

NJIT BOARD OF TRUSTEES
Thursday, February 12th, 2009

PUBLIC SESSION MEETING

NJIT

New Jersey's Science &
Technology University

PLEASE BRING TO MEETING

NEW JERSEY INSTITUTE OF TECHNOLOGY

BOARD OF TRUSTEES

PUBLIC SESSION

February 12, 2009

11:00 AM

Call to Order

1. **Notice of Meeting to Public** (statement to be read by the Chair, a requirement of the NJ Open Public Meeting Act)
2. **Public Comments**
3. **Action Items**
 - A. Approve minutes of the November 6, 2008 meeting of the Board of Trustees
 - B. Approve Sabbatical Leave applications
 - C. Approve Resolution to Authorize New MS in Pharmaceutical Chemistry
 - D. Approve Resolution to Authorize New MS Program in IT Administration and Security
 - E. Approve Resolution to Authorize New MS in Software Engineering
 - F. Approve Resolution to Authorize Student Fee for English Proficiency Exam in MS in Engineering Management Program at Beijing University of Technology
4. **Reports**
 - A. Update on purchase of Central High School (Robert Altenkirch)
 - B. Update on status of NJIT Campus Gateway Plan (Robert Altenkirch)
 - C. Honorary Doctorate Degrees for 2009 (Donald Sebastian)
 - D. Operating Statement Year to Date (Henry Mauermeyer)
 - E. Schedule of Short Term Investments (Henry Mauermeyer)
 - F. Intangible Asset Review (Donald Sebastian)
 - G. Spring 09 enrollment (Joel Bloom)
 - H. Report on gifts and fund raising activities (Robert Altenkirch)
 - I. Fund Raising Growth Strategies (Charles Dees)

5. **Announcement of Next Meeting**

Chair to read resolution regarding Closed Session to discuss Personnel, Real Estate and Contract Matters to be held on Thursday, April 9, 2009, 9:30 AM, Eberhardt Hall NJIT Alumni Center Board Room

Announce next public meeting: Thursday, April 9, 2009, 11:00 AM, Eberhardt Hall NJIT Alumni Center Board Room

Adjourn Public Meeting

New Jersey Institute of Technology
--innovative, entrepreneurial, engaged

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 *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.

1. Notice of Meeting to Public

BOARD OF TRUSTEES

**STATEMENT TO BE READ AT THE OPENING OF EACH
MEETING OF THE BOARD OF TRUSTEES**

“NOTICE OF THIS MEETING WAS PROVIDED TO THE PUBLIC AS REQUIRED BY THE NEW JERSEY PUBLIC MEETING ACT, IN THE SCHEDULE OF MEETING DATES OF THE BOARD OF TRUSTEES OF THE NEW JERSEY INSTITUTE OF TECHNOLOGY WHICH WAS MAILED TO THE STAR LEDGER, THE HERALD NEWS, AND THE VECTOR ON MARCH 16, 2007. THIS SCHEDULE WAS ALSO MAILED TO THE COUNTY CLERK ON MARCH 16, 2007 FOR FILING WITH THAT OFFICE AND POSTING IN SUCH PUBLIC PLACE AS DESIGNATED BY SAID CLERK.”

2. Public Comments

**3A. Approve Minutes of the
November 6, 2008 Meeting
of the Board of Trustees**

**NEW JERSEY INSTITUTE OF TECHNOLOGY
BOARD OF TRUSTEES
MINUTES - PUBLIC SESSION
November 6, 2008**

1. The meeting was called to order by Chairperson Wielkopolski, at 11:50 a.m. Other Trustees in attendance were Vice Chairs DePalma and DeCaprio, and Board Members Bone, Cistaro, Garcia, Knapp and Samuel. Also in attendance were President Altenkirch, Mr. Mauermeyer, Board Treasurer, and Ms. Holly Stern, Board Secretary.

In accordance with the New Jersey Open Public Meeting Act, the Chairperson read the following statement:

“Notice of this meeting was provided to the public as required by the New Jersey Meeting Act, in the schedule of meeting dates of the Board of Trustees of New Jersey Institute of Technology which was mailed to the Star Ledger, The Herald News and Vector on March 16, 2007. The Schedule was also mailed to the City Clerk of Newark on March 16, 2007, for filing with that office and posting in such public place as designated by said Clerk.”

2. The Board of Trustees Scholars, Ms. Hillary Thaon, majoring in civil engineering, and Mr. Anthony Sorgi IV, majoring in mechanical engineering addressed the Board, thanking the Board for the scholarship assistance and describing their activities at NJIT.
3. The meeting proceeded to the public portion for those members of the public having previously registered with the Board Secretary. Dr. Eugene Golub, President of the NJIT PSA/AAUP, spoke on behalf of the PSA. He noted that President Altenkirch sent a letter to the PSA membership, and therefore he was addressing the Board. He provided a handout outlining his comments before the Board. On the negotiating team, there are 3 faculty and 2 professional staff with 120 years of combined experience. He remarked that in the past there has been a model relationship between the PSA and the university, and the philosophy of the PSA is that the university needs to be successful. The litigation process has been replaced with a grievance process by which virtually all faculty grievances have been resolved. The “2 + 2” Committee process has decided all matters before it by consensus. He noted the nominal teaching load of nine hours per semester, and the implementation of a meaningful merit system which took the place of the former system of automatic increments. He stated that the current merit system works. He also noted that during a previous request for givebacks during a time of economic difficulty, the union gave back the ability to receive accumulated vacation upon separation in order to free up funds for the university. He discussed the fact that the professional staff gave up “just cause” in their contracts

25 years ago, and felt that it should be restored. He reviewed the history of the current negotiations, and stated that in 2007, the administration's proposal "gutted" the original contract. He took issue with the concept of eliminating automatic cost of living adjustments for faculty into the next contract, as it is the PSA's position that this would give the university too much discretion; a merit process which yields to individual judgment is a flaw. He further stated that the authority to shift merit between departments is not always exercised in a meaningful way, and this year a department that he described as the best research department in the school with excellent teaching got reduced merit money. He concluded by indicating that he would return at future meetings of the Board regarding other issues.

4. BY A MOTION DULY MADE BY DR. DeCAPRIO, SECONDED BY MR. SAMUEL AND UNANIMOUSLY PASSED, the minutes of the November 6, 2008 meeting were approved.
5. BY A MOTION DULY MADE BY MS. KNAPP, SECONDED BY DR. DeCAPRIO AND UNANIMOUSLY PASSED, the Board voted to approve the Resolution to Establish the School of Art and Design and the College of Architecture of Design to house the New Jersey School of Architecture and the School of Art and Design.
6. BY A MOTION DULY MADE BY MR. SAMULE, SECONDED BY MR. CISTARO, AND UNANIMOUSLY PASSED, the Board voted to approve the Schedule of Meetings for FY 2010 and 2011.
7. Dr. Altenkirch updated the Board on the status of the Gateway Plan and the Greek Village. While the City Council continues to debate the larger Broad Street redevelopment plan, the university's intention is to independently move forward with the development along Warren Street, the Greek Village area, and the building space at 240 King.
8. Senior Vice President Sebastian gave a report on research growth strategies, which was accompanied by a written revised handout. He reported that in FY 2008, research and development expenditures again grew to record heights, with overall expenditures reaching \$90 million for the first time. Recovery for facilities and administrative costs set a new record high in spite of a small decrease in external support for direct expenses, that is attributable to biannual fluctuations in project billings by NJTPA. Grant funding levels were flat or decreased across most sources, consistent with a national trend. While stem cell funding lost support at the State level, NJIT's research portfolio showed remarkable growth in key areas.

Plans for growth of research and development in FY 2009 in key areas of investment include defense (including opportunities for Rehabilitation Engineering), Homeland Security, Life Sciences (including pursuit of private

sector funding), Solar Physics and Transportation. With regard to Solar Physics, it was noted that the Big Bear Solar Observatory will shortly complete construction of the world's largest ground-based solar optical telescope, which will lead to enhanced grant potential.

9. President Altenkirch reported on the Budget Outlook for FY 09 and for FY 10 years ahead. Governor Corzine has announced to the college presidents that there will be no mid-year budget reduction, despite the current economic outlook. We have no real information yet for FY 10, although it will probably be a difficult year.
10. There was no discussion regarding Dubai program planning.
11. Vice President Mauermeyer reported on the Operating Statement Year to Date, and the Schedule of Short Term Investments.
12. Vice President Dees reported on gifts and fundraising strategies and the Athletics Campaign. While we are currently running behind funds raised compared to last year at this time, we are not concerned, as we think this will be a banner year. Considering the economic crisis, fundraising will be challenging.
13. Vice President Dees further reported on the upcoming Celebration event on November 14, 2008. Currently, we are running a little behind last year in terms of tables sold, although the number of individuals buying seats continues at about the same rate.
14. The Chairperson announced that the next scheduled closed session would be convened on Thursday, February 12, 2009, at 9:30 AM, at Eberhardt Hall Alumni Center Board Room, to discuss personnel, real estate and contract matters. The following resolution was read and approved by all Trustees present.

WHEREAS, there are matters that require consideration by the Board of Trustees that qualify under the Open Public Meetings Act for discussion at a Closed Session;

NOW, THEREFORE, BE IT RESOLVED, that the Board of Trustees shall have a Closed Session to discuss such matters as personnel, real estate and contract matters on Thursday, February 12, 2009 at 9:30 AM, Eberhardt Hall Board Room.

The next Public Session of the Board will take place on Thursday, February 12, 2009 at 11:00 AM, Eberhardt Hall Board Room, following the Closed Session of the Board.

The meeting was adjourned at 12:35 p.m.

**3B. Approve Sabbatical
Leave Applications**

To: Robert A. Altenkirch
President

From: Donald Sebastian
Provost (Interim) and Senior Vice President
for Research and Development

Re: Sabbatical Recommendations for AY 2009 – 2010

Date: January 28, 2009

Following our standard procedure of inviting proposals for sabbaticals, 21 proposals have been received from faculty members for sabbatical leave to be taken during Academic Year 2009 – 2010. These proposals were carefully evaluated by the Institute Committee on Sabbaticals. Based upon the deans', the chairs', and the committee's recommendations and my own review of the proposals, I am pleased to recommend that the following six faculty members be approved for sabbatical leave for the period indicated.

Ali Akansu	ECE	Fall 2009
Amit Bose	Math	AY 2009-2010
Zoi-Heleni Michalopoulou	Math	AY 2009-2010
Roberto Rojas-Cessa	ECE	AY 2009-2010
Demetri Theodoratos	CS	AY 2009-2010
Carol Venanzi	Chemistry	AY 2009-2010



New Jersey's Science &
Technology University

To: Members of the Board of Trustees

From: Donald Sebastian
Provost (Interim) and Senior Vice President for
Research and Development

Re: Sabbatical Leave Recommendations for AY 2009-2010

Date: January 28, 2009

Pursuant to the Faculty Handbook and with the concurrence of Dr. Altenkirch, I am pleased to recommend that the five faculty members listed on the attached memo be awarded sabbatical leaves during academic year 2009-2010. A total of 21 proposals were received.

As stated in the handbook:

“The purpose of having a system of sabbatical leaves at New Jersey Institute of Technology is to increase the effectiveness of a faculty member’s university service as well as to afford them an opportunity for professional development by relieving them of all normal campus activity. This philosophy is in consonance with the University Board of Trustees endorsement which was expressed as “further evidence of the Board’s continuing interest in the professional development of the faculty.”

I believe that those faculty members recommended for sabbatical leave during the academic year 2009-2010 will be enriched by this opportunity to immerse themselves in creative, scholarly, and research activities and will thus enhance not only their value to NJIT, but this university’s image as well.

The number of sabbatical leaves awarded since 1993 - 1994 is shown on the attached table.

History of Sabbatical Leaves

Academic Year	Total New Leaves
AY 1993 - 1994	13
AY 1994 - 1995	15
AY 1995 - 1996	13
AY 1996 - 1997	14
AY 1997 - 1998	12
AY 1998 - 1999	14
AY 1999 - 2000	15
AY 2000 - 2001	4
AY 2001 - 2002	13
AY 2002 - 2003	17
AY 2003 - 2004	20
AY 2004 - 2005	9
AY 2005 - 2006	9
AY 2006 - 2007	13
AY 2007 - 2008	14
AY 2008 - 2009	16

SABBATICAL PROPOSALS FOR ACADEMIC YEAR 2009 – 2010

SUMMARY

BOARD OF TRUSTEES

FEBRUARY 12, 2009

Ali Akansu – Professor – Electrical and Computer Engineering

Professor Akansu plans to work with Professor Marco Avellaneda in the Department of Mathematics at the Courant Institute of Mathematical Sciences. Professor Akansu has been focusing on a new research area – Digital Signal Processing Theory and Methods for Finance. His primary goal during the leave will be to get a focused exposure to the current computer trading algorithms and practices that might be improved by the utilization of the state-of-the-art signal processing theory, techniques, and tools. While performing research on financial applications of signal processing, Professor Akansu intends to develop a graduate level course on Digital Signal Processing for Finance and will perhaps co-author a monograph with Professor Avellaneda.

Amit Bose – Professor – Mathematical Sciences

Professor Bose plans to spend his sabbatical leave as a Visiting Professor at Jawaharlal Nehru University in Delhi, India in the Faculty of Physical Sciences. His research will focus on two areas. First, he will continue his research in dynamical systems and their application to neuroscience. He will focus on the modeling of the central nervous system and the role of short term synaptic plasticity on the dynamics of neuronal networks. Dr. Bose will work with Professor Ram Ramaswamy, an expert on the effects of stochastic processes on dynamical systems in physical applications, thus strengthening his background in this area so he can apply this knowledge to his work on neuronal networks. A better understanding of the effects of stochasticity may lead to better understanding of synchronization of neuronal networks, which is related to epilepsy, Parkinson's disease, and memory processes. His work is expected to lead to publications, presentations, strengthened international collaborations, funding opportunities and visibility of NJIT's mathematical neuroscience strengths.

Zoi-Heleni (Eliza) Michalopoulou – Professor – Mathematical Sciences

Professor Michalopoulou is an internationally recognized expert in accurate and computationally efficient inversion for geo-acoustic parameter estimation and source localization. She is also an expert in accurate and quantifiable target detection in the ocean. During her sabbatical leave she will continue her research in these areas and will work on problems of interest to the Office of Naval Research with the expectation that this

leave will lead to new funding opportunities. Professor Michalopoulou will work with Professor Lisa Zurk at Portland State University, an expert in time-frequency analysis in underwater application and with Professor Loren Nolte at Duke University, an expert on signal detection. Since her first successful sabbatical during 2001 - 2002, Professor Michalopoulou has continued her exceptional research productivity both in terms of grants received and with the publication of papers in prestigious journals. She also continues to excel in the classroom and to advise and co-author papers with her Ph.D. students.

Roberto Rojas-Cessa – Associate Professor – Electrical and Computer Engineering

During his sabbatical leave, Dr. Rojas-Cessa plans to conduct research on optical networks with Dr. Eiji Oki at the University of Electro-Communications in Japan and on disruption tolerant networks (DTM) with Professor Taweesak Kikanjanarat at Thammasat University in Thailand. Dr. Oki and Dr. Rojas-Cessa plan to research architectures and packet scheduling schemes for slow optical switches and will design a set of switches and schemes to handle the long configuration time of opto-electromechanical switches in efficient and cost effective ways. Working with Dr. Kikanjanarat will provide a research environment in a country interested in DTM technology which is expected to produce breakthroughs in future communications that are developed under constrained economical conditions. The research conducted during his sabbatical leave will complement his current area of research in wired Internet, especially in packet switches, and provide NJIT with a faculty member with greater experience in these areas.

Demetri Theodoratos – Associate Professor – Computer Science

Dr. Theodoratos intends to pursue a year-long project with Dr. Timos Sellis, a professor at the National Technical University of Athens and a Director of the Institute for the Management of Information Systems (IMIS). Dr. Theodoratos and Dr. Sellis plan to focus on the exploitation of syntactic information that is provided with keyword queries over XML data sources on the web in order to compute semantically meaningful answers and/or rank answers according to their relevance. Dr. Theodoratos expects the results of this research to be published in top international media. He also plans to explore the possibility of obtaining grants for a longer term common project between IMIS and NJIT through the European Union and/or NSF.

Professor Carol Venanzi – Distinguished Professor – Chemistry and Environmental Science

Professor Venanzi proposes to spend the sabbatical leave collaborating with experimentalists (both medicinal chemists and pharmacologists) at the Department of Medicinal Chemistry at the University of Kansas, at the National Institute on Drug Abuse (National Institute of Health) and at the Chemistry Department of Hunter College. The focus of the planned research involves applying computer-aided drug design techniques to develop new opioid pain medications and drugs to treat the effects of Ecstasy. These research topics continue Professor Venanzi's prior interest in treatment for cocaine abuse. This sabbatical will strengthen Professor Venanzi's research expertise in drug

development for drug abuse and lead to papers, presentations, and prospects for funding for her work. The work is also important for NJIT in its development of the MS in Pharmaceutical Chemistry.

**3C. Approve Resolution to
Authorize New MS in
Pharmaceutical Chemistry**

STATEMENT

RESOLUTION TO APPROVE THE MS IN PHARMACEUTICAL CHEMISTRY

The proposed MS in Pharmaceutical Chemistry will provide advanced graduate study and train students for careers in the health sciences and pharmaceutical areas. Since New Jersey has a high concentration of medical, pharmaceutical, environmental, and biotechnology industries with a related demand for a talented workforce, the MS in Pharmaceutical Chemistry will help fill the demand for employees with strong skills in modern chemical techniques as well as a good understanding of issues such as drug action, drug design, and drug development.

NJIT has identified bio related areas as areas for strategic growth in terms of new programs. The emphasis of the Pharmaceutical Chemistry program on the chemical underpinnings of the pharmaceutical industry fits into this strategic plan. This program will contribute to NJIT's mission to promote interdisciplinary cooperation and strengthen NJIT's offerings in the health related areas.

As our consultant explains, the pharmaceutical industry has let go hundreds of Ph.D. chemists during the current downturn; however, MS scientists have been less subject to these fluctuations. Certainly the problems of drug synthesis, assay, testing, drug delivery systems, and manufacture will remain. The pharmaceutical industry remains a powerful economic engine in New Jersey and biomedical research and education are important components in NJIT's master plan.

The proposed program is within the mission of the university, has received favorable independent external review, has received the approval of all appropriate standing committees and the faculty as a whole, is not unduly duplicative of other programs offered in the State of New Jersey, and has been the subject of a Program Announcement issued to institutions of higher education in the State of New Jersey. The incremental costs of the new program will be covered from the tuition and fees of the new students.

RESOLUTION TO APPROVE THE MS IN PHARMACEUTICAL CHEMISTRY

WHEREAS, the Board of Trustees has examined materials provided by the President of the University relative to a proposed program leading to the MS in Pharmaceutical Chemistry; and

WHEREAS, the Board is satisfied that the proposed program is within the mission of the university, has received favorable independent external review, is not unduly duplicative of other programs offered in the State of New Jersey and that the proposed program has been the subject of a Program Announcement issued to institutions of higher education in the State of New Jersey, and further, the incremental costs of the new program will be covered from the tuition and fees of the new students; and

WHEREAS, the Board of Trustees attests to the foregoing;

NOW THEREFORE BE IT RESOLVED, that the Board of Trustees approves the MS in Pharmaceutical Chemistry.

February 12, 2009

PROGRAM ANNOUNCEMENT
April 17, 2008 (Revised October 3, 2008)

Institution:	New Jersey Institute of Technology
New Program Title:	MS in Pharmaceutical Chemistry
Degree Designation:	Master of Science in Pharmaceutical Chemistry
Degree Abbreviation:	M.S. in Pharm Chem
CIP Code and Nomenclature (if possible):	51.2004 Medicinal and Pharmaceutical Chemistry
Campus(es) where the program will be offered:	New Jersey Institute of Technology, University Heights, Newark
Date when program will begin (month and year):	September, 2009
List the institutions with which articulation agreements will be arranged:	No articulation agreements will be arranged but it is expected that cross-registration will take place between NJIT and UMDNJ-Newark and Rutgers University-Newark

Is licensure required of program graduates to gain employment? Yes No

Will the institution seek accreditation for this program? Yes No
 If yes, list the accrediting organization:

Program Announcement Narrative

- Objectives
- Need
- Student Enrollments
- Program Resources
- Curriculum

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Descriptive Information

I. Objectives

The MS in Pharmaceutical Chemistry will provide advanced graduate training to students interested in the pharmaceutical and health sciences. The program will train students in quantitative methods that will prepare them for careers in the health sciences and pharmaceutical areas. This is especially relevant to the large pharmaceutical industry in New Jersey.

II. Need

A. Need for the Program

The pharmaceutical industry is a major employer of chemists, employing over 20% of graduates with B.S., M.S., and PhD's in chemistry. Pharmaceutical companies need employees with strong skills in modern chemical techniques, as well as a good understanding of issues such as drug action, drug design, and drug development.

New Jersey has a high concentration of medical, pharmaceutical, environmental, and biotechnology industries with a related demand for a talented workforce. The MS in Pharmaceutical Chemistry should help fill that demand.

B. Describe the relationship of the program to the following: institutional master plans and priorities.

NJIT has identified "bio-related" (biological, biomedical, health) areas as areas for strategic growth in terms of new programs. The emphasis of the Pharmaceutical Chemistry program on the chemical underpinning of the pharmaceutical industry fits into this strategic plan. This degree program will contribute to NJIT's mission to promote interdisciplinary cooperation and strengthen NJIT offerings in the health-related area.

The program also supports NJIT's mission, as identified by the 1981 Statewide Plan for Higher Education, to offer advanced instruction and research in the applied sciences. The Statewide Plan described NJIT as having "a special responsibility to provide technical services and assistance to the state and local government agencies and the industrial community by providing technical programs and undertaking research applied to New Jersey's needs."

The program also supports NJIT's stated missions: (1) to prepare students for productive careers and enhance their potential for lifelong personal and

professional growth, and (2) to prepare students in the conduct of interdisciplinary research.

C. List similar programs within the state and in neighboring states. How does this program compare to those currently being offered?

No New Jersey public or private university and no university in the New York or Philadelphia metropolitan areas offers a M.S. in Pharmaceutical Chemistry. Although all these institutions offer a M.S. in Chemistry, only Fairleigh Dickenson University (FDU) offers a masters degree in chemistry with a *concentration area* of pharmaceutical chemistry, while Montclair State University (MSU) is in the process of establishing a new M.S. in Pharmaceutical Biochemistry with a strong emphasis on the biochemical aspects. NJIT's program differs from those of FDU and MSU in three major aspects:

(1) The NJIT program draws on the strength of the well-established NJIT Pharmaceutical Engineering (PHEN) masters degree program to provide one core and three elective courses. The proposed MS program in Pharmaceutical Chemistry is complementary to the Pharmaceutical Engineering masters program because it emphasizes the applied science and molecular-level basis of drug design as opposed to the engineering emphasis on design, scale-up, and operations of pharmaceutical facilities. The PHEN courses recommended as part of the MS in Pharmaceutical Chemistry curriculum are not engineering courses, but rather have more general or basic science themes, such as an overview of the pharmaceutical industry (PHEN 601: Principles of Pharmaceutical Engineering), Validation and Regulatory Issues (PHEN 604), Principles of Pharmacokinetics and Drug Delivery (PHEN 618), and a bridge math course (PHEN 500: Pharmaceutical Engineering Fundamentals I (fundamentals of calculus, differential equations, probability and statistics, and finance business mathematics).

(2) NJIT students will have a wealth of relevant, interdisciplinary elective courses available to them through cross-registration at the Newark campuses of UMDNJ and Rutgers, and

(3) The faculty of the NJIT Department of Chemistry and Environmental Science have strong research credentials in computer-aided drug design, pharmaceutical analysis, biochemistry, and bio-inorganic chemistry. These research areas will be available to students who choose to do a 6-credit Masters thesis (with 24 credits of course work) or a 3-credit research project (and 27 credits of courses), instead of completing the degree with 30 credits of course work.

In terms of other related programs in New Jersey, the Department of Pharmaceutics of the Ernest Mario School of Pharmacy, Rutgers University, New Brunswick, NJ, offers a 24-credit masters degree in Pharmaceutical Science, but the thrust of this program is very different than the NJIT chemistry program because it emphasizes pharmaceutics, e.g. the strategies by which biologically active compounds are presented to the body so as to elicit an optimal response. The Department of Medicinal Chemistry of the Ernest Mario School of Pharmacy, Rutgers University, New Brunswick, NJ, offers a 31-credit masters degree in Medicinal Chemistry, but the thrust of this program is much narrower than the proposed NJIT program in Pharmaceutical Chemistry since the emphasis is more on synthesis of drugs. The NJIT program is broader and more flexible than either of the Ernest Mario School of Pharmacy programs in that it allows someone with a basic chemistry background to build on that strength by studying specialized topics related to the pharmaceutical industry. Beyond the 15-credits of basic core courses in the areas of organic, medicinal, and biochemistry as well as pharmaceutical analysis (analytical chemistry), and an overview of the pharmaceutical industry, the student has the flexibility to choose the remaining 15 credits of electives from a wide range of topics including biostatistics, toxicology, business and management, pharmacology, clinical trials, computational chemistry and molecular modeling. It is anticipated that the new faculty member hired to support the program will be a synthetic organic chemist, who will be able to contribute additional courses in the synthesis and design of drugs.

D. For doctoral programs: Supply a select list of distinguished programs nationally in this discipline.

Not applicable

III. Students

It is anticipated that a typical applicant to this program would have a B.S. degree in Chemistry and would attend NJIT part-time while being employed full-time in the New Jersey pharmaceutical industry. The proposed degree should help the student advance in his/her career path. Additionally, some international applicants may have a B.S. in Pharmacy and would attend NJIT full-time while pursuing the degree.

Estimate anticipated enrollments from the program's inception until a steady state or optimum enrollment is reached.

5/year to an optimal enrollment of 20/year

IV. Resources to Support the Program

No additional resources are needed, other than the hiring of a faculty member in the area of pharmaceutical/medicinal/organic chemistry.

A. Course Development

In anticipation of this degree some courses have already been introduced and/or upgraded:

Chem 777 (Principles of Medicinal Chemistry),

Chem 714 (Pharmaceutical Analysis)

Chem 737 (Computational Chemistry and Molecular Modeling)

B. Faculty

The department anticipates hiring a junior faculty at the assistant professor level in the area of synthetic organic chemistry to begin in the fall of 2009. To support the program, the department already has faculty strength in computer-aided drug design, biochemistry, pharmaceutical analysis, and bio-organic chemistry.

C. Libraries and Computing Facilities

Present facilities are adequate.

Library Facilities: This program will draw upon existing courses and upon the same supplemental literature that supports them and other related NJIT programs. NJIT's Van Houten Library has a collection of more than 150,000 books, many of which are appropriate for the program, such as *Cheminformatics in Drug Discovery*, *Fragment-Based Approaches in Drug Discovery*, *Reviews in Computational Chemistry*, *3D QSAR in Drug Design*, *Advanced Drug Design and Development: A Medicinal Chemistry Approach*, *Biological Approaches to Rational Drug Design*, *Biopharmaceutics and Clinical Pharmacokinetics: An Introduction*, *Biopharmaceutical Drug Design and Development*, *Chemistry of Drugs*, *Computer-Aided Drug Design: Method and Applications*, *Drug Discovery and Development*, *Drug Metabolism in Drug Design and Development*, *Fundamentals of Medicinal Chemistry*, *Guide to the Chemical Basis of Drug Design*, *Nanotechnology in Biology and Medicine*, *Nucleic Acid Targeted Drug Design*, *Advanced Organic Synthesis: Methods and Techniques*, *Art of Drug Synthesis*, and *Contemporary Drug Synthesis*. Some additional books will need to be purchased to support the program. The library subscribes to more than 1,000 print periodicals and about 8,000 electronic journals, including specialized journals needed to support the program, such as *The Journal of Medicinal Chemistry*, *Bioorganic and Medicinal Chemistry*, *Medicinal Chemistry Reviews*, *Medicinal Chemistry Research Reviews*, *Pharmaceutical Chemistry Journal*, *Pharmaceutical Development and Technology*, *Pharmaceutical Research*, *the European Journal of the Pharmaceutical Sciences*, *Journal of*

Pharmacology and Experimental Therapeutics, Molecular Pharmacology, Journal of Neuroscience, the Journal of the American Chemical Society, the Journal of Computer-Aided Molecular Design, Journal of Chemical Information and Modeling, the Journal of Computational Chemistry, Organic Letters, and Analytical Chemistry.

The library has an adequate number of networked microcomputers that provide access to many bibliographical databases and full-text electronics journals. Workstations/computers are available for searching the World Wide Web as well as the library's on-line catalog; access to CD-ROM based databases and a variety of on-line journal databases. Journal and conference literature in engineering, science, management, architecture, and other subject areas is accessible through a variety of indexing and abstracting publications in both print and electronic format. Some of the available relevant online databases are Chemical Abstracts (available through SciFinder Scholar), High Wire Press Journals, Journals of the American Chemical Society, DOE Information Bridge, Scopus, Pub Med Central Database, Pub Chem, Toxline, and Wiley Interscience.

Computing Facilities: The Information Services and Technology (IST) Division provides a full range of central information technology services to support the university's academic, research, student service, administrative, and public services initiatives. The Associate Provost for Information Services & Technology and Chief Information Officer oversees five functional departments: (1) Academic Computing Services, (2) Computer Operations and Production Service, (3) Telecommunications and Networks, (4) University Computing Systems, and (5) University Information Systems. IST partners with several other university organizational units: Instructional Technology and Media Services, University Web Services, and the Van Houten Library. Collaboratively, these organizations provide a seamless and robust information resource and technology infrastructure for all NJIT students, faculty, staff, researchers, and alumni. As one of the most computing-intensive campuses in the country, NJIT has long been recognized as a pioneer in the use of information technologies.

Highlander AFS is the primary academic computing environment at NJIT. Highlander AFS, NJIT's implementation of the Andrew File System (AFS) is a distributed computing environment comprised of multiple file and database servers and several hundred Unix, Windows, Linux, and Macintosh client computers. Highlander AFS provides a very broad spectrum of both commercial and open source application software, compilers, and utilities. A great number of applications and compilers are available on Highlander AFS. Highlander AFS is a distributed file system consisting of Linux, IRIX and

Solaris UNIX operating environments. Software types include desktop publishing, plotting, animation, and statistical analysis. NJIT supports generalized software relevant to the proposed program, such as Excel, Mathematica, Microsoft Office, ChemDraw, as well as specialized software used in computer-aided drug design (Gaussian, Sybyl, Spartan, Amber, Autodock, Macromodel, NAMD, and 3DNA)

As New Jersey's science and technology university, NJIT has developed a local cyberinfrastructure well positioned to allow NJIT faculty and students to collaborate at local, national, and global levels on many issues at the forefront of science and engineering research. High performance research computing at NJIT is being facilitated by the creation of a grid of compute clusters, some of which are used in the computer-aided drug design research carried out at NJIT.

NJIT's multi-gigabit wired network connects more than 6,500 nodes in classrooms, laboratories, residence halls, faculty and staff offices, the library, student organization offices and others. With more than 150 access points, the campus wireless network blankets the university's public, classroom and outdoor areas enabling NJIT's users' mobile connectivity. The extensive wireless network has helped to stimulate research towards the development of a wireless NJIT campus community system called SmartCampus. At NJIT, the latest advances in telecommunications and multimedia technologies are used to enhance the delivery of courses and the overall educational experience, allowing students to experience many aspects of a "virtual university" in a traditional campus setting. In addition, with connectivity to the NJEDGE, NJ state-wide higher education network and Internet2, students have the opportunity to work closely with faculty and researchers as new families of advanced applications are developed for an increasingly networked and information-based society.

E. Classrooms and Laboratories

Present facilities are adequate.

V. Curriculum: MS in Pharmaceutical Chemistry, 30 credits

Options:

- (1) 30 credits of course work,
- (2) 27 credits of course work, 3 credits research project,
- (3) 24 credits of course work, 6 credits of master's thesis

(Note: All courses are 3-credits each)

REQUIRED CORE COURSES (15 credits):

CHEM 605: Advanced Organic Chemistry: Structures

CHEM 673: Biochemistry

CHEM 777: Principles of Medicinal Chemistry

CHEM 714: Pharmaceutical Analysis

PHEN 601: Principles of Pharmaceutical Engineering

ELECTIVE COURSES (15 credits):

CHEM 661: Instrumental Analysis Laboratory

CHEM 664: Advanced Analytical Chemistry

CHEM 737: Computational Chemistry & Molecular Modeling

CHEM 610: Advanced Inorganic Chemistry

CHEM 736: Inorganic Biological Chemistry

CHEM 658: Advanced Physical Chemistry

CHEM 748: Nanomaterials

EVSC 616: Toxicology for Scientists & Engineers

MATH 663: Introduction to Biostatistics

MATH 664: Regression Analysis

PHEN 500: Pharmaceutical Engineering Fundamentals I (fundamentals of calculus, differential equations, probability and statistics, and finance business mathematics)

PHEN 604: Validation & Regulatory Issues in the Pharmaceutical Industry

PHEN 618: Principles of Pharmacokinetics & Drug Delivery

PHEN 635/EM635 Management of Pharmaceutical Technology R & D (*)

26:120:572 Concepts in Pharmaceutical Drug Development (Rutgers)

26:120:584 Enzyme Kinetics & Mechanism (Rutgers)

26:160:515 Chemical Structure Determination (Rutgers)

PATH-N5209 Business of Science: From Molecules to Medicine (UMD)

GSND-N5310 Clinical Trials Overview: Methodology & Practices (UMD)

PHPY-N5021 Principles of Pharmacology (UMD)

CHEM 700B: Masters Project (3 credits)

CHEM 701C: Masters Thesis (6 credits)

(*) course to be developed by the Industrial Engineering Department for a new MS degree

REPORT ON THE PROPOSED MS PROGRAM IN PHARMACEUTICAL CHEMISTRY AT NJIT

November 20, 2008

Prepared By:

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A. Objectives

The objectives as stated in the NJIT Program Announcement (Revised Version June 4, 2008) are reasonable if a bit general. There appear to be at least three “quantitative” directions: molecular modeling, metabolic modeling, pharmaceutical reaction engineering. Moreover, students have the opportunity to obtain interesting overviews of the pharmaceutical industry from selected NJIT, Rutgers-Newark, and UMD courses. These objectives fit well with NJIT’s emphasis on bioscience and biomedical science and in its role as a state-supported institution in New Jersey where the pharmaceutical industry is a major economic engine and source of employment.

B. Need for the Program

This program has at least two distinct student audiences. One of these is the group of chemists (or scientists in closely allied areas) presently working in the pharmaceutical industry who wish to enhance their professional credentials while broadening and updating their educational base. They are likely to be part-time students. For example, a chemist is very likely to benefit from exposure to principles of chemical engineering that would allow for better understanding of the links between laboratory and production scales. Similarly, exposure to the three UMD courses listed on page 8 of the NJIT Program Announcement will provide working chemists with background and insights not normally part of their education or likely to be part of their industrial experiences. Full-time students may be predominantly USA citizens but there will undoubtedly be applicants from countries abroad (notably India and perhaps China and South Korea), where the pharmaceutical industry is “gearing up.” Some of these graduates may return to their home countries while others may stay and meet the needs of New Jersey’s pharmaceutical industry.

While the pharmaceutical industry has let go hundreds of Ph.D. chemists during the current downturn, MS scientists have been less subject to these fluctuations. When the economy improves there will be renewed interest in adding new Ph.D. chemists as well as scientists at B.S. and M.S. levels to work with them. Certainly, the problems of drug synthesis, assay, testing, drug delivery systems and manufacture will remain. New paradigms of manufacture (e.g. microreactors- see **CONCLUSIONS AND RECOMMENDATIONS** below) will arise.

Masters degree programs in Pharmaceutical Chemistry are well established at only a very few major universities- University of Kansas and SUNY at Buffalo are two principle examples, neither of which is in geographical proximity to NJIT. In the NJIT Program Announcement, the proposed program is differentiated from the MS in Pharmaceutical Chemistry option in the MS in Chemistry degree offered at Fairleigh Dickinson University Madison Campus. This reviewer agrees that the two programs are significantly different. Moreover, NJIT is much more productive in research and will have collaboration with Pharmaceutical Engineering from its inception. This reviewer also agrees with the differentiation of this program from the Masters degree in Pharmaceutical Science as well as the Masters degree in Medicinal Chemistry both offered out of the Ernest Mario School of Pharmacy at Rutgers University- New Brunswick.

Montclair State University has recently established The Margaret and Herman Sokol Institute for Pharmaceutical Life Sciences. This is a new and significant presence, with newly-established and significant contacts with the State's pharmaceutical industry. The first associated academic program, an MS degree in Pharmaceutical Biochemistry, is now scheduled to begin admitting students in September 2009. While the thrust of this program and its significant industrial contacts make it a potential competitor to the proposed NJIT MS in Pharmaceutical Chemistry, NJIT enjoys many unique aspects and advantages. As an established research institution, NJIT has research infrastructure presently exceeding that of Montclair. The synergy between engineering (especially Pharmaceutical Engineering) and the proposed program is unique to NJIT. Proximity to and established collaborations with New Jersey Medical School of UMDNJ is also a powerful advantage. Nonetheless, NJIT needs to establish its own niche and identity rapidly with the region's industrial partners.

C. Education Program

The program has three options (all totaling 30 credits): courses only (30 course credits); courses plus Masters Project (27 course credits); courses plus Masters Thesis (24 course credits). There are 15 credits of required core courses. This is deemed appropriate for a program of such breadth. The courses seem appropriate since they provide advanced background in chemistry and biochemistry as well as introductions to medicinal chemistry, pharmaceutical analysis and pharmaceutical engineering. The advantages of close geographical proximity to Rutgers- Newark and the New Jersey Medical School of UMDNJ are very apparent. In addition to seven relevant Chemistry Department courses from NJIT and three others from Rutgers- Newark, there are four Pharmaceutical Engineering courses available for students with appropriate mathematics backgrounds and offered by the department of Chemical Engineering at NJIT. It is perhaps worth remarking that while CHEM 748 (Nanomaterials) will be a useful elective course, concentration in this course (or a new course) on nanoscale drug delivery systems could be worthwhile. There are also two mathematics courses and an introductory level toxicology course at NJIT and three medically-oriented courses at UMD. The presence of engineering programs at NJIT and the close proximity of a medical school and another chemistry Ph.D.-granting institution provides this proposed program with a rare advantage.

It is interesting that Stevens Institute of Technology, a quick PATH commute from NJIT, offers some useful potential electives but does not (yet) offer a competing program in Pharmaceutical or Medicinal Chemistry. Montclair State University's new program does offer a core course titled "Biomolecular Assay" and NJIT might consider having a similar course available, at least, as an elective since it is very important to understand surrogate assays for biological end points.

It is clear that there is a rich menu of courses from which to choose, assuming that all courses are regularly offered. In the opinion of this reviewer, each entering student should be carefully counseled concerning the courses chosen. If electives are taken without a goal or some degree of specialization in mind, a student might take a series of unrelated electives. Although this might indeed serve the goals of that specific student, it would appear to be useful to help advise a student in picking a core of courses related to a coherent area of interest and to career goals.

D. Students

It is anticipated that a significant number of students (perhaps the majority) may be chemists with B.S. degrees working in the pharmaceutical industry. Some of these may have particularly strong backgrounds and anticipate benefitting from the technical and research environment at NJIT. Students from other countries will need to be carefully "vetted" since their degrees (chemistry, biochemistry, pharmacy) may have different emphases than those anticipated for students enrolling in the program. In addition, some countries (*e.g.* India) have colleges/universities that vary from among the world's most excellent and competitive to very poor in quality.

This reviewer had the welcome opportunity to meet with at least 21 NJIT chemistry students (4 B.S., 7 M.S., and 8 Ph.D.) during the October 20, 2008 visit. The B.S. and M.S. students were asked whether they could be (or would have been) interested in pursuing the M.S. in Pharmaceutical Chemistry program if offered. Roughly 70 % indicated significant interest. The students were an enthusiastic and independent-minded group. Three other interesting points emerged from that meeting: a) some undergraduate students felt that the Chemistry Department could do more to recruit them to its graduate program; b) some students felt that there were very limited opportunities to pursue graduate research in organic chemistry; c) some students felt that they had little opportunity at NJIT to learn about research in other departments/programs- it is possible that more exchange in this area might strengthen interdisciplinary components in the proposed Pharmaceutical Chemistry M.S. program.

E. Faculty

The present chemistry faculty is judged adequate to teach courses and conduct research in pharmaceutical chemistry. Clearly, the program has particular strength in computational medicinal chemistry. Since organic chemistry (especially synthetic organic chemistry) is fundamental to the pharmaceutical industry, there is a need for the department to add at least one faculty member in this area. The Chemistry Department is about half the size of the Chemistry Division of NJIT some twenty years ago. One result is a huge burden of teaching, research *and* administration resting on the shoulders of a small cadre of talented faculty. Hopefully the department will produce an academic plan that will identify future

areas of strength, including pharmaceutical chemistry, and recruit faculty to achieve excellence in these areas. Light-loading and effective mentoring of new faculty will be vital. To be successful, a new chemistry faculty member at NJIT will need to be resourceful and entrepreneurial, adapting to opportunities, collaborating with departmental colleagues, co-investigators from other departments, universities, and with industry (an opportunity enhanced by an Industrial Advisory Board- see below).

F. Support Personnel

Although support personnel are judged adequate, it seems the situation is borderline in nature. The issue of instrumentation support and maintenance is a significant one. Strong infrastructure in this area can boost a department's competitiveness enormously with the converse also being true. The Chemistry Department is light in staff as well as faculty and this adds to the faculty workload, subtracting time and energy from research and teaching. Hopefully, as the National and the State economies improve, infrastructure support will improve.

G. Finances

There is certainly a need to add at least one faculty immediately and provide adequate start-up funds to provide a good chance for that faculty member's successful promotion and tenure and start toward a distinguished career at NJIT. Beyond this initial investment, there are really no other significant needs that *must* be solved to get this program started and moving in a positive direction.

H. Physical Facilities

The physical facilities are adequate for the program, relying upon space in Tiernan Hall for teaching and research and the Otto York building for research. Joint research projects at Rutgers Newark, UMD, or even the part-time student's place of employ could further articulate this space. However, the size and research opportunities of the Chemistry faculty remain severely limited in Tiernan Hall. The need to expand the NJIT Chemistry faculty as well as the opportunity to offer research space to active, retired pharmaceutical chemists (see **CONCLUSIONS AND RECOMMENDATIONS** below) remains tightly constrained by limited space.

There are significant research instrumentation resources at NJIT- 300 MHz Nuclear Magnetic resonance (NMR) Spectrometer, Fourier Transform Infrared (FTIR) spectrometer, High Performance Liquid Chromatography (HPLC) and other significant instrumentation in Tiernan Hall and the Otto York Building. However, the infrastructure for maintaining and running these instruments is minimal and considerable faculty time is lost as a result. New faculty members will need clear access to these types of instrumentation and should not have to spend too much time in their maintenance. Hopefully, start-up funds will provide needed instrumentation specific to a faculty member. The specific rules for access (and costs) to instrumentation (e.g. high field NMR; high molecular weight mass spectrometers) at Rutgers- Newark and UMD should be assessed. Perhaps "barter" arrangements involving complementary instrumentation at the three campuses can be arranged. Computing facilities at NJIT are more than adequate for the new program.

I. Library

Library resources are judged adequate for the proposed program. Networked microcomputers in the Van Houten Library are adequate and provide ready access to on-line resources such as SciFinder. The book collection and journals collection are adequate although resources for additional subscriptions and book purchases are very limited. The proximity to Rutgers-Newark and NJ Medical School libraries adds significantly to available resources. Presently, the technical reference librarian is a chemist, very experienced, sophisticated and eager to work productively with the new program.

J. Computer Facilities

Computer facilities are much stronger than adequate. NJIT has a strong College of Computing Sciences and appropriate university-wide facilities. Within the department of Chemistry, there are at least three faculty members who employ state-of-the-art computational chemistry including specific software relevant to drug design.

K. Administration

The Dean of the College of Arts and Sciences is clearly very supportive of this program and will likely be an effective advocate for it with the NJIT executive level. The Department chair and other involved faculty are supportive and effective. In general, the department administration suffers from a dearth of faculty and staff.

L. Evaluation

In the Program Announcement (Revised June 4, 2008), the enrollment projection is for an increase of 5 students per year to attain a steady-state enrollment of 20 students. One simple evaluation would be to assess by the end of the fifth year of the program's operation, the degree of success in meeting this goal. It would also be appropriate to assess the number of part-time vs full-time students. By the end of the fifth year, there should also be two-three years of data on the employment track record of program participants. In addition to these metrics, exit interviews of students and interviews of employers (or subsequent graduate schools) might start the assessment process. Obviously, publications with MS student co-authors, presentations, and grants are relevant. An Industrial Advisory Board (albeit chosen by the department, see below) will also provide useful input. Although ABET accreditation is not relevant for this program, the ABET 2000 criteria for assessment are flexible and useful. In particular, ABET now looks for evidence of a "feedback loop" to ensure continual assessment and improvement. The new program will benefit from such a process.

CONCLUSIONS AND RECOMMENDATIONS

It is recommended that New Jersey Institute of Technology **approve** the proposed Masters Degree in Pharmaceutical Chemistry. The pharmaceutical industry remains a powerful economic engine in New Jersey and biomedical research and education are important components in

NJIT's master plan. Although somewhat "late out of the starting gate" and with significant competition from new initiatives at Montclair State University, the field is large enough and dynamic enough to continue to offer opportunities for a well-designed new program. NJIT's status as a research university and the existence of a well-regarded MS in Pharmaceutical Engineering program at NJIT offer promise of success for the proposed program. Below are some specific conclusions and recommendations:

1. It is vital that NJIT develop a niche in the pharmaceutical chemistry field that distinguishes it from other programs and takes advantage of the strengths that already exist at the university.
2. The strengths include the existence of a Masters Program in Pharmaceutical Engineering at NJIT currently led by a chemical engineer who is welcoming to the new program and poised to be helpful. There are natural opportunities for collaboration between these two programs both in teaching and in research.
3. The Department of Chemistry has a relatively small number of tenured/tenure-track faculty members with a number of retirements anticipated over the next decade. This presents an opportunity for the department to produce a vision of focused areas of future strength. One of these could certainly be in pharmaceutical chemistry. Organic chemistry (organic synthesis in particular) is central to pharmaceutical chemistry and this is certainly a high-priority for faculty recruitment. A vision of focused areas of strength could also help the department determine a "right size" for its future faculty.
4. The constraints on the number of chemistry faculty members should provide impetus for seeking research collaborations with faculty members in other NJIT departments (Chemical Engineering, Mechanical Engineering, Computer Science, Biological Sciences are obvious possibilities). Hopefully, collaborations can be enhanced with scientists at Rutgers/Newark as well as NJ Medical School of UMDNJ.
5. Although the proposed program is an MS program with non-thesis as well as thesis options, it is clear that NJIT's research profile and expectations of faculty demand a competitive research program. With relatively small "critical mass" in pharmaceutical chemistry, this suggests looking for emerging and unique opportunities. It would be presumptuous on the part of this reviewer to suggest specific research avenues. However, for illustration purposes, one example of an emerging opportunity would be the exploration of microreactors ("Microreactors Hit the Major Leagues", *Chemical & Engineering News*, October 20, 2008, pp 37-8). This is a research area with great potential for collaboration between chemists and engineers. An illustration of a unique opportunity could be in the field of the chemical and environmental fates of discarded (e.g. past-date) medicines. This is a serious problem in the United States and especially in poorer ("third world") countries. It offers an opportunity to exploit strengths in environmental science at NJIT.

6. The proposed program would greatly benefit from the formation and operation of an Industrial Advisory Board. This need not (and should not) become a burden for the department in terms of numbers of meetings and faculty and staff work. One hopes to convince the region's industry that it has a vested interest in the success of the new program. Clearly, the nature of the program which anticipates a large number of part-time students who are employed full-time in the pharmaceutical industry, makes such a board beneficial. Such a board is not meant to "run" a department but can provide insights into the state-of-the-art from an industrial perspective, helpful suggestions, contacts, internships, and help in garnering resources. Clearly, the new center at Montclair State University has made a strong start in this direction and the Rutgers-Newark Chemistry Department has had strong ties with the region's pharmaceutical industry for decades.
- 7: Serious thought should be given to providing adjunct appointments as well as laboratory space to chemists retiring from the region's pharmaceutical industries. While space in Tiernan Hall (and the York Building) is clearly at a premium, such appointments offer the opportunity to augment the chemistry faculty with outstanding scientists who might bring resources (i.e. their industrial laboratory apparatus), experience, ideas, and contacts without the requirements of a tenure-track position. These scientists could teach special topics courses that could add electives to the proposed program or be offered as continuing education courses for certificates. The opportunities offered by Newark's geographical location are significant.
8. It will be important that new faculty hired for this program be given the tools to succeed along with careful mentoring. A new hire in organic chemistry will almost certainly require start-up funds in excess of \$200K (Research 1 departments such as Rutgers New Brunswick typically offer multiples of this figure). Where equipment is to be made available to and shared by the new faculty member, explicit understandings need to be achieved prior to hire or at least early in the person's appointment.
9. Chemistry (and related disciplines) at NJIT would be well served through development of an infrastructure to run and maintain capital items of equipment. This reviewer's own personal experience has demonstrated that poor infrastructure caused a department at a major Research 1 university to operate non-competitively, while strong infrastructure allowed a chemistry department at a predominantly Masters Degree institution to compete with Ph.D.-granting departments.

Response to Consultant's Report on the Proposed
MS in Pharmaceutical Chemistry Program
Department of Chemistry and Environmental Science
New Jersey Institute of Technology

The Conclusions and Recommendations section of the Consultant's Report submitted by Professor Arthur Greenberg, University of New Hampshire, made several points which the Department of Chemistry & Environmental Science at NJIT plans to address as follows:

1. NJIT should develop a niche in the pharmaceutical chemistry field.

The Department already has research strength in the area of computer-aided drug design and nanoparticles synthesis for drug delivery. The Departmental faculty lead projects in NSF funded IGERT and ERC programs aimed at developing composite structures for drug delivery. Dr. Haidong Huang has accepted the offer for the position of Assistant Professor starting Fall 2009. He brings strong research expertise in the area of synthetic bioorganic chemistry and biochemistry; both quite pertinent to the proposed MS program. We plan to develop a direction based on our strengths.

2. NJIT should tap into the strengths of the Pharmaceutical Engineering (PHEN) program.

The proposed MS in Pharmaceutical Chemistry requires one PHEN course as a part of the core. Three PHEN courses are potential electives. The director of the Pharmaceutical Chemistry program will work closely with the director of the PHEN program to identify other courses and potential opportunities for research and teaching collaboration. For example, students in the Pharmaceutical Chemistry program may choose to do a three-credit research project or independent study with a faculty member in the PHEN program. The department already has strong ties with the PHEN program, with the latter's students taking courses such as Pharmaceutical Analysis and Medicinal Chemistry. Some PHEN students also do their thesis or MS project under Chemistry faculty.

3. The Department should develop a vision of its future direction.

The College of Science and Liberal Arts (CSLA) at NJIT has put together a strategic planning committee with faculty member representatives from each department. This committee has begun its deliberations for developing a five-year vision for CSLA building on the current strategic plan. Each Department is actively engaged in developing a vision for its development, along with benchmarks and multidisciplinary perspectives. The department will be actively engaged in developing its vision for the future keeping the pharma program in mind.

4. Because of the low number of chemistry faculty, the faculty should seek research collaborations with others at NJIT, Rutgers, Newark, and UMDNJ.

Additional interaction with the PHEN program may lead to new research collaborations between the chemistry and chemical engineering faculty. The CSLA strategic planning committee is expected to provide new directions. Collaborations are already underway between NJIT and Rutgers faculty. We also share an X-ray crystallography facility with them. The joint NJIT/UMD/Rutgers Quantitative Neuroscience initiative is expected to lead to more research collaborations, especially those related to pharmaceutical chemistry.

5. Faculty should look for emerging research opportunities related to pharmaceutical chemistry.

The active participation in the NSF IGERT and ERC programs provides us with an opportunity for furthering pharma related research. Recent collaboration between Dr. Lev Krasnoperov and Public Health Research Institute is another new opportunity for the department. It is expected that the hiring of Dr. Haidong Huang will catalyze new initiatives in the pharma area.

6. The Department should establish an Industrial Advisory Board.

An industrial advisory board is being set up.

7. Chemists retiring from New Jersey's pharmaceutical industries should be brought in as adjunct instructors and possible research collaborators with their own laboratory Space.

Chemists from the Pharma industry have always been a source of qualified adjuncts for the department. We see their participation increasing with the introduction of this MS program. Research is also an exciting possibility.

8. New faculty hires should be carefully mentored and given adequate start-up packages.

As already indicated, an assistant professor in synthetic organic chemistry has been hired to start in the fall of 2009. The NJIT administration is committed to giving him the tools including appropriate start up funds so that he can establish his research group. He will also be mentored within the department by senior faculty.

9. NJIT should develop an infrastructure to run and maintain capital equipment.

The basic chemistry infrastructure in support of chemistry education already exists within the university. In addition, an NMR was acquired three years ago and a biochemistry teaching laboratory is currently being set up. The CSLA Dean has been

providing funds on a yearly basis to further upgrade and maintain laboratory facilities. In general, the Department has numerous functional laboratories for both teaching and research which will also be available to this program.

ARTHUR GREENBERG
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Education

Doctoral Degree	Chemistry 1971	Princeton University
Masters Degree	Chemistry 1970	Princeton University
Bachelors Degree	Chemistry 1967	Fairleigh Dickinson University

Awards, Recognition and Honors

- NHPR Program (WEVA) "The Front Porch" interview "Alchemy and Chemistry" (30 minutes), Liz Bulkley, April 24, 2007.
- Listed Consultant, *NOVA* (WBGH, Boston) Program *Newton's Dark Secrets* (November 15, 2005).
- Founding Editor, research journal *Structural Chemistry* (Kluwer Academic/Plenum Press), remained as Editor 1989-2003 [See Review in *Nature*, 353, 472-473 (1991)].
- NHPR Program (WEVA) "The Front Porch" interview about book *A Chemical History Tour* (20 minutes), John Walters, May 8, 2001.
- "From Alchemy to Nanotechnology," An Exhibition of Original and Printed Artwork from My Book *A Chemical History Tour* – New York Academy of Sciences, January 12-March 16, 2001 and Binghamton University Art Museum, March 23-May 25, 2001.
- Co-Organizer with Professor Louise Ball, Sixteenth Meeting of the International Society on Polycyclic Aromatic Compounds, Charlotte, NC, November 4-8, 1997.
- 1996 Morris Katz Memorial Lectureship in Environmental Research, York University, Toronto, CANADA, March 6, 1996
- Session Organizer and Session Chair, Gordon Research Conference on Physical Organic Chemistry, Plymouth, NH, June 11, 1991
- 1990 Joseph B. Hyman Award, North Jersey Section of the American Chemical Society, one outstanding chemistry college teacher/year
- Appeared in WNET Documentary "Not In Your Backyard", October, 1990
- 1986 Harlan J. Perlis Award Research, New Jersey Institute of Technology.
- My research was highlighted twice in *Chemical and Engineering News* (September 17, 1979, pp. 25-26; September 19, 1983, pp. 33-34.
- National Science Foundation Trainee, Princeton University, 1967-68
- Bachelors Degree (1967), *Magna cum Laude*

-President-Elect, UNC Charlotte Chapter, Phi Kappa Phi, 1999-2000

MAJOR ADMINISTRATIVE ACCOMPLISHMENTS

University of New Hampshire (July 1, 2000-June 30, 2005)

Dean, College of Engineering and Physical Sciences and Professor of Chemistry

The University of New Hampshire (UNH) is the “flagship” Land Grant University in New Hampshire. It enrolls approximately 11,000 full-time undergraduate students and approximately 3,000 graduate students on the Durham campus. There are five academic colleges at Durham, the second largest is the College of Engineering and Physical Sciences (CEPS). UNH uses a decentralized budget model called Responsibility-Centered Management (RCM). CEPS enrolls over 1300 undergraduate and over 300 graduate students. It includes nine departments (Chemical Engineering, Civil Engineering, Electrical and Computer Engineering, Mechanical Engineering, Chemistry, Computer Science, Earth Sciences, Mathematics and Statistics and Physics). All nine departments offer B.S., M.S. and Ph.D. programs. There are also interdisciplinary undergraduate and graduate programs and two major and three smaller research centers in CEPS that reported to the dean. The total tenure-track faculty numbers about 125.

1. Advancement in ABET accreditation: Our excellent engineering faculty, students and curriculum have always been well regarded by ABET. However, Kingsbury Hall, which houses the engineering programs (as well as Math and Computer Science) was over 55 years old at the time of the full ABET accreditation visit in 1999, one year before I assumed the dean’s position. This, as well as inadequate budgetary support, led to two corresponding evaluations in each area as a “Weakness” for each of the four undergraduate (ME, EE, CheE, and CiE) programs. I hosted an ABET visit in 2001 and wrote a report in 2004. The progress made on Kingsbury Hall (see below) led to its initial upgrading to a “Concern.” Moreover, successful financial management under the new and highly decentralized Responsibility Centered Management (RCM) model adopted by the university when I arrived in July 2000, led ABET to drop budgetary support both as a “Weakness” and as a “Concern” in July 2002. In addition, I led the ABET accreditation of our new B.S. in Environmental Engineering in Fall, 2000, the first ABET accreditation of our Computer Sciences B.S. program and the re-accreditation of our Mechanical Engineering Technology and Electrical Engineering Technology Baccalaureate Programs shortly after it transferred to the UNH Manchester campus. ABET adopted a “paradigm-shift” in its accreditation philosophy and methodology starting in 2000, that is termed “ABET 2000.” I provided leadership and resources starting in 2001 for our 2006 ABET visit that would be based on ABET 2000 criteria. I completed and submitted the Colleges ABET Report to accompany six individual engineering program reports in May 2005 two months prior to the completion of my five-year term as Dean. The November 2005 visit was the most successful the College has had in two decades: 3 programs received the best possible evaluation (a visit in 6 years or 6V) and the other three received a Report only in 3 years (3R) and at least some of these may be converted into 6V with some efforts by the departments in the next few months. This is an enormous improvement in the ABET accreditation circumstances of the College accomplished during my tenure as Dean.
2. Dedicated and effective work with UNH administration, University System of New Hampshire, legislators, alumni, Board of Trustees and industrial partners to fund the Knowledge Economy Education Program (KEEP) of New Hampshire starting in Spring, 2001. The efforts were directed at obtaining \$185 million from the state to renovate and expand the four CEPS buildings. In Spring 2001 we were successful in obtaining \$44.6 Million for renovation and expansion of Kingsbury Hall, the primary engineering building (see ABET above). UNH further committed itself to fund-raising efforts to build a \$53 Million building

better reflecting the needs of a modern engineering building as well as rapidly rising prices for building materials including steel. I led the efforts to negotiate academic space between the nine constituencies occupying Kingsbury Hall. Ground-breaking occurred in May, 2004. The new Kingsbury wing (laboratories and offices) was occupied in January 2006 and the full project will be completed in April 2007. I also played a major role in our fund raising efforts for Kingsbury Hall. I initiated contact with BAE Systems, the largest technical firm in the state, that led to a \$1 Million donation to the construction of the building (the largest capital donation in UNH history) as well as with the Kingsbury Family and Kingsbury Company in Philadelphia that raised \$250,000. Funds for the remaining three buildings were approved in Spring 2005.

3. My agenda upon arriving at UNH was to greatly increase CEPS collaborations with the other colleges, especially with the College of Life Sciences and Agriculture (COLSA). Aligned with this plan was a plan to increase collaborations with the region's industrial partners. In a productive alliance with the Dean of COLSA we helped support a faculty member (chemist with joint CEPS/COLSA appointment) to obtain an NIH/BRIN grant to start a Structural Biology Center (housed in the Chemistry building). Both COLSA and CEPS then collaborated in jointly searching two tenure-track professors in our respective colleges affiliated with the Center. This degree of collaboration between CEPS and COLSA was unprecedented. I also successfully engaged the Computer Science Department in the bioinformatics aspect of this research. Other related activities included providing moral and monetary support to a member of the Physics Department working on Xenon-based MRI. He subsequently received over \$4 million in funding from NIH. In addition, our College has worked with COLSA to produce an inter-college Ph.D. program in Earth and Environmental Sciences and an undergraduate program in Environmental Sciences. A Bioengineering option in Chemical Engineering was also approved during my tenure as dean. We greatly increased our collaborations with BAE Systems and initiated collaboration with Northrop-Grumman as well.
4. Another early agenda item included improvement in pre-college education in mathematics, science and engineering. The Dean of COLSA and I were instrumental in formulating a proposal that received a \$2 Million gift to start the Joan and James Leitzel Center for Mathematics, Engineering and Science Education. I have remained fundamentally involved in many aspects of K-12 education. The partnership for this Center now involves close collaboration between three colleges: CEPS, COLSA and the College of Liberal Arts (COLA).
5. I was pro-active in increasing the diversity of our faculty (a critical step toward increasing the diversity of our student body). During my term as dean, the number of tenure-track or tenured female faculty in CEPS doubled (now about 15% of total). I appointed the first female department chairs (Math and Physics Departments) in the history of CEPS. We added two Hispanic faculty members but, sadly, we were not successful in recruiting African American faculty.
6. I led the development of a College-wide academic plan and introduced college retreats and started a successful College-wide seminar series (CEPS Frontier Series) as one means of attempting to unify our diverse departmental cultures.
7. I have participated energetically in our College's exchange program with the Budapest University of Technology and Economics (following my visit in November, 2002 the number of engineering students enrolled doubled from 9 to 18 and will probably be 25 this year). I initiated collaborations with the El Salvador Ministry of Environment and Natural Resources as well as the University of El Salvador. My visit in November, 2003 led to signing of formal

agreements that I carried back to San Salvador in January, 2004. Subsequent visits in November, 2004, and December, 2006 and hosting a visit from the President of the University of El Salvador (September 2008) are paving the way for long-standing collaboration.

8. I worked energetically with my College on recruitment and retention. Each year I visited the New Hampshire Science Teachers Association and, at my encouragement, CEPS faculty members are now presenting workshops at the annual meetings. We also revised our freshman math curriculum to improve retention. In the first three years of its operation, retention of our CEPS freshmen improved from 65% to over 80%.
9. We have worked collaboratively with our Industrial Advisory Board and many industries in the State on specific projects and now on Homeland Security. I have helped to develop a nanotechnology initiative with Northeastern University, the University of Massachusetts at Lowell, and the region's industry that was funded by NSF (NU is the lead institution). Along with my successor as Dean of CEPS, I am on the Institutional Advisory Board of the NSF NSEC High Speed Nanomanufacturing Center of the three institutions. The center will receive a second five-year period of NSF funding (2009-2014).
10. UNH is developing a new General Studies Program (the UNH Discovery Program). As Dean I continued to teach one course per year and developed and taught twice one of the first experimental freshman "Inquiry" courses- a course on Symmetry that is highly interdisciplinary and innovative in approach.

University of North Carolina at Charlotte (1994-2000)
Chair, Department of Chemistry

1. Initiated in Fall, 1994, with concurrence of Department of Chemistry faculty, first Industrial Advisory Board for a non-engineering Department at UNC-Charlotte. Board meets twice per year. Results include donation of \$25,000. match toward successful NSF/MRI Grant (1998), donations of two excellent-condition 300 MHz NMR spectrometers, enhanced visibility for the University, research opportunities for faculty and opportunities for jobs and co-op-study for students.
2. Originated the concept and started the Regional Analytical Chemistry Laboratory (RACheL) to raise the level of research capability at the University and in the region. This entity was approved by the Provost in 1996 and now occupies three laboratories in the Cameron Applied Research Center. It received donations of four major items of equipment in excellent working order and is actively supporting the region's industry. I was the PI on a NSF/MRI grant (1998) for \$139,400 and \$25,000 match from two companies which, with matching funds from the University brought a MALDI/TOF and HPLC (Electrospray) MS instruments to campus. I believe my interaction with local constituencies beyond the University is a personal strength. I am also the PI on a grant from the Livingstone Foundation that brought a GC/MS and a Chemical Technician for RACheL.
3. Convinced the Department to support a system of common exams and a common syllabus for the Freshman Chemistry Program. Improvements in test quality, efficiency and uniformity, accomplished in an atmosphere of collegiality, significantly improved our offering. Convinced the Department and Administration to hire a Chemical Educator on tenure track to direct this program. He has had significant positive impact. Convinced administration to place an excellent Lecturer on Tenure-Track as another Chemical Educator.

4. Played a very significant and positive role in designing the new PhD Program in Biology (Biotechnology/Biomedicine), which started in Fall, 1998. The program is now truly interdisciplinary in scope and includes faculty from the Departments of Biology, Chemistry, Physics, Mechanical Engineering, and Electrical Engineering as well as scientists from the Carolinas Medical Center. I am a strong believer in interdisciplinary collaboration and served two years on the University's Interdisciplinary Program Committee.
5. Chaired the University's successful Provost Search Committee during the 1997-98 Academic Year. I believe that I was chosen because I was regarded as having strong administrative and leadership skills, a campus-wide perspective and integrity. The Committee worked extremely well together. I have always had very strong interdisciplinary interests and am invariably invited to participate in projects by faculty members in the Arts and Humanities. My books *A Chemical History Tour* (Wiley, 2000) and *The Art of Chemistry* (Wiley, 2003), newly consolidated into *From Alchemy to Chemistry in Picture and Story* (Wiley, 2006), strongly reflect these interests.
6. Intangible accomplishments include taking an excellent Chemistry Department having very low visibility on the campus and in the region and making it "a player" in both as well as improving collegiality and morale among Department faculty and staff. During my term we hired seven excellent tenure-track faculty including a Distinguished Professor.

Rutgers University New Brunswick Campus, (1989-1994)

Professor and Graduate Director, Department of Environmental Sciences

1. As Graduate Director (1991-94) I broadened the participation of faculty outside of the Department of Environmental Sciences, who actually constituted about 60% of the total graduate faculty, and completely revamped the Program's core curriculum to make it more modern, rigorous and to improve the intellectual and interdisciplinary environment.
2. Set in motion, in collaboration with the Dean for Research at Cook College, a university-wide effort in Natural Products Chemistry as part of a wider program in Biodiversity.

New Jersey Institute of Technology (1977-1989)

Professor of Chemistry and Founding Co-Director of the Air Pollution Research Laboratory

1. One of three founding Co-Directors of the Air Pollution Research Laboratory (APRL) in 1981 and originated and published its newsletter *Air Currents*. This laboratory was critical in helping to establish an NSF Center of Excellence in Hazard Substance Management Research.
2. I chaired for two years the University-wide Promotion and Tenure Committee (usually Chairs serve for one year). The most significant accomplishments were a) beginning the incorporation of outside letters of recommendation into candidates' packages, and b) helping to make the evaluation of College of Architecture faculty fairer and more rational and for eventually having a member of that College on the University-wide Committee.

ACADEMIC EXPERIENCE

-Professor of Chemistry, University of New Hampshire, Durham, New Hampshire, 7/1/00-Present.

-Dean of the College of Engineering and Physical Sciences and Professor of Chemistry, University of New Hampshire, Durham, New Hampshire, 7/1/00-6/30/05.

-Professor and Chair, Department of Chemistry, University of North Carolina at Charlotte, Charlotte, North Carolina, 8/94—6/00.

-Professor, Department of Environmental Sciences, Rutgers University, New Brunswick, New Jersey 9/89-8/94;

-Director, Graduate Program in Environmental Sciences, Rutgers University, 1991-94 (60 Faculty; 200 Students); Deputy Director, Exposure, Measurements and Assessment Division, Environmental and Occupational Health Sciences Institute (EOHSI), Jointly Administered by Rutgers University and University of Medicine and Dentistry of New Jersey (UMDNJ); Laboratory Leader, Organic Chemical Analysis Support Laboratory (Organic CASL), NIEHS CENTER (Rutgers Univ./UMDNJ); Member of Graduate Faculty in Toxicology, Rutgers University, New Brunswick, NJ

-Professor, Department of Chemical Engineering and Chemistry, New Jersey Institute of Technology, Newark, New Jersey 9/84-8/89

-Associate Professor, New Jersey Institute of Technology 9/80-5/84.

-Assistant Professor, New Jersey Institute of Technology, 9/77-5/80

-Associate Professor, Department of Chemistry, Frostburg State College, Frostburg, Maryland, 9/75-5/77

-Assistant Professor of Chemistry, Frostburg State College, 9/72-5/75

-Assistant Professor and Chair of Science Department, Englewood Cliffs College, Englewood Cliffs, NJ (Now part of St. Peter's College) 9/71-5/72

-Visiting Assistant Professor, Department of Chemistry, Fairleigh Dickinson University, Teaneck, New Jersey 1/71-8/71

Significant Previous Administrative and Related Experiences

-Chair, Search Committee for Provost and vice Chancellor for Academic Affairs, University of North Carolina at Charlotte, Charlotte, NC, August, 1997 - March, 1998.

-Established Regional Analytical Chemistry Laboratory (RACHEL) at UNC Charlotte.

-Graduate Director, Department of Environmental Sciences, Rutgers University, 7/91-6/94.

-Associate Chair for Graduate Studies in Chemistry, Department of Chemical Engineering and Chemistry, New Jersey Institute of Technology, Newark, NJ 7/88-8/89

-Chair, University-Wide Promotion and Tenure Committee, New Jersey Institute of Technology, 9/86-6/88.

-Co-Director, Air Pollution Research Laboratory, New Jersey Institute of Technology (I also developed the concept and edited the newsletter Air Currents), 9/80-8/89.

-Chair, New Jersey Institute of Technology Committee on Joint PhD Program in Chemistry with Rutgers-

Newark.

-Faculty Liaison to the Dean of the College (Elected), Frostburg State College, 9/75-6/76. In this position I fostered communication between Faculty and Administration and coordinated the College Self-Study for Middle States Accreditation.

-Established, following visits, exchange program between Farnborough College of Technology (UK) and New Jersey Institute of Technology and initiated cooperative exchange program between New Jersey Institute of Technology and Shenzhen University (People's Republic of China)- the latter, frozen following June 4, 1989 repression.

Additional Education/Research Appointments/Special Courses

-Research Associate, Institut de Chimie, Universite de Liege Sart Tilman, Liege, Belgium, 7-12/70 (Professeur Pierre Laszlo).

-NSF Summer Institute: Computational Methods and Computer Applications in Chemistry, New York University, Summer, 1971

-NSF Summer Institute: Photoelectron and Auger Spectroscopies, University of Tennessee, Summer, 1973.

-Research Associate, Department of Chemistry, Yeshiva University, New York City, Summer, 1974 (Professor Irving Borowitz).

-NSF Chataqua Course: Chemical Origins of Life, Mount Holyoke College, Winter, 1976.

-School of the International Crystallography Union: Importance of Small Differences in Molecular Structure, Erice (Sicily), May-June, 1985.

SERVICE ACTIVITIES

A. Professional

-Member, American Chemical Society Historical Landmarks Committee, 2003-2011.

-Founding Co-Editor, research journal Structural Chemistry, Springer-Verlag, New York, 1989-2003

-Member, Editorial Board, Structural Chemistry, Springer-Verlag, 1989-Present

-Editor, Molecular Structure and Energetics (Book Series), VCH Pub., New York, 1983-1990.

-Editor, Structure Energetics and Reactivity in Chemistry (SEARCH) (Book Series), Chapman and Hall Pub., New York, 1991-1998

-Advisory Board, Stereochemical Methods of Analysis (Book Series), A. Marchand (Ed), John Wiley & Sons, 1984-2002.

-Editorial Board, Polycyclic Aromatic Compounds (Research Journal) Gordon and Breach Pub., 1989-2001

-Co-Organizer, Sixteenth International Symposium on Polycyclic Aromatic Compounds, November, 1997, Charlotte, North Carolina

-Member 1991 Baekeland Medal Committee, North Jersey ACS

-Councilor/Alternate Councilor, North Jersey Section, American Chemical Society, 1980-1986

-Alternate Councilor, North Jersey Section, American Chemical Society, 1991-93

-Chair, Organic Chemistry Section, North Jersey Section, American Chemical Society, 1984

-Chaired Symposia at American Chemical Society Middle Atlantic Regional Meeting (MARM) and Metrochem Meeting

-Member, Education Committee, North Jersey Section, American Chemical Society, 1983-84

-Chemistry, Physics and Thermodynamics Subcommittee of International Committee on Polycyclic Aromatic Compounds (ICPAC)

-I review research proposals for National Science Foundation, Petroleum Research Fund,

Administered by the American Chemical Society, Binational (U.S.A./Israel) Science Foundation, USEPA

-I regularly review papers for Journal of the American Chemical Society, Journal of Organic Chemistry, Environmental Science and Technology, Journal of Physical Organic Chemistry, Atmospheric Environment, Polycyclic Aromatic Compounds, Atmospheric Environment; Journal of Physical Chemistry.

-Mentor for 13 American Chemical Society Project SEED Students

-Mentor for 4 Liberty Science Center Partners-In-Science Students

-Mentor for 6 Cook College "Discovery" High School Summer Interns

B. College Service Other Than Administrative

-Chair, Parsons Hall Building Renovation Committee, Spring 2008-

-Elected Chair, Promotion and Tenure Committee, UNH, CEPS, Fall 2007

-Elected Member of UNH Faculty Senate, 2007-9

-Davis Faculty Fellow, UNH Discovery Program, 2006-8

-Faculty Fellow, UNH Honors Program, 2006-8

-Elected Member of UNH Graduate Council, 2006-8

-Chair, Search Committee, Provost and Vice Chancellor for Academic Affairs, UNC Charlotte, August, 1997 – March, 1998

-Member Search Committee, Intellectual Properties Officer, UNC Charlotte, March, 1998

-Member, Committee on Interdisciplinary Studies, UNC Charlotte, Summer, 1997

-Member, Interdisciplinary Biology Ph. D. Program, UNC Charlotte, Summer, 1997

-Member, Search Committee, Director Human Resources, UNC Charlotte, Summer, 1997

-Member, UNC Charlotte University Patents Committee, 1996

-University Senator, Rutgers University, 1991-94

-Rutgers College Fellow, 1990-94

-Douglas College Fellow, 1990-94

-Member, Environmental Sciences Department Self-Study Comm., 1991

-Initiated and run Environmental Sciences Department, Rutgers University, Seminar Series, 1990-92

-Cook College Freshman Advisor, 1991-94

-Set up rare book exhibit titled *A Distillation of the Chymicall Spirit*, Rutgers University Library of Science and Medicine, 10/24-12/19/91.

-Member of New Jersey Institute of Technology University-Wide Promotion and Tenure Committee, 1985-1988 (Chair, 1986-88)

-Faculty Advisor, Omicron Delta Kappa, Student Service Society, New Jersey Institute of Technology, 1980-82

-Faculty Advisor, American Chemical Society Student Affiliate, New Jersey Institute of Technology, 1980-84

-New Jersey Institute of Technology Representative to the New Jersey Marine Sciences Consortium, 1980-84

-Member, Search Committee for Dean of College of Arts and Sciences, New Jersey Institute of Technology, 1984

-Initiated and ran Department of Chemical Engineering and Chemistry Seminar Series at New Jersey Institute of Technology, 1983-86

-Chair, Materials Science and Engineering Program Committee, New Jersey Institute of Technology, 1984-85

-Faculty Advisor to Student Government, Frostburg State College, 1975-76

-Faculty Advisor to American Chemical Society Student Affiliate at Frostburg State College, 1974-77

C. State-Wide Service

- Member, New Hampshire Industrial Research Council, 2000-2005.
- Member, Advisory Board, Charlotte-Mecklenburg Student Internship Committee, Spring, 1995-Present
- Member of NJDEPE Committee to Develop Mercury Emissions Standard for Municipal Incinerators, 1992
- New Jersey Department of Health Board on Ethylene Dibromide, 1984
- Member of New Jersey College Outcomes Evaluation Program (COEP) Committee, 1985-87; First Chair, Research, Scholarship and Creative Expression Subcommittee of COEP, 1985 and Member of this Subcommittee, 1985-1988
- Member of Evaluation Visitation Team for Environmental and Occupational Health Sciences Institute (EOHSI) (Rutgers/UMDNJ) 1986
- Member and Chair, Environmental and Occupational Health Sciences Institute Doctoral Fellowship Review Panels, 1987-1990
- Resource Person for Liberty Science Center and Hall of Technology, Jersey City, New Jersey, 1989-1994
- Member, Environmental Exhibits Committee, Liberty Science Center and Hall of Technology, 1988-1994
- Mentor, Science-By-Mail Program (Liberty Science Center), 1989-1994
- Advisor, Partners-In-Science Program, 1989-1994
- Judge, High School Chemistry Olympics, 1986-92

Paid Consulting

- Communications Satellite Corporation (COMSAT), Washington, D.C., Fall, 1982
- Gordon and Roper Law Offices, San Francisco, CA, Fall, 1983.
- Dresdner Associates, Jersey City, NJ, January, 1985-
- J.C. Anderson Associates, Hackensack, NJ, June, 1989-1991.
- U.S. Department of Justice, Washington, D.C., August, 1990-1998.
- WASHTECH, Washington, D.C., May-October, 1994
- U.S. Department of Justice, Washington, D.C., October, 2003-Present.

RESEARCH INTERESTS

Structural organic chemistry of organic molecules including polycyclic aromatic hydrocarbons (PAH), substituted cyclopropanes, cyclopropenes and bridgehead lactams; Relationship between calculational (ie quantum chemical), experimental thermochemical properties and reactivity; Relationship between structure and bioactivity of silatranes; Analysis, occurrence, reactivity and metabolic fate of PAH, related nitro-PAH and quinones; Use of bioassays for directing fractionation of complex environmental mixtures; Human exposure to pollutants; Studies of impacts of municipal incinerators on the environment; Mercury in environment.

GRADUATE DISSERTATIONS DIRECTED

A. Ph.D. Dissertations Directed (5)

1. Jung-Hen Lwo, Rutgers University, 1993
2. Hsiu-Wen (Sandy) Chen, Rutgers University, 1994
3. Che-Han Hsu, Rutgers University, 1994
4. Jau-Jang Lu, Rutgers University, 1997
5. Clyde Johnson, Rutgers University, 1997

B. Masters Dissertations Directed (22)

1. Tyler A. Stevenson, New Jersey Institute of Technology, 1984
2. Yalan Wang, New Jersey Institute of Technology, 1986
3. Jose L. Reyesgavilan, New Jersey Institute of Technology, 1987
4. Ping Chiang Lyu, New Jersey Institute of Technology, 1987
5. Xueying (Linda) Sun, New Jersey Institute of Technology, 1987
6. Robert Cebula, New Jersey Institute of Technology, 1988
7. Anulfo A. Valdez, New Jersey Institute of Technology, 1988
8. Suyi Luo, New Jersey Institute of Technology, 1988
9. Jung-Hen Lwo, New Jersey Institute of Technology, 1989
10. Yea-Yi Chiu, New Jersey Institute of Technology, 1989
11. Wenhui Wu, New Jersey Institute of Technology, 1989
12. Jung-Chou Tsai, New Jersey Institute of Technology, 1989
13. Deyi Yang, New Jersey Institute of Technology, 1989
14. Hsiu-wen (Sandy) Chen, New Jersey Institute of Technology, 1989
15. Ouyang Zheng, New Jersey Institute of Technology, 1989
16. Che-Han Hsu, New Jersey Institute of Technology, 1990
17. Sathish Pushpala, New Jersey Institute of Technology, 1990
18. Yadan Wang Chen, New Jersey Institute of Technology, 1990
19. Kecheng Liao, Rutgers University, 1993
20. Hung-Jung Lee, Rutgers University, 1993
21. David T. Moore, University of North Carolina at Charlotte, 1997
22. Kenneth L. Strickland, University of North Carolina at Charlotte, 1998

**3D. Approve Resolution to
Authorize New MS Program
in IT Administration and
Security**

STATEMENT

The objective of the MS in IT Administration and Security is to educate students in the concepts, principles, techniques, and practices needed to administer a modern IT environment and its security. Those who complete the program will be well prepared to play leadership roles as database, network, security and web services administrators; as enterprise application administrators; and as IT administration managers.

As organizations deploy progressively more complex computer and software systems, there will be a growing need for specialists in computer system administration and security. Graduates of the MS in IT Administration and Security program will fill this need. The graduate of this program will be well qualified for high level IT administration positions; they will be trained in the required principles, skills and practices of IT administration and security. With industry and government in the New Jersey area having extensive IT needs, graduates will provide a ready and professionally trained workforce for these businesses.

The proposed program is within the mission of the university, has received favorable independent external review, has received the approval of all appropriate standing committees and the faculty as a whole, is not unduly duplicative of other programs offered in the State of New Jersey, and has been the subject of a Program Announcement issued to institutions of higher education in the State of New Jersey. The incremental costs of the new program will be covered from the tuition and fees of the new students.

RESOLUTION TO APPROVE THE MS IN IT ADMINISTRATION AND SECURITY

WHEREAS, the Board of Trustees has examined materials provided by the President of the University relative to a proposed program leading to the MS in IT Administration and Security; and

WHEREAS, the Board is satisfied that the proposed program is within the mission of the University, has received favorable independent external review, is not unduly duplicative of other programs offered in the State of New Jersey and that the proposed program has been the subject of a Program Announcement issued to institutions of higher education in the State of New Jersey, and further, that the incremental costs of the new program will be covered from the tuition and fees of the new students; and

WHEREAS, the Board of Trustees attests to the foregoing;

NOW THEREFORE BE IT RESOLVED, that the Board of Trustees approves the MS in IT Administration and Security

February 12, 2009

PROGRAM ANNOUNCEMENT September 2008

Institution:	New Jersey Institute of Technology
New Program Title:	MS in IT Administration and Security
Degree Designation:	MS in IT Administration and Security
Degree Abbreviation:	MS IT AS
CIP Code and Nomenclature (if possible):	11.0103 Information Technology
Campus(es) where the program will be offered:	Newark Campus, NJIT
Date when program will begin (month and year):	September 2009
List the institutions with which articulation agreements will be arranged:	

Is licensure required of program graduates to gain employment? Yes No

Will the institution seek accreditation for this program? Yes No
 If yes, list the accrediting organization:

Program Announcement Narrative

- | | |
|---------------------------|--------------|
| • Objectives | page(s) 2 |
| • Need | page(s) 2-3 |
| • Students | page(s) 3-4 |
| • Program Resources | page(s) 4-5 |
| • Curriculum | page(s) 6 |
| • Appendices | page(s) 7-8 |
| • New Course Descriptions | page(s) 9-10 |

Descriptive Information

I. Objectives

The objective of the MS in IT Administration and Security degree (MS IT AS), offered by the Information Technology (IT) program at NJIT, is to educate students in the concepts, principles, techniques, and practices needed to administer a modern IT environment and its security. Students will gain extensive practical experience doing IT administration. Security will be a component of core courses in addition to a specific security course. Those who complete the program will be well prepared to play leadership roles as database, network, security and web services administrators, as enterprise application administrators, and as IT administration managers.

Need

II. A. Need for the Program

The MS in IT Administration and Security degree program will fill a persistent and growing need for specialists in computer system administration and security, as organizations, large and small, deploy progressively more complex computer and software systems. Every computing infrastructure needs IT administration and security personnel. These positions are difficult to outsource because they tend to require local presence for a variety of reasons, including security restrictions and strong requirements for direct personal interactions. The graduates of this program will be well-qualified for high level IT administration positions because they will be trained in the required principles, skills and practices of IT administration and security. This program will provide its graduates with a broad perspective on the different elements of computer system administration and security. A MS in IT Administration and Security graduate would could become an IT administration manager, in addition to being able to fill customary IT administration roles.

Two of the top dozen fastest growing and highest paying occupations projected for the 10 years 2004-14 by the US Department of Labor (Appendices A and B), would be ideally suited for MS in IT Administration and Security graduates:

- Network and system administrators
- Database administrators

With industry and government in the New Jersey area having extensive IT needs, graduates will provide a ready and professionally trained workforce for these businesses.

II. B. Relationship to the Institute Master Plans

NJIT's strategic plan is to grow enrollment at both the graduate and undergraduate levels. Based on Department of Labor statistics, as well as internal surveys of IT undergraduate students and our best professional judgment regarding growth opportunities in IT Administration and Security, this degree is likely to attract a significant number of new

students. It will be attractive to our IT undergraduates, who currently do not have an IT graduate degree at NJIT to transition into. At the graduate level a degree in IT Administration and Security will educate students for a spectrum of advanced IT administration and management positions.

II. C. Relationship to Similar Programs in the State and Region

There are currently no graduate level programs in IT Administration and Security in the region. However, because of the intense demand for specialists in this area, we believe such programs are likely to be developed in the near future. There are some nearby programs with elements comparable to those in our proposal. For example, Pace University in NY has a Master's degree in Information Technology with specialized concentrations similar to elements of the proposed degree. Monmouth University offers an MS in Computer Science with concentrations related to this area but not a complete degree. Drexel in Philadelphia has a general MS in Information Technology program.

II. D. Distinguished Programs Nationally

Rochester Institute of Technology (RIT) has an undergraduate program in Networking and System Administration. At the graduate level, RIT offers a more broadly scoped MS in Networking and Systems Administration as well as an MS in IT with many concentrations including ones in networking and system administration. Tufts and Michigan Technological University have prominent graduate programs in IT

III. A. Students

Students will include working professionals and graduates of our undergraduate computing programs. A major feeder for the program will be our undergraduate IT program. We have strong evidence from surveys (2006, 2008) of the strong appeal of such a program from undergraduate IT students. A new undergraduate survey again demonstrates strong interest among both current students and alumni. While some of our IT undergraduates obtain a Master's in Computer Science or Information Systems, many do not pursue graduate study at NJIT because the orientation, content and requirements of the available programs differ considerably from the proposed program. The new program focuses on the administrative and security aspects of IT, which are closely related to the largest concentration area in our undergraduate IT degree (approximately 70% of the BS IT students select the networks and security concentration).

Domestic students are expected to be the primary audience but we expect to also have international students. NJIT's traditional methods of student recruitment will be used. We anticipate attracting approximately 25 students in the first year increasing to 50-100 students over the next five years. It is expected that most of the students would not otherwise have enrolled at NJIT for graduate study.

III.B. Admission Requirements

To be eligible for admission, a student must have completed an undergraduate degree, preferably in Information Technology, Computer Science, Computer Engineering,

Information Systems, or a related field, with a GPA of 2.8 or higher. Students not satisfying these criteria will be considered for conditional admission on a case-by-case basis. This includes students whose bachelor's degree is in a non-technical field but who have professional experience in computing or systems administration. Such students are expected to have had the following courses or their equivalent in order to qualify for matriculation: CS 505 Programming, Data Structures and Algorithms (or a background in C or C++ such as CS 114), IT 102 Introduction to Information Technology II, IT 230 Computer and Network Security, CS 332 Principles of Operating Systems, IT 420 Computer Systems and Networks. An admitted student not fulfilling these requirements will be required to complete corresponding bridge courses with a GPA of 3.0 or higher, which will not be counted towards the Master's degree.

IV. Resources to Support the Program

A number of new core courses must be developed and taught. We anticipate offering two of the core courses each semester. We will need either one new faculty member (an IT University Lecturer) or several competitively compensated industry specialists to handle the additional course load as adjuncts. Laboratory and equipment requirements are described under IV.C.

IV.A. Course Development

The following new courses will need to be developed:

- IT 6xx – Wireless Network Security & Administration
- IT 6xx – Database Administration
- IT 6xx – System Administration
- IT 6xx – Web and Domain Server Administration

IV.B. Faculty

There are two University Lecturers in the IT program with industrial and governmental experience in security and system administration. There are also CCS faculty from the CS and IS departments with expertise in security, system administration or related areas. These faculty will teach and assist in evaluating adjunct expertise. Elective requirements can be satisfied by current computer science and information systems courses.

IV.C. Libraries and Computing Facilities

Since this program will draw upon existing courses and the same supplemental literature that supports other related NJIT programs, library holdings are more than adequate to support the new program. NJIT's Van Houten Library has a collection of more than 130,000 books and subscribes to about 500 printed journals and about 13,000 electronic journals. The library's home page provides access to the library's online catalog and links to a wide array of information services. The library purchases between 2,500 and 3,000 new books each year. Requests for new books or journals are made through the academic department's faculty representative to the library.

The library has a wide array of networked PCs that provide access to a large number of bibliographical databases and full-text electronic journals, for searching Internet sites, searching each library's on-line catalog, and access to various on-line journal databases. VCR's for viewing videocassettes reserved for courses are also available. Journal and conference literature in engineering, science, management, architecture and other subject areas is accessible through a variety of indexing and abstracting databases. Among the databases available on line are CompendexWeb (Engineering Index); ProQuest Direct (articles on business, management and industry), Applied Science and Technology Index. The library also borrows through interlibrary loan (ILL) for materials.

The libraries web site describes the services and resources more completely. Please see www.library.njit.edu.

As a technological research university, NJIT has excellent computing systems, networks and software to support this program. The Newark campus' gigabit Ethernet network backbone connects more than 6,000 nodes in classrooms, laboratories, residence halls, faculty and staff offices, the library, and student organization offices. Wireless access is available in over 90% of campus buildings and locations. The network provides access to a wealth of shared information services. Some of these include high-performance computing servers providing CPU cycles for simulation and computational research, disk arrays for storage of large data sets, communication servers for electronic mail and document exchange, databases, digital journal subscriptions and a virtual "Help Desk." A virtual private network combined with Internet access, plus a large ISDN modem bank extend access to campus information resources to faculty, staff and students working at home, work, any of the university's extension sites or throughout the world. Wide-area network access through NJEDge.Net (New Jersey's Higher Education Network) and the Internet provide collaboration opportunities with students, faculty, and researchers, locally, regionally, nationally, and throughout the world.

IV.D. Classrooms and Laboratories

There are several existing classrooms and laboratories available to support the courses and projects in this program, all with Internet access. The Networking Laboratory (GITC 1301) is one resource that allows administrative networking and security experiments in a closed environment, albeit using older hardware. The Open Source Laboratory (GITC 2315) is another laboratory that houses an extensive set of Linux workstations. It uses open or free software that covers the gamut of tools needed in an administrative environment. However, to support the extensive hands-on experience that is essential to the program, we will need to upgrade the resources in GITC 1301 to more current hardware standards and to develop an additional laboratory. Each of the laboratories will require administrative support. While we expect to be able to internally generate some of the support needed for this effort, there will also be a need for university support to provide the best learning environment for the student.

V. Curriculum

The Information Technology Program will administer the MS in IT Administration and Security. The IT Program Director, Professor James McHugh, together with a CCS

Faculty Committee composed of IT University Lecturers and CS and IS faculty will oversee the advisement of students in the program and monitor their progress.

The Faculty Advisory Committee for the program will consist of:

IT faculty: S. Senesy (System Administration), R. Statica (Networks and Security),
G. Saxon (System Administration and Security)
CS faculty: C. Borcea (Networking), D. Karvelas (Networks and Security)
IS faculty: G. Widmeyer (Management of Information Systems), J. Scher (Databases)

Required Courses

IT 6xx – Wireless Network Security & Administration
IT 6xx – Database Administration
IT 6xx – System Administration
CS 656 - Internet and Higher Layer Protocols (or ECE 637 Introduction to Internet Engineering)
CS 696 - Network Management and Security (or ECE 683 Network Management and Security)
IT 6xx – Web and Domain Server Administration

Elective Courses (EXISTING – select four)

CS 631 - Data Management System Design
CS 632 - Advanced Database System Design
CS 633 - Distributed Systems
CS 652 - Computer Networks-Architectures, Protocols and Standards (or ECE 683 Computer Network Design and Analysis)
IS 631 - Enterprise Database Management
IS 677 - Information System Principles
IS 679 - Management of Computer and Information Systems
IS 680 - Information Systems Auditing
IS 681 - Computer Security Auditing
ECE 645 - Wireless Networks
CS 697/ECE 639 - Principles of Broadband Networks
HRM 601 – Organizational Behavior

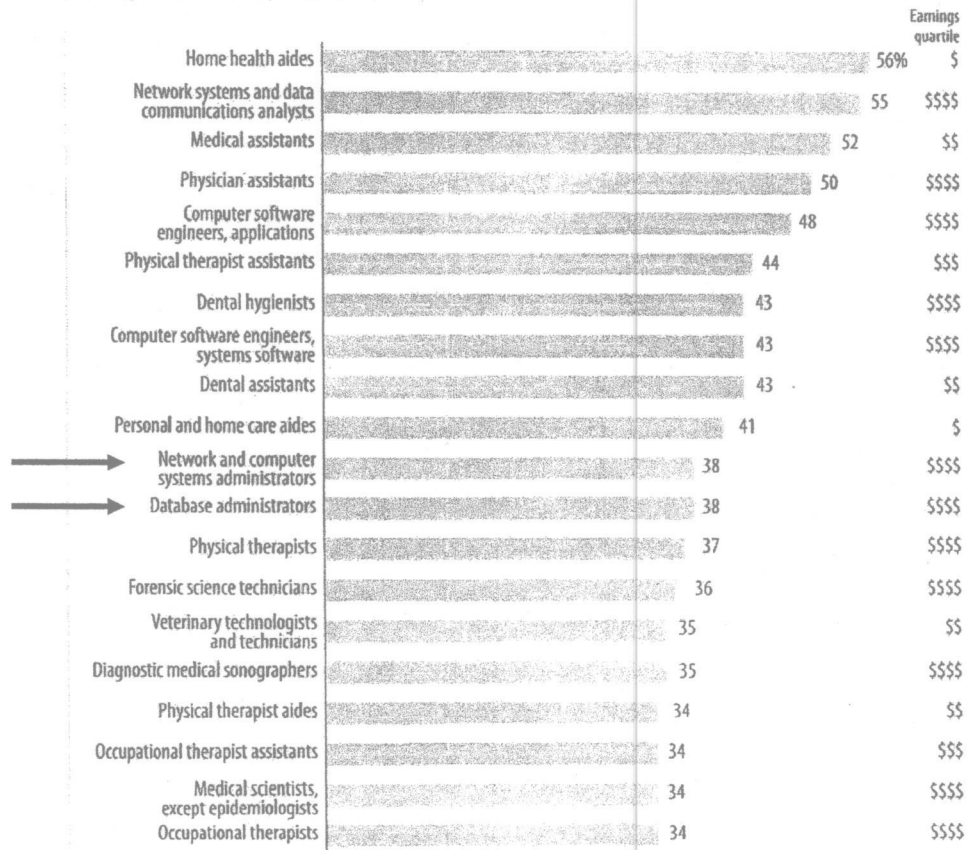
Appendix A

Fastest Growing Occupations

Occupational employment

Fastest growing occupations

Percent growth in employment, projected 2004-14



Average, all occupations = 13%

16

Nearly all of the occupations that are projected to grow fastest relate to healthcare or computers. Earnings are highest in the computer-related occupations.

Appendix B

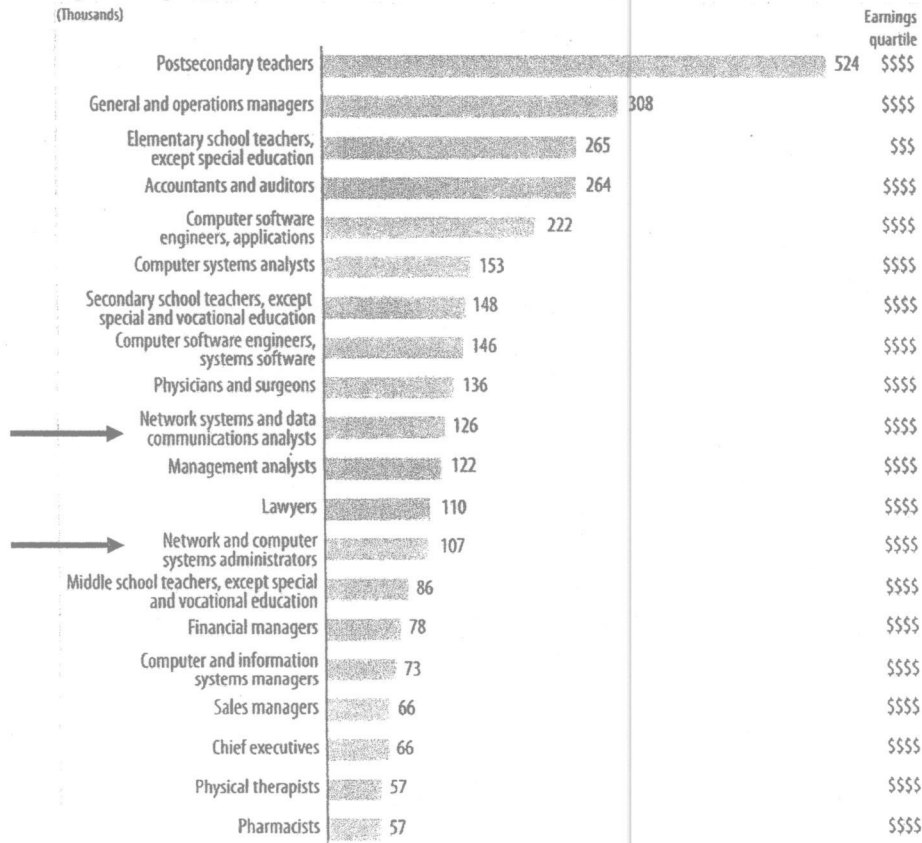
Most New Jobs (Undergraduate or Graduate)

Occupational employment

Most new jobs, highest paying: Bachelor's or graduate degree

Numeric change in employment in the top 20 large-growth, high-paying occupations that often require a bachelor's or graduate degree, projected 2004-14

(Thousands)



18 Each of these occupations is projected to gain at least 50,000 new jobs over the projections decade. In many of these high-paying occupations, workers usually have experience along with a bachelor's degree. In some of these occupations, workers have a graduate degree.

Occupational Outlook Quarterly - Winter 2005-06

Core Course Descriptions

IT 6xx – Wireless Network Security & Administration
IT 6xx – Database Administration
IT 6xx – System Administration
CS 656 - Internet and Higher Layer Protocols
CS 696 - Network Management and Security
IT 6xx – Web and Domain Server Administration

Only the IT courses are new.

IT6xx – Wireless Network Security & Administration (3 credits)

Prerequisites: Completion of Bridge requirements. This course introduces the fundamentals of wireless network security administration. Topics include: Wireless LAN Vulnerabilities, Passive and Active Wireless Attacks, Enterprise Wireless Hardware Security, Secure Wireless Authentication and Communication, Wireless Intrusion Detection and Prevention Systems, WiFi and Cellular Networks Management, Privacy in Wireless Networks, Bluetooth Security, Ad Hoc and Sensor Networks Security. The course provides both a theoretical foundation in security and hands-on experience in these areas.

IT 6xx System Administration (3 credits)

Prerequisites: Completion of Bridge requirements. This course is an introduction to the skills needed for and tasks performed by a System Administrator. The course will cover administration of host and server systems in modern operating system environments. Topics to be covered include: user, configuration and change management, shell scripting, performance analysis, disaster mitigation and recovery, and auditing.

IT 6xx Database Administration (3 credits)

Prerequisite: Completion of Bridge requirements and IT 6XX System Administration
This course provides a broad overview of the tasks and techniques necessary to function as a Database Administrator (DBA) in a modern relational database environment. Students will learn the duties typically performed by a DBA, which include: disaster planning and recovery, performance analysis, metadata maintenance as well as data modeling, analysis and database design.

CS 656 - Internet and Higher Layer Protocols (3 credits)

Prerequisite: Completion of Bridge requirements. The course provides a foundation of knowledge of the Internet and its protocols. Topics include: Addressing, Routing and Forwarding, Classless Interdomain Routing, the IP and ICMP protocols, the UDP and TCP protocols, the layering models in OSI and in TCP/IP, IGMP, Routing methods (RIP, OSPF, BGP), The Domain Name System, The World Wide Web and http. In addition, students will be made familiar with use of a packet sniffer (such as tcpdump or ethereal) and with tools such as ping, nslookup and traceroute. Students will develop the detailed knowledge of packet headers needed to understand output of packet sniffers.

CS 696 - Network Management and Security (3 credits)

Prerequisites: Completion of Bridge requirements (or CS 652 or ECE 683), and CS 656. Thorough introduction to current network management technology and techniques, and emerging network management standards. In-depth study of the existing network security technology and the various practical techniques that have been implemented for protecting data from disclosure, for guaranteeing authenticity of messages, and for protecting systems from network-based attacks. SNMP family of standards including SNMP, SNMPv2, and RMON (Remote Monitoring), OSI systems management. Various types of security attacks (such as intruders, viruses, and worms). Conventional Encryption and Public Key Cryptology. Various security services and standards (such as Kerberos, Digital Signature Standard, Pretty Good Privacy, SNMPv2 security facility).

IT 6xx – Web and Domain Server Administration (3 credits)

Prerequisites. Completion of Bridge requirements and IT 6XX Security Administration. Servers play an increasingly important role in the IT infrastructure of businesses. This course provides an introduction to the basics of web and domain oriented services. It introduces how web-based and domain services operate, integrate and communicate. Topics covered include: the fundamental technologies that underpin the web service paradigm and the key standards necessary for their development, as well as other critical domain oriented services. The student will gain the skills necessary to plan, install, configure, secure and maintain resources such as web servers, the Domain Naming System (DNS), email & print servers, resource sharing systems, as well as domain authentication systems.

Consultant Report

Recommendation:

- Approve

A. Objectives

1. Describe whether or not the objectives and underlying principles of the program are sound and clearly stated.

The objectives of the proposed Masters program in IT Administration and Security degree (MS IT AS) are two- fold. Masters programs in Computer Science and related areas typically focus on educating students on the fundamental concepts, principles and techniques of computer science, but do not emphasize on the practical needs of administering computer systems. There exist certificate courses and programs whose primary emphasis is on training students solely on administrative skills. One of the objectives of the proposed program is to bridge this gap where students are educated on both the underlying theoretical principles as well as the practical administrative aspects of computer systems.

Additionally, the computer systems being employed in organizations need to be carefully designed and configured before deployment. This requires a significant amount of domain knowledge. However, personnel that perform such tasks often possess computer system administrative and design skills, but lack domain expertise. For example, designing a database for a pharmaceutical company requires not only knowledge of the organizational process and data being maintained, but also administrative and design knowledge of a database system. The second objective of the proposed masters program is to educate students from different backgrounds in computer system administrative skills.

In summary, the proposed program will educate students in the concepts, principles, techniques and practices needed to administer a modern IT environment and its security. Students will gain extensive practical experience in administering computer and database systems, networks and the security of these systems, as well as the developed applications. The objectives and underlying principles of the program are sound and clearly stated.

2. Discuss whether or not the program is consistent with the institution's programmatic mission and educational goals.

The proposed program is consistent with the goal's of the institution's strategic plan for enrollment growth at both the graduate and undergraduate

levels, especially in areas with broad, industrial application and strong employment opportunities both regionally and nationally. The proposal indicates that based on Department of Labor statistics and surveys of current NJIT's IT undergraduate students, there will be a growth in opportunities in IT Administration and Security. As a result, the proposed program will likely attract a significant number of new students.

B. Need for the Program

1. Analyze the need for this program (e.g., student demand), and indicate why it is likely or unlikely that students will be able to secure employment and/or continue advanced study upon graduation.

Every organization today, either small or large in size, uses computers and software systems for running their day-to-day business processes, and for capturing, maintaining and analyzing the resultant data. As such there is a tremendous need for professionals whose expertise encompasses the whole spectrum from IT concepts, principles and technologies to the practical administrative capabilities. There is no program that I am aware of can offer education at these two extreme ends. Students graduating from this program may be hired as computer system administrators, database administrators, network administrators, security administrators, web service application administrators, and the like. In addition, engineers and experts in their own fields will have an added advantage of gaining administrative skills as employers may prefer these in this competitive job market.

It is unlikely that students graduating from this program will seek advanced study (such as PhD).

2. In the case of career programs:

Do the results of market surveys indicate a sufficient level of student demand to justify the creation of the proposed program? (Please explain.)

As indicated under item A2, internal surveys of undergraduates at NJIT, especially the large (400+ and growing) number of undergraduate IT students substantiates strong interest in such a program. A large majority of these students (about 70%) already concentrate in areas involving networking and security, but they currently lack a suitable Master's program to attend, either at NJIT or in the state. These students are expected to be one major ongoing source of applicants to this program. Additionally, since many individuals professionally involved in systems administration positions have similarly lacked venues for graduate education in their field, that pool of students is expected to be attracted especially on a part-time basis.

Do employment projections indicate a sufficient number of job opportunities in the region and the State to justify the creation of the program? (Please explain.)

As indicated under item A2, national labor surveys predict strong national need and above average employment growth in this area over the long term.

C. Educational Programs

1. Discuss the distribution and nature of required courses, electives, and research (if appropriate) in terms of meeting the objectives of the program. Compare and contrast the proposed curriculum with recognized programs of quality at other institutions, if appropriate.

The objective of the program is to educate students in both theoretical concepts as well as practical administration skills. The core courses include 4 administration courses and two concepts courses. The remaining concept courses are offered as electives. Therefore, the proposed course requirement meets the objectives of the program. I am not aware of similar graduate programs at other institutions, and therefore cannot compare. A similar program is being offered at Rochester Institute of Technology (RIT), however, the proposed curriculum is more comprehensive with respect to the courses offered in the administration focus. The proposed program is also related to that offered by the University of Oslo. Other MS in IT programs in geographically closer universities exist, however, they offer a few courses, but not a degree with an administrative focus.

2. Are the instructional modes and credit distribution consistent with the objectives of the curriculum? (Please explain.)

Yes, the credit distribution is consistent with the curriculum. (explained in item 1 above)

3. Does the curriculum represent a suitable approach to professional study in the particular field, if appropriate? (Please explain.)

Yes, the proposed courses offer an appropriate mixture of concept level and practical level courses with emphasis on networks, databases and security, that are key to any computer system and application. Therefore, the proposed curriculum is suitable for the professional study under consideration.

4. Does the curriculum meet certification and/or accreditation standards, if appropriate? (Please explain.)

Graduate programs in computing are not traditionally involved in any standardized accreditation process such as by ABET; only the undergraduate programs are.

5. Are the requirements for admission to the program clearly defined and appropriate to ensure a student body capable of meeting the objectives of the program, without such requirements being artificially strict, rigid, or discriminatory? (Please explain.)

Yes, the admission requirements are clearly stated in the proposal. Specifically, to be eligible for admission, a student must have completed an undergraduate degree, preferably in Information Technology, Computer Science, Computer Engineering, Information Systems, or a related field, with a GPA of 2.8 or higher. Students not satisfying these criteria will be considered for conditional admission on a case-by-case basis. This includes students whose bachelor's degree is in a non-technical field but who have professional experience in computing or systems administration. These students are expected to have done certain concept courses. The requirements are reasonable and also somewhat flexible. These are not in any way discriminatory.

6. Discuss whether or not standards for completion of the program are clearly defined and consistent with the objectives of the program.

Yes, the standards for completion of the program are clearly defined and these are consistent with the objectives. These have been stated in terms of the core courses and elective courses required to be completed by every student.

7. Discuss whether or not an appropriate mechanism for transfer students to enter the program exists and comment upon the suitability of any articulation arrangements between this and other existing programs.

This has not been explicitly stated in the proposal. I believe standard procedures in other masters programs (such as MS in Computer Science) may be applicable. Students can be flexibly admitted to the program from other disciplines via the Bridge Program option. Undergraduates in the existing IT undergraduate program could also be eligible for a joint BS/MS degree.

8. If other academic units within the university are to provide educational services to the program, describe whether or not their commitment to participate is consistent with offering a program of quality in this field.

The proposal does not indicate requiring services from other academic units. So this is not applicable. The program is however intimately involved with

both the Computer Science and Information Systems programs in the College of Computing Sciences. The Electrical and Computer Engineering program is available for some electives and jointly offered core courses. The Human Resource Management (HRM) Program offers extensive graduate courses, one of which is an elective option for the program.

9. If a program has a clinical component, discuss the adequacy of facilities and the arrangements to support the objectives of the program.

Not applicable.

D. Students

1. Is the percentage of part-time students projected for the program consistent with the goals of the program? (Please explain.)

No specific percentage of projected part-time students has been mentioned, but the program is expected to be particularly attractive to professionals working in the field who currently lack graduate degrees.

2. Comment upon the adequacy of provisions made to ensure successful target population (e.g., minorities and women) participation in the program.

No specific mention of it has been made in the proposal.

3. Comment upon the adequacy of counseling and advisement to be provided to students enrolled in the program.

The IT faculty involved in the program will advise students, supplemented by support from a current full-time graduate advisor in the College of Computing Sciences. The current full-time advisor for the undergraduate IT program will also be able to provide basic information to existing undergraduates who express interest in the program or seek guidance about further educational options.

E. Faculty

1. Describe whether or not the faculty possess the appropriate (terminal) degrees and other academic credentials to provide a program of high quality.

Yes, the faculty involved in the program have the relevant academic credentials. Most faculty members have doctoral degrees in relevant areas such as networking and security. Other faculty members have MS degrees in computer science with extensive industrial, governmental and educational experience in practical systems administration, networking and security.

2. Comment upon the faculty's involvement in research, teaching, scholarship, creative activity, and community service and whether or not it is appropriate to the discipline and to the proposed program.

Although most of the faculty have some research involvement, the program is not expected to be research oriented.

3. Discuss whether or not the number of faculty and the amount of time to be devoted by each to the program are compatible with the goal of offering a program of quality.

The teaching resources are quite satisfactory.

- F. Support Personnel. Discuss the adequacy of support personnel to be associated with the program, e.g., secretaries, administrative assistants, bookkeepers, technicians, etc. as appropriate.

The program appears to have adequate support personnel.

- G. Finances

1. Discuss the institution's commitment to provide the resources necessary to guarantee a program of high quality (e.g., faculty, equipment, library support staff for the program, below-the-line support for faculty travel, research, etc.).

The program has the full backing of the NJIT administration for both faculty and staff support.

2. Discuss the possible need for significant additional financial support from the State of New Jersey.

The program will not require any additional state support.

- H. Physical Facilities

1. Discuss the adequacy of laboratory, special facilities, and equipment intended to support the program and indicate if they are consistent with offering a program of high quality.

Adequate laboratory facilities are essential for the proposed program. The laboratory and equipment are adequate to support the program.

2. Comment upon the adequacy of classroom facilities.

Classroom facilities are adequate.



Memo

TO: Dr. Donald H. Sebastian, Interim Provost
FROM: Dr. Narain Gehani, Dean
CC: Dr. Michael Baltrush, Interim Chair, Computer Science
DATE: January 16, 2009
SUBJECT: Response to Consultant's Report for MS in IT Administration & Security

Consultant's Name: Dr. Vijay Atluri
Management Science and Information Systems Department
Rutgers Business School, Newark and New Brunswick
Rutgers University
Consultant's Visit Date: December 19, 2008
Date of Consultant's Report: January 16, 2009

We would like to thank Dr. Atluri for her thorough evaluation of our proposed MS in IT Administration and Security degree. We are very pleased that her report is positive.

Dr. Atluri's report, *Consultant Report*, does not contain any recommendations for changes to the *MS in IT Administration and Security Program Announcement*.

Curriculum Vita

Vijay Atluri

Professor

Management Science and Information Systems Department
Rutgers Business School, Newark and New Brunswick

Rutgers University

Newark, NJ 07102

973-353-1642 (phone), 973-353-5003 (fax)

email: atluri at rutgers dot edu

home page: <http://cimic.rutgers.edu/~atluri/>

EDUCATION:

- **Ph.D.**, Information Technology, May, 1994, George Mason University, Fairfax, VA.
Dissertation: Concurrency Control in Multilevel Secure Databases
Dissertation Adviser: Sushil Jajodia
- **M.Tech.**, Electronics and Communication Engineering, (Controls and Automation), June 1979, Indian Institute of Technology, Kharagpur, India.
Thesis: Implementation of Nearest Neighbour Identification Algorithms
- **B.Tech.** Electronics and Communications Engineering, May 1977, Jawaharlal Nehru Technological University, Kakinada, India

EXPERIENCE:

- **Professor**, MSIS Dept., Rutgers University. July 2006 - present; Associate Professor, July 2001 - June 2006; Assistant Professor, July 1995 - June 2001; Visiting Assistant Professor, Sept 1994- June 1995.
- **Research Director**, Center for Information Management, Integration and Connectivity (CIMIC), Rutgers University. January 2002 - present
- **Faculty Associate**, Center for Information Management, Integration and Connectivity (CIMIC), Rutgers University. September 1994 - December 2001
- **Visiting Associate Professor**, Computer Science Department, New Jersey Institute of Technology. July 2004 - June 2005
- **Member**, Graduate School-Newark Faculty of the Ph.D. in the Management program, Rutgers University. October 1996 - October 2011
- **Research Assistant**, Center for Secure Information Systems, George Mason University. August 1990 - August 1994
- **Assistant Professor**, Dept. of Electronics & Communication and Computer Engineering, Nagarjuna University, India. March 1985 - August 1990
- **Lecturer**
 - Dept. of Electronics & Communication and Computer Engineering, Nagarjuna University, India. December 1983 - March 1985
 - Dept. of Electronics & Communication Engineering, Andhra University, India. December 1982 - December 1983
 - Dept. of Electronics & Communication Engineering, Nagarjuna University, India. August 1980 - December 1982

RESEARCH INTERESTS:

Information Systems Security, Database Management Systems, Distributed Systems, Workflow Management, Multimedia, Spatial Databases, Digital Libraries and Electronic Commerce

TEACHING INTERESTS:

Database Management Systems, Distributed Databases, Computer Information Systems, Information Systems Security, Formal models of Computer Security, Electronic Commerce, Multimedia Information Systems, Operating Systems, Computer Architecture, Programming Languages, Object-Oriented Systems, and Computer Networking

HONORS and SCHOLARLY RECOGNITION:

- Received the Research Award for untenured faculty for outstanding research contributions, Rutgers University, 1999
- Received the CAREER Award from National Science Foundation, 1996
- Received National Merit Scholarship from the Government of India, June 1970 - May 1977
- Secretary/Treasurer, ACM SIGSAC (Special Interest Group in Security, Audit, and Control), Elected, 2005 - 2007
- Senior Member, IEEE (December 2006 -)
- Finalist, Paul Nadler Teaching Excellence Award, Rutgers University, 1996, 1997, 1999
- Keynote Speaker, The Third International Conference on Availability, Reliability and Security, Barcelona, Spain, March 2008.
- Finalist, Research Award for untenured faculty, Rutgers University, 1998
- Listed in *Who's Who in Business Higher Education* 2005 -
- Listed in *International Who's Who of Professionals* 1997 -
- Listed in *International Who's Who of Information Technology* 1998 -
- Listed in *MARQUIS Who's Who in the World* 2000 -

MEMBERSHIPS:

- Member, IFIP WG11.3 on Data and Information Security (July 1994 -)
- Member, IEEE Technical Committee on Security and Privacy (May 1995 -)
- Member, IEEE Technical Committee on Data Engineering (May 1995 -)
- Member, IEEE Technical Committee on Multimedia (May 1996 -)
- Member, IEEE Technical Committee on Digital Libraries
- Member, IEEE Computer Society (Jan 1996 -)
- Member, Association for Computing Machinery (December 1996 -)

EXTERNAL GRANTS:

1. Principal Investigator, "Research on Theoretical and Practical Aspects of Computer and Communications Security," *Army Research Office*, \$10,000, September 2008 - February 2009. (No Co-PIs)
2. Principal Investigator, "Computer and Communications Security: Issues and Research Directions," *Army Research Office*, \$10,000, September 2007 - February 2008. (No Co-PIs)
3. Principal Investigator, "Access Control for Spatial Databases," *National Science Foundation*, \$320,000, July 2003 - June 2007. (No Co-PIs)

4. Co-Principal Investigator, Improving Business Knowledge Management & Analysis Through the use of the RFID Technology and Semantic Web Services. \$538,254, August 01, 2007 - June 30, 2009, SAP America. (Nabil R. Adam, PI)
5. Co-Principal Investigator, Technology Transfer: A Context Sensitive Alert Management System *National Science Foundation*, \$50,000, Jul 2008 - June 2009.
6. Principal Investigator, "Security of Sensor Networks: Issues and Research Directions," *Army Research Office*, \$10,000, September 2005 - February 2006. (No Co-PIs)
7. Co-Principal Investigator, "Secure Agency Interoperation for Effective Data Mining in Border Control and Homeland Security Applications," *National Science Foundation*, \$1,050,000, July 2003 - June 2007. (Nabil R. Adam, PI) 30% effort
8. Co-Principal Investigator, "Improving Business Knowledge Management and Analysis Through the use of Semantic Web Services and RFID Technology," *SAP Research Labs*, \$320,000, June 2004 - June 2007. (Nabil R. Adam, PI) 40% effort
9. Co-Principal Investigator, "Semantic Based Emergency Management System," *Department of Homeland Security*, \$80,000, July 2005 - December 2005 (Nabil R. Adam, PI) 40% effort
10. Co-Principal Investigator, "A Study for Improving Business Intelligence Through the use of Text Mining and Ontology" *Relevant Noise*, \$43,748, July 2005 - June 2006 (Nabil R. Adam, PI) 30% effort
11. Co-Principal Investigator, Meadowlands Environmental Research Institute, *Hackensack Meadowlands Development Commission*, \$350,000, July 2005 - June 2006. (Nabil R. Adam, PI). 30% effort
12. Co-Principal Investigator, Municipal Technology Initiative, *Hackensack Meadowlands Development Commission*, \$150,000, July 2005 - June 2006. (Nabil R. Adam, PI). 30% effort
13. Co-Principal Investigator, "Technology Transfer of Inter-agency e-Government Services and Their Transnational Feasibility Studies," *National Science Foundation*, \$99,928 September, 2004 - August, 2005. (Nabil R. Adam, PI) 30% effort
14. Co-Principal Investigator, "A Decision Support System to Assess Urban Women's HIV Sexual Risk Behavior," *National Library of Medicine*, \$398,000, Feb 2005 - Jan 2008. (Rachel Jones, PI) 30% effort
15. Principal Investigator, "Security of Sensor Networks: Issues and Research Directions," *Army Research Office*, \$10,000, July 2004 - June 2005. (No Co-PIs)
16. Co-Principal Investigator, Meadowlands Environmental Research Institute, *Hackensack Meadowlands Development Commission*, \$350,000, July 2004 - June 2005. (Nabil R. Adam, PI). 30% effort
17. Co-Principal Investigator, Municipal Technology Initiative, *Hackensack Meadowlands Development Commission*, \$150,000, July 2004 - June 2005. (Nabil R. Adam, PI). 30% effort
18. Co-Principal Investigator, "Improving Business Knowledge Management and Analysis Through the use of Semantic Web Services and RFID Technology," *SAP Research Labs*, \$320,000, June 2004 - July 2006. (Nabil R. Adam, PI). 30% effort
19. Principal Investigator, "Supporting Workflow, Long Duration and Nested Transaction Models in a Multilevel Secure Database Environment," *National Science Foundation*, The CAREER Award, \$214,337, June 1996 - May 2000. (No Co-PIs)
20. Principal Investigator, "A Petri Net Based Approach to Enforcing Mandatory and Discretionary Security in Workflow Management Systems," *National Security Agency*, \$59,986, October 1996 - December 1997. (No Co-PIs)
21. Co-Principal Investigator, "E-Government: Human-Centered Systems for Business Services," *National Science Foundation*, \$916,949, June 2000 - May 2003. (Nabil R. Adam, PI) 30% effort

22. Co-Principal Investigator, Meadowlands Environmental Research Institute, *Hackensack Meadowlands Development Commission*, \$8,000,000, Jan 2002 - December 2006. (Nabil R. Adam, PI) 25% effort
23. Co-Principal Investigator, "Spatially Integrated Coastal Permitting System," *National Oceanic and Atmospheric Administration (NOAA)*, \$87,750 September 2002 - August 2003. (Robert Ceberio, PI) 30% effort
24. Co-Principal Investigator, "Workshop on Advanced Technologies in Real-Time Monitoring and Modeling for Drinking Water Safety and Security," *Environmental Protection Agency*, \$75,000, June 2002-December 2002. (Nabil R. Adam, PI) 30% effort
25. Co-Principal Investigator, "Exploratory Research on Reconfigurable and Scalable Enterprise Planning Systems," *National Science Foundation*, \$111,977, July 2000 - June 2001. (Mohsen Jafari, PI) 20% effort
26. Co-Principal Investigator, "On Management Theory and Approach under Electronic Commerce Environment," *National Science Foundation of China*, 600,000BMR (\$72,000), January 2001 - December 2003. (Prof. Deli Yang, Dillion Technology Institute, PI) 20% effort
27. Co-Principal Investigator, "Change Detection in Data Warehousing," *Lawrence Livermore National Laboratory*, \$21,271, September 1, 1998 - June 30, 1999. (Nabil R. Adam, PI) 30% effort
28. Co-Principal Investigator, Meadowlands Environmental Research Institute, *Hackensack Meadowlands Development Commission*, \$3,000,000, July 1998 - June 2003. (Nabil R. Adam, PI) 25% effort
29. Co-Principal Investigator, "Trader In Distributed Computing Environment," *National Security Agency*, \$50,000, April 1998 - September 1998. (Yelena Yesha, PI) 25% effort

INTERNAL GRANTS:

1. Co-Principal Investigator, "information Technology for Emergency mAnageMent (iTEAM)," Academic Excellence Fund (AEF), Rutgers University, \$40,000 2007-08.
2. Principal Investigator, "Enforcing Security and Privacy Policies in a Mobile Commerce Environment," *Rutgers Business School*, \$4000 July 2007 - June 2008.
3. Principal Investigator, "Efficient Enforcement of Security Policies in a Peer-to-Peer Mobile Environment," *Rutgers Business School*, \$3000 July 2006 - June 2007.
4. Principal Investigator, "Spatio-temporal Indexing Structure for the CIMIC Image Database," *Meadowlands Environmental Research Institute*, \$10,500, January 1, 2000 - December 31, 2000.
5. Co-Principal Investigator, "Strengthening the Electronic Commerce Certificate and Graduate Program at Rutgers Newark - Support for Resources," *Strategic Resources and Opportunity Analysis (SROA) Process*, \$30,000, 1999-2000.
6. Co-Principal Investigator, "Developing and Implementing an Innovative Instruction Methodology for MSIS Courses," *GE Grant*, \$14,000, 1988-99.
7. Principal Investigator, "A Multi-layered Clinical Decision Support System," *Rutgers FOM Research Grant*, \$4,800, March 1997 - February 1998.
8. Principal Investigator, "Microsoft Access for SOM-ENG," *Newark Campus Computer Planning Committee*, \$1,970, July 1996.
9. Co-Principal Investigator, "Computer Proficiency Assessment for Effective MIS Undergraduate Education," *Rutgers Dialogues Grant*, \$6,100, January 1995 - June 1995.

**3E. Approve Resolution to
Authorize New MS in
Software Engineering**

STATEMENT

The objective of the MS in Software Engineering is to teach students concepts, techniques, and skills that are required to develop and build large modern software systems. Software engineering encompasses a wide range of topics including software specification, analysis, design, implementation, verification, deployment, reuse, and evolution of software products and software product lines.

The migration of larger and larger sectors of the global economy online, along with the deployment of software applications in ever expanding sectors of modern life, place increasing demands on the software industry. These demands are both in terms of quantity and in terms of quality. At the same time, we are witnessing the migration of some sectors of the software industry from developed nations to emerging nations.

The College of Computing Sciences at NJIT proposes an MS in Software Engineering that takes into account the new market conditions, the needs of the state/region, and the strengths of the College and University.

Students with an MS in Software Engineering will be prepared for professional careers in the software industry, an economic sector that is experiencing a global expansion, and is increasingly critical to the technological advancement and the competitiveness of the State and the Nation.

The proposed program is within the mission of the university, has received favorable independent external review, has received the approval of all appropriate standing committees and the faculty as a whole, is not unduly duplicative of other programs offered in the State of New Jersey, and has been the subject of a Program Announcement issued to institutions of higher education in the State of New Jersey. Note that the minor recommendations proposed by the reviewer have been incorporated into the revised program announcement. The incremental costs of the new program will be covered from the tuition and fees of the new students.

RESOLUTION TO APPROVE THE MS IN SOFTWARE ENGINEERING

WHEREAS, the Board of Trustees has examined materials provided by the President of the University relative to a proposed program leading to the MS in Software Engineering; and

WHEREAS, the Board is satisfied that the proposed program is within the mission of the University, has received favorable independent external review, is not unduly duplicative of other programs offered in the State of New Jersey and that the proposed program has been the subject of a Program Announcement issued to institutions of higher education in the State of New Jersey, and further, that the incremental costs of the new program will be covered from the tuition and fees of the new students; and

WHEREAS, the Board of Trustees attests to the foregoing;

NOW THEREFORE BE IT RESOLVED, that the Board of Trustees approves the MS in Software Engineering

February 12, 2009

PROGRAM ANNOUNCEMENT

January 2009 revised as suggested by external reviewer

Institution:	New Jersey Institute of Technology
New Program Title:	MS in Software Engineering
Degree Designation:	Masters of Science in Software Engineering
Degree Abbreviation:	MSSE
CIP Code and Nomenclature (if possible):	11.0199 Computer and Information Sciences
Campus(es) where the program will be offered:	Newark Campus, NJIT
Date when program will begin (month and year):	September 2009
List the institutions with which articulation agreements will be arranged:	None

Is licensure required of program graduates to gain employment? Yes No

Will the institution seek accreditation for this program? Yes No
 If yes, list the accrediting organization:

Program Announcement Narrative

- | | |
|---|-------------|
| • Objectives | page(s) 2 |
| • Need | page(s) 2 |
| • Student Enrollments | page(s) 3 |
| • Program Resources | page(s) 4-5 |
| • Curriculum/New Course Descriptions | page(s) 6-8 |
| • Appendix A: Fastest Growing Occupations | page(s) 9 |
| • Appendix B: Most New Jobs | page(s) 10 |

Descriptive Information

I. Objectives

The objective of the MS in Software Engineering is to teach students concepts, techniques and skills that are required to develop and build large modern software systems. Software engineering encompasses a wide range of topics including software specification, analysis, design, implementation, verification, deployment, reuse, and evolution of software products and software product lines. Also, software engineering encompasses not only the technical aspects of software production, but also the economic and organizational aspects.

Students with an MS in Software Engineering will be prepared for professional careers in the software industry, an economic sector that is experiencing a global expansion, and is increasingly critical to the technological advancement and the competitiveness of the state and the nation. MS in SE graduates will be able to develop and manage the development of large software systems.

II. A. Need for the Program

According to the US Department of Labor (Appendix A and B), 2 of the top 10 fastest growing and high paying occupations projected for the 10 years 2004-14 are computing specialties:

1. Computer software engineers, applications (rank #5)
2. Computer software engineers, system software (rank #8)

The US Department of Labor (DOL) splits Software Engineering into two categories: applications and systems software. Combining these categories makes Software Engineering the number one fastest growing occupation.

The migration of larger and larger sectors of the global economy online, along with the deployment of software applications in ever expanding sectors of modern life, place increasing demands on the software industry. These demands are both in terms of quantity and in terms of quality. At the same time, we are witnessing the migration of some sectors of the software industry from developed nations to emerging nations.

The College of Computing Sciences at NJIT proposes an MS in Software Engineering that takes into account the new market conditions, the needs of the state / region, and the strengths of the college and Institute.

II. B. Relationship to the Institute Master Plans

The MS in Software Engineering is consistent with the Institute's master plan in the sense that it is geared towards increasing graduate enrollment in an emerging field that is of great interest to the state and the region. It is also consistent with the goal of encouraging cooperation between departments, in the sense that this program serves as the focal point of synergy between software engineering and computer science in the computer science department and information systems. We anticipate that this synergy will enable to Institute to remain on *The Edge of Knowledge* in all three relevant areas.

II. C. Relationship to Similar Programs in the State and Region

Monmouth University and Stevens Institute of Technology in New Jersey offer an MS in Software Engineering. In the region, Pace University in New York, University of Scranton in Scranton, PA, Villanova University in Philadelphia, and Drexel University in Philadelphia all have MS in Software Engineering programs.

II. D. Distinguished Programs Nationally

The largest software engineering degree programs are at San Jose State University, Southern Methodist University, Northwestern Polytechnic University, and Carnegie Mellon University. Seattle University has the oldest MS Software Engineering program in the country. University of Texas at Dallas and Rochester Institute of Technology have an MS in computer science with a major in software engineering.

III. Students

NJIT has the same general attributes as many of the universities that offer MS programs in Software Engineering. They are all located in large metropolitan areas (Dallas, San Francisco, Chicago, New York, Seattle, Pittsburgh, etc), in the middle of very dynamic high technology corridors (Avionics, electronics, software, finances, etc). We anticipate that NJIT will capitalize on its urban location (Newark/ NYC) and its proximity to software companies that build, deploy, and buy software such as those in telecommunication, pharmaceutical, finance, etc to develop a thriving MS in Software Engineering program. We expect domestic students to be recruited among current undergraduates and from a large regional pool of working computing professionals. We also expect to recruit foreign students, who will find the combination of high quality education in software engineering and access to a large job market attractive. We anticipate 15 new students in the first two years for a total of 30 students in year 2. We estimate 20 new students in year 3 and approximately 25 new students per year in subsequent years. The total number of students in the program after 4 years is estimated to be 60-80 students.

IV. Resources to Support the Program

Many of the courses applicable to the new MS in Software Engineering degree presently exist in NJIT's Department of Computer Science and Department of Information Systems. However, some new core courses must be developed.

There are currently many computer science, information systems, and management electives that will fulfill the elective needs for the program – however, some additional software engineering elective courses will need to be developed as the program evolves and more students enter the program.

IV.A. Course Development

The following new courses will need to be developed:

- CS 6**: Software Architecture
- CS 6**: Software Project Management
- CS 6**: Software Testing and Quality Assurance
- CS 6**; Capstone Project

IV.B. Faculty

There are two faculty members with credentials and research interests in software engineering in the Departments of Computer Science and Information Systems: Dr. Ali Mili and Dr Vassilka Kirova. The College of Computing Science has two faculty members with extensive experience in building software systems: Dr. John Ryon and Dr. Cristian Borcea. The current faculty will develop the new courses. Initially we will use adjuncts with software engineering expertise and experience to teach some of the courses. The Department is currently searching to fill a position for an assistant professor in software engineering.

Also, in keeping with the general orientation of the proposed program, we envision a significant participation from industry. Such participation will make it possible for us to maintain the level of university-industry cooperation that is needed to maintain the credibility of our program, and to secure high quality internships and coops for our students. Hence, we expect to continue to use some adjuncts in addition to our regular faculty to teach the core and elective software engineering courses.

IV.C. Libraries and Computing Facilities

Since this program will draw upon many existing courses and upon the same supplemental literature that supports other related NJIT programs, library holdings are adequate to support the new program. NJIT's Van Houten Library has a collection of more than 130,000 books and subscribes to about 500 printed journals and about 13,000 electronic journals. The library's home page provides access to the library's online catalog and links to a wide array of information services. The library purchases between 2,500 and 3,000 new books each year. Requests for new books or journals are made through the academic department's faculty representative to the library.

The library has a wide array of networked PCs that provide access to a large number of bibliographical databases and full-text electronic journals, for searching Internet sites, for searching each library's on-line catalog, and access to a variety of on-line journal databases. VCR's for viewing videocassettes reserved for courses are also available. Journal and conference literature in engineering, science, management, architecture and other subject areas is accessible through a variety of indexing and abstracting databases. Among the databases available on line are CompendexWeb (Engineering Index); ProQuest Direct (articles on business, management and industry), Applied Science and Technology Index. The library also borrows materials through interlibrary loan (ILL).

The libraries web site describes the services and resources more completely. Please see www.library.njit.edu.

As a technological research university, NJIT has excellent computing systems, networks and software to support this program. The Newark campus' gigabit Ethernet network backbone connects more than 6,000 nodes in classrooms, laboratories, residence halls, faculty and staff offices, the library, and student organization offices. Wireless access is available in over 90% of campus buildings and locations. The network provides access to a wealth of shared information services. Some of these include high-performance computing servers providing CPU cycles for simulation and computational research, disk arrays for storage of large data sets, communication servers for electronic mail and document exchange, databases, digital journal subscriptions and a virtual "Help Desk." A virtual private network combined with Internet access, plus a large ISDN modem bank extend access to campus information resources to faculty, staff and students working at home, work, any of the university's extension sites or throughout the world. Wide-area network access through NJEDge.Net (New Jersey's Higher Education Network) and the Internet provide collaboration opportunities with students, faculty, and researchers, locally, regionally, nationally, and throughout the world.

IV.D. Classrooms and Laboratories

There is a broad range of classrooms and laboratories available to offer the courses and projects in this program, including many with Internet access and multimedia facilities. Thus, no new classrooms or laboratories are specifically needed for the program.

V. Curriculum

The Department of Computer Science will administer the MS in Software Engineering degree. The day-to-day administrative responsibilities will be handled by the Program Director. The current graduate computer science advisor will oversee the advisement of all students in this program, and will work closely with the current graduate curriculum committee of the Departments of Computer Science in monitoring the progress of students in the program.

Required Background:

CS 505 – Programming
CS 435 – Advanced Algorithms and Data Structure
CS 490 – Software Engineering

Required Courses – 18 credit hours

CS 6** – Software Testing and Quality Assurance
CS 6** – Software Project Management
CS 6** – Software Architecture
IS 676 – Requirements Engineering
CS 673 – Software Design & Production Methodology
CS 6** – Graduate Capstone Course

Elective Courses – 15 credit hours

CS 590 – Graduate Co-op Course
CS 6** -- Software Security & Dependability – future course
CS 633 – Distributed Systems
CS 652 – Network Architecture & Protocols
CS 656 – Internet and Higher Level Protocols
CS 630 – Operating System Design
CS 631 – Data Management Systems Design
CS 696 – Network Management & Security
IS 6** – Web Services Authentication [Previously taught as IS 698 in Fall 07]
IS 663 – Advanced Systems Analysis and Design
EM 636 – Project Management
EM 637 – Project Control
MGMT 620 – Management of Technology

Total – 33 credit hours, GPA of 3.0 to graduate

New Course Descriptions

CS 6 - Graduate Capstone Course**

Prerequisites: Enrolled in MS SE curriculum in last semester. An opportunity for the student to integrate the knowledge and skills gained in previous software engineering course work in a team-based project driven by a real customer. The project focuses on obtaining and refining the requirements, team communication, and domain expertise. The outcome is a software system.

CS 6 - Software Testing & Quality Assurance**

Topics include

- Types of Software errors and when they arise
- Cost of Errors
- Design & Code Reviews
- Verification and validation
- When to do testing
- Testing Techniques
 - Black box
 - White box (coverage testing)
 - Grey box
- Test Scripts / Plans
- Regression Testing
- Testing Tools
- Production Quality Software
- Pre Release Testing
 - Unit testing
 - Integration Testing
 - Functional Testing (including model testing)
 - System Testing
 - Performance Testing
 - Acceptance Testing
- Post Release testing
 - Alpha Testing
 - Beta Testing
- Managing Testing
- Functional attributes,
- Operational attributes,
- Process attributes,
- Static and dynamic attributes,
- Software metrics,
- Models of software quality,
- Quantifying software quality,

- Software qualities and software architectures

CS 6 Software Project Management**

Topics include:

- Ethics
- Using project management software
- Estimating effort
- Budgeting
- Timing
- Monitoring progress
- Managing people
- Offshore project management
- Outsourced project management
- Software processes
- Development teams
- Distributed development
- Software cost estimation
- Configuration control
- Software evolution
- Software copyrights and patents
- Software liability

CS 6 Software Architecture**

Software architecture deals with the structure of a software product in terms of components and connectors, and is known to determine the non functional attributes of software products. The purpose of this course is to explore the tradeoffs that arise in deriving and analyzing the architecture of software products. Topics include:

- Software requirements
- Functional and Non Functional requirements
- Software architecture and non functional requirements
- Architectural styles (including case study)
- Architectural description languages
- Architectural description/ analysis tools
- Architectural frameworks
- Product line architectures
- Reference architectures
- Standard architectures

Expected Outcome & Measures of Success

MS in Software Engineering Outcome & Measures of Success

MS in Software Engineering graduates will be able to develop and manage the development of large software systems. The ultimate measures of success will be MS in Software Engineering graduates finding attractive jobs, NJIT receiving positive feedback from employers, and a healthy, sustained enrollment.

Required Courses Outcome & Measures of Success

CS 6 – Software Testing and Quality Assurance**

Outcome: Be able to test systems for correctness and functionality.

Measure of success: Ensuring that a software system works as specified in the requirements.

CS 6 – Software Project Management**

Outcome: Be able to manage a software project, from requirement specification to development to delivery.

Measure of success: Timely delivery within budget of a quality software system.

CS 6 – Software Architecture**

Outcome: Understand how to architect a software system based on requirements.

Measure of success: Software system implements functionality and performs as per requirements

IS 676 – Requirements Engineering

Outcome: Learn how to determine system requirements using appropriate tools and methodologies.

Measure of success: A system implemented using these requirements matches expected functionality and performance.

CS 673 – Software Design & Production Methodology

Outcome: Knowledge of tools, techniques, and methodologies for building large software systems.

Measure of success: Successfully applying these techniques to build a large system.

CS 6 – Graduate Capstone Course**

Outcome: Work in teams with a real customer to build a system in an particular business domain.

Measure of success: Customer satisfaction.

Appendix A

Fastest Growing Occupations

Occupational employment

Fastest growing occupations

Percent growth in employment, projected 2004-14

Occupation	Percent growth in employment, projected 2004-14	Earnings quartile
Home health aides	56%	\$
Network systems and data communications analysts	55	\$\$\$\$
Medical assistants	52	\$
Physician assistants	50	\$\$\$\$
Computer software engineers, applications	48	\$\$\$\$
Physical therapist assistants	44	\$\$\$
Dental hygienists	43	\$\$\$\$
Computer software engineers, systems software	43	\$\$\$\$
Dental assistants	43	\$
Personal and home care aides	41	\$
Network and computer systems administrators	38	\$\$\$\$
Database administrators	38	\$\$\$\$
Physical therapists	37	\$\$\$\$
Forensic science technicians	36	\$\$\$\$
Veterinary technologists and technicians	35	\$
Diagnostic medical sonographers	35	\$\$\$\$
Physical therapist aides	34	\$
Occupational therapist assistants	34	\$\$\$
Medical scientists, except epidemiologists	34	\$\$\$\$
Occupational therapists	34	\$\$\$\$

Average, all occupations = 13%

16

Nearly all of the occupations that are projected to grow fastest relate to healthcare or computers. Earnings are highest in the computer-related occupations.

Occupational Outlook Quarterly • Winter 2005-06

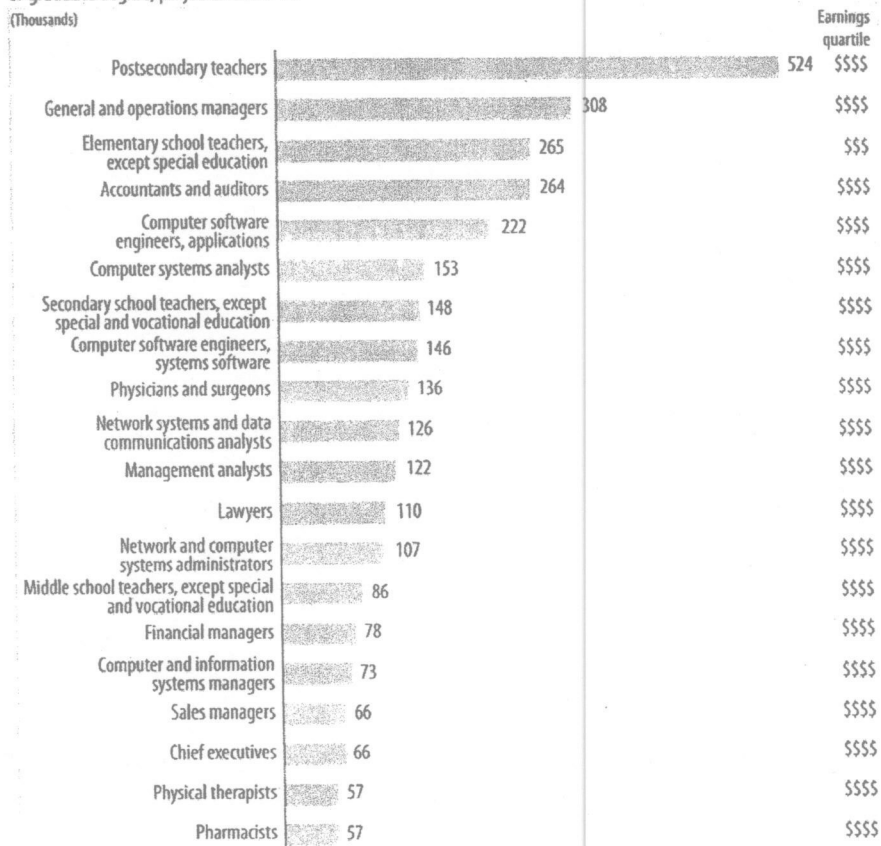
Appendix B

Most New Jobs (Undergraduate or Graduate)

Occupational employment

Most new jobs, highest paying: Bachelor's or graduate degree

Numeric change in employment in the top 20 large-growth, high-paying occupations that often require a bachelor's or graduate degree, projected 2004-14



18 Each of these occupations is projected to gain at least 50,000 new jobs over the projections decade. In many of these high-paying occupations, workers usually have experience along with a bachelor's degree. In some of these occupations, workers have a graduate degree.

Occupational Outlook Quarterly • Winter 2005-06

Review of New Jersey Institute of Technology Proposed M.S. in Software Engineering

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I. Introduction

This report provides an evaluation of and recommendation for the New Jersey Institute of Technology's proposed M.S. in Software Engineering program. It is based on the following sources and activities.

- A review of the written proposal, as supplied by Dean Narain Gehani, dated 10 September 2008, and incorporated here as Section V Appendix A.
- A visit to the NJIT campus, including discussions with faculty from both the Computer Science and Information Systems department, and from the Van Houten Library. Faculty with whom I talked included Dean Narain Gehani, Department Chairs Michael Baltrush and Michael Bieber, Professors Jim Geller, Ali Mili, Christian Borcea, and David Massimi, Librarian Davida Scharf, and Provost Priscilla Nelson.
- Discussions with faculty at other universities that offer an M.S. degree in Software Engineering, such as Portland State University, and at universities that offer M.S. degrees in computer science, but not in Software Engineering, such as the University of Maryland.
- Review of the proposed Graduate Software Engineering Reference Curriculum (GSwERC) sponsored by the DoD and under development at Stevens Institute.
- Experience teaching a project course as part of the Master of Software Engineering program offered at the Wang Institute of Graduate Studies [5].

As noted and explained in section III, my recommendation is to approve the program upon minor modification.

This recommendation is based on evaluation of the factors discussed in sections II A, through II L. In general, the program seems to be focused on appropriate objectives and needs, has about the right educational content, is consistent with expected student interest, has or will acquire the faculty needed to teach the program, has appropriate support personnel, institutional commitment, physical, library, computer facilities, and administrative structure.

There appear to be two primary weaknesses: (1) the expected outcomes of the program are not defined in sufficient detail to allow for precise mechanisms to evaluate the success or failure of the educational objectives of the program and, (2) there is no particular effort to attract women to the program. Section VI Appendix B contains an example set of proposed outcomes and briefly describes a method for enabling the achievement of each outcome and measuring the success of achieving it.

II. Evaluation

A. Objectives

The program seems clearly designed to meet the needs of the student community of NJIT, both existing and potential, and of the needs of the business and technology communities of the state of New Jersey. Particularly, the program is based on the idea that there is and will continue to be a strong need in the state and the country for professional software engineers, that is, professionals who understand that development of industrial software systems should be an engineering discipline and who understand the underlying principles and a set of methods needed to exercise that discipline. Such professionals will be in a position to lead the development of the increasingly complex software systems that are and will be developed to help drive the state's and the country's businesses and economy.

This program is consistent with NJIT's mission to

- prepare its graduates for positions of leadership as professionals and as citizens;
- provide educational opportunities for a broadly diverse student body;
- respond to needs of large and small businesses, state and local governmental agencies, and civic organizations;
- partner with educational institutions at all levels to accomplish its mission; and
- advance the uses of technology as a means of improving the quality of life.

Accordingly, the program's objectives appear to be sound and consistent with NJIT's goals.

B. Need for the Program

There are relatively few M.S. programs in Software Engineering in the state or in the country. Many universities prefer to offer the M.S. in computer science. Nonetheless the demand in the job market and in industry is for those who can develop large-scale software systems. As noted in the program announcement, the U.S. Department of Labor has projected that Software Engineering will be among the top 10 fastest growing and most highly paid occupations in the interval 2004-2014. The Bureau of Labor Statistics (BLS) in its 2008-2009 Occupational Outlook Handbook [2] shows computer software engineers as one of the occupations having the largest numerical growth.

The BLS Handbook states that computer software engineering is "one of the occupations projected to grow the fastest and add the most new jobs over the 2006-16 decade," and goes on to say that "Computer software engineers must continually strive to acquire new skills in conjunction with the rapid changes that occur in computer technology." It further notes that "Employment of computer software engineers is projected to increase by 38 percent over the 2006 to 2016 period, which is much faster than the average for all occupations. This occupation will generate about 324,000 new jobs, over the projections decade, one of the largest employment increases of any occupation" [2].

Based on the preceding analysis, it is quite likely that graduates of NJIT's M.S. in Software Engineering program will be able to find employment. Furthermore, it is likely that those already employed as software engineers who are interested in improving their skills and knowledge will be attracted to NJIT's program because the program will build on skills expected of those with undergraduate degrees in computer science and related fields and with industrial experience.

It appears that there is considerable need and will be considerable demand for the M.S. in Software Engineering.

C. Educational Programs

The topics covered by the curriculum for the program cover the topics that one would expect in an M.S. in Software Engineering program, and are consistent and overlap considerably with what one sees in other such programs. As noted in [4], the average Software Engineering graduate program requires between 33 and 36 course credits typically packaged into 11 or 12 3-credit semester courses. The NJIT program requires 33 credit hours over 11 courses. Most curricula include at least one practicum or project course, as does NJIT. Table 2 on page 32 of [4] describes the core body of knowledge expected of a graduate of an M.S. program in Software Engineering. It is based on bodies of knowledge for Software Engineering produced by professional societies and universities, such as [1, 4, 6, 7].

Comparison of the top-level topics in Table 2 of [4] with the curriculum for NJIT's M.S. in Software Engineering shows considerable overlap, with differences occurring primarily in the systems engineering and software maintenance areas, which are included in the table but do not explicitly appear in the NJIT curriculum. As noted in [4], its authors do not expect complete overlap with any particular institution's program, and it is very encouraging that the NJIT program and the GSWERC body of knowledge show as much overlap as they do. However, the comparison of the GSWERC core body of knowledge and curriculum architectural structure with the NJIT M.S. program show two differences that I believe are important.

a. Require a Project Course

First is that the capstone project in the GSWERC is required, and the project course in the NJIT program is elective. Some key skills and knowledge can only be acquired through experience in team software development. In a university setting, the only practical way to provide such experience is through a project. A project course, therefore, should be a required part of the curriculum and not an elective part.

b. Discuss Ethics

Second, some discussion of ethics should be part of any Software Engineering professional's background. Particularly since NJIT is expecting to produce Software Engineering professionals who will be leaders in their field, it is important that ethics be

covered as a topic in the curriculum. I would not expect there to be a separate course devoted to the topic, but it should be included in one or more of the existing courses, perhaps Software Project Management. Note that engineering programs in other areas, such as civil or electrical engineering, include this topic in their undergraduate curricula.

c. Rectify Omissions and Misplacements

Finally, some topics seem to be omitted that should be included in the course curricula, particularly for courses that NJIT will add for the program (see VIII, Appendix A for descriptions of courses to be added) and some topics seem misplaced, as follows.

- For Software Testing & Quality Assurance, the topics of Design Reviews, Model Checking, Coverage Testing, and Operational Profile Testing should be covered.
- For Software Project Management, management of distributed development should be covered. Product line engineering is probably best moved to Software Design & Production Methodology, CS 673.
- For Software Architecture, case studies of architectures should be an integral part of the course.
- For Software Design & Production Methodology, CS 673, distributed development and product line engineering should be covered.

The preceding discussion leads to the following points.

1. The distribution and nature of the required courses and electives, with some minor modifications, both meets the objectives of the curriculum and defines a program that is comparable with recognized programs. Minor modifications that are needed include making the project course a requirement instead of an elective and including the subject of ethics in one of the required courses, such as Software Project Management, as noted in Sections II.C a and b preceding. Consider also implementing the omissions and misplacements suggestions made in Section II C c preceding.
2. The instructional modes and credit distribution are consistent with the objectives of the curriculum.
3. The curriculum represents a suitable approach to professional study in the field of Software Engineering.
4. Since there are no certification or accreditation standards in the field of Software Engineering, one cannot make a judgment as to whether the NJIT program meets such standards. However, the program is quite consistent with the proposed GSwERC reference curriculum, which is sponsored by the DoD and could become a standard for universities seeking to establish an M.S. in Software Engineering.

Entrance and completion requirements for the M.S. in Software Engineering are clearly defined and consistent with other M.S. degree programs at NJIT and with M.S. in

Software Engineering programs elsewhere. They are also consistent with those described in [3], which are based partly on surveys of M.S. programs throughout the U.S. Section 7 of [3] provides detailed descriptions of several other M.S. programs, and the proposed NJIT program is similar to those. One area of difference is that most other programs require some practical experience for admission to the program, usually one or two years of experience, whereas NJIT has no such requirement.

In general, the educational requirements for the M.S. in Software Engineering seems to be consistent with other M.S. programs in Computer Science at NJIT. Therefore it appears that the same policies, resources, and facilities to manage the student population will be available to students in the M.S in Software Engineering program as are available to students in other M.S. programs.

I also note that the NJIT admission requirements, similar to many other institutions, say little about the expected mathematics backgrounds of incoming students, apparently assuming that an incoming student with a B.S. in Computer Science, or related field, will have had the necessary mathematics, particularly discrete mathematics. NJIT should consider making it plain that they have such an expectation of incoming students.

As an industrial researcher and long-time observer of industrial software development, I have noticed that most software developers have been educated in computer science or a related discipline, but have had little education in Software Engineering. Graduates of NJIT's M.S. program in Software Engineering should have an advantage over those without such education, and should have an initial competitive advantage that could lead to leadership positions, helping to achieve the goal of creating leaders in the field.

Finally, in a very appropriate and strategically sound way, the Information Systems Department has allied with the Computer Science Department in offering courses that are part of the M.S. in Software Engineering program. This alliance appears to be based on a historically close relationship between the departments, encouraged by the dean, and helps broaden the educational background of the students and makes more resources available for teaching courses within the program.

Based on this analysis, we can add the following to the preceding points.

5. The requirements for admission to the program are clearly defined and appropriate to ensure a student body capable of meeting the objectives of the program, without such requirements being artificially strict, rigid, or discriminatory.
6. The standards for completion of the program are clearly defined and consistent with the objectives of the program.
7. There seems to be no particular plan or need to accommodate transfer students beyond what already exists for Computer Science.

8. Another academic unit within the university, namely Information Systems, is providing educational services to the program, has a strong commitment to participate, and will strengthen the quality of the program.

D. Students

Because a significant part of the NJIT master's population is part-time, and because of the abundance of industry in the state requiring software development skills, the M.S. in Software Engineering program may well benefit from attracting students who already have significant experience in software development and will bring an appropriate focus and knowledge to the program, that is, it may be possible to educate the student community more quickly and deeply than otherwise. The program should be attractive to these students and should benefit from their experience.

Students in the M.S. program in Software Engineering will be treated in the same way as students in other M.S. programs in Computer Science. Therefore they will have the same advisory and counseling programs open to them and have the same policies and resources for encouraging minorities and women.

Based on this analysis, we can make the following points.

1. The percentage of part-time students projected for the program is consistent with the goals of the program.
2. There are no special provisions beyond what the Computer Science Department already has in place to ensure successful target population (e.g., minorities and women) participation in the program. It is important to note that the enrollment of women in Computer Science in general has been declining in recent years and that perhaps it is time to make a special effort to encourage them to enroll in programs such as the M.S. in Software Engineering.
3. The counseling and advisement facilities to be provided to students enrolled in the program seem adequate.

E. Faculty

Based on my knowledge of, past interactions with, and recent discussions with the faculty and Dean, the faculty can be characterized as follows.

1. The faculty has the appropriate degrees and credentials to support the program.
2. The faculty is active in both education and research in the area of Computer Science in general and of Software Engineering in particular. As an example, Professor Ali Mili is an accomplished researcher and educator in the area of Software Engineering.

3. At least one additional faculty member with a background in Software Engineering will be needed to staff the program, and the Computer Science Department has planned the recruitment. One new member should allow for sufficient staffing for the initial years of the program, but as the program evolves it may be necessary to recruit additional faculty.

F. Support Personnel

The support personnel seem adequate for the program.

G. Finances

1. The Information Systems Department seems to have the necessary financial resources in place to support the program since the program does not require any new course development or additional faculty from Information Systems. The Computer Science Department has budgeted for the acquisition of one new faculty member to support the program. This seems to be the minimal need to support the program in its initial year or two. If the program evolves to meet a growing need, as the projections of the Bureau of Labor Statistics suggests it might, then additional faculty members may be needed to support the program.

All other resource needs seem to be in place for the initial few years of the program, including equipment, library support staff, and others.

In summary, the institution seems prepared and committed to supporting the program.

2. Additional financial support from the State of New Jersey would likely be needed to add new faculty if the program expands after the first year or two, and if courses that require specialized equipment, such as a Distributed Software Development Course requiring videoconferencing equipment were added to the program.

H. Physical Facilities

1. The computer laboratory, and networking equipment currently in use seem adequate to support the program and are consistent with offering a program of high quality.
2. The classroom facilities seem adequate for the requirements of the program.
3. The only places where there might be any adverse affect on resources would be in Computer Science and Information Systems. Since Information Systems has already been teaching the courses that it would support for the program, and since Computer Science has most of the courses in place already, and is planning to add additional faculty to support the program, it seems unlikely there will be any adverse affect on the resources needed and used by these departments.

4. The accessibility to program facilities by the handicapped would be the same as for existing programs.

I. Library

The Van Houten library seems more than adequate to support the program. Particularly notable is the enthusiasm and creativity of the library staff, and their systematic approach to providing support to the academic departments at NJIT.

J. Computer Facilities

The Computer Science Department appears to have adequate computing and networking facilities available to support the proposed M.S. in Software Engineering program. If the program evolves to include a course in distributed software development, the department may want to invest in videoconferencing facilities.

K. Administration

1. The administrative structure of the program seems sufficiently defined and reasonable. It will be the same structure utilizing the same resources as other Computer Science Department graduate programs.
2. The only intra-institutional cooperation involved is between Computer Science and Information Systems, both of which are committed to the program and seem to have defined the budgetary, administrative, and educational responsibilities clearly and adequately.

L. Evaluation.

The mechanisms used to evaluate the program will be the typical mechanism the Computer Science Department currently uses: exit questionnaires and a success criterion of three job offers per graduate. However, if the specific educational objectives of the program are to be evaluated, then more specific mechanisms will need to be put into place. One way to do so is to make the expected outcomes more precise and then define activities needed to achieve those outcomes and success measures associated with the activities, as described in Section VI Appendix B.

III. Recommendation

Based on the preceding analysis and discussion, I recommend that the program be approved with some minor modifications. Those modifications should include the following.

1. Define the expected outcomes of the program and the measures of success associated with those outcomes. Map each course offered as part of the program to

at least one outcome. For most courses the mapping should be straightforward to perform, based on their current descriptions and titles, Section VI Appendix B gives an example of how this might be done. It is particularly important to do such an analysis and mapping for the project course to ensure that it has specific objectives and that those objectives are met.

2. Put a plan in place to encourage women to enter the program.
3. Make the project course a requirement instead of an elective.
4. Add the subject of ethics to one of the required course offerings.
5. Make the mathematical prerequisites for the program, particularly a course in discrete mathematics, explicit.
6. Correct, as appropriate, the omissions and misplacements noted in Section II C, Educational Programs.

Please do not hesitate to contact me if you have any questions regarding this report.



David M. Weiss

IV. References

1. ACM/IEEE-CS Joint Task Force on Computing Curricula, Software Engineering 2004, Curriculum Guidelines for Undergraduate Degree Programs in Software Engineering. August 2004.
2. Bureau of Labor Statistics, 2008-2009 Occupational Outlook Handbook, <http://www.bls.gov/oco/ocos267.htm>
3. Graduate Software Engineering Reference Curriculum [GSwERC] Version 0.50. Stevens Institute of Technology, October 31, 2008
4. SWEBOK, Guide to the Software Engineering body of Knowledge, ed. P. Bourque and R. Dupuis. IEEE Computer Society Press, 2004.
5. Weiss, D.; Teaching A Software Design Methodology, IEEE Transactions on Software Engineering, vol. SE-13, no. 11, November, 1987
6. Ford, G., SEI Report on Graduate Software Engineering Education. CMU/SEI 91-TR-002, Software Engineering Institute, Carnegie Mellon University, April 1991.
7. Jain, R. and D. Verma, A Report on Curriculum content for a Graduate Program in Systems Engineering: A Proposed Framework. 2004, INCOSE.

V. Appendix A

PROGRAM ANNOUNCEMENT

September 2008

Institution:	New Jersey Institute of Technology
New Program Title:	MS in Software Engineering
Degree Designation:	Masters of Science in Software Engineering
Degree Abbreviation:	MSSE
CIP Code and Nomenclature (if possible):	11.0199 Computer and Information Sciences
Campus(es) where the program will be offered:	Newark Campus, NJIT
Date when program will begin (month and year):	September 2009
List the institutions with which articulation agreements will be arranged:	None

Is licensure required of program graduates to gain employment? Yes No

Will the institution seek accreditation for this program? Yes No

If yes, list the accrediting organization:

Program Announcement Narrative

- | | |
|---|-------------|
| • Objectives | page(s) 2 |
| • Need | page(s) 2 |
| • Student Enrollments | page(s) 3 |
| • Program Resources | page(s) 4-5 |
| • Curriculum/New Course Descriptions | page(s) 6-8 |
| • Appendix A: Fastest Growing Occupations | page(s) 9 |
| • Appendix B: Most New Jobs | page(s) 10 |

Descriptive Information

I. Objectives

The objective of the MS in Software Engineering is to teach students concepts, techniques and skills that are required to develop and build large modern software systems. Software engineering encompasses a wide range of topics including software specification, analysis, design, implementation, verification, deployment, reuse, and evolution of software products and software product lines. Also, software engineering encompasses not only the technical aspects of software production, but also the economic and organizational aspects.

Students with an MS in Software Engineering will be prepared for professional careers in the software industry, an economic sector that is experiencing a global expansion, and is increasingly critical to the technological advancement and the competitiveness of the state and the nation.

II. Need

II. A. Need for the Program

According to the US Department of Labor (Appendix A and B), 2 of the top 10 fastest growing and high paying occupations projected for the 10 years 2004-14 are computing specialties:

1. Computer software engineers, applications (rank #5)
2. Computer software engineers, system software (rank #8)

The US Department of Labor (DOL) splits Software Engineering into two categories: applications and systems software. Combining these categories makes Software Engineering the number one fastest growing occupation.

The migration of larger and larger sectors of the global economy online, along with the deployment of software applications in ever expanding sectors of modern life, place increasing demands on the software industry. These demands are both in terms of quantity and in terms of quality. At the same time, we are witnessing the migration of some sectors of the software industry from developed nations to emerging nations.

The College of Computing Sciences at NJIT proposes an MS in Software Engineering that takes into account the new market conditions, the needs of the state / region, and the strengths of the college and Institute.

II. B. Relationship to the Institute Master Plans

The MS in Software Engineering is consistent with the Institute's master plan in the sense that it is geared towards increasing graduate enrollment in an emerging field that is of great interest to the state and the region. It is also consistent with the goal of encouraging cooperation between departments, in the sense that this program serves as the focal point of synergy between software engineering and computer science in the computer science department and information systems. We anticipate that this synergy will enable to Institute to remain on *The Edge of Knowledge* in all three relevant areas.

II. C. Relationship to Similar Programs in the State and Region

Monmouth University in New Jersey offers an MS in Software Engineering. In the region, Pace University in New York, University of Scranton in Scranton, PA, Villanova University in Philadelphia, and Drexel University in Philadelphia all have MS in Software Engineering programs.

II. D. Distinguished Programs Nationally

The largest software engineering degree programs are at San Jose State University, Southern Methodist University, Northwestern Polytechnic University, and Carnegie Mellon University. Seattle University has the oldest MS Software Engineering program in the country. University of Texas at Dallas has an MS in computer science with a major in software engineering.

III. Students

NJIT has the same general attributes as many of the universities that offer MS programs in Software Engineering. They are all located in large metropolitan areas (Dallas, San Francisco, Chicago, New York, Seattle, Pittsburgh, etc), in the middle of very dynamic high technology corridors (Avionics, electronics, software, finances, etc). We anticipate that NJIT will capitalize on its urban location (Newark/ NYC) and its proximity to software companies that build, deploy, and buy software such as those in telecommunication, pharmaceutical, finance, etc to develop a thriving MS in Software Engineering program. We expect domestic students to be recruited among current undergraduates and from a large regional pool of working computing professionals. We also expect to recruit foreign students, who will find the combination of high quality education in software engineering and access to a large job market attractive. We anticipate 15 new students in the first two years for a total of 30 students in year 2. We estimate 20 new students in year 3 and approximately 25 new students per year in subsequent years. The total number of students in the program after 4 years is estimated to be 60-80 students.

IV. Resources to Support the Program

Many of the courses applicable to the new MS in Software Engineering degree presently exist in NJIT's Department of Computer Science and Department of Information Systems. However, some new core courses must be developed. There are currently many computer science, information systems, and management electives that will fulfill the elective needs for the program – however, some additional software engineering elective courses will need to be developed as the program evolves and more students enter the program.

IV.A. Course Development

The following new courses will need to be developed:

- CS 6**: Software Architecture
- CS 6**: Software Project Management
- CS 6**: Software Testing and Quality Assurance

IV.B. Faculty

There are three faculty members with credentials and research interests in software engineering in the Departments of Computer Science and Information Systems. The current faculty will develop the new courses. Initially we will use adjuncts with software engineering expertise and experience to teach some of the courses. Going forward if we have the expected growth in enrollment that we expect, we will need to hire faculty.

Also, in keeping with the general orientation of the proposed program, we envision a significant participation from industry. Such participation will make it possible for us to maintain the level of university-industry cooperation that is needed to maintain the credibility of our program, and to secure high quality internships and coops for our students. Hence, we expect to continue to use some adjuncts in addition to our regular faculty to teach the core and elective software engineering courses.

IV.C. Libraries and Computing Facilities

Since this program will draw upon many existing courses and upon the same supplemental literature that supports other related NJIT programs, library holdings are adequate to support the new program. NJIT's Van Houten Library has a collection of more than 130,000 books and subscribes to about 500 printed journals and about 13,000 electronic journals. The library's home page provides access to the library's online catalog and links to a wide array of information services. The library purchases between 2,500 and 3,000 new books each year.

Requests for new books or journals are made through the academic department's faculty representative to the library.

The library has a wide array of networked PCs that provide access to a large number of bibliographical databases and full-text electronic journals, for searching Internet sites, for searching each library's on-line catalog, and access to a variety of on-line journal databases. VCR's for viewing videocassettes reserved for courses are also available. Journal and conference literature in engineering, science, management, architecture and other subject areas is accessible through a variety of indexing and abstracting databases. Among the databases available on line are CompendexWeb (Engineering Index); ProQuest Direct (articles on business, management and industry), Applied Science and Technology Index. The library also borrows materials through interlibrary loan (ILL).

The libraries web site describes the services and resources more completely. Please see www.library.njit.edu.

As a technological research university, NJIT has excellent computing systems, networks and software to support this program. The Newark campus' gigabit Ethernet network backbone connects more than 6,000 nodes in classrooms, laboratories, residence halls, faculty and staff offices, the library, and student organization offices. Wireless access is available in over 90% of campus buildings and locations. The network provides access to a wealth of shared information services. Some of these include high-performance computing servers providing CPU cycles for simulation and computational research, disk arrays for storage of large data sets, communication servers for electronic mail and document exchange, databases, digital journal subscriptions and a virtual "Help Desk." A virtual private network combined with Internet access, plus a large ISDN modem bank extend access to campus information resources to faculty, staff and students working at home, work, any of the university's extension sites or throughout the world. Wide-area network access through NJEDge.Net (New Jersey's Higher Education Network) and the Internet provide collaboration opportunities with students, faculty, and researchers, locally, regionally, nationally, and throughout the world.

IV.D. Classrooms and Laboratories

There is a broad range of classrooms and laboratories available to offer the courses and projects in this program, including many with Internet access and multimedia facilities. Thus, no new classrooms or laboratories are specifically needed for the program.

V. Curriculum

The Department of Computer Science will administer the MS in Software Engineering degree. The day-to-day administrative responsibilities will be handled by the Program Director. The current graduate computer science advisor will oversee the advisement of all students in this program, and will work closely with the current graduate curriculum committee of the Departments of Computer Science in monitoring the progress of students in the program.

Required Background:

CS 505 – Programming
CS 435 – Advanced Algorithms and Data Structure
CS 490 – Software Engineering

VI. Required Courses – 15 credit hours

CS 6** – Software Testing and Quality Assurance
CS 6** – Software Project Management
CS 6**: Software Architecture
IS 676 – Requirements Engineering
CS 673 – Software Design & Production Methodology

VII. Elective Courses – 18 credit hours

CS 6** -- Software Security & Dependability – future course
CS 633 – Distributed Systems
CS 652 – Network Architecture & Protocols
CS 656 – Internet and Higher Level Protocols
CS 630 – Operating System Design
CS 631 – Data Management Systems Design
CS 696 – Network Management & Security
CS 700B – Software Project
IS 6** – Web Services Authentication [Previously taught as IS 698 in Fall 07]
IS 663 – Advanced Systems Analysis and Design
EM 636 – Project Management
EM 637 – Project Control
MGMT 620 – Management of Technology

Total – 33 credit hours

VIII. New Course Descriptions

CS 6 - Software Testing & Quality Assurance**

Topics include

- Types of Software errors and when they arise
- Cost of Errors
- Code Reviews
- Verification and validation
- When to do testing
- Testing Techniques
 - Black box
 - White box
 - Grey box
- Test Scripts / Plans
- Regression Testing
- Testing Tools
- Production Quality Software
- Pre Release Testing
 - Unit testing
 - Integration Testing
 - Functional Testing
 - System Testing
 - Performance Testing
 - Acceptance Testing
- Post Release testing
 - Alpha Testing
 - Beta Testing
- Managing Testing
- Functional attributes,
- Operational attributes,
- Process attributes,
- Static and dynamic attributes,
- Software metrics,
- Models of software quality,
- Quantifying software quality,
- Software qualities and software architectures

CS 6 Software Project Management**

Topics include:

- Using project management software
- Estimating effort
- Budgeting
- Timing
- Monitoring progress
- Managing people
- Offshore project management
- Outsourced project management
- software processes,
- development teams,
- software cost estimation,
- product line engineering,
- configuration control,
- software evolution,
- software copyright, patent,
- software liability.

CS 6 Software Architecture**

Software architecture deals with the structure of a software product in terms of components and connectors, and is known to determine the non functional attributes of software products. The purpose of this course is to explore the tradeoffs that arise in deriving and analyzing the architecture of software products. Topics include:

- Software requirements
- Functional and Non Functional requirements
- Software architecture and non functional requirements
- Architectural styles
- Architectural description languages
- Architectural description/ analysis tools

- Architectural frameworks
- Product line architectures
- Reference architectures
- Standard architectures

Appendix A

IX. Fastest Growing Occupations

Occupational employment

Fastest growing occupations

Percent growth in employment, projected 2004-14

Occupation	Percent growth in employment, projected 2004-14	Earnings quartile
Home health aides	56%	\$
Network systems and data communications analysts	55	\$\$\$\$
Medical assistants	52	\$\$
Physician assistants	50	\$\$\$\$
Computer software engineers, applications	48	\$\$\$\$
Physical therapist assistants	44	\$\$\$
Dental hygienists	43	\$\$\$\$
Computer software engineers, systems software	43	\$\$\$\$
Dental assistants	43	\$\$
Personal and home care aides	41	\$
Network and computer systems administrators	38	\$\$\$\$
Database administrators	38	\$\$\$\$
Physical therapists	37	\$\$\$\$
Forensic science technicians	36	\$\$\$\$
Veterinary technologists and technicians	35	\$\$
Diagnostic medical sonographers	35	\$\$\$\$
Physical therapist aides	34	\$\$
Occupational therapist assistants	34	\$\$\$
Medical scientists, except epidemiologists	34	\$\$\$\$
Occupational therapists	34	\$\$\$\$

Average, all occupations = 13%

16

Nearly all of the occupations that are projected to grow fastest relate to healthcare or computers. Earnings are highest in the computer-related occupations.

Occupational Outlook Quarterly - Winter 2005-06

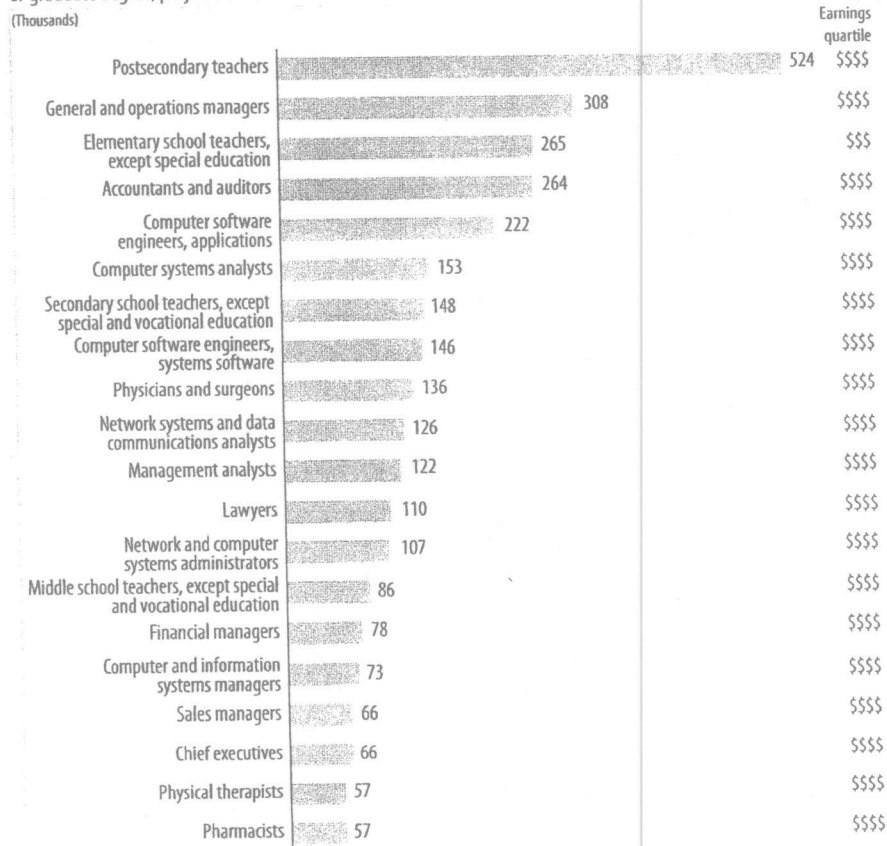
VI. Appendix B

X. Most New Jobs (Undergraduate or Graduate)

Occupational employment

Most new jobs, highest paying: Bachelor's or graduate degree

Numeric change in employment in the top 20 large-growth, high-paying occupations that often require a bachelor's or graduate degree, projected 2004-14



18 Each of these occupations is projected to gain at least 50,000 new jobs over the projections decade. In many of these high-paying occupations, workers usually have experience along with a bachelor's degree. In some of these occupations, workers have a graduate degree.

Occupational Outlook Quarterly • Winter 2005-06

VI. Appendix B

Proposed Expected Outcomes for M.S. in Software Engineering

David M. Weiss

david.m.weiss@comcast.net

Following is a proposed list of expected outcomes for students graduating with an M.S. in software engineering. Outcomes are organized into two types: what a graduate should be expected to know, and what a graduate should be able to do. Based on these outcomes, one could identify the specific actions one would need to take to enable each outcome and could define the measure of success for the outcome. For example, if one wanted to assure that students learn how to conduct code inspections, the actions to be taken might be to give a lecture in a class on Software Testing and Quality Assurance about how to conduct code inspections, provide reading material on different types of code inspections, and then assign homework wherein students must perform a code inspection on a set of code that the instructor knows contains certain defects. The measure of success might be what percentage of the defects students find. Maximal success would be finding all known defects and perhaps some previously-unknown defects. Minimal success might be finding 50% of the known defects.

1. What should recipient know?
 - 1.1. Basic mathematics needed to understand techniques for and limitations in constructing and verifying and validating software and system architectures and code,
 - 1.2. Limitations prescribed by computational theory.
 - 1.3. Underlying principles of software engineering needed to construct well-engineered systems, e.g., meaning of structure, information hiding, object orientation, definition of interface, role of specification, i.e., what distinguishes software engineering from simply writing code.
 - 1.4. Meaning of engineering, and what constitutes good engineering practice. A few examples from other industries.
 - 1.5. Architecture and its role.
 - 1.6. Architecture, algorithms, and a few tricks of the trade in at least one domain, such as telecommunications, finance, medicine, control systems.
 - 1.7. Basic theory and use of operating systems, databases, language parsers, performance analysis, human-computer interfaces (some of this should be a precondition).
 - 1.8. Basics of project planning and types of development processes, e.g., waterfall, iterative, product-line.
 - 1.9. Principles underlying the specification and design of a product line.
 - 1.10. Principles underlying configuration and change control systems.
 - 1.11. Problems of scale, i.e., what problems dominate as systems become larger.
 - 1.12. Basic theory of teamwork and how it is manifested in software development teams, what different manifestations are, and what their strengths and weaknesses are, e.g., distributed development, open source development, iterative (including agile) development, Conway's Law.
 - 1.13. Theory of software measurement, e.g., goal-question-metric paradigm, CMMI scale, complexity measures.
 - 1.14. Strunk & White and why it's important to apply it.

- 1.15. Ethical guidelines for engineering in general and software engineers in particular.
 - 1.16. Economic principles underlying cost and value analyses for software systems, and return on investment calculations.
 - 1.17. Finance and marketing principles applied to software engineering, e.g., the quality-interval-cost cycle.
 - 1.18.
2. What should recipient be able to do?
 - 2.1. Write a program, in at least two different languages, and give a convincing argument that it is correct.
 - 2.2. Review an architecture. Review a requirements specification.
 - 2.3. Operate as a member of a software development team in at least two different roles, e.g., developer, system tester, including knowing the process for making a change to the code to add a new feature or to correct an error.
 - 2.4. Construct a project plan.
 - 2.5. Check code into and out of a configuration control system.
 - 2.6. Conduct a performance analysis of a small system.
 - 2.7. Conduct code inspections.
 - 2.8. Write a good interface specification. Review an interface specification.
 - 2.9. Estimate how long it will take to implement a module.
 - 2.10. Use a software development environment such as Eclipse.
 - 2.11. Distinguish between well-founded research and poorly conceived or executed research, particularly be able to read journal and books relevant to software engineering and understand what's useful and what's not.
 - 2.12. Be able to cite at least two examples of good software architectures and two examples of failed software architectures and explain why they succeeded or failed.
 - 2.13. Review both cost and value analyses of software systems.
 - 2.14. Review the design of a graphical user interface.
 - 2.15. Design a small product line.

Memo

TO: Dr. Donald H. Sebastian, Interim Provost
FROM: Dr. Narain Gehani, Dean
CC: Dr. Michael Baltrush, Interim Chair, Computer Science
DATE: January 15, 2009
SUBJECT: Response to Consultant's Report for MS in Software Engineering

Consultant's Name: Dr. David Weiss, Avaya Laboratories
 Consultant's Visit Date: November 19, 2008
 Date of Consultant's Report: January 7, 2009

We would like to thank Dr. Weiss for his thorough evaluation of our proposed MS in Software Engineering degree. We are very pleased that his report is positive.

Dr. Weiss' report, *Review of NJIT Proposed MS in Software Engineering*, contains recommendations for minor modifications to the degree program (Section III of the report).

The *MS in Software Engineering Program Announcement* has been updated as appropriate to incorporate Dr. Weiss' recommendations. The updated Announcement is attached.

The changes recommended by Dr. Weiss and our specific responses are as follows:

1. Define outcomes of the program ...

We have added an extra section *Expected Outcome and Measures of Success* that addresses this issue for the degree and for the required courses.

2. Plan to encourage women to apply.

CCS will continue to work with both Graduate Admissions and the Murray Center for Women in Technology to target women students.

3. Require a project course.

CS 6xx, Graduate Capstone, has been added to the required courses. This course solicits projects from industrial sources and small teams of students implement the project from gathering the requirements, designing the solution, implementing it, testing it, and documenting it.

4. Require an ethics topic course.

The ethics topic has been added to the CS 6xx Software Project Management proposed course.

5. Mathematics prerequisite explicitly requires discrete mathematics.

Discrete mathematics requirement will be added to the admissions requirements.

6. Correct omissions and misplacements.

We have modified the proposed new courses. Also, as it turns out, product line engineering is covered in CS 673. We will instruct the CS 673 course instructor to also teach distributed development.

RESUME**Education**

Ph.D. Computer Science, University of Maryland,
December, 1981
M.S. Computer Science, University of Maryland,
August, 1973
B.S. Mathematics, Union College, June, 1964

Personal

Address: David M. Weiss
10 Liberty Hills Ct.
Long Valley, NJ 07853—3087

Telephone: (908) 876-3841 (home)
(908) 696-5600 (work)

Family Status: Married, 2 children, 4 grandchildren

Birthdate: 27 February, 1945

Experience

July 2000- present Director, Software Technology Research Department
Avaya Laboratories

Helped to create a new research laboratory in a new company. The department specializes in software technology research focused on improving Avaya's software development processes and knowing it, i.e., being able to measure the impact of the department. Requires recruiting researchers, connecting the department's work to the needs of the company, and building a reputation for excellence within the company, the external industrial community, and the external research community. Department size fluctuates but is currently 12 people.

Activities include teaming with technology strategists to identify key technologies for the company; assessing the state of software development within the company; forming joint projects with product units and other research departments to improve product unit software development processes and introduce new software technology into those processes; motivating researchers to create new research projects relevant to the company, the industry, and the software technology research community; establishing a diverse research culture that contributes to attracting and retaining the best researchers; and recruiting both junior and senior researchers.

In an article in the June, 2007, Communications of the ACM, we were the second highest ranked industrial software engineering research organization in the world.

August 1996- June 2000 Director, Software Production Research Department
Lucent Technologies Bell Laboratories

Managed department of 30 people conducting research in software engineering. Responsible for setting research directions, managing budget, recruiting, evaluating performance, identifying opportunities for teaming with and transferring technology to large software development organizations, and fomenting the creation of new business

ventures based on research results. My department originated two new ventures for Lucent (one based on my personal research), created new products, and developed and transferred into use within Lucent a variety of new methods, tools, and languages that help software developers to improve their productivity. The intellectual property encompassing this work is embodied in numerous patents, papers, books, software and its documentation, and presentations.

June 1995- Distinguished Member of Technical Staff
 July 1996: AT&T Bell Laboratories, Lucent Technologies Bell Laboratories

Researcher in Software Production Research Department. Responsible for conducting research in methods and supporting tools to improve the development of large real-time systems, such as telephone switching systems. Principal research areas include software production processes, domain engineering, formal specification, software design, process modeling, and language design. Responsible for collaborating with software developers to conduct experiments in software engineering and to apply the results of research, i.e., for transferring technology. Developed and transferred to software development organizations a new process for domain engineering based on the idea of software families, that improves productivity by a factor of 3 to 5. My book describing this process, known as the FAST process, was published in August, 1999.

September 1993 - Technical Manager
 May 1995: AT&T Bell Laboratories

Supervisor of a group of 12 researchers and 5 interns within the Software Production Research Department. Responsibilities include providing research direction, assisting researchers to establish collaborations with developers and with researchers in other departments, and conducting research in methods and supporting tools to improve the development of large real-time systems, such as telephone switching systems. Also responsible for managing and administering the group, including conducting performance reviews, approving equipment purchases and travel, and other similar activities.

February 1992 - Member of Technical Staff,
 August 1993: AT&T Bell Laboratories

Researcher in Software Production Research Department. Responsible for conducting research in methods and supporting tools to improve the development of large real-time systems, such as telephone switching systems. Principal research areas include software production processes, formal specification, process modeling, and measurement. Responsible for collaborating with software developers to conduct experiments in software engineering and to apply the results of research.

December 1990 - Director, Reuse & Measurement Division, Software
 February 1992: Productivity Consortium

Director of a group of 20 people working in the areas of reuse and measurement. Responsibilities include managing 5 research and technology transfer projects, providing technical leadership, finding ways to transfer the resulting technology to the Consortium's member companies, forming strategic alliances with other companies, writing proposals, and assisting in broadening the Consortium's member base.

November 1990 - Director, Synthesis Project, Software
 December 1990: Productivity Consortium

Director of a group of 25 people working on Synthesis, the Consortium's long term project to improve software productivity in its member companies. Responsibilities included planning and managing the project, providing technical leadership, finding ways to transfer the resulting technology to the Consortium's member companies, forming strategic alliances with other companies, writing proposals, and assisting in broadening the Consortium's member base.

January 1990 - Principal Member of the Technical Staff
November 1990: Synthesis Project, Software Productivity Consortium

Senior technical staff on the Synthesis Project. Responsibilities included providing technical leadership, defining the Synthesis process and identifying the technology needed to implement it, and explaining the methods and technology to member companies (in cooperation with other senior staff).

September 1987 - Group Leader, Methodology and
January 1990: Measurement Group, Software Productivity Consortium

Leader of a group of 12 people responsible for defining, transitioning, and helping automate the Consortium's software life cycle methodology. Group projects include research into testing and certification techniques, prototyping a reusable software library, defining and transitioning a software development methodology based on reuse and prototyping, and measuring the effects of the methodology and of the products that the Consortium builds. The methodology is for use both internally at the Consortium and by the Consortium's member companies.

June 1986 - Senior Analyst, U.S. Congress, Office Of
September 1987: Technology Assessment

Member of a 4 person team assessing the feasibility of building the Strategic Defense Initiative system. The study was congressionally mandated and resulted in a report to Congress in August, 1987. (Unclassified version published in May, 1988.) Responsible for producing the computing technology, battle management, and software chapters of the report.

June 1985 - Visiting Scholar, Wang Institute of
June 1986: Graduate Studies

Sabbatical year at The Wang Institute of Graduate Studies. Presented a lecture series on software design and conducted research in the area of software engineering. The research focussed on finding a way of comparing different software design methodologies in order to perform a rational analysis of their benefits and weaknesses.

January 1974 - Head, Combat Management Section,
June 1986: Computer Science and Systems Branch,
Information Technology Division,
U.S. Naval Research Laboratory

Primary responsibilities of the position were to lead and participate in research in software engineering. Responsibilities also included supporting the transfer of research results to Navy and DoD operational systems. Associated supervisory duties included

directing 4 full-time computer scientists, several consultants, and several part-time employees. Also supervised the staff responsible for the maintenance and upgrade of the branch computer system, including a local network.

Projects included evaluating software development methodologies by analysis of change data, participating in the redevelopment of the flight software for the Navy's A-7E aircraft, investigating techniques for translating formal, abstract specifications into procedural specifications, and consulting on the application of state-of-the-art software engineering techniques to a large Navy system.

The analysis of change data was based on measurement techniques developed in association with Dr. Victor Basili at the University of Maryland as part of NASA's Software Engineering Laboratory project. As part of this project invented a technique called the Goal-Question-Metric paradigm that is now widely used for software measurement.

Redeveloping the A-7E flight software was an NRL project to show that software engineering techniques such as information hiding, cooperating sequential processes, abstract data typing, and formally specifying abstract interfaces can be used in situations where the software is very tightly constrained with respect to memory and cpu utilization. Dr. David Parnas was the project leader. Many of the techniques pioneered on this project are now commonly seen in object-oriented software development methodologies.

Other activities at NRL included consulting on the use of software engineering techniques to various Navy agencies, investigating the state-of-the-art in software cost estimation, evaluating the Ada programming language for compatibility with modern software engineering techniques, participating in the development and teaching of a software engineering course for Navy software acquisition managers, and consulting on the design of a proposed new Navy standard programming language. Also was principal investigator of NRL's first software engineering task, many of the results from which led to the initiation of the projects described in the foregoing.

In addition to the preceding, took an active role in defining NRL's software engineering research program and in writing and presenting proposals to sponsors.

January 1984 - Part-time Faculty, University of
December 1984: Maryland, Computer Science Department

Taught a senior-level course in computer architecture in the computer science department. Textbooks used included Computer Organization by Hamacher, Vranesic, Zaky; Computer Structures: Readings and Examples, by Bell and Newell; and Operating Systems, by Madnick and Donovan.

May 1970 - Senior Member of the Technical Staff,
January 1974: Computer Sciences Corporation

Activities at CSC included the following:

* providing enhancements to the EXEC 8 operating system for a dedicated UNIVAC 1106 located at the Pentagon,

* providing technical supervision for several software support tasks at NASA/GSFC, generally involving the development and maintenance of satellite telemetry data processing and attitude determination programs,

* maintaining a software monitor for a multiprocessor UNIVAC 1108, a generalized re-entrant assembly language I/O handler running under EXEC 8, the ISIS-A and ISIS-B telemetry data processing systems, and developing a geopotential recovery system to run on an IBM 360/95,

* participating in writing several successful proposals.

February 1967 - Mathematician, U.S. Naval Research
April 1970: Laboratory

Provided programming and mathematical support for a group of physicists involved in basic research in upper atmospheric physics. This included writing data reduction, analysis, and graphical display programs on CDC 3100 and CDC 3800 computers. In addition, helped to maintain and enhance the operating system for a CDC 3100 computer, and provided programming consultation services to its users.

Professional Services and Activities

Software Engineering Institute, Technical Advisory Group

Software Product Line Hall of Fame, organizer

Associate Editor-In-Chief, IEEE Transactions on Software Engineering, 2004-2006

Program co-chair, Software Product Lines Conference, 2004

Reviewer for Computing Reviews, IEEE Software, Communications of the ACM, National Science Foundation, Defense Advanced Research Projects Agency, NSERC

Program committee member for a variety of conferences

Member of ACM.

Senior Member of IEEE.

Best Retrospective Paper Award from 7th International Conference on Software Engineering, awarded at 17th International Conference on Software Engineering, with D. Parnas and P. Clements

Industrial Program Chair, International Conference on Requirements Engineering 2000

Instructor at Rocky Mountain Institute of Software Engineering for tutorial entitled "Measurement For Management."

**3F. Approve Resolution to
Authorize Student Fee for
English Proficiency Exam in
MS in Engineering Management
Program at Beijing University
of Technology**

Resolution to Establish English Proficiency Testing Fee

Whereas, it is necessary to have a process to evaluate the English proficiency of potential international students, and

Whereas, in addition to a commercial test that is available, it is desirable, due to access and timing of the commercial test, to have an alternative means to assess the potential students, and

Whereas, an NJIT English Proficiency test has been developed and approved by its Undergraduate Curriculum Review Committee, and

Whereas, to cover the costs associated with the administration and grading of the NJIT test, a student fee of \$125 is proposed,

Now, Therefore Be It Resolved that the Board of Trustees establishes a student fee of \$125 for the NJIT English Proficiency Exam.

12 February 2009

**4A. Update on Purchase of
Central High School**

**4B. Update on Status of NJIT
Campus Gateway Plan**

**4C. Honorary Doctorate
Degrees for 2009**

4D. Operating Statement
Year to date

A

NEW JERSEY INSTITUTE OF TECHNOLOGY
STATEMENT OF CURRENT FUND REVENUES AND EXPENDITURES
FOR THE SIX MONTHS ENDED DECEMBER 31, 2008
(dollars in thousands)

RESTRICTED YEAR TO DATE					UNRESTRICTED YEAR TO DATE				
AMOUNT			(50%) % OF BUDGET		AMOUNT			(50%) % OF BUDGET	
BUDGET	2008/2009	2007/2008	2008/2009	2007/2008	BUDGET	AMOUNT	2008/2009	2007/2008	
REVENUES									
Education and General									
					\$	\$			
\$ 67,830	\$ 30,126	\$ 30,799	44%	48%	105,586	99,310	94%	93%	
					80,685	37,508	46%	49%	
					7,595	3,361	44%	52%	
					2,375	760	32%	44%	
67,830	30,126	30,799	44%	48%	TOTAL	196,241	140,939	72%	71%
					Auxiliary Enterprises	12,260	10,625	87%	89%
67,830	30,126	30,799	44%	48%	TOTAL REVENUES	208,501	151,564	73%	72%
EXPENDITURES									
Educational and General									
	260	2,299				71,800	35,859	50%	47%
	18,177	17,683				8,500	2,265	27%	35%
	174	162				3,300	1,649	50%	55%
	141	139				20,700	8,989	43%	46%
	1,065	1,050				13,700	6,836	50%	52%
	176	286				27,900	15,369	55%	46%
						17,734	7,181	40%	42%
	10,133	9,180				18,197	8,927	49%	52%
67,830	30,126	30,799	44%	48%	TOTAL EDUCATIONAL & GENERAL	181,831	87,075	48%	47%
					TRANSFERS	14,410	7,095	49%	50%
67,830	30,126	30,799	44%	48%	TOTAL	196,241	94,170	48%	47%
					Auxiliary Enterprises	6,948	3,769	54%	52%
					Auxiliary Transfers	5,312	2,656	50%	50%
					TOTAL AUXILIARY	12,260	6,425	52%	51%
67,830	30,126	30,799	44%	48%	TOTAL EXPENDITURES & TRANSFERS	208,501	100,595	48%	47%
\$ 0	\$ 0	\$ 0			EXCESS OF REVENUES OVER	\$ 0	\$ 50,969		
					EXPENDITURES AND TRANSFERS				

B

NEW JERSEY INSTITUTE OF TECHNOLOGY
EXPENSE REPORT
FOR THE SIX MONTHS ENDED DECEMBER 31, 2008
(dollars in thousands)

	CURRENT MONTH AMOUNT	YEAR TO DATE ACTUAL	BUDGET	50% PERCENT OF BUDGET		
				ACTUAL YEAR TO DATE	INCLUDES ENCUMBRANCES PRIOR YEAR	CURRENT YEAR
ACADEMIC						
Salaries & Fringe Benefits	\$ 8,164	\$ 48,862	\$ 103,323	47%	87%	86%
Equipment Purchases	181	1,019	2,816	36%	46%	48%
Financial Aid to Students	217	8,927	18,197	49%	61%	58%
Other Operating Expenses:						
Materials & Supplies	111	737	1,600			
Travel & Development	209	979	2,050			
Library Collections	0	221	1,064			
Other General Operating	740	3,369	8,686			
Total Other Operating	1,060	5,306	13,400	40%	66%	55%
TOTAL ACADEMIC	9,622	64,114	137,736	47%	81%	79%
SUPPORT						
Salaries & Fringe Benefits	2,451	15,084	26,289	57%	95%	112%
Equipment Purchases	34	88	417	21%	46%	31%
Utilities	448	3,866	9,005	43%	97%	98%
Other Operating Expenses:						
Materials & Supplies	51	385	920			
Travel & Development	45	175	489			
Other General Operating	216	2,603	4,600			
Total Other Operating	312	3,163	6,009	53%	94%	116%
TOTAL SUPPORT	3,245	22,201	41,720	53%	95%	109%
TRANSFERS	1,239	7,095	14,410	49%	100%	100%
TOTAL ACADEMIC, SUPPORT & TRANSFERS	14,106	93,410	193,866	48%	85%	87%
Auxiliary Enterprises	765	3,769	6,948	54%	92%	96%
Auxiliary Transfers	443	2,656	5,312	50%	100%	100%
TOTAL OPERATING EXPENSES	15,314	99,835	206,126	48%	86%	87%
EXPENSES FROM ALLOCATED FUNDS	29	760	2,375	32%	100%	100%
TOTAL UNRESTRICTED EXPENSES	15,343	100,595	208,501	48%	85%	87%
RESTRICTED	3,816	30,126	67,830	44%	48%	44%
TOTAL EXPENSES AND TRANSFERS	\$ 19,159	\$ 130,721	\$ 276,331	47%	76%	76%

4E. Schedule of Short Term Investments

NEW JERSEY INSTITUTE OF TECHNOLOGY

SCHEDULE OF INVESTMENTS
AS OF DECEMBER, 31 2008

<u>DATE PURCHASED</u>	<u>MATURITY DATE</u>	<u>RATE</u>	<u>TYPE</u>	<u>WACHOVIA BANK</u>	<u>CITY NATIONAL BANK</u>	<u>MERRILL LYNCH</u>	<u>JP MORGAN CHASE</u>	<u>TOTAL</u>
--	OVERNIGHT	3.78	CMA*			\$ 4,471,012		\$ 4,471,012
7/25/2008	1/23/2009	2.96	CD		\$ 500,000			500,000
--	VARIES	1.84	PRIME MONEY MARKET				\$ 2,275,831	2,275,831
--	VARIES	2.37**	MONEY MANAGER	\$ 7,690,398				7,690,398
--	OVERNIGHT	1.34**	MONEY MARKET	4,263,604				4,263,604
--	OVERNIGHT	1.48	REPO*	8,068,000				8,068,000
				<u>\$ 20,022,002</u>	<u>\$ 500,000</u>	<u>\$ 4,471,012</u>	<u>\$ 2,275,831</u>	<u>\$ 27,268,845</u>
							Crossfoot	\$ 27,268,845

INVESTMENT AS OF DECEMBER, 31,2007 WERE \$39,033,370

* MONIES IN THIS ACCOUNT ARE INVESTED IN GOVERNMENT SECURITIES

** NET OF FEES

4F. Intangible Asset Review

NJIT Board of Trustees
Intangible Asset Review

Dr. Donald H. Sebastian, Sr. Vice President for Research & Development
Judith Sheft, Assoc. Vice President for Technology Development
February 12, 2009

NJIT's activities in patents and licensing continue the upward trend established since the restructuring of the Office of Technology Development (OTD) and the implementation of the new Patent Policy in 2003. Invention Disclosures have tripled from under 30 in 2003 to greater than 90 in FY08 and the pipeline of patent applications pending with the USPTO has more than doubled in the past 4 years to ~250 pending applications. Table 1 summarizes the activity for the past 3 fiscal years. The number of issued patents continues to grow as a result of this increase in submissions (on average patents issue 33 months after a Non-Provisional Patent Application is submitted to the USPTO). The addition of an in-house patent attorney has enabled us to cost effectively handle a large number of provisional patents filings.

Table 1. Patent Statistics

	FY 07	FY 08	FY 09 (YTD)
Invention Disclosures	73	93	40
US Patent Applications	69	64	24
Issued Patents	9	11	4

The other significant change coming out of the restructuring of the OTD is the growth in licensing revenues, which increased from only \$16K in 2003 to an average of \$390,000 annually for the past four fiscal years. FY09 is expected to increase to more than \$600,000 and we expect this upward momentum will continue based on the steady growth of new, licensable IP and the development of trusted license partners that seek repeat business from the university. For example we began FY09 with the execution of our fifth and sixth deals with one particular licensee. In addition we are just beginning to receive the milestone payments due upon issuance of the 65 patents our licensee is currently prosecuting on behalf of NJIT, not to mention several other projects we hope will bear substantial fruit in the near future.

Table 2. License Statistics

	FY 07	FY 08	FY 09 (YTD)
License & Option Agreements	73	88	37
License Income	\$315K	\$334K	\$272,500

The Office of Technology Development is expecting its third annual special grant from the New Jersey Commission on Science and Technology (NJCST) to accelerate the commercialization of university based intellectual property. These GAP funds are intended to take inventions that are beyond basic research but need proof of concept or additional development to make the technology viable for licensing. This type of translational development is typically too applied for consideration by traditional Federal funding sources. Last year 31 proposals were received from NJIT research faculty of which 11 were funded.

This GAP funding has already facilitated several new relationships: a \$100k subcontract on a NIH SBIR award to Infoscitex, a Boston based research, development, & engineering company, to continue development of the Smart Shunt for Hydrocephalus (Professors Thomas & Farrow); several new relationships for unique applications of the phthalocyanine dyes (Professor Gorun); and potential licensing of NJIT recently patented LTP Ultrasound technology (Professor Chang) to Medsonics, a medical device start-up located at NJIT's Economic Development Center.

We are awaiting on the NJCST's notice of the size of this year's award before making a call for new proposals (the NJCST's overall budget for this activity is substantially less than the total amount awarded last year). Continuing the model we implemented last year, the NJCST GAP awards will be judged by a panel of experienced technologists (last year's panel consisted of Dr. Sebastian, Vince DeCaprio and two others, Joe Urich and John Patberg, not formally associated with NJIT).

The following NJIT professors are named inventors on assets licensed to third parties in 2008:

- Yeheskel Bar-Ness (ECE)
- Alexander M. Haimovich (ECE)
- Oswaldo Simeone (ECE)
- Swades K. De (ECE)
- Yun-Qing Shi (ECE)
- Nirwan Ansari (ECE)
- Roberto Rojas-Cessa (ECE)
- Edip Niver (ECE)
- Yehoshua Perl (CS)
- James Geller (CS)

4G. Spring 09 Enrollment

NEW JERSEY INSTITUTE OF TECHNOLOGY

Office Of The Registrar

2009 Spring Enrollment by Enrollment Status

(All inquiries regarding official enrollment statistics should be directed to the Office of Institutional Research)

	Continuing Students	Freshman	New Grad Students	Non-Matric Students	Readmitted Students	Transfer Students	2009 Total Enrolled	"+" / "-" 2008 SP	% Of Total Enrollment
Undergraduate									
Full-Time	3942	23	NA	8	48	137	4158	272	53.5%
Part-Time b.	738	3	NA	212	34	78	1065	-7	13.7%
Total	4680	26	0	220	82	215	5223	265	67.2%
Graduate									
Full-Time a.	1102	NA	243	10	5	NA	1360	-70	17.5%
Part-Time	880	NA	159	126	21	NA	1186	77	15.3%
Total	1982	0	402	136	26	0	2546	7	32.8%
Grand Total	6662	26	402	356	108	215	7769	272	100.0%
% of Total	85.8%	0.3%	5.2%	4.6%	1.4%	2.8%	100%		

09sprogstatus

4H. Report on Gifts and Fund Raising Activities

Summary - 2007 (7/1/2006 to 12/31/2006) vs 2008 (7/1/2007 to 12/31/2007) vs 2009 (7/1/2008 to 12/31/2008)

Comparison of Total Giving Year to Date:

	2007	2008	2009
To All Sources:	\$4,874,803	\$9,118,070	\$7,225,645
To All Sources without Gifts in Kind:	\$3,790,358	\$7,049,077	\$5,894,149
Matching Gifts:	\$62,425	\$25,521	\$45,527

Comparison by Donor Type Year to Date for 2007, 2008, 2009

Category	2007		2008		2009	
	\$ Giving	% # Donors	\$ Giving	% # Donors	\$ Giving	% # Donors
Alum	\$1,095,883	22.48 3,004	\$2,180,473	23.91 3,308	\$2,180,636	30.18 2,718
Corp	\$2,357,502	48.36 204	\$3,241,884 ¹	35.55 200	\$2,704,756 ²	37.43 239
Foundations	\$506,233	10.38 11	\$2,493,415 ³	27.35 15	\$1,927,548	26.68 14
Friends	\$648,231	13.30 345	\$1,008,531 ⁴	11.06 231	\$312,812	4.33 256
Other	\$266,953	5.48 10	\$193,767	2.13 9	\$99,892	1.38 14
Totals:	\$4,874,803	100.0 3,574	\$9,118,070	100.0 3,763	\$7,225,645	100.0 3,241

Year End Totals

Total Dollars	% of FY 07 Funds Raised		% of Year Elapsed	
2007	\$8,205,293	100%	100%	
2008	\$13,318,420	163%	100%	
2009	\$7,225,645	88%	50%	

¹ Corporation - Anonymous \$1.9M
² Corporation - Anonymous \$1.2M
³ Foundations - Stable \$1.5M in 2008 and \$1M in 2009
⁴ Friends - Murawski \$700K, Metz \$102

HIGHLANDER ATHLETICS CAMPAIGN INTERNAL UPDATE
Confidential – December 31, 2008

Campaign Purpose

The purpose of the Highlanders Athletics Campaign is to raise funds necessary to upgrade selected athletics facilities and increase the amount of money available for athletic scholarships. A \$5 million goal has been set, which will provide \$3 million for athletics facilities, \$1.5 million for athletic scholarships and \$500,000 for program support.

<u>Campaign Progress</u>	<u>10/31/08</u>	<u>11/30/08</u>	<u>12/31/08</u>
Cash in hand	\$2,943,766	\$2,949,486	\$3,063,536
Balance of Pledges	\$1,590,720	\$1,770,289	\$2,019,798
Total	\$4,534,486	\$4,719,775	\$5,083,334

Recent Highlights:

- EE Cruz Gift Confirmed \$250K
- Additional \$100K Gift from Naimoli (CRUT)
- Received Final Payment from Zoom Fleisher \$50k on \$250k pledge

Upcoming:

- Campaign Final Appeal Going to Print
- Stewardship Calls
- Prudential Center - Double Header Game with Reception February 12, 2009
- Hall of Fame Dinner – May 2009

4I. Fund Raising Growth Strategies

DEVELOPMENT GROWTH STRATEGIES

The Highlander Athletics Campaign is in the final stages with 98% of the goal achieved. A final mass appeal will take place in early February and we anticipate that the campaign will come to a successful conclusion by June 2009.

To ensure the strength of the campaign's message and help identify leadership prospects, campaign counsel Changing Our World completed 101 interviews and reviewed 255 responses to the mail/online surveys received before June 30, 2008. The planning study findings were presented to the Board of Trustees in September 2008. President Altenkirch and Vice President Dees have begun the recruitment of volunteer leaders to form the nucleus of the Campaign Leadership Committee. The campaign plan and case for support will be reviewed in February for presentation to the Board of Overseers and the Advancement Committee in March.

The Annual Fund effort this year is enjoying some increases, in spite of difficult economic times. Total dollars raised from alumni donors is showing a slight increase in large part due to the success of this year's phonathon. At mid year, the total dollars raised by phonathon is up 5% over last year's year-end number. Collections have increased 34% over the same time last year and the average pledge is up \$12 over last year. Part of this success can be attributed to a concentration on credit card donations which has increased 4% over last year.

The staff continues to work to expand Leadership Circle donors, who give annually at the highest levels, and to reinforce their sustained membership. Focus will be given to the acquisition of new donors at the thresholds of the major-giving ladders. Leadership Circle Gift Clubs currently include: Eberhardt Society (\$25,000 or more), Weston Society (\$10,000-\$24,999), Founders' Club (\$5,000-\$9,999), President's Circle (\$1,000-\$4,999), Dean's Club (\$500-\$999), and Annual Fellow (\$100-\$499). Other Gift Clubs include: Olympian Society (Lifetime giving of \$1m or more), and the 1881 Society (Planned Gifts). As of this report both the President's Circle and Dean's Club giving levels are up (7%) and (4%) respectively over this time last year.

The Leadership Circle recognition dinner was also a great success this year. There were 127 attendees at this year's gala, a 35% increase over the previous year. The event's success was highlighted by the participation of a guest speaker, New York Yankees announcer, John Sterling.

Email communications and email appeals are also receiving a significant response this year. To date \$5,131 has been donated through email appeals, a 16% increase over email appeals for the same time frame last year.

The overall development effort has been extremely productive this year. As of December 31st we have reached 81% of the goal for FY '09 with \$7,225,645 raised to date.

The development team has continued to cultivate and expand advisory boards and alumni councils, encouraging the involvement of deans and department chairs, and using one-to-one solicitation methods to the greatest extent possible. Fifty-four new board members have been added to overseers, college, advisory and alumni boards since the beginning of this year.

Targeted dinners and receptions remain strategic to the cultivation process. These initiatives targeting alumni and corporate contacts are expected to garner an increase in funds raised for each college and to generate an expanded pool of major donor prospects for the campaign

The Planned Giving Program continues to employ a variety of outreach methods. They include local and regional cultivation visits/events with alumni and friends, and stewardship events for members and prospective members of the 1881 Society. In addition, they also include financial and estate planning seminars, newsletters and postcards, as well as e-communications and articles in the alumni magazine. The Emergency Economic Stabilization Act of 2008, which was signed into law on October 3, 2008, has extended a charitable giving provision that was originally passed as part of the Pension Protection Act of 2006. Known as the Charitable IRA Rollover, the provision, which will be in effect through 2009, allows individuals aged 70-1/2 and older who have a traditional or Roth IRA to make a direct transfer from their IRA Rollover amount from their taxable income. The individual will also be eligible to exclude the Charitable IRA Rollover amount from their taxable income and satisfy their required minimum distribution by making a direct Charitable IRA Rollover contribution. The Planned Giving Program anticipates an increase of 25% from the donations received as a result of the extended Charitable IRA Rollover provision.

Due to the recent economic downturn, the interest rates for Charitable Gift Annuities declined in 2008 and are expected to decline, once again, during the first quarter of 2009. The gift annuity portfolio provided a substantial contribution to overall gift receipts in 2008 and will likely continue to make significant contributions in 2009. While the payout rate has declined, the income stream is a guaranteed and fixed source of income for our alumni and friends. This guaranteed income is highly attractive during these uncertain times.

As a constant staple, the Planned Giving Program will continue to promote traditional gift planning opportunities such as bequests, gifts of stock and other gifts of real or personal property.

January 2009

Chairperson's Closing Statement

BOARD OF TRUSTEES

**RESOLUTION RE: CLOSED SESSION TO DISCUSS PERSONNEL MATTERS,
REAL ESTATE AND CONTRACT MATTERS.**

**WHEREAS, THERE ARE MATTERS THAT REQUIRE CONSIDERATION BY
THE BOARD OF TRUSTEES THAT QUALIFY UNDER THE OPEN PUBLIC
MEETINGS ACT FOR DISCUSSION AT A CLOSED SESSION.**

**NOW, THEREFORE, BE IT RESOLVED, THAT THE BOARD OF TRUSTEES
SHALL HAVE A CLOSED SESSION TO DISCUSS MATTERS INVOLVING
PERSONNEL, REAL ESTATE AND CONTRACTS TO TAKE PLACE ON
APRIL 9, 2009 AT 9:30 AM, EBERHARDT HALL NJIT ALUMNI
CENTER BOARD ROOM.**