as the pharmaceutical engineering masters program and the materials science and engineering program will see increased student enrollment. Large-scale educational programs funded by NSF and NIH should also augment these activities.

Budget Summary: Advanced Engineered Particulate Materials

Faculty (4)	\$360,000
Postdoctoral Fellows (3)	\$90,000
Research/Business Administrator (1)	\$65,000
Research Technician (1)	\$45,000
Start Up – Equipment/Lab	\$100,000
Matching Funds – Start Up	<u>\$500,000</u>

Total Identified Needs: \$1,160,000

Total Identified Needs (\$000's) Advanced Engineered Particulate Materials				
FTE #	Salary \$	Start-Up	Equipment/Gen. Operating	Grand Total
9	\$560	\$600	\$0	\$1,160

Summary Identified Needs (\$000's) Develop a Core of Nationally Recognized Programs				
FTE #	Salary \$	Start-Up	Equipment/Gen. Operating	Grand Total
35	\$2,385	\$3,501	\$1,006	\$6,892

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INSTRUCTIONAL EQUIPMENT FUND

Budget limitations over the past eight years have taken a toll on the quality of instructional and laboratory support equipment. The \$6.480 million received through the Equipment Leasing Fund had a significant impact on improving campus-wide laboratory instruction. However, in order to continue with the recent progress made, additional FY2005 budget support is required. State-of-the-art academic equipment is critical in order for students to be educated in the newest methods and applications. These new programs have put cutting edge instructional equipment in classrooms and laboratories and ensured that the state's investment in these classrooms is protected.

Imaging Laboratory

The School of Architecture is a nationally recognized leader in the use of computers in architectural education. The following equipment priorities will maintain the adequate delivery of the computer aided design program to our undergraduate and graduate students.

The objective of the Imaging Laboratory and School of Architecture is to continue to implement computer based design studios needed in the School of Architecture. The full need is for six labs in the third year studio curriculum, eight in the fourth/fifth year options studio curriculum, and one in the graduate studio curriculum.

Total Identified Needs: \$500,000

Engineering Laboratories

During the past several years, NJIT received funding from the State of New Jersey through the Equipment Leasing Fund (ELF). However, the ELF funding was able to fund only the most pressing needs of the more than \$19 million requested from the various NJIT departments. In the Newark College of Engineering, where the changes in technology have been especially rapid during the past decade, modernization of all laboratories is needed as soon as possible. NJIT has been successful at the national level having received several million dollars of equipment grants from NSF. The combined funding from State and Federal sources has so far not met all of the programmatic needs.

Civil Engineering

Replacement of the Undergraduate Strength of Materials lab antiquated equipment with bench scale testing equipment along with a flume for the hydraulic lab. Additionally, they require a state of the art data acquisition and modeling facilities in the soils lab. The estimated cost is \$257,000.

Chemical Engineering

Chemical Engineering Laboratory and Design Courses

There is a need to upgrade the existing Chemical Engineering senior laboratories to bring in more modern experiments pertinent to the broad range of areas that our Chemical Engineering graduates go into after leaving NJIT. In addition, investment is required to further develop a pharmaceutical unit operations type laboratory to enhance the capabilities of the new pharmaceutical engineering program. The estimate for these undertakings is \$350,000.

Electrical and Computer Engineering

The department has requests for upgrading laboratories in room 109F (energy conversion lab), 211F (computer engineering lab), 410F (communications/telecommunication/multimedia lab), 316F (control systems lab), 318F (biomedical lab), at a total cost of \$915,000.

Interdisciplinary Program in Transportation

NJIT offers the only designated graduate and Ph.D programs in Transportation in New Jersey. Laboratory equipment is required to teach Transportation courses in Traffic Control, Transportation

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INSTRUCTIONAL EQUIPMENT FUND

Facility Capacity Analysis, Travel Demand Forecasting, and Systems Engineering. Hands-on experience is required for the classes to become more effective. \$84,000.

Industrial and Manufacturing Engineering

The IME Department needs to upgrade their lab facilities in the human factors/ergonomics, environmental and safety laboratories, the robotics and flexible manufacturing labs and the simulation laboratories. Approximate cost is \$55,000.

Mechanical Engineering

The department requires updating and modernization in the biomaterial lab, the instrumentation labs, fluids labs and the general mechanical engineering lab. \$249,000.

Grand Total Needs – Instructional Equipment Funds: \$2,410,000

Total Identified Needs (\$000's) Instructional Equipment Fund				
FTE #	Salary \$	Equipment	General Operating	Grand Total
0	\$0	\$2,410	\$0	\$2,410

Grand Total Identified Needs (\$000's) Instruction				
FTE #	Salary \$	Equipment	General Operating	Grand Total
35	\$2,385	\$2,530	\$4,387	\$9,302

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ACADEMIC SUPPORT SERVICES

The mission of the NJIT library is to satisfy the book and other published document and information needs of the students, faculty and staff, quickly and accurately in meeting NJIT academic and research goals and provide an environment conducive to study and research. The library provides a full range of services including the loan and/or use on-site as well as remotely of hard copy and online books, journals, abstracts and indexes, databases, videos, films, audio CDs, other materials, local catalog access, reference and research services, interlibrary loan, document delivery, local web publishing, reciprocal borrowing as well as the use of other academic libraries, information competency materials and instruction and general assistance. Additional space is necessary to support the university growth, which has been included in the capital budget request.

Library Development Program

The library is quickly moving to satisfy both traditional library user needs as well as user demands for networked access to library services anywhere and at any time. The movement to remote networked access is continuing to accelerate and requires a massive shift in the infrastructure. The increase in NJIT students, the increase in distance education students, the increase in BS, MS, and PhD programs, and the increased computer intensive learning and research environment strains the library infrastructure. The library needs to increase resources in the following areas: staffing, technology and facilities infrastructure, and published resources.

Staffing

The staffing of the library should be expanded to include four additional professional positions including a Technical Reference Librarian, Information Literacy Librarian, Digital Projects Librarian and Acquisition Librarian. The library needs additional staff positions to implement fully the expanded program of services.

Subtotal New Staffing Positions: \$220,000

Technology Infrastructure

NJIT libraries are increasingly providing online access over the web to digital publications and information. The library student (Information Commons) computers and network needs have grown rapidly with both the size of the student body and the increase in computer learning and research activities. The NJIT libraries need to add about 100 more user reader seats (chairs, carrels, and tables) (\$150,000), compact shelving to store the hard copy journal titles (\$500,000) and use existing space more efficiently; add 20 group study rooms with HVAC, tables, chairs, blackboards and network and power (\$500,000); renovated main library space and equipment to expand the 101 public workstations to 142; and public computers in the library by 58; (\$200,000) and add workstations and equipment to the architecture library (\$50,000).

Subtotal: Library Technology and Facilities Infrastructure \$1,400,000

Published Resources: Additional Online and Traditional Books, Monographs, Databases and Serials
The library needs to expand greatly the purchase of published materials to support the academic programs, especially in science and technology, and increased numbers of users. The book and monograph collection needs to be expanded by 12,000 titles next year at an average cost of \$110 each (\$1,320,000). NJIT has scanned, cataloged and made accessible for public access on the web 150 NJIT theses and dissertations (over 10,000 uses in just six months). NJIT needs to place all 3,000 retrospective items on the web for scholars and others at \$35 each (\$105,000). Online full text journal, bibliographic and reference publications need to be expanded greatly from the current databases available (\$700,000).

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Subtotal: Published Resources: \$2,125,000

Grand Total Identified Needs - Library Needs: **\$3,745,000**

Albert Dorman Honors College

In the fall 2002, the Albert Dorman Honors College at NJIT increased in size for the eighth consecutive year, to 130 first year students, and 500 students overall. Average combined SAT scores remained above 1300. With its increase in size, the College has increased activities that bring well-deserved recognition. The College now has a named James A. Kennedy Resource Center including lounge, quiet study and fully equipped computer laboratory. It has established a Leadership Colloquium series, freshman retreat and freshman leadership seminar. More students are engaged in research and professional projects, which they articulate through their individual Educational Plans. In addition, the Honors College continues to move towards being a residential college. Two thirds of this year's Honors students now live on campus. The average GPA of graduating honors students continues to be around 3.6

This past year, 129 students reported conducting research either at NJIT research centers, with an individual professor, at UMDNJ or another university. Projects are as complex and diverse as transradial heart cauterization, modeling of neurotransmitters, soil toxicity, and solar research at our Big Bear Observatory in California. Several students work with Panasonic to develop the statewide high school Robotics Challenge. One hundred and twenty-five students participated in corporate CO-OPs or internships with companies such as Exxon, Goldman-Sachs, Smith Kline Beechman and Schering-Plough. One hundred and ninety-one students performed leadership service to the NJIT or the greater Newark Community, including student government, blood drives, community clean-ups, tutoring and mentoring in the local public schools. The honors college continues to attract highly qualified students to the accelerated seven-year BS/MD and BS/DMD programs it shares with the University of Medicine and Dentistry of New Jersey.

Our goal is to increase the Honors College to 150 first year students, 650 overall, within five years, including a minority enrollment at a minimum of 10% and women of 35%. The attraction of the Honors College to students who would otherwise leave the state is the small class size, the Individual Educational Plan, the ability to work directly with top flight professors, corporate relationships, personal attention by staff from recruitment to graduation, and the availability of research and internship opportunities both on and off campus. The Honors College will partner with the NJIT Educational Opportunity Program (EOP) enabling talented EOP students to work with Honors students and professors in research projects. The projects will be juried with the intention of presenting them at regional and national conferences. The college is developing articulation agreements with High Tech High Schools in the state that would enable students to enroll at NJIT as sophomores, thereby, accelerating the education of these high achieving students and saving them a year of undergraduate education and costs. An example of an agreement is with the Bergen Academics.

Additional funds are needed to recruit, enroll, and support the high achieving New Jersey students of the Honors College. A staff position and operating funds are necessary to support these functions including, but not limited to academic advising, research and industry projects, placement, and articulation with New Jersey high schools.

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ACADEMIC SUPPORT SERVICES

Academic Advisor/Projects CoordinatorFTE1.0	\$75,000
Student Research Stipends (20 students @ \$1500/student)	\$30,000
Operating Funds	<u>\$10,000</u>
Total Identified Needs – Honors College	\$115,000

Information Services and Technology Infrastructure

NJIT is a *computing intensive* university. During the last 20 years the university has invested heavily in computing equipment and technology with the aim of placing NJIT on the forefront of computing intensity in higher education. In each of the years that **Yahoo! Internet Life** magazine published its lists of the "Most-Wired" schools for the use of technology on college campuses, NJIT was ranked in the top 10 nationally. Computers have come to play a role in virtually every task performed on the NJIT campus, from cutting-edge research to parking space reservations. Computers assist in teaching and independent study, campus communications, library research, as well as engineering and architectural designs. A range of "self-service" functions through the university portal allows students to process most administrative transactions electronically, such as choosing a class schedule, registering for courses, checking financial aid status, and paying tuition bills. Faculty members have access to course management systems and electronic discussion spaces that extend the traditional classroom experience to one of a virtual classroom. The university's computing infrastructure facilitates technology transfer to industry and maintains contacts with its alumni, friends, and other constituents.

Computing is an intrinsic part of the campus culture, as vital a part of the university's infrastructure as the bricks and mortar of its physical plant. But unlike bricks and mortar with a lifespan measured in decades, many aspects of a university's technology infrastructure average three to five years until obsolescence. The university's active research agenda has a need for additional high performance computing resources. Finally, the core of the university's information system infrastructure is based on legacy applications that are sixteen years old and in need of replacement. NJIT's planning process recognizes the new economics of information technology and the priority packages listed below aim not only to prevent technological obsolescence, but also to keep the university ahead of the curve in information technologies and serve as a national model for higher education institutions.

Faculty Desktop Computer Lifecycle Replacements

During FY1999, all full-time faculty received a desktop computer as part of a special distribution program. Most of the computers issued at that time have been upgraded with additional disk and memory to gain additional useful life. Although some faculty have received new computers over the past several years, many are still using the computers issued in FY1999. It is estimated that 200 computer systems should be replaced in FY 2005, half of which would be replaced with notebook computers, and the remaining with desktop computers. The estimated cost for this project is \$300,000.

Wireless Network Expansion

NJIT plans to expand its wireless computer network to provide additional coverage for support of the increasing numbers of laptop computers and PDA's (personal digital assistants) used by the campus community. The wireless network upgrade also provides the opportunity to introduce new technologies for evolving wireless standards. The current wireless network provides access in the public areas of most buildings. However the growth in users is beginning to strain existing capacity. The expansion

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plans described here will allow members of the campus community access to network resources while in classrooms, lounges, labs, the library, the cafeteria, and on the campus green without having to worry about physical network connections. The expansion would be phased over a three-year period building on the initial pilot program initiated two years ago. Installation of wireless access points would require the use of outside contactors. The annual cost is \$150,000.

Wired Network Lifecycle Maintenance

The irony of campus networking is that colleges must support both wired and wireless networks. Wireless networks support convenience, short connection times, and relatively low bandwidth applications. High bandwidth applications in engineering, science, and architecture still require dedicated network connections and hardware in these areas should be replaced on an appropriate lifecycle basis. Assuming a five-year lifecycle for network building switches, \$100,000 should be planned annually beginning in FY2005 for equipment that was first installed in FY1998.

High Performance Computation Services

The primary computation servers available to NJIT researchers are Sulcus, a 20-processor SGI Origin 2000 server with 20 GB of RAM, and Fermi, a 28-processor Origin 3400 server with 28 GB of RAM. These servers support research computing for software requiring very large amounts of memory, high floating-point capability, and very fast direct memory access and disk I/O, as well as parallel processing. Researchers can wait as much as eight days for their jobs to process because of the high demand for these high performance computation servers. A proposal to double the number of processors and RAM in Fermi, the SGI Origin 3400 server is estimated at \$300,000.

Enterprise Information Systems Replacement

NJIT's core information systems to support student, financial, human resource, and alumni/development functions are based on 1980's technologies. Functional and mature, these legacy systems have met most of the university's information needs to date. However, as the university moves ahead on leveraging information resources to manage itself better and relationships with all its constituents, the legacy systems should be replaced. The university seeks modern enterprise information systems based on a relational database management system platform. The migration of NJIT's enterprise information systems would be a major project and most likely be planned over a three-year period. Migration services, software licensing, training, and hardware acquisitions are currently estimated at \$2,000,000 for the entire project.

Total Identified Needs – Information Services and Technology Infrastructure: \$2,850,000

Grand Total Identified Needs – Academic Support Services: \$6,710,000

Total Identified Needs (\$000's) Academic Support Services				
FTE #	Salary \$	Equipment	General Operating	Grand Total
5	\$325	\$2,250	\$4,135	\$6,710

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STUDENT SUPPORT SERVICES

Services provided include: admissions processing, residence, athletics (including an extensive program of intercollegiate and intramural sports), counseling services (including testing, course placement and career information, as well as academic and personal counseling), veterans and international student services, student activities (government, Greek, club and cultural), health services, and financial aid programs. Under established policies and procedures, financial aid is provided to students through a program of loans, scholarships and work opportunities. Funds are derived from state appropriations, federal grants and private sources. Also provided are supportive instructional services including tutoring, mentoring, and undergraduate research experience. Career planning and placement services include: workshops, resume writing, job fairs, job networks, internships, co-op, community service, counseling and placement.

Retention and Graduation

To date, NJIT has implemented the following programs and strategies to improve student retention, and ultimately graduation:

- Dean of First-Year Studies
 - Placement Assessment
 - Miniversity Orientation
 - Freshman Seminar Program
 - Early Academic Warning (Freshman Fifth Week Exams)
- University Learning Center
- Education Learning Assistance/ELAs (for Mentoring and Tutoring)
- Workshops
 - Time Management
 - Study skills
 - Test Taking
 - Career Awareness
 - Test Anxiety
 - Procrastination
- Peer Counseling
- Registration Holds and Mandatory Advising
- On-Going Transcripts Audits
- Data Collection and Analysis of Retention and Graduation in Compliance with Federal and State Standards
- Follow-up Study of Students who left NJIT at the end of Freshman Year
- Study to Determine Possible Barrier Courses
- Financial Aid Monitoring
- Women's Center
- SSSP, Vanguard and AMP (externally funded for minorities and first generation students) Programs
- Wintersessions (non-credit)
- Newark College Engineering (NCE) Retention Committee
- Study of Placement Exam Results

The FY2000 through FY2003 FTFTF Retention Analysis indicated that student retention, freshman to sophomore, is improving as compared to a decade ago when it was 75 percent.

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STUDENT SUPPORT SERVICES

FRESHMEN to SOPHOMORE

<u>2000-01</u>	<u>2001-02</u>	<u>2002-03</u>
80%	80%	85%

Residential students, Honors and EOP are retained at higher rates than commuters.

Issues

The retention Key Performance Indicators (KPIs) for freshman is 90% and 80% for sophomores by 2005. Graduation rate has increased about 12% since 1977 to 49% (for six years). The KPIs should be 55% by 2005.

Next Steps

- A residential freshman “Connections Program” was initiated fall 2002 and expanded for an additional 60 students fall 2003.
- Students in Math 103 are being closely monitored in partnership with the Department of Mathematical Sciences and mandatory tutoring will occur for students who did not pass the first common exam.
- Wintersession '03 (for credit) to retake classes in computer science, humanities, math, and physics was implemented enabling students to make “Satisfactory Academic progress” is being evaluated and expanded for winter '04.

Identified Needs – Student Support Services:

Residential Tutors (8 seniors or graduate students at \$4,000/student)	\$32,000
Math 103 Workshop Sessions (6 faculty stipends @ \$2,000/faculty)	\$12,000
Wintersession (Need-Based) Scholarships (30 student @ \$1500/student)	<u>\$45,000</u>

Grand Total Identified Needs – Student Support Services: \$89,000

Total Identified Needs (\$000's) Student Support Services				
FTE #	Salary \$	Equipment	General Operating	Grand Total
0	\$0	\$0	\$89	\$89

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INSTITUTIONAL SUPPORT

Institutional Support - Additional Staff and Resources

NJIT has experienced exceptional development of its academic programs and physical facilities over the past quarter century. Such growth inevitably tends to run ahead of the full administrative infrastructure necessary for the on-going management of a rapidly evolving, complex enterprise.

As an example, until recently, the Department of Human Resources and the Office of Legal and Employment Affairs operated under the Vice President and General Counsel. These two functions have now been separated for administrative purposes. An independent consultant recently provided the following summary for recommendations for reorganizing these important functions:

- Renew a charter for and re-establish a Human Resources organization that incorporates all functional aspects appropriate to its primary mission of helping NJIT achieve and retain a highly motivated, well-trained, productive, effective, and fairly rewarded staff.
- Refocus the charter for the Office of General Counsel regarding its roles in Human Resources Management to providing legal advice and counsel, rather than engaging in direct management and/or administration of policies and programs in that functional area.

NJIT is committed to reengineer systematically administrative and academic processes to improve customer and student satisfaction, starting with those processes identified as having the highest priority.

Institutional Support Staff Requested	FTE	Total (\$000's)
Financial /Budget Analyst	3	\$135
Assistant Bursar	1	\$55
Dir. Business Svcs	1	\$70
Cashier	1	\$25
Restricted Fund Accountant	1	\$45
Advancement Professional	3	\$180
Human Resource Professional	<u>3</u>	<u>\$180</u>
Total Identified Needs	13	\$690

Total Identified Needs (\$000's) Institutional Support				
FTE #	Salary \$	Equipment	General Operating	Grand Total
13	\$690	\$0	\$0	\$690

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PHYSICAL PLANT

Physical Plant Support

State, university, corporate and individual support have built a sizable campus. The replacement value of the campus now approaches a half billion dollars. To protect this investment, the university needs to strengthen the preventive and standard maintenance of the facilities. In addition, owing to the sophisticated nature of some facilities, e.g., computerized air handling systems in the Otto York Center and in the Microelectronics Center, constant vigilance must be maintained to ensure proper operation for the safety of employees and students, and for environmental protection.

The size of NJIT's custodial and grounds staff has not kept pace with facility usage and growth, making it increasingly difficult to maintain facilities at appropriate levels of cleanliness. Currently, gross square feet totals 2,587,684, an increase of 73% from FY92, at which time gross square feet totaled 1,496,933. By the fall of FY2004, gross square footage will total 2,603,867.

State appropriations over the past few years have not taken inflation into account, thereby diminishing the purchasing power of the university. Electrical, water and fuel costs continue to rise, requiring the university to address these price increases by reallocation of limited existing resources. In addition, the tremendous growth of added square footage and increased use of the campus to seven days per week add to increases in energy costs. Further, due to electrical supply industry deregulation, the cost of electricity will rise by an estimated 18 to 20 percent. All of these factors amount to a 25 percent increase in utility costs for FY 2004.

As part of an aggressive energy management plan, the university has installed energy management systems in all of its 29 buildings. Each building reports to a central monitoring location staffed by an energy engineer.

In order to protect the investment in plant, a preventive maintenance work order system has been implemented that automatically issues work orders on a weekly basis for predetermined preventive maintenance work to be performed. With an increased usage and complexity in our new buildings, energy management and associated controls a significant amount of work is necessarily done by outside contractors leaving the NJIT HVAC and craft staff free to respond to emergencies, minor repairs and 24 hour campus monitoring. This increased demand has necessitated the use of higher-level technicians for repair and maintenance resulting in higher labor costs.

Physical Plant Support Staff Requested	FTE	Total \$
Support Staff – Custodial	10	\$240
Support Staff - Grounds	3	\$60
Support Staff - Security	6	\$240
General Services		\$100
Utilities	—	<u>\$1,000</u>
Total Identified Needs	19	\$1,640

Total Identified Needs (\$000's) Physical Plant Support				
FTE #	Salary \$	Equipment	General Operating	Grand Total
19	\$540	\$0	\$1,100	\$1,640

**NEW JERSEY INSTITUTE OF TECHNOLOGY
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UNIVERSITY - WIDE

State Authorized FTE's

NJIT has experienced significant growth over the past ten years. Total operations have grown from \$112.7 million in FY1994 to estimated \$220.4 million in FY2004, an increase of \$107.7 million, or 96%. At the same time, student enrollment has increased from 10,044 to 11,820, or 18%. Additionally, the State Appropriation has increased from \$41.9 million to \$48.8 million, or 16.5%. Throughout this period, however, the State authorized FTE's have remained constant at 805. This authorized level has not been adjusted since FY1995. An analysis of the FY2004 Governor's Budget of New Jersey's institutions of higher education (excluding Thomas Edison and UMDNJ) concludes that NJIT's ratio of authorized employees to student enrollment headcount is the lowest of the ten institutions.

As part of the FY 2005 budget submission, NJIT is requesting an additional 258 FTE be recognized. Salary support for these positions has been identified from existing unrestricted operations. These positions in the academic, student, administrative and facilities areas are required to support appropriately a senior public research university and need to be recognized in our authorized state funded FTE.

Total Identified Needs (\$000's)	
University – Wide	
FTE	\$
258.0	\$0