NJIT BOARD OF TRUSTEES
Thursday, September 18th, 2008

PUBLIC SESSION MEETING

NJIT

New Jersey's Science & Technology University

PLEASE BRING TO MEETING

NEW JERSEY INSTITUTE OF TECHNOLOGY

BOARD OF TRUSTEES
PUBLIC SESSION
September 18, 2008
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. **Minutes** (Approve minutes of the July 17, 2008 meeting of the Board of Trustees)

3. **Public Comments**

4. **Action Items**

   A. Approve resolution Accepting FY08 Audit
   B. Approve resolution to Authorize Various Training Contracts in the Division of Continuing and Professional Education
   C. Approval to proceed with Planning Process for Offering Engineering Programs in Dubai
   D. Approve disposition of Intellectual Property
   E. Approve resolution to establish MS in Critical Infrastructure Systems
   F. Approve resolution to establish MS in Pharmaceutical Systems Management

5. **Reports**

   A. Enrollment update
   B. Status of Gateway Plan and Greek Village
   C. NCAA Certification
   D. Operating Statement Year to Date
   E. Schedule of Short Term Investments
   F. Report of Gifts and Fund Raising Activities
   G. Update on Celebration 08

6. **Announcement of Next Meeting**

Chair to read resolution regarding Closed Session to discuss Personnel, Real Estate and Contract Matters to be held on Thursday, November 6, 2008, 9:30 AM, Eberhardt Hall NJIT Alumni Center.

Announce next public meeting: Thursday, November 6, 2008, 11:00 AM, Eberhardt Hall NJIT Alumni Center.

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."

2A.   Approve Minutes of the July 17, 2008 Meeting of the Board of Trustees

NEW JERSEY INSTITUTE OF TECHNOLOGY
BOARD OF TRUSTEES
MINUTES - PUBLIC SESSION
July 17, 2008

1. The meeting was called to order by Chairperson Wielkopolski, at 12:00 noon. Other Trustees in attendance were Vice Chair DePalma (telephonically), and Board Members Bone, Beachem, Cistaro, DeCaprio, 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. BY A MOTION DULY MADE BY MR. BEACHEM, SECONDED BY DR. DeCAPRIO AND UNANIMOUSLY PASSED, the minutes of the June 5, 2008 meeting were approved.

3. BY A MOTION DULY MADE BY MR. CISTARO, SECONDED BY MS. GARCIA AND UNANIMOUSLY PASSED, the Board voted to approve the Resolution to set FY 2009 Schedule of Tuition and Fees, with the amounts set forth in Attachment "A" amended so that the per semester increase to full-time, in-state undergraduate tuition is $400 and fees is $166, and to increase all other regular tuitions and fees by a proportionately.

4. BY A MOTION DULY MADE BY MR. BONE, SECONDED BY MR. CISTARO, AND UNANIMOUSLY PASSED, the Board vote to approve the Resolution to adopt FY 2009 Operating and Capital Budgets, amended to reflect the additional income resulting from the amended tuition and fee schedule and to reduce the "one-time" funding in the operating budget.

5. BY A MOTION DULY MADE BY MR. SAMUEL, SECONDED BY MR. BEACHEM AND UNANIMOUSLY PASSED, the Board approved the appointment of Board Officers and Committee Chairs, as follows:

Board Chair – Kathleen Wielkopolski
Vice Chair – Steven DePalma
Vice Chair – Vincent DeCaprio
Treasurer – Henry Mauermeyer
Secretary - Holly Stern
Chair, Planning Committee – Philip Beachem
Chair, Academic Affairs & Research Committee – Vincent DeCaprio
Chair, Advancement Committee – Peter Cistaro
Chair, Audit and Finance Committee – Diane Montalto
Chair, Nominating Committee – Liz Garcia
Chair, Joint Committee on Investments – Peter Cistaro

6. President Altenkirch gave a report regarding NJIT's recent affiliation with the Great West Conference, an expanded all-sports league, in conjunction with NJIT's move to Division I Athletics. The teams in the Conference are the same ones we have been playing, and formalizes our current practice. In addition, its gives the university a guaranteed schedule, and award opportunities.

7. Treasuer Mauermeyer updated the Board with respect to the Operating Statement Year to Date and the Schedule of Short Term Investments, referring to the Board materials. We are on target with what we expected, and the auditors have started their annual review. With respect to short term investments, we have approximately $37 million in working capital, and it will be the end of July before the State releases the '09 appropriations.

8. Vice President Dees reported on gifts and fundraising strategies. He referenced the reports in the Board handbook, noting that while we have additional updated numbers, the bottom line for the year to date is not significantly different. We have raised $5 million more than last year; this has been a banner year in fundraising. We are 83% towards our goal with respect to the Annual Fund, and will be able to go out in the Fall. With respect to the Athletics Campaign, we expect to meet our goal in early Fall.

9. Chair Wielkopolski discussed the scheduling of the Board Retreat on September 18, 2008, which will take place on campus following the regularly scheduled Board meeting.

10. The Chairperson announced that the next scheduled closed session would be convened on Thursday, September 18, 2008, 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, September 18, 2008 at 9:30 AM, Eberhardt Hall Board Room.

The next Public Session of the Board will take place on Thursday, September 18, 2008 at 11:00 AM, Eberhardt Hall Board Room, following the Closed Session of the Board.

The meeting was adjourned at 12:20 p.m.

3. Public Comments

4A. Approve Resolution Accepting FY08 Audit

Resolution to Accept FY 2008 Audited Financial Statements

Whereas, the independent certified public accounting firm of KPMG has completed its review of the financial statements of the university for the fiscal years ended June 30, 2007 and 2008, and

Whereas, the Audit and Finance Committee of the Board of Trustees has reviewed the financial statements and has meet with the external auditors and recommend acceptance of the audited financial statements,

Now Therefore Be It Resolved that the Board of Trustees accepts the audited financial statements for the University for the fiscal years ended June 30 2007 and 2008

18 September, 2008

4B. **Approve Resolution to Authorize Various Training Contracts in the Division of Continuing and Professional Education**

STATEMENT CONCERNING
RESOLUTION TO AUTHORIZE VARIOUS TRAINING CONTRACTS

The Division of Continuing Professional Education (CPE) helps employers in New Jersey keep pace with a changing world marketplace by training their current workforce and future workforces. CPE provides customized training at the premises of New Jersey companies; on the NJIT campus; at off-campus training facilities; through distance learning; and through combinations of each of these means. Payments to NJIT for these activities are made by the companies themselves on behalf of their employees and directly by the trainee. Many companies receive funding for their training initiatives from the New Jersey Department of Labor and Workforce Development under the provisions of the New Jersey Workforce Development Partnership Program.

Based on past experience, it is possible to forecast the general content areas in which companies are likely to request training. These content areas include: manufacturing, computer skills; website design/development skills; quality control, and health and safety. As a means of ensuring that training needs can be met in a timely fashion, CPE has established a roster of pre-qualified consulting firms and training organizations that are adept at customizing and providing instruction in the probable content areas.

For FY 2009 it is anticipated that: (a) CPE will receive separate contracts from various companies or consortia of companies for training in the general content areas designated above; (b) CPE will select 15 - 20 pre-qualified outside training providers to best meet the needs of the companies; and (c) CPE will engage the appropriate training provider to customize and deliver classes under CPE oversight and with CPE monitoring. Even though, as per (a) above, no single contract may amount to more than $750,000, the aggregate for all such contracts issued to a particular pre-qualified provider during the fiscal year could be higher. Accordingly, a resolution to authorize contracts with FLS Logistics, L.L.C. in an amount not to exceed $1.7 million has been prepared for your consideration. FLS Logistics has been a highly effective pre-qualified training provider since 1999, and will be one of the up to 20 training providers used this year.

RESOLUTION TO AUTHORIZE VARIOUS TRAINING CONTRACTS

WHEREAS, NJIT Continuing Professional Education expects to secure contracts from multiple companies each of which require training in a designated general content area, and

WHEREAS, the services of training providers adept in the general content area are necessary for successful implementation of such contracts, and

WHEREAS, shown below are the designated content areas, and expected amount for FY2009 for the vendor for which the aggregate contract amounts may exceed $750,000, and

WHEREAS, funds for these services are included either in contracts between NJIT and the client or among NJIT, New Jersey Department of Labor and Workforce Development and the client.

NOW, **THEREFORE BE IT RESOLVED**, that the Board of Trustees authorizes the President to execute the necessary contracts with the designated provider in an amount not to exceed as shown below:

Content Area	Provider	Amount
Manufacturing, Computer Training, Website Design and Development, Quality Control, Health and Safety	FLS Logistics, L.L.C.	$1,700,000

August 11, 2008

4C. Approval to Proceed with Planning Process for Offering Engineering Programs in Dubai

STATEMENT
Establishment of a Dubai Location of NJIT

As NJIT continues to develop, it would be beneficial for the University to have an international presence. At this time, in response to an invitation, NJIT is preparing a proposal to offer four (4) undergraduate degrees at the Academic City in Dubai, UAE. The four courses of study will be started in Fall semester, 2009. This proposal will be prepared in a three-party partnership as described in the attached Memorandum of Association. The three parties involved include NJIT, the Educare International Foundation FZ-LLC (the AIP or Academic Infrastructure Provider) and the Focus Research and Development Private Limited (the ASP or Academic Service Provider). Various aspects of the proposal are outlined below.

Why Should NJIT Act Now?
    a. Once established, the Dubai location of NJIT will be a steady source of revenue for NJIT. Because all costs for infrastructure and program development and delivery are covered by the AIP and ASP, this is a low risk enterprise.
    b. Establishing degree offerings in Dubai will give NJIT a major international presence.
    c. The Dubai location will attract more undergraduate students to NJIT.
    d. The Dubai location will be a conduit for recruitment of international students for graduate studies at NJIT.
    e. Many universities in India have signed articulation agreements (typically 2+2 or 2+3 arrangements) with US universities, including NJIT. NJIT can direct such students to the Dubai location of NJIT. This will increase activity under existing articulation agreements, and additional such agreements may be anticipated.
    f. Establishment of the Dubai campus will facilitate study-abroad programs for Newark campus students.

Overall Structure: The Government of Dubai has set up a free zone in Dubai for the establishment of 37 different academic institutions. The free zone is called Dubai Academic International City (DAIC) and is managed by a Dubai organization, TECOM, acting for the government. Under TECOM, the institutional sites in DAIC are being set up with a financial partner (the Academic Infrastructure Provider (AIP)) and a University partner. TECOM provides all of the facilities including campus center, gymnasium, dispensary, etc. The AIP provides all of the investments needed to run the university. For NJIT, the AIP will be FOCUS R&D, a company based in Kolkata, India. FOCUS R&D has already been approved by TECOM as an AIP confirming their ability to invest in this venture. NJIT provides all of the academic programs. There are currently 26 institutions associated with DAIC under this operating structure.

Degrees: The following four degrees will be offered initially starting Fall 2009
    1. B.S. Electrical Engineering
    2. B.S. Computer Engineering
    3. B.S. Computer Science
    4. B.S. Civil Engineering
Additional degrees in Chemical Engineering, Mechanical Engineering and Architecture are under consideration for offering in Fall 2012.

Enrollment: Dubai is experiencing unprecedented growth and there is a great demand for university degrees in the area. Eighty percent of the population in Dubai is composed of expatriates whose preference is to send their children to college within Dubai. A large number of students from neighboring countries including India, Sri Lanka, Middle East, Pakistan, etc. will also be interested particularly if American education is available. NJIT will limit the class size in each of the degrees offered to 40 incoming students per year. Thus, NJIT intends to recruit a total of 160 students to start in Fall 2009 evenly split between the four degree programs that are planned to be offered.

Competition: The main competition in engineering education in DAIC is an Indian institution – Birla Institute of Technology and Science (BITS). BITS has had a presence in Dubai for several (7-8 years) and now boasts a total enrollment of 1,100 students. Michigan State University started a campus in DAIC in Fall 2008 and offers only one degree in Engineering. A private British University also offers degrees in engineering but has business offerings as its main focus. There is a clear preference for Western (in particular, American) education among the potential students. In addition, a large number of US engineering companies are located in Dubai. NJIT will partner with these companies (e.g., Advisory Boards, industry projects, etc.) to further enhance the attractiveness of NJIT programs to the students compared to the competition.

Budget: Based on the Memorandum of Association now in development 70% of each tuition dollar will be allocated to the ASP for operating costs (e.g., student services, faculty salaries, travel, and housing, student advertisement and recruitment costs), 15% will be allocated to the AIP for costs including facilities development and NJIT receives 15%. An estimated reasonable tuition for the Dubai academic market is on the order of US $12,500 per academic year (two semesters). Thus, based on a first-year enrollment of 160 students, NJIT can anticipate an earning of US $300,000 in the first year. It is re-emphasized that all direct costs and financial obligations will be borne by others.

Faculty: The faculty at the Dubai location of NJIT will be members of the NJIT faculty as contract, tenure-track or tenured faculty members. Some may be hired expressly to serve at that campus, and these faculty members will be trained by NJIT Newark faculty members. Faculty members from NJIT in New Jersey will be assigned to serve at the Dubai location as agreed to and needed. The academic programs offered at the Dubai location of NJIT will be identical to those offered at the Newark campus, and accreditation of these programs will occur as an integral part of the NJIT Newark Campus accreditation processes, including the Middle States Commission on Higher Education.

MEMORANDUM OF ASSOCIATION (M.O.A.)

This **tripartite Memorandum of Association (M.O.A.)** is between:

A. **The New Jersey Institute of Technology (NJIT),** in the State of New Jersey in the USA and located at University Heights, Newark, NJ 07102-1982, hereinafter identified as **THE UNIVERSITY** as the FIRST PARTY,

And

B. **The Educare International Foundation FZ-LLC,** established at AS - IV, Block – III, Knowledge Village, Dubai, U.A.E, hereinafter referred to as the **ACADEMIC INFRASTRUCTURE PROVIDER (AIP)** as the SECOND PARTY,

And

C. **The Focus Research and Development Private Limited,** with its Corporate office at 23/34,Gariahat Road, Golpark, Kolkata – 700 029, India, hereinafter nomenclatured as the **ACADEMIC SERVICE PROVIDER (ASP)** as the THIRD PARTY

For establishing and operating the Dubai location of New Jersey Institute of Technology, USA, at the Dubai International Academic City (DIAC), Dubai, UAE.

1. PREAMBLE:

Dubai International Academic City (DIAC) has been set up as a free zone by TECOM, a Govt. of Dubai organization, to establish a Higher Education center in collaboration with well reputed foreign Universities of International standard for the development of intellectual human resources. DIAC has since accorded its approval for setting up a Dubai location for the New Jersey Institute of Technology (NJIT), USA at DIAC. The NJIT University has planned to establish the Dubai location in DIAC in collaboration with the financial partner Educare International Foundation as Academic Infrastructure Provider (AIP) and Focus R&D Pvt. Ltd as Academic Service Provider (ASP) for providing high quality technical education. NJIT shall be responsible for the operation and administration of all Academic Programs at the Dubai location. The AIP shall provide all the investments needed to create the resources required for the Dubai location of NJIT. The ASP shall be responsible for the day to day operation and management

of the academic and student services, and TECOM shall provide all other common facilities like Campus Centre, gymnasium, dispensary, etc. The Dubai location of NJIT shall begin with four undergraduate degree programs, and the campus shall have the capability of future expansion and augmentation of programs.

(ii). WHEREAS a space of approximately FIVE ACRES of land has been earmarked by the DIAC, in Dubai International Academic City, Dubai, UAE, on a lease basis, in favor of the AIP, for developing necessary infrastructure for the Dubai location of the NJIT, USA;

It is proposed to utilize this facility to establish four departments and to offer, at the first instance, 4-year Bachelor of Science (B.S) program leading to undergraduate degrees in:

     i.   Computer Engineering
     ii. Electrical Engineering
     iii. Computer Science
     iv. Civil Engineering

with provisions for inclusion/expansion to cover additional departments and degree programs in areas including specializations in:

     i.   Mechanical Engineering
     ii. Chemical Engineering
     iii. Architecture

besides introducing graduate and doctorate program in all the above specialized disciplines, as prescribed from time to time by the University, leading to award of degrees by the New Jersey Institute of Technology, U.S.A, subject to successful completion of prescribed program and earning of suitable credits, in the subsequent phases of development.

Now this agreement witnesseth and it is hereby agreed by and between the parties that:

2. UNIVERSITY'S OBLIGATIONS:

a) The intent to establish the Dubai location shall be established through a Resolution passed by the NJIT Board of Trustees.

b) Subject to approval of the Knowledge Human Development Authority (KHDA), Government of Dubai and DIAC, the NJIT University shall, under its overall responsibility, authorize the ASP (Focus R&D) to oversee the conduct of academic services and administrative support of NJIT at its Dubai location, on its behalf.

c) The Academic Programs offered by NJIT at the Dubai location shall be, generally, in accordance with the programs offered and prescribed by NJIT at its location in New Jersey, USA.

d) Any other academic degree program, if desired to be offered at the Dubai location of NJIT University, based on special need perceptions of the Region, shall require approval of the Competent Authorities of the Parent University and Accreditation Board(s) before the same is actuated in the program.

e) Performance evaluation of students and by students shall be the same as that followed by NJIT at its location in New Jersey, USA.

f) Teaching staff at the Dubai location of NJIT will be hired through the ASP, and they shall be appointed by and considered employees of NJIT.

g) At the Dubai location, NJIT shall appoint and supervise, and the ASP shall fund a minimum of three tenured or tenure-track professors in each degree program and department, and sufficient additional teaching faculty (e.g., professors, lecturers) to provide an adequate faculty/student ratio in the disciplinary department and also in service departments (e.g., Sciences, Humanities and Liberal Arts) as per norms of the NJIT University and the appropriate Accreditation Board.

h) All Faculty appointments for the Dubai location of NJIT shall be made the responsibility of the faculty of the NJIT University through duly constituted Selection Committees. All faculty members appointed to teach at the Dubai location of NJIT will be members of the NJIT faculty in New Jersey, USA, and they shall be governed by Parent University Rules.

i) The Parent University will appoint and supervise a full-time Director of all programs offered at the Dubai location of NJIT. This Director shall

serve as the Dean for NJIT in Dubai. He/she shall have employment contracts with the University and the services shall be governed by Rules of the Parent University.

j) Faculty members shall be paid by the ASP under employment contract with the Parent University and their services shall be governed by Rules formulated by the Parent University.

k) The NJIT University in New Jersey shall be responsible for all academic related activities of the Dubai location of NJIT.

l) The Parent University shall provide the curricular structure, course details and their schedule of introduction; specifications regarding infrastructure requirements in terms of computers, laboratories, Laboratory equipment, language laboratory; specifications regarding other logistic support including Library requirements, furnishings, office equipment etc. These specifications will be established in consultation and after agreement with the AIP and the ASP.

m) The Dubai location of NJIT shall have an annual visit by a duly appointed Delegation from the Parent University, who shall perform Quality assessment and submit its findings in the form of a Report to Parent University.

n) The Parent University shall ensure that all programs conducted at the Dubai location of NJIT are accredited/validated during the First Year of operation, and re-accredited/re-validated as per country standards by the appropriate accrediting bodies from the USA.

o) At the Dubai location of NJIT, student admissions criteria shall, as far as practicable, follow Parent University Norms and/or Norms set down by the Accrediting Body. Prospective students shall be drawn from 10+2 qualified group, and prospective students with test scores for Scholarship Aptitude Test (SAT) and Test for English as Foreign Language (TOEFL) shall be accorded preference.

p) Admitted students, registered at the Dubai location of NJIT, shall be automatically registered in the Parent University with all privileges at par with regular students of NJIT, USA.

q) Degree Certificates of all successful students shall be issued by the Parent University and the degrees shall be awarded by the Board of Trustees of the NJIT University in New Jersey.

r) Any new program initiated or discontinuation of any existing program shall be undertaken only after the same is approved by the Dubai International Academic City (DIAC), Dubai / Knowledge Human Development Authority (KHDA), Government of Dubai.

3. OBLIGATIONS OF ACADEMIC INFRASTRUCTURE PROVIDER (AIP):

a) The AIP, on its part, shall provide financial resources and other inputs required for infrastructure development for the Dubai location of NJIT University and shall provide (non-academic) logistic support in the administration of the University.

b) It shall create Administrative Units, Class Rooms, Tutorial Rooms, Library, Laboratories, Seminar Rooms, Computational Facilities, Infrastructure for delivery of Course Materials, Language Laboratories and all other infrastructure as required/specified by the University from time to time.

c) It shall run the start-up campus in the allotted built-up area provided by the DIAC on lease for the first three years. Thereafter, AIP shall develop its own permanent campus on the five acres of land, earmarked at DIAC.

d) During the above period the AIP shall also arrange for the required logistic support required for the newly built space at the regular campus.

4. OBLIGATIONS OF ACADEMIC SERVICE PROVIDER (ASP):

Subject to due approval received from the DIAC / KHDA, the University shall outsource all its academic service, logistical and operational responsibilities associated with the Dubai location of NJIT in favor of the ASP. In addition, expenses incurred by NJIT in New Jersey to support the programs at the Dubai location of NJIT will be covered by the ASP.

Accordingly, as agreed to by the NJIT University in New Jersey, the ASP shall be responsible for and shall oversee all activities in respect of –

a) Advertising, International Marketing, Campaigning, Recruiting and administration of Student Admissions.
b) Appointment of non-academic staff and faculty on behalf of the University.
c) Academic Services and Operations, which shall include execution of day-to-day academic services and logistical support needed for the conduct of classes, internal evaluation, preparation and disbursal of academic support materials, conduct of examinations, planning and execution of Workshops, Seminars and Symposia in the region, Advising and Placement Assistance to students, Preparation of Research Projects, Overseeing Industrial Interaction including Consultancy and Testing, Visiting Faculty.
d) Co-ordination of all academic services, logistics and related activities with the Parent University – the NJIT, USA.
e) Academic / Operational Accounting and maintenance of records.
f) All matters connected with periodic Inspection by the authorized University Team and the Accreditation Authorities.
g) Maintenance of Accountability.

5. FINANCIAL IMPLICATIONS

a) All capital expenses related to the development of infrastructure, labs, Library, accommodation, transportation, visa, medicals, interest on bank loans shall form the legitimate expenses of AIP.

b) All expenses related to salaries of faculty members and staff, advertisements, marketing, seminars, workshop, research & development, travelling, classes and examinations shall be the legitimate expenses of ASP.

c) The Parent University, NJIT, USA, shall not have any financial obligation for setting up and maintaining resources and services at the Dubai location of NJIT at DIAC. The Parent University shall, however, be responsible for the conduct of annual inspections of operations and quality of services at the Dubai location of NJIT as well as the conduct of examinations regarding the quality of academic programs and the publication of results by the Parent University to maintain a uniform

6

standard. Costs associated with these responsibilities will be borne by the ASP.

d) The distribution of income from tuition shall be as follows:
    i. NJIT shall receive 15% of the tuition.
    ii. The AIP shall receive 30% of the tuition.
    iii. The ASP shall receive 55% of the tuition.

e) Additional fees may be assessed for specific purposes as mutually agreed to under this MOA.

In witness thereof the parties hereto set and subscribe their respective hands and seals on this (day) day of (month) in the year 2008

_____
For New Jersey Institute of
Technology, New Jersey, USA

_____
For Educare International Foundation
FZ-LLC, Knowledge Village,
Dubai, UAE

_____
For Focus Research and Development
Private Limited
Kolkata, India.

Resolution to Approve Establishment of a Dubai Location for Certain NJIT Programs

WHEREAS   NJIT is a well regarded university of renown and excellence, and

WHEREAS   NJIT has been invited by TECOM, an organization of the government of Dubai. U.A.E. to establish a location in Dubai to deliver excellent NJIT programs at a Dubai location of NJIT, and

WHEREAS   it would be beneficial for NJIT to have an international presence, and

WHEREAS   all expenses and resources needed for the development of the Dubai location including infrastructure, and student and academic services will be provided by the identified Academic Infrastructure Provider (AIP) and the Academic Service Provider (ASP), and

WHEREAS   under the conditions of the Memorandum of Association (MOA), all authority for the quality of the academic programs at the Dubai location is appropriately retained by the administration and faculty at the NJIT New Jersey home location, and

WHEREAS   under the conditions of the Memorandum of Association (MOA), the hiring of academic administration and teaching faculty will be under the direct control of NJIT, and the administrators and teaching faculty at the Dubai location will be members of the NJIT faculty and subject to all policies, rules and governance in place at the NJIT New Jersey home location,

Now, therefore, be it resolved that the Board of Trustees approves the establishment of the Dubai location for NJIT, subject to completion of a satisfactory Memorandum of Association to be established between NJIT, the AIP and the ASP, and subject to the approval of the Dubai location by the Middle States Commission on Higher Education.

15 September 2008

4D. Approve Disposition of Intellectual Property

STATEMENT OF INFORMATION FOR
EXCLUSIVE LICENSE OF NJIT INVENTION DISCLOSURES
September 18, 2008

Introduction

As part of its Intellectual Property ("IP") Program, NJIT assesses the commercial value of its Intellectual Property to determine the most appropriate avenue to achieve a return on its investment. Options include the exclusive licensing of Intellectual Property.

A subsidiary of Intellectual Ventures ("IV"), has expressed interest in acquiring an exclusive license to certain NJIT Invention Disclosures listed below for the life of each patent issued by the USPTO and/or foreign jurisdiction.

As the exclusive license of the Invention Disclosures and patent applications derived therefrom for the life of the patent essentially represents a disposition of NJIT property, the Board of Trustees is being asked to approve the same. A Resolution has been prepared for consideration.

Background of Intellectual Ventures

IV is a private company founded in 2000 by Nathan Myhrvold and Edward Jung, both former executives of Microsoft. The purpose of the company is to invest in innovations and technologies across a broad spectrum of industries (i.e., technology, biotechnology, consumer electronics, nanotechnology and others). IV has also acquired inventions and related IP from a combination of individual inventors, government agencies, and universities. IV's business plan is to group all acquired patents into clusters of like technology and then license the patents to potential users and/or infringers of each technology cluster. The goal is to derive more value than is likely to be attained from the licensing of any individual patent.

Current Licensing Offer

At its April 10, 2008 meeting the Board of Trustees authorized the execution of a one year Master Patent License Agreement, which was executed on August 15, 2008.

This request is for the exclusive license of additional Invention Disclosures with right to sublicense. IV will pay for all on-going patent prosecution costs levied by the USPTO and/or foreign jurisdictions, including issuance fees on allowed patents as well as maintenance fees that become due on any and all issued patents. If any of the patents are sublicensed to third parties, NJIT will also receive an annual royalty payment. A list of the individual Invention Disclosures included in this third request under the new Master License Agreement is found below.

After NJIT's reimbursement of associated out-of-pocket expenses, if any, the remaining net amount derived from the transaction shall be shared with the inventors pursuant to NJIT's current Patent Policy.

List of Invention Disclosures

<u>Double Threshold Scheme of Neighborhood-Fluctuation Guided Reversible Image Data Hiding into Prediction Errors</u>, (Inventors: Yun-Qing Shi and GuoRong Xuan) NJIT Reference Number 09-004.

<u>Implementation and Performance Analysis of Space-Time Spreading DS-CDMA Systems over Fast-Fading Correlated Channels</u>, (Inventors: Yeheskel Bar-Ness and Kodzovi Acolatse) NJIT Reference Number 09-005.

<u>Downloader-initiated Random Linear Network Coding for Peer-to-Peer File Sharing</u>, (Inventors: Nirwan Ansari and Nan Wang) NJIT Reference Number 09-008.

<u>Method and Apparatus for Full Rate Space Time Codes (STC) With Large Number of Transmitting Antennas, Linear Complexity Decoder and High Performance</u>, (Inventors: Yeheskel Bar-Ness and Amir Laufer) NJIT Reference Number 09-009.

RESOLUTION TO AUTHORIZE EXCLUSIVE LICENSE OF
UNIVERSITY INTELLECTUAL PROPERTY

WHEREAS, the Board of Trustees of New Jersey Institute of Technology is empowered to direct and control the disposition of NJIT intellectual property if deemed necessary or advisable to carry out the goals of NJIT; and

WHEREAS, the Board of Trustees at its April 10, 2008 approved the execution of a one year Master Patent License Agreement with a subsidiary of Intellectual Ventures, which was executed on August 15, 2008; and

WHEREAS, a subsequent transaction under such Master Patent License Agreement is for the exclusive licensing of certain identified NJIT Intellectual Property.

NOW THEREFORE BE IT RESOLVED by the Board of Trustees of New Jersey Institute of Technology that the proposed exclusive licensing of the Intellectual Property by NJIT is hereby approved; and

THEREFORE BE IT FURTHER RESOLVED by the Board of Trustees of New Jersey Institute of Technology, that the Senior Vice President for Research & Development is hereby authorized to execute any and all agreements or documents on behalf of NJIT to consummate such licensing transactions.

_____
Holly C. Stern, Esq.
General Counsel and
Secretary to the Board of Trustees
New Jersey Institute of Technology

_____
Date

4E. Approve Resolution to Establish MS in Critical Infrastructure Systems

STATEMENT

RESOLUTION TO APPROVE THE MS IN CRITICAL INFRASTRUCTURE SYSTEMS

The proposed MS in Critical Infrastructure Systems presents an integrated end-to end approach to the areas of critical infrastructure lifecycle and emergency management education and research across multiple sectors. The challenges posed by the maintenance and upgrading of our aging inter-dependent infrastructure go beyond what any one profession (engineering, management, computer sciences) can prepare for. We must also recognize the importance of managing infrastructure as a multi-disciplinary problem both today and in the future. The array of technologies and systems required to participate in the infrastructure challenges ranging from the upgrading of the civil infrastructure to hardening the control systems and cyber infrastructure make it difficult for traditional degrees to meet these challenges without a new breed of multi disciplinary professional. This degree will meet that need and NJIT's location in Newark, which is experiencing strong redevelopment, offers opportunities for both student recruitment and research.

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 CRITIAL INFRASTRUCTURE SYSTEMS

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 Critical Infrastructure Systems; 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 Critical Infrastructure Systems

September 18, 2008

PROGRAM ANNOUNCEMENT

April 2008 (Updated Curriculum August 2008)

Institution:	New Jersey Institute of Technology
New Program Title:	Master's Program in Critical Infrastructure systems
Degree Designation:	MS in Critical Infrastructure Systems
Degree Abbreviation:	MSCI
CIP Code and Nomenclature (*if possible*):	14.2701
Campus(es) where the program will be offered:	New Jersey Institute of Technology, University Heights, Newark
Date when program will begin (month and year):	Fall 2008
List the institutions with which articulation agreements will be arranged:	School of Public Health - UMDNJ

Is licensure required of program graduates to gain employment?   □ Yes X No
(not at this time)

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

_____

Program Announcement Narrative

Descriptive Information

I.   **Objectives**

This program presents an integrated end-to-end approach to the area of Critical Infrastructure Lifecycle and Emergency Management Education and Research, across multiple sectors. *Life-cycle Management* focuses on planning issues, maintainability and safety engineering, vulnerability analysis, hazard/crisis impact analysis and mitigation, infrastructure inter-dependencies, rehabilitation technologies, condition assessment, problem detection, diagnosis and process propagation, and program management. *Security and Emergency Management* includes critical infrastructure and population protection, emergency management, preparedness and response management, enabling and protective technologies, evacuation planning and information systems applications to infrastructure and homeland security.

A cooperative agreement with UMDNJ – School of Public Health will be in place with relevant courses from their preparedness and other relevant areas shown in the curriculum.

II.   **Need**

A. **Need for the Program**

The challenges posed by the maintenance and upgrading of our aging inter-dependent infrastructure go beyond what any profession (engineering, management, computer sciences) can prepare for; more importantly, the recognition of the management of today's and tomorrow's infrastructure as a multi-disciplinary problem, both across sectors of infrastructure inter-dependency and across functional areas needed to solve the lifecycle planning, design, construction, secure operation, protection, detection and response. The array of technologies and systems required to participate in the infrastructure challenges ranging from the upgrading of the civil infrastructure to hardening the control systems and cyber-infrastructure, makes it difficult for traditional degrees to meet these challenges without a new breed of multi-disciplinary professional. NJIT's location in Newark, a key infrastructure hub, and an area with major infrastructure dependencies, adds to the incentive for providing an educational background and research opportunities in an area ripe with test-beds and job opportunities in this new and growing field. Also, NJIT's partnership with the City of Newark, which is experiencing strong re-development, offers opportunities for both student recruiting and research.

These graduates/professionals will be the urban infrastructure planners (city/utility regional planners, systems design engineers, development project managers) of the future, as well as the Construction Managers for large facilities (Army, Navy, Air Force, National Guard, etc.). Other jobs relate to DHS personnel/analysts, security management and infrastructure systems consultants, and a myriad of different job titles in the private and public sectors. The program will also target UN, US Aid and the World Bank for Infrastructure Development Specialists and Project Managers as well as high-level officials in developing countries.

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

The 1981 Statewide Plan for Higher Education identified NJIT as New Jersey's comprehensive technological public university. Furthermore, the Statewide Plan indicates that NJIT "has 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." All of these are subsumed in the four-pronged mission of NJIT, namely education, research, economic development, and public service. Indeed, the proposed Critical Infrastructure Systems program is a step in this direction since the program aims to address the following:

- "Prepare students for productive careers and enhance their potential for lifelong personal and professional growth."
- Prepare students in the conduct of inter-disciplinary research.
- Serve "both its local communities and the broader society of the state and nation by conducting public policy studies, making educational opportunities widely available, and initiating community-building projects."

Also, NJIT has an interest through its Provost and Deans in this inter-disciplinary program with large opportunities for dual degrees with the School of Architecture (MIP), the School of Management, and the Colleges of Engineering, Sciences and Liberal Arts, and Computing Sciences.

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

This Program is quite unique in terms of its goals, its target student base, and its inter-disciplinary matrix approach to the problem of Critical Infrastructure Lifecycle/Security Systems and Management.

Rutgers' Center for Advanced Infrastructure and Transportation (CAIT) has a focus on maintenance of high volume transportation infrastructure and is aligned with the goals of US DOT. It is the goal of CAIT to be a catalyst for creating a multi-modal transportation

infrastructure research and education paradigm that incorporates input from members of the Transportation community.

Polytechnic University in NY offers a MS In Civil Engineering with an Urban Systems Engineering and Management concentration.

Carnegie Mellon University's Advanced Infrastructure Systems (AIS) with a MS in AIS also bears some similarities with our program. It has a strong focus on data capture technologies, data management and analysis technologies, and decision support technologies. It aims at developing the ability to design and evaluate systems for intelligent behavior in an infrastructure-oriented domain.

The Master of Infrastructure Planning from the University of Stuttgart bears some similarities to our proposed program. However, it presents a rather structured set of pre-defined courses with more required/mandatory courses across all infrastructure areas. Our MS program offers more optional electives related to lifecycle management, security/emergency management and enabling technologies.

The strength of this proposed NJIT Program lies in its end-to-end cross-sector infrastructure systems orientation **to address both lifecycle and security systems in the management of critical infrastructure** of the future.

III. Students

Anticipated Enrollment can be around 20 in the first year from NJ Homeland Security and Infrastructure Protection Units, engineering firms, agencies and utilities. The enrollment can be ramped up to 50 based on solid marketing, and possibly 100 with extensive outreach to national and international agencies.

IV. Resources to Support the Program

A. Course Development

In anticipation of the introduction of an MS degree in Critical Infrastructure Systems, over the last two years some courses that are specifically required for training in Critical Infrastructure Systems, Performance and Risk Analysis of Infrastructure Systems (CE 671), and "Security Management of Critical Infrastructure" (CE 672), have been designed and implemented as part of our current graduate curriculum in MS-CEE.
All core courses and a large number of the electives of this Program are now in place. Some course development is still envisioned to strengthen some of the key areas. For example, in the Engineered Systems sub-area, the following courses are planned for development over the next 2 years:

- CE Water/Wastewater Maintenance and Capital Improvement

Management Systems
- CE Highway, Bridge and Tunnel Maintenance and Rehabilitation
- CE Managing the Design/Build/Operate Environment: BIM

Similarly, in the Emergency and Preparedness sub- area, the following course is planned for development in the next 2 years:

- CE/Tran Network Optimization and Emergency Evacuation Planning

In the Enabling Systems and Technologies, the following 2 courses are planned for development:

- Design of Protective Technologies
- Cyber Infrastructure Forensics and Security

These courses can be developed with existing resources, and the use of adjunct faculty members in some cases, as the number of enrolled student increases.

B. Faculty

The Program can be launched with total reliance on internal course development and adjuncts, and no additional new faculty.

C. Libraries and Computing Facilities

Since this program will draw upon existing courses and upon the same supplemental literature that supports them and other related NJIT programs, existing library holdings are more than adequate to support the new program. NJIT's Van Houten Library has a collection of more than 150,000 books and subscribes to more than 1,000 print periodicals and about 8,000 electronic journals. The library's home page provides access to NJNEER, the library's electronic catalog and links to a wide array of information services.

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. VCRs for viewing videocassettes reserved for courses are also available. Journal and conference literature in engineering, science, management, architecture, and other subject areas is accessible though a variety of indexing and abstracting publications in both print and electronic format. Among the databases available on line are CompendexWeb (Engineering Index); Proquest Direct (articles on business, management and industry); Applied Science and Technology Index; and UnCover, a document delivery service that faxes articles within 48 hours.

A student user manual describing library services is available at the circulation and reference desks.

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 through Internet2 provides collaboration opportunities with students, faculty, and researchers, locally, regionally, nationally, and throughout the world.

D. Classrooms and Laboratories

No new classrooms would be needed for this program. The computational resources on campus, including SAS software available to students, are currently sufficient for instructional purposes. As demands on faculty for research in security modeling and consulting services grow with the program, we visualize a possible future need for a dedicated Critical Infrastructure laboratory with supporting hardware and software.

V.   Curriculum

Requirements for the Program:

Admission Requirements:

- 4 year baccalaureate degree
  Students applying for admission to this program will usually have a baccalaureate degree in Engineering, Statistics, Mathematics, Sciences, or Computer Science. Applicants with other baccalaureate degrees will also be considered and may be subject to a suitable bridge program.
- GPA of at least 3.0 on a 4.0 scale or equivalent in combined core (math, sciences, engineering) subjects
- At least 12 credits in mathematics, including calculus
- at least one upper division course in statistics

Bridge Program: Students who do not satisfy the credit requirement in mathematics will be required to take a suitable bridge program of appropriate mathematics/statistics courses. Such courses do not count towards the graduate degree.

Degree Requirements:

A minimum of 30 credits is required for the degree. Bridge courses, if any, will not count toward degree credits. The graduate curriculum consists of four core courses (12 credits) in background Performance and Risk analysis of infrastructure systems, Security Management, Management Science and Elements of Infrastructure Planning, as described in the curriculum below. The remaining 18 credits are elective courses of which 12 credits should be from the concentration area. Electives are chosen in consultation with the Program Director and Academic Advisors from 2 key concentration areas (**Critical Infrastructure Life-Cycle Management (CILC)** and **Critical Infrastructure Security and Emergency Management (CISE))** which consist of 6 sub-areas:

CILC: - **Planning and Facilities Management**
- **Engineered Systems**
- **Public Health Systems (Joint UMDNJ)**
- **Program/Impact Management**

CISE: - **Emergency and Preparedness (Joint UMDNJ)**
- **Enabling Systems and Technologies**

In order to qualify for a concentration, a student should take 12 credits from a master list of courses. However, if these courses are not offered, equivalent subjects may be assigned by Academic Advisor. A master's project or thesis is an elective course which counts towards the minimum 30 credits. Also, if a core

course was already taken at the graduate level with a 3.0 or above (B and above), the Academic Advisor can substitute such core course by another course on the Electives list.

Curriculum:

Suggested Curriculum for MS-CI

The Program cover all engineered public and private sector infrastructure (civil and engineered systems including buildings/urban development, transportation (highways/tunnels/bridges/airports), power plants/systems, environmental (water/wastewater/ecological), telecommunications, computer networks and Cyber Infrastructure), and Public Health Infrastructure management.

Integrating Infrastructure Performance and Security Management
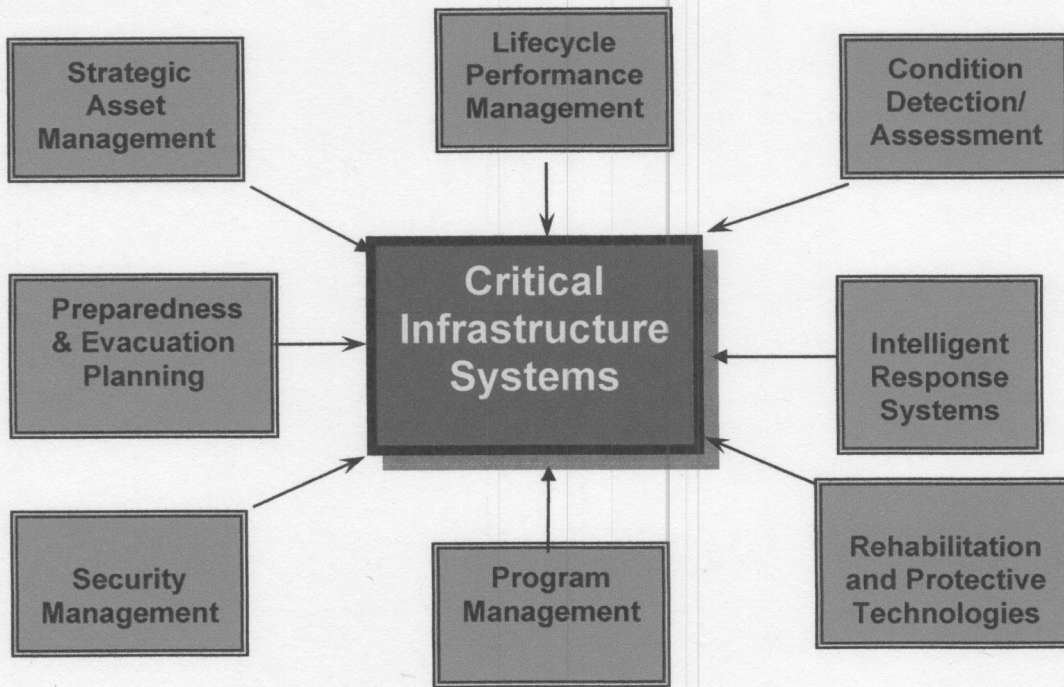
Core Courses (12 credits)

CE 671	Performance and Risk Analysis of Infrastructure Systems		*Fall 08*
CE 672	Security Management of Critical Infrastructure		Spring 09
EM 602	Management Science	or MIS 680	F08
ARCH 675	Elements of Infrastructure Planning		F08

The remaining 18 Credits of Electives can be taken from 2 Concentrations: the **Critical Infrastructure Life-Cycle Management (CILC) Elective Area** and the **Critical Infrastructure Security and Emergency Management (CISE) Elective**

Area. An area of concentration is earned when at least 12 credits are taken from that Elective area of Concentration and its component sub-areas:

MS in Critical Infrastructure Systems Elective Areas (TBD)- To Be Developed	
Critical Infrastructure Life-Cycle Management Elective Area	**Critical Infrastructure Security and Emergency Management Elective Area**
Planning and Facilities Management CE 602 Geographic Information Systems (Or MIP 652 Geo Info Systems) CE 615 Infrastructure & Facilities Remediation IE 605 Engineering Reliability IE 614 Safety Engineering Methods **Engineered Systems** Tran 705 Mass Transportation Systems ECE 610 Power Systems Analysis CE650 Urban Systems Engineering ECE 637 Introduction to Internet Engineering ECE 683 - Computer Network Design & Analysis ECE 673 - Random Signal Analysis I ECE 642 Communication Systems ECE 683 Computer Network Design and Analysis **Public Health Systems (Joint UMDNJ)** PHCO 0502 Principles and Methods of Epidemiology PHCO 0503 Introduction to Environmental Health **Program/Impact Management** EM 636 Project Management EM 637 Project Control CE610 Construction Management CE 616 Construction Cost Estimating EM 771 Operations Cost and Management Control CE611 Project Planning and Control IIE 651 Industrial Simulation EnE 663 Water Chemistry EnE 671 Environmental Impact Analysis EnE 610 Hazardous Site Operations ENE 662 – Site Remediation HRM 601 Organizational Behavior CE 700/701 – Master's Project or Thesis	**Emergency and Preparedness (Joint UMDNJ)** (TBD) 2007/08 CE/Tran Network Emergency Evacuation Planning ECE 638 Network Management and Security MGT 612 Principles of Emergency Management ENOH xxxx – Public Health Preparedness I: Agents of Mass Injury or Destruction ENOH 0696 Public Health Preparedness II: Emergency Management and Response HEBS 0679 Health Communications/Risk Communications IS 613 Design of Emergency Management Information Systems IS 615 Improvisation in Emergency Management (as of Fall 09) IS 614 Command and Control Systems **Enabling Systems and Technologies** (TBD) Design of Protective Technologies (TBD) Cyber Infrastructure Forensics and Security MIS 648 DSS for Managers Tran 752 Traffic Control Tran 615 Traffic Studies and Capacity TRAN 755 Intelligent Transportation System MGT635 Data Mining & Analysis MGT 650 Knowledge Management CS 631/ Database Mgt Systems CS 632 Advanced DB Mgt Design CS 782 Pattern Recognition and Applications IE 621 Systems Analysis and Simulation CE 700/701 – Master's Project or Thesis

Consultant Report

for the

Proposed M.S. in Critical Infrastructure Systems

Site Visit on May 29, 2008

Lucio Soibelman, PhD
Professor of the Advance Infrastructures Systems Group
of the Civil and Environmental Engineering Department
at Carnegie Mellon University

Distributed
August 25, 2008

1 Introduction

On May 29 I visited the New Jersey Institute of Technology, University Heights, Newark campus to evaluate the proposed new Master's program in critical infrastructure systems. Dr. Fadi Karaa hosted me during the visit that I had the opportunity to meet with Provost Priscilla Nelson, with deans Fadi Deek and Sunil Saigal (phone conference), with department chairs from Civil Engineering (Walter Konon), Industrial Engineering (Athanassios Bladikas), and Chemistry and Environmental Science (Som Mitra), with faculty from several departments, with library staff, and with PhD students.

The proposed program objective is to present an integrated end-to-end approach to the area of Critical Infrastructure Lifecycle and Emergency Management Education and Research, across multiple sectors. A cooperative agreement with UMDNJ – School of Public Health will guarantee the availability of all needed courses to fulfill the program requirements without the need for hiring new faculty or developing new courses.

2 Recommendation

This consultant found the proposed program to be an excellent idea. No issues surfaced that needed prompt or significant attention. Support for the proposed program among the faculty, staff, and students was found to be very high. There was an omnipresent sense of energy, purpose, vision, collegiality and engagement. The faculty leading this effort, Fadi Karaa, is an engaging and effective leader, whose energy, drive, vision, and personality is inspiring the faculty, staff, and students to excel.

My recommendation is:

- *Approval.*

This consultant perceives that this program will provide a leadership role for NJIT in the national and international arena.

3 Evaluation of the Program

3.1 Objectives

The objectives:
"This program presents an integral end-to-end approach to the area of Critical Infrastructure Lifecycle and Emergency Management Education and Research, across multiple sectors. **Life-cycle Management** focuses on planning issues, maintainability, and safety engineering, vulnerability analysis, hazard/crisis impact analysis and mitigation, infrastructure interdependencies, rehabilitation technologies, condition assessment, problem detection, diagnosis and process propagation, and program management. **Security and Emergency Management** includes critical infrastructure and population protection, emergency management, preparedness and response management, enabling and protective technologies, evacuation planning, and information systems applications to infrastructure and homeland security."

clearly describe the underlying principles of the program.

The program objectives are aligned with the institution mission and goals by preparing qualified students with strong background to serve state and local government agencies needs, by supporting inter-disciplinary research, by creating several dual degrees opportunities, and by creating community-building projects opportunities.

3.2 Need for the Program

There is a clear need for a program like the one proposed. It is known that the existing infrastructure in the US is not being maintained as it should. The American Society of Civil Engineers (ASCE) states in their report card for America's infrastructure that USD 1.6 Trillion over five years is needed to bring the infrastructure up to acceptable standards. However, we cannot promote the idea of spending this money exactly as we have in the past.   For example, the FHWA has conducted a study that questions the reliability of the visual inspection method. We must take action to move away from the traditional, more manual modes for collecting information about our infrastructure systems and related processes (i.e., visual inspection) while constructing, monitoring, maintaining and operating these infrastructure systems over their lifetimes. We must educate a new class of professional that would implement new approaches to manage our infrastructure.

Also, as we learned during and in the aftermath of the Katrina hurricane and attacks on transportation and other key infrastructure systems worldwide, the modern world is not prepared to deal with the challenges posed by extreme events (natural and man made disasters). It is clear that the country needs a large number of professionals trained to act in an optimal way during extreme events, as well as protect that infrastructure from the impacts of planned and unplanned events.

The proposed program aims at training the professional to fulfill the needs described above. Government agencies are searching for professionals with this background and are reporting back that no school is educating this type of professional.

Graduates from this program will have opportunities in industry (there are several private organizations managing infrastructure worldwide), in government agencies that manage infrastructure and provide first response during extreme events, and in academia to continue in advanced studies (there are several research opportunities in this area).

This consultant is a faculty member at the Advanced Infrastructure Systems (AIS) Group at the Civil and Environmental Engineering Department at Carnegie Mellon University. Our research group is working on developing a new generation of Advanced Infrastructure Systems that we define as sensor data-driven and intelligent systems, components, devices, and processes that improve the performance and/or reduce the life-cycle cost of a broad range of physical infrastructure systems.   We propose the use of a variety of sensor systems, and information and communication technologies (ICT), that will make it possible to collect, manage, and analyze data so as to immediately determine the state of infrastructure elements and its construction and management processes, what problems are emerging or are likely to emerge, and what should be done to mitigate those problems. We are focused on information technology based solutions and every year we have a large number of students applying to our program that are looking for a broader perspective of infrastructure management. Until now we didn't have a program to recommend to those applicants. It is now clear to this consultant that they are looking for something like the program that NJIT is proposing. A very similar situation is occurring with infrastructure management agencies when searching for new staff. Today, we are not producing enough professionals for the existing large demand.

3.3 Educational Programs

The suggested curriculum is broad with several options allowing students to specialize in 2 key concentration areas (Critical Infrastructure Life-Cycle Management and Critical Infrastructure Security and Emergency Management) with the option of 6 sub-areas (Planning and Facility Management, Engineered Systems, Public Health Systems, Program/Impact Management, Emergency and Preparedness, and Enabling Systems and Technology). Every student will be requested to take 12 credits of core courses (Performance and Risk Analysis of Infrastructure Systems, Security Management of Critical Infrastructure, Management Science, and Elements of Infrastructure Planning) and at least another 18 credits of elective from the 2 concentration areas.

The required courses are either available or have been developed during the last 2 years. All core courses and a large number of electives are now in place. The offered courses are aligned with the objectives of the proposed program. To my knowledge, there is no other institution with such a broad course offering in this area.

The requirements for admissions are clearly defined requesting a baccalaureate degree with at least 12 credits in mathematics, calculus, and upper division course in statistics. Students who do not satisfy the credit requirement will be required to take a suitable bridge program of appropriate mathematics/statistics courses.

I have some minor comments related to the offering and support structure of the suggested curriculum and the requirements for admission. There are a large number of courses offered to fulfill the requirements of the 2 concentration areas and the 6 sub-areas and a high probability that the program will end up admitting students with several backgrounds many being required to attend the bridge program. Many classes are likely not going to be offered every semester and some may not even be offered every year. Sequencing core and elective classes for students with different backgrounds many requiring the bridge program will end up being a puzzle difficult to solve. It seems that the existing Admissions and Advising Committee is the right approach, as good advising will be fundamental for the program success. Furthermore, this consultant believes that Faculty will have to develop some templates curriculum with the recommended sequence of classes for each sub-area and incoming students will have to be introduced early in their first semester to the program objectives and curriculum options.

I would also recommend the development of a capstone design course where students will be able to apply the theory learned during the program to a practical engineering, systems, management or inter-disciplinary problem. This could be done as a group project, a master thesis or an independent study with a research faculty, or a master thesis or an independent study based on an internship (supported by a faculty) in an organization that manages infrastructure.

3.4 Students

Adequacy of Part-time Students: During the visit, I learned that the new core courses developed for the Critical Infrastructure Systems program have attracted a good balance of both graduate full-time and part-time Students, primarily from the Civil and Environmental Engineering graduate programs interested in this new specialty area. I expect that, as the Program is officially open for admission by a broad population of professionals, the part-time population would be a strong component of enrollment.

Minority Targeting and Outreach: During the visit I learned that NJIT targets its own undergraduates a significant proportion of whom are minority students, for participation in the BS/MS and BS/PhD programs and for applications to fellowship programs including GEM, NSF, and others. Other outreach programs include undergraduates from selected national programs such as the REU that is in place in the Colleges of Engineering and Science and Liberal Arts. I was informed too that NJIT also has a McNair grant that is focused on advising,

5

mentoring, and guiding minority students toward graduate study. The Dean of Graduate Studies and staff do regular talks to this group about the process of moving on to graduate study. The Associate Director of Graduate Studies is personally involved in a number or organizations that assist in efforts to recruit Hispanic students and minority students in general. Within Newark, the Council for Higher Education in Newark, including NJIT, Rutgers-Newark UMDNJ-Newark continue to cooperate in cross-registration, joint programs and transfer agreements. All these Schools have large minority populations. NJIT staff and faculty have combined attendance at AGEP meetings, such as the one in Puerto Rico, with recruiting visits to the local universities in Puerto Rico.

The program director informed me that he has established strong links to and coordination mechanisms with the NJIT entities with a direct responsibility for outreach to minorities and female students, including the Director of Graduate Studies and leaders of the ADVANCE program, which seeks the advancement of female doctoral students and faculty. As this new inter-disciplinary program is launched, the participation of minority and female students will be targeted with all means available to NJIT.

From what I was able to learn the proposed program has a solid outreach plan targeting minorities and I have no doubts that it will be successful achieving its goals on attracting minorities.

Adequacy of Counseling and Advisement: In anticipation of enrollments from a variety of backgrounds and industry sectors (transportation, utilities, etc.), a Committee structure has been devised to provide a continuous end-to-end admission/profile analysis and specialized advising by assigning Committee members representing various source disciplines to the advisement of new Students. This matrix structure makes it possible to keep student counseling strong and relevant to each student background and career goals. But according to what I presented above on session 3.3, special advising effort will be needed to make sure that students understand the large number of options offered to them.

3.5 Faculty

The program can be launched with total reliance on existing faculty. There is no need to hire additional faculty. Faculty possesses the appropriate degree and academic credentials to provide a high quality program. The number of faculty and the amount of time to be devoted to the program is compatible with the program goals.

3.6 Support Personnel

I was informed that at its inception, the Program will derive strong direct support from the Civil Engineering Department administrative and secretarial staff, as well as laboratory technicians. The Civil Engineering Department is well organized with qualified staff to achieve this goal. I understood by discussions with the dean and with the provost that as the needs for augmenting such personnel may arise, the program leader will be able to coordinate such needs with the Offices of the Dean and of the Provost.

3.7 Finances

From the meetings with the provost and with the deans it was clear to me that there is a strong commitment from the institution to provide the resources necessary to guarantee a high quality educational program. The proposed program is creating a collaborative environment for faculty from a large number of NJIT and UMDNJ – School of Public Health units. The collaboration among faculty added to the availability of graduate students with expertise in this area will create a perfect environment for multidisciplinary research.

3.8 Physical Facilities

NJIT has a beautiful campus with state of the art facilities accessible to handicapped students. The university has well equipped classrooms, laboratories consistent with the needs to offer a program of high quality.

3.9 Library

NJIT's Van Houten Library has a large collection of books and subscribes to more than 1,000 print periodical and about 8,000 electronic journals. The library holdings are adequate to support the new program. I met with Bruce Slutsky, a library staff that demonstrated strong interest and support to the new proposed program. There is just one small issue that could be problematic. New books are bought with a budget allotted to each department. There is no clear procedure for a program like the one proposed that has participation of a large number of departments. It is recommended that budget sources be made available in support of book acquisition for the program and that a program budget be created based on contributing department quotas. As I understand, the university has requested a program library budget. An independent library budget for the program is essential to its growth as a quality state-of-the art program.

3.10 Computer Facilities

The university has adequate computer facilities and resources to support the proposed program. NJIT has excellent computing systems and networks that allow wired, wireless, and remote connection. The Civil Engineering computing lab has all the required software to support the program.

3.11 Administration

Administrative Structure of the Program: I was informed that the Administrative Structure of the proposed program is designed based on a matrix/network organization, enabling the Program leader to interact effectively with the various constituent concentration areas and disciplines within their own home organizations. This interaction is sufficient for efficiently providing this breadth of coverage and program choices at this stage of program launch and offering, while keeping a strong program unity through a strong advisement and counseling process. However, a center approach covering and integrating both educational and research components is strongly recommended.

Administrative and Budgetary Responsibilities: I was informed that the administrative and budgetary responsibilities of the Program are currently embedded within its sponsoring Department, the Civil and Environmental Department at NJIT. This is a good solution during the initial stages of program launch but a center approach will give much more flexibility to the program.

3.12 Evaluation

I was informed that a process to evaluate the program success was developed. The process focuses on the evolution of key metrics that would be used to manage and control program resources. These metrics go beyond simple overall enrollment tracking, and include the tracking and analysis of enrollment from both the professional disciplines/ segments with critical infrastructure focus, and the research-focused graduates

interested in this inter-disciplinary area of endeavor. A semi-annual partial and yearly full review process will be in place to measure not only Program penetration in key lifecycle and security-oriented areas, but also the success of its graduating alumni in their home agencies and the achievement of future career tracks. There is a need to develop questionnaires to be answered by graduating students to obtain feedback on advising, curriculum, and resources quality. Metrics to evaluate the research component success will have to be developed.

Furthermore, a periodic review process is already in place and is managed by the NJIT institutional research unit. The Program will be subject to this evaluation and its metrics.

Professional Interests	Use of information technology for economic development. Information technology support for construction management. Process integration during the development of large-scale engineering systems. Information Logistics. Artificial Intelligence, Data Mining, Knowledge Discovery, Image Reasoning, Text Mining, Machine Learning, Multi-reasoning Mechanisms, sensors, sensor networks, and advanced infrastructure systems

Education

June 1998   Massachusetts Institute of Technology   Cambridge, MA

Ph.D. in Civil Engineering Systems

- **Dissertation Title**: The Exploration of Meta-Representation for the Conceptual Phase of Structural Design for Tall Buildings through Distributed Multi-Reasoning Algorithms.

This dissertation deals with the development of a model that aim to assist engineers in the conceptual phase of the structural design of tall buildings by providing him/her with organized and reliable information. This preliminary conceptual design involves selecting preliminary materials, selecting the overall structural form of the building, producing a rough dimensional layout, and considering technological possibilities. Decisions are made on the basis of such information as height of the building, building use, typical live load, wind velocity, earthquake loading, design fundamental period, design acceleration, maximum lateral deflection, spans, story height, and other client's requirements. The model objective is to provide designers with adapted past design solutions with the help of a distributed multi-reasoning mechanism creating a support system to enhance creativity, engineering knowledge and experience of designers. To prove the feasibility of the proposed model I developed a distributed artificial intelligence computer system that works as a decision support tool for the preliminary design of tall buildings structures. This system applies an agent like approach developing competence modules, which is an expert at a particular small task oriented competence. The Internet is being used as a communication backbone among the different systems that implement the reasoning mechanisms being employed. The current implementation was developed with three modules: The classification module implemented by a C4.5 agent, the past cases/experience module implemented by a Case Based Reasoning agent, and the adaptation module implemented by the Genetic Algorithm agent.

August, 1993   Universidade Federal do RGS   Porto Alegre, Brazil

Master of Science in Civil Engineering

- **Thesis Title**: Material Waste in the Construction Industry: Incidence and Control.

February, 1991   Japan International Cooperation Agency   Tokyo, Japan

Specialist in Advanced Construction Technology

January, 1984   Universidade Federal do RGS   Porto Alegre, Brazil

Bachelor of Science in Civil Engineering

Academic Experience

2007-2008   Carnegie Mellon University   Pittsburgh, PA

12-610: Special Topics: ICCM International Collaborative Construction Management –Teacher

- This course is intended to provide a comprehensive overview of the life cycle of the facility development process and of relevant project management techniques. While primary emphasis is on the construction phase, the techniques and perspective apply to the

10

other phases of the facility development process as well. Students learn not only how to develop construction estimates and schedules, but also, globalization issues, methods to work on multicultural teams, negotiation techniques, and methods to improve international collaboration enhanced by the use of Information Technology. Students work in international teams to collaborate from remote locations (USA, Turkey, Brazil, and Israel) via the Internet taking maximum advantage of information technology. Students also report on lessons learned on working with different cultures.

2005-2008   Carnegie Mellon University   Pittsburgh, PA
2-741: Data Management –Teacher
- This is a class where the students are introduced to the basics of databases and database management systems as applied to engineering problems in general and civil engineering problems in specific and to data mining concepts and techniques and knowledge discovery in databases principles applied to engineering problems/data in general and civil engineering problems/data in specific. Students learn how to extract patterns representing knowledge implicitly stored in large civil engineering databases or other massive information repositories. The course lectures emphasizes on issues relating to the feasibility, usefulness, efficiency and scalability of techniques for the discovery of patterns hidden in engineering databases.

2006   Carnegie Mellon University   Pittsburgh, PA
12-705: Advanced Techniques for Project Management – Teacher
- This class is intended to provide a sampling of advanced techniques, concepts and research topics in project management. The course focus is a systems view of construction and its interactions with related activities. The course is taught as a tutorial, with presentations by speakers and discussion classes led by students. Students have to research one or two topics of their choice, and give presentations and do a final presentation and a report. This format has the objective of enhancing the participants' ability to research, organize, and communicate advanced material.

2006 - 2008   Carnegie Mellon University   Pittsburgh, PA
12-744: AIS Systems Project Preparation Course – Teacher
- The intent of this course is (1) to prepare students for the project course 12-745 by exposing them to the following topics: technical communication; team-based problem solving, negotiation, and collaboration support technologies; individual and team ethics; library skills; readings/discussions relevant to the domain of project topic intended for 12-745 and (2) to design, estimate, plan, and specify the project that will be executed during the project course 12-745.

2006 - 2008   Carnegie Mellon University   Pittsburgh, PA
12-745: AIS Systems Project Course – Teacher
- The iAdvanced Infrastructure Systems (AIS) program has been designed to equip civil engineering students with the skill-set required to approach conventional problems from nontraditional approaches. The focus of the program is on teaching principles of computer science and information technology to allow engineers to efficiently acquire appropriate data and analyze the data to reveal

trends and yield knowledge. The AIS Project Course serves as an appropriate culmination of this pedagogical philosophy. A real-world, industry driven problem is provided to students and the requirements are broadly defined. In the first semester of the academic year, students analyze the problem and determine the scope of the project. The design and implementation of the solution is then performed in the second semester of the academic year. The goal of the course is to allow students to practically utilize the skills they have acquired from the instructional courses in the AIS program.

2005   Carnegie Mellon University   Pittsburgh, PA
12-271: Introduction to Computer Applications in Civil & Environmental Engineering – Teacher
- This class is an introduction to the use of computer-based applications in civil engineering, using generic tools such as spread-sheets, equation solvers and computer graphics. Discussion of the role of computer-based methods in civil engineering practice.

2005   Carnegie Mellon University   Pittsburgh, PA

12-742/48-742: Database Concepts in CAE – Teacher
- This is a class where students are introduced to databases and database management systems for Computer Aided Engineering (CAE). Topics include: the relational and object-oriented models; engineering data modeling issues; and the design of engineering data bases. Each student develops a prototype database application of his or her choice.

2005   Carnegie Mellon University   Pittsburgh, PA

12-738 Advanced Data Management & Analysis – Teacher
- This is a class where students are introduced to concepts and techniques of data mining learning how to automate the extraction of patterns that represent the knowledge implicitly stored in large databases, data warehouses, and other massive information repositories. The class is a comprehensive introduction to Computer Aided Engineering (CAE) data mining applications.

2001- 2004   University of Illinois at Urbana/Champaign   Urbana, IL

CEE498CDP Collaborative Design Processes – Teacher
- This is a capstone design class where students learn methods of collaborative design in the AEC industry enhanced by the use o information technology. Students work in multi-disciplinary teams to collaborate from remote locations (UIUC-Urbana and UF-Gainesville) via the Internet on the design of a facility. Team members from structural engineering, architecture and construction management generate designs while experimenting with different work practices to take maximum advantage of information technology using commercially available software. Students also develop process designs for the integration of technology into the work of multi-disciplinary design teams.

2000- 2004   University of Illinois at Urbana/Champaign   Urbana, IL

CEE495 Civil and Environmental Engineering Seminar – Construction

Management – Teacher

- This class is a research seminar class with guest speakers and graduate students' presentations.

1999- 2004   University of Illinois at Urbana/Champaign   Urbana, IL

CEE498AID Artificial Intelligence in Design – Teacher

- This class is an introduction to the design theory and to Artificial Intelligence applications in design. It introduces AI, Distributed AI, Machine Learning, Neural Networks, Decision Tress, Case Based Reasoning, Genetic Algorithms, and Data Mining

1998 – 2003   University of Illinois at Urbana/Champaign   Urbana, IL

CEE318 Construction Cost Analysis and Estimates – Teacher

- This class is an introduction to the application of scientific principles to costs and estimates of costs in construction engineering; concepts and statistical measurements of the factors involved in direct costs, general overhead costs, cost markups and profits; and the fundamentals of cost recording for construction cost accounts and cost controls.

2001-Present Universidade Federal do Rio Grande do Sul   POA, Brazil
New Information Technology Support for Construction Management – Teacher

- This class is a graduate one week 15 hours course offered once a year. It presents new information technology tools developed and being developed to support construction management. It introduces modeling, 4DCAD, data acquisition, sensors, laser scanners, wireless computing, data mining, knowledge generation, and simulation.

1996 - 1998   Massachusetts Institute of Technology   Cambridge, MA

1.432J Project Control - Teacher Assistant

- Lectured recitations for a graduate level project control course. This class looks at project control as the art and science of directing and coordinating human, equipment, material and financial resources through the life of a project, using modern management techniques and information technology systems to achieve predetermined objectives of scope, quality, budget, and schedule within the context of the natural, social and political environment in which the project is being developed. Supervised several group design projects, created the course package, and created and graded the problem sets

1994 - 1995   Massachusetts Institute of Technology   Cambridge, MA

1.12 Computer Models of Physical and Engineering Systems - Teacher Assistant

- Lectured recitations for a undergraduate level modeling and programming course. This class adopted a top-down approach to study modeling: from conceptualization of the overall model to implementation of the model in C++. Supervised several group design projects, created the course package, and created and graded the problem sets

January, 1996   Massachusetts Institute of Technology   Cambridge, MA
Instructor of the IAP Course Introduction to C++

July-August, 1995   Escuela Politecnica del Ejercito   Quito, Ecuador
Teacher of the Course Strategic Planning for Construction Companies

July-August, 1994   Universidade Federal do RGS   Porto Alegre, Brazil
Teacher of the Course Strategic Planning in Construction

Professional Experience

2000 – 2002 Patrick Engineering   Chicago, IL
Consultant
2000 – 2001 PiniWeb   São Paulo, Brazil
Consultant
1991 - 1993   L.Soibelman Engenharia e Fundações Porto Alegre, Brazil
Owner and President
1992 - 1993   Condomínio Edifício Guaporé   Porto Alegre, Brazil
Project Manager
1986 - 1991   Sigma Ensaios Tecnológicos   Porto Alegre, Brazil
Chief Technology Officer
1985 - 1986   Condomíno Edifício Minerva   Porto Alegre, Brazil
Project Manager
1983 - 1985   Chão e Teto Colocadora de Revestim. Porto Alegre, Brazil
Owner and President
1981 - 1993   Mosaico Empreeendimentos Imob.   Porto Alegre, Brazil
Trainee
1980 - 1981   Estaqueamento Gaúcho Ltda.   Porto Alegre, Brazil
Trainee

Books and Books Chapters Authored or Co-Authored

Peña-Mora, F., Lyneis, J., Karapidakis, S., Anumba, Soibelman, L., and Helms, P., "*System and Project Management*", under preparation – contract signed with Prentice Hall on 01/2002

O'Brien, W. and Soibelman L, "Technology and Engineering Dimensions: Collecting and Interpreting New Information for Civil and Environmental Infrastructure Management" in *Digital Infrastructures Enabling Civil and Environmental Systems Trough Information Technology* edited by Zimmerman and Horan, Routledge – Taylor and Francis, London, UK, 2004

Soibelman, L.., and Peña-Mora, F. "*Computing in Civil Engineering, Proceedings of the 2005 ASCE International Conference on Computing in Civil Engineering*", Editor, ASCE, Reston, VA, 2005

Soibelman, L., and Akinci, B. "Computing in Civil Engineering, Proceedings of the 2007 ASCE International Workshop on Computing in Civil Engineering", Editorm ASCE, Reston, VA, 2007.

Peer Reviewed Articles

Soibelman, L. and Peña-Mora, F., "A Distributed Multi-Reasoning Mechanism to Support the Conceptual Phase of Structural" *Journal of Structural Engineering*, American Society of Civil Engineers (ASCE) – June, 2000 -Volume 126, Issue 6 pp. 733-74.

Soibelman, L., and Kim, H., "Data Preparation Process for Construction Knowledge Generation through Knowledge Discovery in Databases" *Journal of Computing in Civil Engineering*, American Society of Civil Engineers (ASCE), January 2002, Volume 16, Number 1 pp 39-48.

Soibelman, L Formoso C., DeCesare, C., and Issatto, E., " Material Waste in the Building Industry: Main Causes and Prevention" *Journal of Construction Engineering and Management*, American Society of Civil Engineers (ASCE), July/August 2002, Volume 128, Number 4 pp 316-

325.

Soibelman, L. and Gonzales, M. A. S. "A Knowledge Discovery in Databases Framework to Property Valuation", *Journal of Property Tax Assessment and Administration, International Property Tax Institute*, Volume 7, number 2 2002, pp 77-106.

Soibelman, L, and Caldas, C. and Han, J. "Automated Classification of Construction Project Documents" *Journal of Computing in Civil Engineering*, American Society of Civil Engineers (ASCE), October 2002, Volume 16, Number 4 pp 234-243.

Soibelman, L. and Peña-Mora, F., "The Multi-Reason Artificial Mind (M-RAM) Project - A Model and a System Prototype to Support the Conceptual Phase of Structural Design for Tall Buildings Through Distributed Multi-Reasoning Algorithms," *International Journal of IT in Architecture, Engineering,* and Construction (IT-AEC) Millpress Science Publishers, January 2003, pp 27-42.

Caldas, C. and Soibelman, L. "Automating Hierarchical Document Classification for Construction Management Information Systems", *Automation in Construction*, Elsevier Science, volume 12, number 4, July 2003, pp 395-406.

Soibelman, L., Liu, L. Y., Kirby, J. G., East, E. W. Caldas, C. H., and Lin, K. Y. "Design Review Checking System (DrChecks)/Corporate Lessons Learned (CLL)" *Journal of Construction Engineering and Management*, American Society of Civil Engineers (ASCE), September/October 2003, pp 475-484.

Soibelman, L., and O'Brien, W. and Elvin, G. "Collaborative Design Processes: An Active and Reflective Learning Course in Multidisciplinary Collaboration" *Journal of Construction Education*, Associated Schools of Construction (ASC), summer 2003, Vol. 8, No. 2, pp 78-93.

Caldas C, Soibelman, L., and Gasser, L. "A Methodology for the Integration of Project Documents in Model-Based Information Systems " *Journal of Computing in Civil Engineering*, American Society of Civil Engineers (ASCE), Jan 2005, Volume 19, Number 1, pp 25-33.

Soibelman, L, and Kim, H., "Knowledge Discovery for Project Delay Analysis" *Bauingenieur*, Springer VDI Verlag, February 2005.

Brilakis, I., and Soibelman, L., "Content-Based Search Engines for Construction Images Databases" *Automation in Construction*, Elsevier Science, Volume 14, Issue 4, August 2005, Pages 537-550.

Soibelman, L., Gonzalez, M.A.S., and Formoso, C.T. "A New Approach to Spatial Analysis in CAMA" *Journal of Property Management*, Emerald, Volume 23 Issue 5, 2005, Pages 312-327

Brilakis, I., Soibelman, L. and Shinagawa, Y. (2005) "Material-Based Construction Site Image Retrieval" Journal of Computing in Civil Engineering, American Society of Civil Engineers, Volume 19, Issue 4, October 2005, Pages 341 – 355

Soibelman, L, NG, H, and Toukourou, A. "Knowledge Discovery in a Facility Condition Assessment Database Using Text Clustering" *Journal of Infrastructure Systems*, American Society of Civil Engineers (ASCE), Volume 12, Issue 1, March 2006, Pages 50-59

Lin, K. Y., and Soibelman L., "Promoting Transactions for A/E/C Product Information" *Automation in Construction*, Elsevier Science, Volume 15, Issue 6 , November 2006, Pages 746-757

Brilakis, I. and Soibelman, L. "Multi-Modal Image Retrieval from Construction Databases and Model-Based Systems", Journal of Construction Engineering and Management, American Society of Civil Engineers, Volume 132, Issue 7, July 2006, Pages 777 – 785

Brilakis, I., Soibelman, L., and Shinagawa, Y. "Construction Site Image Retrieval Based on Material Cluster Recognition", Journal of Advanced Engineering Informatics, Elsevier Science, Volume 20, Issue 4, October 2006, Pages 443-452

Soibelman, L., Wu, J., Caldas, C., Brilakis, I. and Lin, K.Y. "Data Analysis on Complicated Construction Data Sources: Vision, Research, and Recent Developments", Revised selected paper from keynote article at the 13th EG-ICE Workshop on Intelligent Computing in Engineering &Architecture, *Lecture Notes in Artificial Intelligence Journal*, Springer, Volume 4200, October 2006, Pages 637 - 652

Lin, K. Y., and Soibelman, L., "Knowledge Assisted Retrieval of Online Product Information in A/E/C" Journal *of Construction and Engineering Management,* American Society of Civil Engineers (ASCE), November 2007, 133(11), pp. 871-879.

Brilakis, I., and Soibelman, L., "Shape-Based Retrieval of Construction Site Photographs" *Journal of Computing in Civil Engineering*, American Society of Civil Engineers (ASCE), Volume 22, Issue 1, January/February 2008, Pages 14-20.

Soibelman, L., Wu, J., Caldas, C. Brilakis, I, and Lin, K.Y., "Management and Analysis of Unstructured Construction Data Types", Journal of Advanced Engineering Informatics, Elsevier Science, in print

Lin, K. Y., and Soibelman, L., "Incorporating Domain Knowledge and Information Retrieval Techniques to Develop an Architectural/Engineering/Construction (A/E/C) Online Product Search Engine" J*ournal of Computing in Civil Engineering*, American Society of Civil Engineers (ASCE), in print
Kim, H., Soibelman, L., and Grobler. F., "Factor Selection for Construction Delay Analysis Using Knowledge Discovery in Databases", Automation in Construction, Elsevier Science, in print.

Wu, J., and Soibelman, L., "Graphical Representation for CPM-Based Construction Networks to Support Scheduling Data Analysis and Knowledge Discovery" *Automation in Construction*, Elsevier Science, in review

Shih, C.Y., Scown, C., Soibelman, L., Matthews, H.S., Garrett, J.H., Dodrill, K., McSurdy, S., "Data Management for Geospatial Vulnerability Assessment of Interdependencies in US Power Generation ", Journal of Infrastructure Systems, American Society of Civil Engineers (ASCE), in review.

Soibelman, L., Guo, W., and Garrett, J.H., "Automated Defect Detection for Sewer Inspection and Condition Assessment", *Automation in Construction*, Elsevier Science, in review

Soibelman, L., Guo, W., and Garrett, J.H., "Visual Pattern Recognition

Supporting Defect Reporting and Condition Assessment of Wastewater Collection Systems", *Journal of Computing in Civil Engineering*, American Society of Civil Engineers (ASCE), in review

Articles in Conference Proceedings

Oliveira, D., Guo, W., Soibelman, L, and Garrett, J.H., "Data Management and Analysis for Sewer Systems Operations and Maintenance". 1st No-Dig 2008 – Latin American Edition and 3rd Brazilian Congress on Trenchless Technology, Feb 13 -15, 2008, Sao Paulo, Brazil.

Soibelman, L, and Garrett, J. H., "Sensor Data-Driven Management of Infrastructure Systems", Information Technology in Architecture, Engineering, and Construction Workshop", September 6-7, 2007, Cork, Ireland.

Oliveira, D., Guo, W., Soibelman, L, and Garrett, J.H., "Spatial Data Management and Analysis in Sewer Systems Condition Assessment: an Overview", ASCE 2007 International Workshop on Computing in Civil Engineering, July 24-27, 2007, Pittsburgh, USA.

Guo, W., Soibelman, L, and Garrett, J.H., "Automatic Defect Detection and Recognition for Asset Condition Assessment", ASCE 2007 International Workshop on Computing in Civil Engineering, July 24-27, 2007, Pittsburgh, USA.

Shih, C.Y., Scown, C.D., Soibelman, L., Matthews, H.S., Garrett, J.H., Dodrill, K., and McSurdy, S., "Decision Support Framework for Electricity Production Vulnerability Assessment", ASCE 2007 International Workshop on Computing in Civil Engineering, July 24-27, 2007, Pittsburgh, USA.

Dodrill, K., Garrett, J. H., Matthews, H. S., Shih, C. Y., Soibelman, L., and McSurdy, S. (2007). "Knowledge Management and Visualization in Support of Vulnerability Assessment of Electricity Production." *TRB 86th Annual Meeting*, January, 21-25, 2007, Washington, DC.

Soibelman, L., Wu, J., Caldas, C. Brilakis, I, and Lin, K.Y., "Data Analysis on Complicated Construction Data Sources, Vision, Research, and Recent Developments", 13th EG-ICE Workshop 2006, Ascona, Switzerland, June 2006.

Soibelman, L, and Brilakis, I., "Shape Recognition of Linear Construction Entities from Construction Site Images", Joint International Conference on Computing and Decision Making in Civil and Building Engineering, June 14-16 2006, Montreal, Canada.

Soibelman, L, Garret, J., and Shih, C.Y., "Steel Bridge Corrosion Detection by Wavelet Transform Theory", Joint International Conference on Computing and Decision Making in Civil and Building Engineering, June 14-16 2006, Montreal, Canada.

Soibelman, L., and Wu, J., "Advanced Scheduling Data Preparation, Representation, and Analysis in Support of Construction Planning and Scheduling", Joint International Conference on Computing and Decision Making in Civil and Building Engineering, June 14-16 2006, Montreal, Canada.

Soibelman, L., and Caldas, C., "A Combined Text Mining Method to

17

Improve Document Management in Construction Projects", Joint International Conference on Computing and Decision Making in Civil and Building Engineering, June 14-16 2006, Montreal, Canada.

Soibelman, L. Guo, W. and Garrett, J. H. "Automatic Visual Data Interpretation for Pipeline Infrastructure Assessment" International Association for Bridge and Structural Engineering (IABSE) 2006 Symposium - Responding to Tomorrow's Challenges in Structural Engineering, September 13-15, 2006, Budapest, Hungary.

Brilakis, I., and Soibelman., L., "Automated Integration of Construction Images in Model Based Systems", 1st International Conference on Construction Engineering and Management, ICCEM 2005, October 16-19, 2005, Seoul, Korea

Soibelman, L. and Brilakis, I., ""Automatic Integration of Construction Images using Digital Imaging and Pattern Recognition Tools" 3rd International Conference on Construction in the 21st Century – Advancing Engineering, Management and Technology, September 15-17, 2005, Athens, Greece.

Soibelman, L. and Brilakis, I., "Identification of Material from Construction Site Images Using Content Based Image Retrieval Techniques" ASCE 2005 International Conference on Computing in Civil Engineering, July 12-15, Cancun, Mexico.

Soibelman, L. and Runner, K.Y.L., "Knowledge-Assisted Retrieval of Online Product Information in A/E/C (Architecture/Engineering/Construction)" ASCE 2005 International Conference on Computing in Civil Engineering, July 12-15, Cancun, Mexico.

Soibelman, L. and Garrett, J.H., "Advanced Construction Data Management to Support Proactive Project Control" TIC 2005, April 7-8, 2005, Sao Paulo, SP, Brazil

Soibelman, L. and Brilakis, I., ""Comparison of Manual and User-Guided Methodologies for the Classification and Retrieval of Construction Images" ASCE 2005 Construction Research Congress, April 5-7, 2005, San Diego, CA.

Soibelman, L and Oliveira Filho, N, ""Sequential Analysis of Reasons of Non-Completion of Activities: Case Study and Future Directions" 12th Annual Conference in the International Group of Lean Construction, August 3-5, 2004, Elsinore, Denmark.

Soibelman L, Liu L, and Wu J, "Data Fusion and Modeling for Construction Management Knowledge Discovery" 10th International Conference on Computing in Civil and Building Engineering, June 02-04, 2004, Weimar, Germany

Liu L, Soibelman L, and Torsten T, "Technologies for Construction Field Data Collection" 10th International Conference on Computing in Civil and Building Engineering, June 02-04, 2004, Weimar, Germany

Soibelman L, O'Brien W, and Elvin G, "Collaborative Design Processes: A Class on Concurrent Collaboration in Multidisciplinary Design" 10th International Conference on Computing in Civil and Building Engineering, June 02-04, 2004, Weimar, Germany

Soibelman, L. and NG, H. " Knowledge Discovery in Maintenance

Databases Enhancing the Maintainability in Facilities", Construction Research Congress, 19-21 March 2003, Honolulu, Hawaii

Soibelman, L. and Caldas, C. "Integration of Construction Documents in IFC Project Models", Construction Research Congress, 19-21 March 2003, Honolulu, Hawaii

Caldas, C. H. and Soibelman, L. "Implementing Automated Methods for Document Classification in Construction Management Information Systems", ASCE & EG-ICE Workshop, 2-3 November, 2002, Washington, DC

Soibelman L, and Kim, H. ".Knowledge Discovery and Supervised Machine Learning in a Construction Project Database", Data Mining 2002 – Third International Conference on Data Mining and Databases for Engineering, Finance and Other Fields, 25-27 September, 2002, Bologna, Italy.

Gonzales, M.A.S., Soibelman, L., and Formoso C.T. "Explaining Neural Networks in Property Valuation" - 4to Simposio Argentino en Inteligencia Artificial (ASAI 2002), Santa Fe, Argentina – 9-13, Sept. 2002.

Caldas, C. and Soibelman, L. "Improving Construction Information Flows with Automated Text Classification Tools", 10th Annual Conference for Lean Construction, 6-8 August, 2002, Gramado-RS-Brazil

Soibelman, L., O'Brien, W. and Elvin G. "Encouraging Concurrent Collaboration in Multidisciplinary Design Projects: A Classroom Based Study", Concurrent Engineering in Construction – CECO2" 1-3 July 2002, Berkeley, CA.

Gonzales, M.A.S., Soibelman, L., and Formoso C.T. "A New Approach to Spatial Analysis in CAMA" I - 9th European Real Estate Society Conference (ERES2002). Glasgow: ERES, 2002.

Gonzales, M.A.S., Soibelman, L., and Formoso C.T. "Explaining Results in a Neural-Mass Appraisal Model" - 9th European Real Estate Society Conference (ERES2002). Glasgow: ERES, 2002.

Soibelman, L., O'Brien, W. and Elvin G. "CDP-Collaborative Design Processes: A Classroom Based Study Serving as a Laboratory for Studying A/E/C Distributed Design" Invitational Workshop on the Role of Empirical Studies in Understanding and Supporting Engineering Design, 4-5 April, 2002, NIST, Gaithersburg, MD.

Soibelman, L. and Caldas, C., "Modeling Information Flows In Construction Inter-Organizational Processes" Special Conference on Fully Integrated and Automated Project Processes in Civil Engineering 23-25 January 2002 - Blacksburg, VA.

Soibelman, L and Kim, H., "A KDD Framework for Construction Databases" Special Conference on Fully Integrated and Automated Project Processes in Civil Engineering, 23-25 January 2002 - Blacksburg, VA.

Caldas, C, and Soibelman, L., "Avaliação da Logística de Informação em Processos Inter-Organizacionais na Construção Civil" II Simpósio Brasileiro de Gestão da Qualidade e Organização do Trabalho no Ambiente Construído 4 a 6 de setembro de 2001. Fortaleza, CE – Brasil.

Soibelman, L and Kim, H., "KDD Process Framework for Construction Knowledge Generation", Innovation in AEC Industry, 18-20 July 2001 – Loughborough, UK.

Soibelman, L., and Kim, H., "Generating Construction Knowledge with Knowledge Discovery in Databases" The 8th International Conference on Computing in Civil and Building Engineering (VIII-ICCCBE) August 2000, Stanford, CA.

Soibelman, L, and Caldas, C., "Information Logistics for Construction Design Team Collaboration", The 8th International Conference on Computing in Civil and Building Engineering (VIII-ICCCBE) August, 2000, Stanford, CA

Soibelman, L, and Kim, H., "Generating Knowledge from Large Construction Databases", International Group for Lean Construction Eighth Annual Conference (IGLC-8), July 2000, Birmingham, UK.

Soibelman, L, and Caldas, C., "Information Logistics Approach for Construction Inter-organizational Information Systems", Construction Information Technology 2000, CIB W78, IABSE, WC6, EG SEA AI, June 2000, Reykjavik, Iceland

Soibelman, L, and Caldas, C., "Extranets Applications for Project Management: The North American Example", Antac-2000 May, 2000, Salvador, Brazil1999

Soibelman, L. "Construction Knowledge Generation and Dissemination", Berkeley-Stanford CE&M Workshop: Defining a Research Agenda for AEC Process/Product Development in 2000 and Beyond, Stanford, August 1999

Soibelman, L. and Peña-Mora, F., "M-RAM: An Artificial Intelligence Distributed System to Support the Conceptual Phase of Structural Design", *Civil-Comp99-The Seventh International Conference on Civil and Structural Engineering Computing*, Oxford, England, 13-15 September 1999

Soibelman, L., Peña-Mora, F., "A Geographically Distributed Multi-Reasoning Mechanism for change negotiation Management of Large Scale Engineering Systems", In Proceedings of the *W78 "Information Technology in Construction" and TG10 "Computer Representation of Design Standards and Building Codes" Workshop: Construction on the Information Highway/BLED/96* - Bled -Slovenia, June, 1996.

Soibelman, L., Formoso, C.T., Franchi, C., "A Study on the Waste of Materials in the Building Industry in Brazil " In Proceedings of the *First international Conference on Sustainable Construction - CIB - Task Group 16*, Tampa, Florida, USA, November, 1994.

Soibelman, L., Formoso, C.T., Franchi, C., "A Study on the Material Waste in the Construction Industry", In Proceedings of *ENTAC 93* - Brazilian National Construction Convention, Sao Paulo, Brazil, November, 1993.

Soibelman, L., Formoso, C.T., Franchi, C., "A Methodology for Controlling Material Waste on Building Sites", In Proceedings of the *International Symposium on Economic Evaluation and the Built Environment - W55 Symposium*, Lisbon, Portugal, September, 1993.

Soibelman, L., Formoso, C.T., Franchi, C., "Material Loss in the Construction Industry", In Proceedings of the *II Seminar for Quality in Construction*, Porto Alegre, Brazil, June, 1993.

Soibelman, L., Scommazon, B., Silva, N., "Study of a Method for the Determination of Construction Undertakings Profitability", In Proceedings of *VIII ENCO* - Brazilian National Construction Convention, Goiania, Brazil, May 1986.

Soibelman, L., Scommazon, B., Silva, N., "Apartment Houses for Social Purpose - Alternative Techniques for its Planning, Programming and Control", In Proceedings *of VIII ENCO* - Brazilian National Construction Convention, Goiania, Brazil, May 1986

Bulletins or Reports

El-Rayes, K. Liu, L., Soibelman, L., and Hyari, K. *"Nighttime Construction: Evaluation of Lighting for Highway Construction Operations in Illinois".* (Final Report). Project VD-H1, FY 00/01, Illinois Transportation Research Center, Illinois Department of Transportation, August 2003.

El-Rayes, K. Liu, L., Soibelman, L., and Hyari, K. *"Recommendations for Lighting Arrangements: Evaluation of Lighting for Highway Construction Operations in Illinois".* (4th Interim Report). Project VD-H1, FY 00/01, Illinois Transportation Research Center, Illinois Department of Transportation, April 2003.

El-Rayes, K. Liu, L., Soibelman, L., and Hyari, K. *"Development of Design Criteria for Nighttime Construction Lighting".* (3rd Interim Report). Project VD-H1, FY 00/01, Illinois Transportation Research Center, Illinois Department of Transportation, November 2002.

El-Rayes, K. Liu, L., Soibelman, L., and Hyari, K. *"Survey Results: Nighttime Construction: Evaluation of Lighting for Highway Construction Operations in Illinois".* (2nd Interim Report). Project VD-H1, FY 00/01, Illinois Transportation Research Center, Illinois Department of Transportation, June 2002

El-Rayes, K. Liu, L., Soibelman, L., and Hyari, K. *"Literature Review: Nighttime Construction: Evaluation of Lighting for Highway Construction Operations in Illinois".* (1st Interim Report). Project VD-H1, FY 00/01, Illinois Transportation Research Center, Illinois Department of Transportation, December 2001.

Soibelman, L. et. all., *"A Model to Improve Quality Management in Small Construction Companies"*, University Press - Universidade Federal do Rio Grande do Sul, Porto Alegre, Brazil, May, 1993.

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Soibelman, L., Scomazon, B. and Silva, N., *"Methods for Profitability Analysis of Housing Construction Projects"*, University Press – Universidade Federal do Rio Grande do Sul, Porto Alegre, Brazil, June 1987.

Soibelman, L., Scomazon, B. and Silva, N., *"Planning, Programming and Controlling - The Line of Balance Methodology"*, University Press - Universidade Federal do Rio Grande do Sul, Porto Alegre, Brazil, December 1985.

Guest Speaker

Machine Learning/Google Seminar, Carnegie Mellon University, "Data Management and Knowledge Discovery for Advanced Infrastructure Systems", Jan 28, 2008, Pittsburgh, PA

University College Cork, Ireland, Information Technology in Architecture, engineering, and Construction Workshop, "Sensor Data-Driven Management of Infrastructure Systems", September 7, 2007, Cork, Ireland.

3 Encontro de Tecnologia de Informacao e Comunicacao na Construcao Civil, "BIM – Presente e Futuro" , Keynote Speaker, July 11, 2007, Porto Alegre, RS, Brazil.

Arup, "Beyond BIM, the future of Advanced Building information Models", March 27, 2007, New York, NY

ASCE – Northern New Jersey Chapter, "From BIM to Proactive Project Control" , March 27, 2007, Newark, NJ.

85th TRB Annual Meeting, Data Stewardship – Meeting the Challenges of Enterprise Data Management Workshop, "Advanced Construction Data Management and Knowledge Discovery", January 22, 2006, Washington, DC

National Central University, Institute for Construction Engineering and Management, "Advanced Construction Data Management and Knowledge Discovery" October 20, 2005, Jung-li City, Taoyuan, Taiwan

National Taiwan University of Science and Technology, Department of Construction Engineering, "Advanced Construction Data Management and Knowledge Discovery", October 21, 2005, Taipei, Taiwan

National Taiwan University, Department of Civil Engineering, Division of Construction Engineering and Management, "Advanced Construction Data Management and Knowledge Discovery", October 21, 2005, Taipei, Taiwan

National Chiao Tung University, "Advanced Construction Data Management and Knowledge Discovery", October 20, 2005, Hsinchu, Taiwan.

CERIK – Construction & Economy Research Institute of Korea, "Advanced Construction Data Management and Knowledge Discovery", October 19, 2005, Seoul, Korea.

University of Seoul, School, of Architecture and Architectural Engineering, "Advanced Construction Data Management and Knowledge Discovery", October 18, 2005, Seoul, Korea.

The "Contractor and Construction Manager Issues" International Superconference, Invited Speaker, "Beyond 4DCAD – Advanced Construction Data Management to Support Proactive Project Control and Knowledge Discovery" May 20, 2005, London, UK.

TIC2005, Universidade de Sao Paulo (USP), Keynote Speaker, "Advanced Construction Data Management to Support Proactive Project

Control", April 8, 2005, Sao Paulo, SP, Brazil

University of Rio Grande do Sul, Norie, "Advanced Data Management for Construction Management" Porto Alegre, RS, December, 2004

University of Sao Paulo, USP, SP, "KDD, Text Mining, and Image Reasoning Research at the CKDD Group," Brazil, July 2003

Centro de Tecnologia de Edificacoes - CTE, SP – Brazil, "New IT support for construction management," July 2003

IABSE Working Commission 6, Antwerp, Belgium "Data Mining Applications in Civil Engineering," August 2003

University of Texas – Austin – Civil Engineering Department – "UIUC Construction Management Program and the CKDD Group", February 28, 2003

University of California at Berkeley, Civil and Environmental Engineering Department – "The CKDD Group at UIUC, Research and Developments", February 24, 2003

Stanford University, Civil and Environmental Engineering Department – "The CKDD Group at UIUC, Research and Developments", February 21, 2003

Key speaker for the Seminario Tecnologia da Informacao e Comunicacao na Construcao Civil – Programa Construbusiness do Estado do Parana – Curitiba – PR – Brazil – November 28, 2002.

UIUC Graduate School of Library and Information Science, "Automated Classification and Integration of Text-Based Information in Construction", March 6, 2002

Key speaker for the II Simpósio Brasileiro de Gestão da Qualidade e Organização do Trabalho no Ambiente Construído and Sinduscon – CE - Fortaleza, CE – Brazil "A/EC Industry and New Information Technollogy Trends", September 4 and 6, 2001.

Sinduscon – SP – Brazil
"A/EC Industry and New Information Technollogy Trends", August 8 2001.

Sinduscon – PR and Universidade Federal do Parana – PR – Brazil
"A/EC Industry and New Information Technollogy Trends", August 9 2001

Sinduscon – RS – Brazil
"A/EC Industry and New Information Technollogy Trends", August 13 2001

PINI – SP - Brazil
"New IT in Construction Management", December 14, 2000

Universidade Federal do Rio Grande do Sul – Porto Alegre Brazil – "Advanced Construction Management", December 22, 2000

Virginia Tech – Department of Civil Engineering – Blacksburg – Virginia "The KDD Group", September 28, 2000

The GSLIS-2000 Clinic on ELECTRONIC COMMERCE IN THE
INFORMATION INDUSTRIES - Technical Frontiers and Institutional
Issues for Information Management Professionals – Urbana – IL - USA
"Cross-Organizational Information Logistics", April 2-4, 2000, Beckman
Institute for Advanced Science and Technology, University of Illinois at
Urbana-Champaign, Urbana, USA

7 Simposium International de Ingeniaria Civil ITESM – Monterrey –
Mexico
"Material Waste in the Construction Industry: Incidence and Control"
Monterrey, March 03, 2000, Monterrey, Mexico

Sinduscon – SP - Brazil
"Extranets Applications in Project Management", January 17, 2000, São
Paulo, Brazil

Grants

2008 IBM   Yorktown Heights, NY
"A Demonstration of Sensor Andrew as a Framework to Support Data
Fusion and Integration for Multiple Sensor Platforms using IBM's
System-S" $40,000.00

2007 Bosch Research   Pittsburgh, PA
"Learning Based Systems for Residential Electricity
Monitoring" $49,638.00

2007 IMTS-NASA   Fairmont, WV
"Computer Vision and Image Reasoning for Automatic Defect Detection:
A Case Study on Sewage Pipes Inspection" $ 90,000.00

2007 PITA   Pittsburgh, PA
"Framework for Data Management and Analysis in Wastewater
Collection Systems' Inspection" $ 55,200.00

2007 PITA   Pittsburgh, PA
"Coordination of Campus Sensing and Diagnostic Platforms for Long-
Term Sensor Andrew Project" $ 27,600.00

2007 PITA   Pittsburgh, PA
"Continuous Monitoring of Distributed Pipeline Systems" $ 55,200.00

2006 RedZone Robotics   Pittsburgh, PA
"Sewage Pipe Defect Classification" $27,000.00

2006 Carnegie Mellon University   Pittsburgh, PA
"The Global Education Initiative – ICCM International Collaborative
Construction Management" $30,000.00

2006 (SEER) Steinbrenner Institute of Environmental Education and
Research   Pittsburgh, PA
"Advanced Infrastructure Systems Project" $8,000.00

2005 PITA   Pittsburgh, PA
"Automatic Visual Data Interpretation for Pipeline Infrastructure
Assessment" $59,711.00

2005-2006 NETL-DOE
Morgantown, WV
"Knowledge Management and Visualization in Support of Vulnerability
Assessment of Electricity Production" $ 218,000.00

2004 NSF - National Science Foundation - Arlington, VA
"ITR: IT-Based Collaboration Framework for Preparing Against,
Responding to, and Recovering from Disasters Involving Critical
Physical Infrastructures" $ 2,370,002.00

2003 NSF - National Science Foundation - Arlington, VA
"Career: Knowledge Discovery in Databases and Data Mining as New
tools to Support Research and Educational Advances in Modern
Construction Management" - REU Supplement $ 4,979.00

2003 NSF - National Science Foundation - Arlington, VA
"Dynamic Planning and Control Methodology (DPM) for Large-Scale
Concurrent Design and Construction Projects $397,521.00

2002 NSF - National Science Foundation - Arlington, VA
"Integration of Unstructured Text Documents in A/E/C Model Based
Systems " $177,227.00

2001 NSF - National Science Foundation - Arlington, VA
"Career: Knowledge Discovery in Databases and Data Mining as New
tools to Support Research and Educational Advances in Modern
Construction Management" $375,000.00

2001 IDOT - Illinois Department of Transportation Springfield, IL
"Nighttime Construction: Evaluation of Lighting for Highway
Construction" $ 150,000.00

2001 IDOT - Illinois Department of Transportation Springfield, IL
"Nighttime Construction: Evaluation of Construction
Operations $ 150,000.00

2000 UIUC-CSE – UIUC-Computer Science in Urbana-IL
Engineering "Information Access and Distribution
In Construction Inter-Organizational Processes 1RA

2000 CERL - US Army Corps of Engineers – Construction Engineering
Research Laboratory Champaign, IL
"Dr. Checks/CLL" $10,000.00

1999 University of Illinois at Urbana/Champaign Urbana, IL
Campus Research Board
"Data Mining and Machine Learning: A new approach to evaluate
rework" $25,000.00

1999 NCSA – Nat. Center for Supercomputing Applic. Champaign, IL
Data Mining in Applications in Civil Engineering 4,000 SU Hours

**Former PHD
Students**   Hyunjoo Kim, Carlos Caldas, Ken-Yu Lin, Ioannis Brilakis

PHD Students

                    Jiafeng Wu, Wei Guo, Chung-Yan Shih, Daniel Oliveira, Mario Berges,
                    Abhinav Agrawal

**PHD Students –
member of thesis
committee**   Semiha Kiziltas, Pingbo Tan

25

**Former PHD
Students –
member of thesis
committee**   Chul So, Shih-Ping Ho, Marco Aurelio Stumpf Gonzales, Ghassan Abu-
Lebdeh, Montty Girianna and Khaled Hyari, William East and Amr A.
Kandil.

**Journal
Editorship**

2008-Present	Journal of Computing in Civil engineering - ASCE – Co-Chief-Editor
2000-2008	Journal of Computing in Civil engineering - ASCE Associate Editor
2001-Present	Revista da ANTAC –Associação Nacional de Tecnologia do Ambiente Construido – POA – Brazil Editorial Board
2004-Present	International Journal of Architectural Engineering and Design Management – James & James, London - UK Editorial Board
2006-Present	Engineering, Construction and Architectural Management – Emerald – Bradford – UK Editorial Board
2007-Present	Automation in Construction – Elsevier Science – Oxford – UK – Editorial Board
2007-Present	Journal of Advanced Engineering Informatics – Elsevier Science – Oxford – UK – Editorial Board

Journal Reviewer

2001-Present	Automation in Construction – Elsevier Science – Oxford – UK
2001-Present	Journal of Artificial Intelligence in Engineering, Elsevier, Neitherlands
2001-Present	AIEDAM – Artificial Intelligence for Engineering Design, Analysis and Manufacturing, Cambridge University Press, Cambridge – UK
2000-Present	CIDAC – International Journal of Computer Integrated Design and Construction, SETO – London - UK
1999-Present	Computed-Aided Civil and Infrastructure Engineering – Blackwell - Oxford - UK

1999-Present	Construction Management and Economics - E&F.N. Spon – London – UK
1998-Present	Engineering Construction and Architectural Management – Blackwell – Oxford - UK

Professional Registration

Professional Civil Engineer – CREA-RS-Brazil
Registration number 54206D, 1994

Professional Affiliations

American Society of Civil Engineering (ASCE) – Member
Project Management Institute (PMI)
American Society for Engineering Education (ASEE)
International Association for Bridge and Structural Engineering (IABSE)
Conselho Regional de Engenharia e Arquitetura - RS (CREA/RS)
Sociedade de Engenharia do Rio Grande do Sul (SERGS)

Professional Service

2007-2008 – Vice Chair for the ASCE-CI-Construction Research Council Committee.

2006-2007– Secretary for the ASCE-CI-Construction Research Council Committee.

2007 - Co-Chair of the ASCE International Workshop on Computing in Civil Engineering, July 24-27, 2007, Pittsburgh, PA.

2005 – Member of the International Program Committee of the 1st International Conference on Construction Engineering and Management (ICCEM 2005), October 16-18, 2005, Seoul, Korea.

2005 – Technical Chair of the ASCE 2005 International Conference on Computing in Civil Engineering, July 12-15, Cancun, Mexico.

2004 – Chair of the Information Technology Track for the 12th International Conference in Lean Construction, August 3-5, 2004, Elsinore, Denmark.

2004 – Member of the Scientific Committee of the 10th International Conference on Computing in Civil and Building Engineering (ICCCBE), 2-4 June, 2004, Weimar, Germany.

2003 – Chair of the "Current Trends and Professional Needs for Information Technology in Civil Engineering" session for the Information Technology in Civil Engineering during the National ASCE Symposium, 10-11 November, 2003 – Nashville, TN.

2003 – Chair of the Information Technology Track for the 11th International Conference in Lean Construction, 22-25 July, 2003, Blacksburg, VA

2003 – NSF Division of Information & Intelligent Systems Review Panel for Data Mining Research, June 16th, 2003, Arlington, VA

2003 – Chair of the Information Technology Project Data Integration Track for the Construction Research Congress, 19-21 March, 2003 – Honolulu, Hawaii.

2002 - Chair of the Information Technology Track for the 10th

International Conference in Lean Construction, 6-8 August, 2002, Gramado-RS-Brazil.

2002 – NSF Unsolicited Review Panel for Information Technology and Infrastructure, May 31st , 2002, Arlington, VA.

2002 - Member of the Technical Committee of the Special Conference on Fully Integrated and Automated Project Processes in Civil Engineering 23-25 January 2002 - Blacksburg, VA.

2002 - International Co-Chair of the 9th ISPE International Conference on Concurrent Engineering Research and Applications (CE2002), 27-31 July, 2002, Cranfield University, UK.

2001 – NSF Review Panel for the Scalable Enterprise Systems Initiative, Phase II, 7-8 June , 2001, Arlington, VA.

2003-2007   ASCE – American Society of Civil Engineers – Technical Council on Computing & Information Technology (CIT) – **Vice Chair** of the Technical Committee on Intelligent Computing

2000-2003   ASCE – American Society of Civil Engineers – Technical Council on Computing & Information Technology (CIT) – Secretary of the Technical Committee on Intelligent Computing

2003-2007   IABSE – International Association for Bridge and Structural Engineering – Member of the Work Commission 6 on Information Technology

2000-Present   ASCE – American Society of Civil Engineers – Technical Council on Computing & Information Technology (CIT) – Member of the Technical Committee on Intelligent Computing

2000-Present   ASCE – American Society of Civil Engineers – Technical Council on Computing & Information Technology (CIT) – Member of the Technical Committee on Databases and Information Management.

2002-2005   ASCE – American Society of Civil Engineers – Technical Council on Computing & Information Technology (CIT) – **Chair** of the Technical Committee on Databases and Information Management.

1999-Present   ASCE – American Society of Civil Engineers – Construction Division – Member of the Technical Committee on Computing in Construction (CIC)

1999-Present   ASCE – American Society of Civil Engineers – Member of the Construction Research Council (CRC)

1998-2001   Project Management Institute - Member of the Executive Advisory Council (EAC) – Central Illinois Chapter

1996 Massachusetts Institute of Technology - Organizer of the 1st

Brazilian Conference on Science and Technology
▪ Worked with the Brazilian Consulate in Boston, with the Brazilian Embassy in Washington, with the Department of Science and

Technology of the Brazilian Foreign Affair Ministry in Brasilia, and with sponsor companies. Provided the conceptual framework, planed and organized the three days conference. Introduced speakers and co-moderated discussion sections

University Service

2005-2007 Carnegie Mellon University   Pittsburgh, PA
University Committee on Nontenure Appointments

2006-Today Carnegie Mellon University   Pittsburgh, PA
Civil and Environmental Engineering Department - Graduate Recruiting and Admission Committee – Chair

2006-Today Carnegie Mellon University   Pittsburgh, PA
Carnegie Mellon University (CMU) – Civil and Environmental Engineering Department – Admission Coordinator for the AIS Group

2006-Today Carnegie Mellon University   Pittsburgh, PA
Carnegie Mellon University (CMU) – Civil and Environmental Engineering Department – Computer Committee

2006-Today Carnegie Mellon University   Pittsburgh, PA
Carnegie Mellon University (CMU) – Civil and Environmental Engineering Department – Publications Committee

2006-Today Carnegie Mellon University   Pittsburgh, PA
Carnegie Mellon University (CMU) – Civil and Environmental Engineering Department – Undergraduate Curriculum Committee

2007-Today Carnegie Mellon University   Pittsburgh, PA
Carnegie Mellon University (CMU) – Civil and Environmental Engineering Department – Chi Epsilon Faculty Advisor

2001 University of Illinois at Urbana/Champaign   Urbana, IL
Department of Civil and Environmental Engineering Head Search Committee

2001 University of Illinois at Urbana/Champaign   Urbana, IL
Department of Civil and Environmental Engineering Information Technology Committee

1998-2000   University of Illinois at Urbana/Champaign   Urbana, IL
Construction Search Committee

1999-2001   University of Illinois at Urbana/Champaign   Urbana, IL
Department of Civil and Environmental Engineering Advisory Committee

1999-2001   University of Illinois at Urbana/Champaign   Urbana, IL
Department of Civil and Environmental Engineering Curriculum Committee

1999-2001   University of Illinois at Urbana/Champaign   Urbana, IL
Department of Civil and Environmental Engineering Computer Support Committee

1997   Massachusetts Institute of Technology   Cambridge, MA
Civil and Environmental Engineering Department – Ethics Committee

1994 - 1998   Massachusetts Institute of Technology   Cambridge –
Webmaster of the Department of Civil and Environmental Engineering

1996 - 1997 AGC/MA IT Task Force - Webmaster

1994 - 1998 Massachusetts Institute of Technology - Webmaster of the Brazilian Student Association

Graduate Advisors	Feniosky Peña-Mora, Robert Logcher, Jerome Connor, John Williams, Luiz Fernando Mahlmann Heineck, and Carlos Torres Formoso

Awards received

2002 UIUC Office of Instructional Resources, Urbana, IL, Ranked as an outstanding instructor according to the Incomplete Lists of Teachers Ranked as Excellent for the 2002 spring semester.

2001 UIUC Office of Instructional Resources, Urbana, IL, Ranked as an excellent instructor according to the Incomplete Lists of Teachers Ranked as Excellent for the 2001 spring semester.

2001 National Science Foundation – NSF Career Award	Alexandria, VA
1997 Massachusetts Institute of Technology Teacher Assistant Fellowship	Cambridge, MA
1996 Massachusetts Institute of Technology Department of Civil and Environmental Engineering Outstanding Student Contribution	Cambridge, MA
1993 - 1997 CNPq Doctoral Fellowship	Brasilia, Brazil
1985 - 1986 CAPES Masters Fellowship	Brasilia, Brazil

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NJIT
New Jersey's Science &
Technology University

MEMORANDUM

To: Provost Nelson

From: Fadi Karaa, Associate Professor of Critical Infrastructure, Department of Civil and Environmental Engineering

Subject: Response to Consultant's Report for MS in Critical Infrastructure Systems (CIS)

Date: August 27, 2008

Degree Name: MS in Critical Infrastructure Systems

Consultant's Name: Dr. Lucio Soibelman, Carnegie Mellon University

Consultant's Visit: May 29, 2008

Date of Consultant's Report: August 25, 2008

Institute's Response:

We thank Dr. Soibelman for his insightful and thorough review of the new MS program in Critical Infrastructure Systems. Lucio Soibelman has a wealth of experience in the field of critical infrastructure systems both as a Professor in the Advanced Infrastructure Systems (AIS) at Carnegie Mellon University (CMU) and as co-chief editor of the "Journal of Computing in Civil Engineering".

To quote Dr. Soibelman, "This consultant found the proposed program to be an excellent idea. No issues surfaced that needed prompt or significant attention. Support for the proposed program among the faculty, staff, and students was found to be very high. There was an omnipresent sense of energy, purpose, vision, collegiality and engagement." Dr. Soibelman recommended enthusiastically "Approval" of the proposed MS in CIS.

The report is very positive across all aspects covered. It suggests that the inter-disciplinary curriculum of the MS in Critical Infrastructure Systems, which combines infrastructure life-cycle management and emergency and security systems (vis-à-vis natural and man-made events) is a timely and innovative educational and research platform. It also plays an essential role in training current and future professionals in a range of industries. In particular, the Consultant elaborates that "Government agencies are searching for professionals with this background (CIS curriculum) and are reporting back that no school is educating this type of professional. Graduates from this program will have opportunities in industry (there are several private organizations managing infrastructure worldwide), in government agencies that manage infrastructure and provide first response during extreme events, and in academia to continue in advanced studies (there are several research opportunities in this area)."

The report considers the MS CIS's broad offering as a key asset, in comparison to more traditional or narrowly focused infrastructure or urban systems programs. Objectively

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reflecting on the AIS Program at CMU and comparing it to the proposed program in CIS, Dr. Soibelman adds that "We (AIS) are focused on information technology based solutions and every year … a large number of students applying to our program …are looking for a broader perspective of infrastructure management. Until now we did not have a program to recommend to those applicants. It is now clear to this consultant that they are looking for something like the program that NJIT is proposing. A very similar situation is occurring with infrastructure management agencies when searching for new staff. Today, we are not producing enough professionals for the existing large demand."

Beyond the areas of need for the Program addressed above, we include for the key report sections more details from Dr. Soibelman's evaluation and comments. Where needed, our responses, and implemented or planned remedial actions are listed in italic.

A. Objectives and Mission Alignment

1. Describe whether or not the objectives and underlying principles of the program are sound and clearly stated. Discuss whether or not the program is consistent with the institutions' programmatic mission and educational goals.

The Consultant finds that the following statement "This program presents an integral end-to-end approach to the area of Critical Infrastructure Lifecycle and Emergency Management Education and Research, across multiple sectors. Life-cycle Management focuses on planning issues, maintainability, and safety engineering, vulnerability analysis, hazard/crisis impact analysis and mitigation, infrastructure interdependencies, rehabilitation technologies, condition assessment, problem detection, diagnosis and process propagation, and program management. Security and Emergency Management includes critical infrastructure and population protection, emergency management, preparedness and response management, enabling and protective technologies, evacuation planning, and information systems applications to infrastructure and homeland security", clearly describes the underlying principles of the program.

He adds: "The program objectives are aligned with the institution mission and goals by preparing qualified students with strong background to serve state and local government agencies needs, by supporting inter-disciplinary research, by creating several dual degrees opportunities, and by creating community-building projects".

B. Educational Programs

Dr. Soibelman states:

"The suggested curriculum is broad with several options allowing students to specialize in 2 key concentration areas (Critical Infrastructure Life-Cycle Management and Critical

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Infrastructure Security and Emergency Management) with the option of 6 sub-areas (Planning and Facility Management, Engineered Systems, Public Health Systems, Program/Impact Management, Emergency and Preparedness, and Enabling Systems and Technology). Every student will be requested to take 12 credits of core courses (Performance and Risk Analysis of Infrastructure Systems, Security Management of Critical Infrastructure, Management Science, and Elements of Infrastructure Planning) and at least another 18 credits of elective from the 2 concentration areas. The required courses are either available or have been developed during the last 2 years. All core courses and a large number of electives are now in place. The offered courses are aligned with the objectives of the proposed program. The requirements for admissions are clearly defined requesting a baccalaureate degree with at least 12 credits in mathematics, calculus, and upper division course in statistics. Students who do not satisfy the credit requirement will be required to take a suitable bridge program of appropriate mathematics/statistics courses."

The Consultant adds: To my knowledge, there is no other institution with such a broad course offering in this area."

We agree with Dr. Soibelman's comparative evaluation and expectation that "the program will end up admitting students with several backgrounds some being required to attend the bridge program. "

To simplify the advising of students with various backgrounds, he believes that Faculty will have to develop some curriculum templates with the recommended sequence of classes for each sub-area and incoming students will have to be introduced early in their first semester to the program objectives and curriculum options.

Here again, we agree and have already developed such templates and course sequencing models for students of different areas of interest. Also, as addressed by Dr. Soibelman, in anticipation of candidates from various infrastructure industries, we have formed a multi-disciplinary advising Committee to help steer new students in their elective choices.

Dr. Soibelman also recommends "the development of a capstone design course where students will be able to apply the theory learned during the program to a practical engineering, systems, management or inter-disciplinary problem. This could be done as a group project, a master thesis or an independent study with a research faculty, or a master thesis or an independent study based on an internship (supported by a faculty) in an organization that manages infrastructure.

We agree and have made the master thesis and report a key option of the program. We are planning a strong Industry Advisory Board and would elicit their input on the development of reliable sources of relevant practical independent studies and projects on real-world advanced infrastructure management and systems priority topics.

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C. Finances and Institutional Commitment

Dr. Soibelman reports positively on the institutional commitment to the MS in CIS program. He presents his views on ways to address important research opportunities in this new inter-disciplinary field:

"From the meetings with the Provost and with the Deans it was clear to me that there is a strong commitment from the institution to provide the resources necessary to guarantee a high quality educational program. The proposed program is creating a collaborative environment for faculty from a large number of NJIT and UMDNJ – School of Public Health units. The collaboration among faculty added to the availability of graduate students with expertise in this area will create a perfect environment for multidisciplinary research."

We agree that there is such a commitment and have used the platform of the Program in pursuit of major multidisciplinary initiatives such as EPA's Water Infrastructure Sustainability Initiative, and NSF's IGERT.

4F. **Approve Resolution to Establish MS in Pharmaceutical Systems Management**

STATEMENT

RESOLUTION TO APPROVE THE MS IN PHARMACEUTICAL SYSTEMS
MANAGEMENT

The objective of the MS in Pharmaceutical Systems Management is to train and educate professionals for careers in the pharmaceutical industry by providing them with skills in the areas of quantitative systems analysis, planning and design of pharmaceutical process operations, and project management and implementation relative to all technology intensive operations in this highly sophisticated industry. This program is designed for students with an undergraduate degree in a technical discipline such as engineering, computer science, information technology or physics.

Rutgers-Newark has objected to certain aspects of the MS in Pharmaceutical Systems Management and NJIT agreed to revise the original program announcement to address those concerns. That revised program announcement is attached as is our response to Rutgers – Newark.

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 SYSTEMS MANAGEMENT

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 Systems Management; 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 Systems Management

September 18, 2008

PROGRAM ANNOUNCEMENT

August 2008

Institution:	**New Jersey Institute of Technology**
New Program Title:	**Master of Science in Pharmaceutical Systems Management**
Degree Designation:	**M.S. in Pharmaceutical Systems Management**
Degree Abbreviation:	**MSPhM**
CIP Code and Nomenclature (*if possible*):	**14.27 - Systems Engineering**
Campus(es) where the program will be offered:	**Newark**
Date when program will begin (month and year):	**Spring 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

New Jersey has one of the largest pharma concentrations in the world, and it is the backbone of our knowledge-based, high-technology economy. According to the Star-ledger J&J (14,000 jobs), BMS (7,600 jobs), and Merck (7,500 jobs) rank among the top 25 largest employers in New Jersey. In 2006 New Jersey had 14% of the nation's total employment in the pharmaceutical industry as measured by the U.S. Bureau of Labor Statistics. This is an extraordinary concentration and powerful economic presence, that is second only to California. The job opportunities for technical managers in the pharmaceutical industry continues to be very strong and this degree will certainly increase their skill base and facilitate their career growth.

Today there are many challenges facing the pharmaceutical industry ranging from the need to lower development, manufacturing and distribution costs to competition between, branded, generic and OTC products. Large Pharmacy Benefits Manger organizations (PBMs) are expecting the pharmaceutical industry to achieve the same levels of productivity and efficiency as seen in the consumer products industry. Historically the pharma industry has enjoyed relatively high profit margins, but this has been declining steadily. As a result pharma companies are becoming more focused on cost containment and productivity improvement. The MSPhM curriculum focuses on this need.

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

The NJIT vision is to be a preeminent technological research university known for innovation, entrepreneurship, and engagement. Within this vision the university has identified a graduate growth initiative by creating industry focused programs. The pharmaceutical industry represents a sizeable industry in the state and NJIT has specifically identified the biological and biomedical fields as strategic growth areas. The proposed MSPHM fits into this overall strategy.

The 1981 Statewide Plan for Higher Education identified NJIT as New Jersey's comprehensive technological public research university, whose role, among others, is to offer advanced instruction and research in the applied sciences. The Statewide Plan also indicates that NJIT "has 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 pharmaceutical industry is a critical component of the state's economy, and the MSPhM program supports this industry by creating a technically trained workforce. The program will also foster the growth of groups and companies that develop new technologies in the associated fields.

The recent *Report of the Governor's Commission on Health Science, Education, and Training* recognized NJIT's role in "increasing interactions between the fields of biology, engineering, and computer science." It is expected that the proposed MSPhM would enhance this role.

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

There are three graduate programs in the Pharmaceutical Management area in NJ. Two of these (Rutgers and FDU) are MBA specializations while the third is in a school of technology. Brief descriptions of exemplary programs in pharmaceutical management that were evaluated in preparing the proposed program include the following:

- Rutgers University - MBA in Pharmaceutical Management - Provides MBA students with a specialization in either operations management or marketing specific to the pharmaceutical industry. Program is quite successful and is sponsored by at least 7 of the big pharma companies in NJ

- Stevens Institute of Technology – MS in Pharmaceutical Management offered by the Howe School of Technology Management. On the management side this program overlaps the proposed programs, but lacks the technology and processing content of the NJIT program.

- Drexel University – MBA in Pharmaceutical Management is designed to focus on the medical science and health policies subjects specific to the pharmaceutical industry.

- Boston University – MS in Pharmaceutical Management program focuses on policy issues and brings together expertise in infectious diseases, public health, demography, epidemiology, economics, and social sciences in an effort to improve the use of medicines.

Of these the Stevens program is most closely aligned with the program proposed here, in that it has strong emphasis on systems engineering analysis and tools. The MBA based programs focus primarily on preparing graduates for advancement in a management track and the technology focus is quite limited. Our program is designed for individuals who are progressing in a technical management track. A key strength of MSPhM will be its association with the Pharmaceutical Engineering (PHEN) program at NJIT. Appropriate technical curricula from PHEN is combined with our engineering management strengths to create a program that is distinguishable from the existing programs.

4

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

III. Students

A wide variety of jobs titles can be related to the MSPhM program. Typically these would be prefixed with titles such as Project Leader, Manager/Senior Manager, Associate Director or Scientist. The pharma industry is by nature a knowledge intensive place and most jobs have a creative and innovative component to them. The target student population would be individuals who have been working in a pharmaceutical related organization for two or more years, and are now looking for additional skills to further their progress their careers in the industry. Individuals working in a managerial track involved in functions that require a strong analytical and technical background would be candidates for this program.

Admission requirements will be a BS degree in a technical discipline (e.g., Engineering, Computer Science, Informational Technology, Physics etc.). The enrollment is expected to be a mixture of part-time and full-time students.

IV. Resources to Support the Program

A. Course Development

During the development of this program we had discussions with faculty in the MBA Pharmaceutical Management program at Rutgers Newark. The purpose was to highlight the differentiation between the programs and explore the possibility of using some of their courses in the proposed program, so as to make better use of our individual resources. Two Rutgers courses were identified as alternates for the MSPhM courses. One is for a new course and this is listed below. A second course alternates an existing NJIT course and is listed in section V. Other synergies will be explored as we progress.

The program will require the development of at least two new courses. One of these is EM 6H1 Introduction to Healthcare Delivery Systems which is being developed for the MS Healthcare Systems Management program. In addition one of our existing courses (EM635) will be modified to better fit this program, and will be cross listed with PhEn. One new course (EM6P1) is planned specifically for this program. Brief descriptions of the new and modified courses are as follows:

EM 6H1 Introduction to Healthcare Systems & Technologies - Definitions of the key healthcare system functions and entities including: workforce roles and classification, facilities and equipment, information processes, medical technologies, and patient services. Introduction to healthcare finance and economics as they relate to systems analysis.

5

Presentation of healthcare delivery as a system with complex time constrained flow processes.

EM 6P1 Pharmaceutical Product Management –This course covers a number of product management topics as related to the pharmaceutical industry. Topics covered included market analysis, new product launches, sales forecasting, and supply chain and distribution planning. The interaction between all stages of the pharmaceutical value chain and their relationship to system efficiency and costs are examined in detail. The integration of regulatory issues including labeling and quality control are studied.

Students could take the Rutgers 618 Pharmaceutical Product Management course as a substitute (space permitting).

EM/PhEn 635 Management of Pharmaceutical Technology R&D – A systems approach to management of resources, and tasks needed for pharmaceutical technology research and development. Identification, analysis, and evaluation of the operational characteristics and structure of the research laboratory and engineering office; functions of planning, organizing, staffing, direction, control, innovation, and representation; and planning and control theories, techniques, and current practices in R&D management.

B. Faculty

The Department of Industrial and Management Systems Engineering expects to add adjunct faculty in the Engineering Management area as the MSPHM program enrollment grows beyond 12. These adjunct faculty will have practical experience in the pharmaceutical management field and specific expertise in one or more of the proposed new MSPHM courses.

C. Libraries and Computing Facilities

This program will draw upon existing courses and upon the same supplemental literature that supports them and other related NJIT programs. Since healthcare management will be a relatively new topic at NJIT some new books and journals will need to be acquired, NJIT's Van Houten Library has a collection of more than 150,000 books and subscribes to more than 1,000 print periodicals and about 8,000 electronic journals.

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,

6

management, architecture, and other subject areas is accessible though a variety of indexing and abstracting publications in both print and electronic format. Among the databases available on line are CompendexWeb (Engineering Index); Proquest Direct (articles on business, management and industry); Applied Science and Technology Index; and UnCover, a document delivery service that faxes articles within 48 hours.

As a technological research university, NJIT has excellent computing systems, networks and software to support this program. The campus' ATM network backbone connects more than 3,900 nodes in classrooms, laboratories, residence halls, faculty and staff offices, the library, and student organization offices. The network provides access to a wealth of shared information services. Some of these include high-performance computer servers providing CPU cycles for simulation and computational research, disks and data base management systems for storage of large data sets, communications 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 at home, work, or at any of the university's extension sites or elsewhere.

D. Classrooms and Laboratories

No new classrooms would be needed for this program.

V. Curriculum

MASTER OF SCIENCE IN PHARMACEUTICAL SYSTEMS MANAGEMENT (MSPhM)
Department of Industrial and Management Systems Engineering

Requirements for the Program:

Admission Requirements:

- 4 year baccalaureate degree in a technical discipline (e.g., Engineering, Computer Science, Informational Technology, Physics etc.).
- Undergraduate GPA of at least 2.80 on a 4.0 scale or equivalent

Bridge Program: Students who do not satisfy the admission requirements may take a suitable bridge program of appropriate courses. Such courses do not count towards the graduate degree.

Degree Requirements:

A minimum of 30 credits is required for the degree. Bridge courses, if any, will not count toward degree credits. The graduate curriculum consists of six core courses and four electives, as described in the curriculum below. The program relies significantly on knowledge and courses taught in the existing Engineering Management (EM) and Pharmaceutical Engineering (PhEn) programs at NJIT. The proposed curriculum is as follows: The electives may include a 3 credit masters project.

Curriculum:

<u>**Suggested Curriculum for MSPhM**</u>

Core Courses: (18 Credits)

EM 602	Management Science
EM 636	Project Management
IE 673	Total Quality Management
IE 618	Engineering Costs & Production Economics
PhEn 601	Principles of Pharmaceutical Engineering
PhEn 604	Validation and Regulatory Issues in the Pharma Industry

Technical Electives: (12 Credits – Select 4 from 11)

EM 634   Legal, Ethical and Intellectual Property Issues for Engg Mgrs
(Allternate is Rutgers 621 course on Legal, Regulatory, And Ethical Issues In The Pharma Industry - space permitting)

Consultant's Report

NJIT's Proposed M.S. Program in Pharmaceuticals Systems Management

Gaurab Bhardwaj
Assistant Professor of Strategy
& Management
Babson College

Date

May 14, 2008

Report Written By

Gaurab Bhardwaj

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Background

I was invited by NJIT to evaluate their proposed M.S. in Pharmaceuticals Systems Management (MSPSM) program. The program has been proposed by the Department of Industrial & Management Systems Engineering (IMSE).

In addition to documents provided to me, I visited the department on April 24 and 25, 2008. During the trip, I met administrators and faculty members involved with the program, inspected the facilities, and spoke to industry professionals invited for a discussion with NJIT faculty. In writing this report, I am also drawing upon my own expertise in the life sciences industries and my experience in running an executive education program for pharmaceuticals and biotechnology industry professionals.

Recommendation

The MS in Pharmaceutical Systems Management program should be approved.

A.   Objectives

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

They are. The IMSE department has clearly described the program and how it is different from those offered at NJIT and at other institutions. The objectives and underlying principles have been articulated by describing the focus of the program (systems management of the technical, engineering, and operational side of the pharmaceuticals business), content of its courses (technical, engineering, operations, and systems management), its target student population (those with backgrounds in engineering, IT, and science), and the kinds of careers a graduate would pursue (engineering, operational, and technical management).

The objectives are sound because the program prepares students for careers in an important aspect of the pharmaceuticals business that is not covered by programs offered by business schools. Besides granting a valuable degree to students, the program also provides an important service to the New Jersey economy and pharmaceutical industry (a dominant part of the New Jersey economy) by developing skills and knowledge essential to the industry's continued health and growth and thus the state economy's.

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

NJIT is a respected institution of higher education with a strong national and global reputation. While remaining true to its roots in science, technology, and engineering, NJIT has decided to grow by focusing on the biological and biomedical fields, among others. This focus also serves the state's economy and industry. The proposed MS program in pharmaceutical systems management is clearly consistent with NJIT's mission and educational goals. In fact, the program adds greatly to these institutional objectives.

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.

The program will develop skills and knowledge that are directly applicable to one of the most important industries in New Jersey – the pharmaceuticals industry. With the large number of pharmaceutical companies located in New Jersey, students should find employment. Conversations with local industry professionals have underlined the value of such a program to the industry and the employability of the graduates.

In targeting engineers and people with technical degrees who have an interest in managing the technical side of a pharmaceuticals business, the program is different from those offered at

3

business schools, such as the one at Rutgers. In addition to full-time students, the program aims to attract part-time students who already work in the pharmaceutical industry. The latter groups will simply continue their employment while the former group should not have trouble finding employment in a thriving segment of the local economy.

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.)*

No formal market survey was conducted.

→   *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.)*

No employment projections data were used.

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 MSPSM program has 6 required courses and gives students a selection of 11 electives from which to choose 4. These add up to 30 credits. The number of courses and their content are perfectly suited for the proposed program. NJIT offers other 30-credit programs that are successful. There are few programs at other institutions that are similar to the one being proposed due to its engineering and operational focus and in targeting students with backgrounds in engineering, IT, and science. Research is not part of this applied master's degree. However, if so inclined, a student has the option of doing an applied research project in lieu of an elective.

Given the program's focus on technical, engineering, and operational aspects of the pharmaceuticals business, it is different from an MBA and MS degrees offered by business schools. The latter degrees focus on other aspects of the pharmaceuticals business (e.g., finance, accounting, sales, marketing, strategy, etc.). There is thus no overlap between the proposed degree and those offered by business schools.

The MSPSM program complements the pharmaceuticals engineering MS degree offered by NJIT's Chemical Engineering Department. The latter's focus is on manufacturing.

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

The instructional modes are typical of engineering management programs and similar to those in other NJIT programs. About two-thirds of the instruction is through in-class lectures and about one-third involves e-learning. The manufacturing elective involves some lab work in automation. The distribution of the 30 credits required for the MS degree is fairly typical and is the same as other NJIT programs. These 30 credits are split 18 credits for required core courses and 12 credits for electives. The former impart essential knowledge and the latter allow students to pursue knowledge related to their interests and career plans. The total credits and their distribution are consistent with the program and curriculum objectives and for providing a rigorous education.

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

It does, as explained immediately above.

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

The proposed program does not involve certification and the department is not seeking accreditation.

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.)

They are, as explained in A1 on page 3. I do not believe that the requirements are artificially strict, rigid, or discriminatory.

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

The number of courses and credits, and core and elective courses are well-defined and articulated. The standards for completion are consistent with the objectives of the program and also with other programs currently offered at NJIT.

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

As a 30-credit graduate program, the issue of transfer students is not applicable.

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.*

A few courses constituting this program are from among those offered by other academic units within NJIT. Of the six required core courses, two are from those offered by the Department of Chemical Engineering (CE). Of the 11 courses that fall under electives (students have to take 4), two are offered by the CE department and one is taught at the School of Management. The system at NJIT allows students to take courses across academic units and these two units have the capacity for MSPSM students to enroll in their courses. All of these courses have been taught for some time. This is a good means for NJIT to better utilize the investments it has already made and launch a new program with a more sensible amount of investment while not compromising on quality.

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

The program does not have a clinical component.

D.   Students

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

The IMSE department anticipates that about two-thirds of the students will be part-time and one-third will be full-time. Given the applied and professional nature of the MSPSM program, and the close ties between the department and industry, such a ratio will actually add to the quality and goals of the program. Because the classes are in the evening or online, having part-time students will not take away from the program.

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

The program will draw upon such provisions that are already in place by the larger School of Engineering and NJIT.

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

The IMSE department already has two graduate advisors who will suffice for the 10-12 students that are expected to enroll in the new program. If enrollment proves to be much higher, additional personnel will be allocated to these tasks.

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.

The IMSE department faculty members teaching in the new program have PhDs. About two-thirds of the courses will be taught by them. The remaining one-third of the courses will be taught by adjunct faculty members who will be industry professionals. The latter group will have a master's degree in an appropriate discipline and more than 10 years of industry experience. The qualifications of these two kinds of faculty members are appropriate, and desired, to providing high quality education to students.

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.

The IMSE department faculty members are active scholars, engaging in both research and teaching in systems management. This expertise is directly relevant to the proposed program. Faculty members in the CE department are similarly engaged in scholarship that relates to the courses they teach and which are part of the proposed program.

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.

With anticipated enrollment of 10-12 students, four faculty members from the IMSE department will be involved with the new program and two from the CE department. All of these faculty members will be teaching in other programs as well. This allocation of faculty members is appropriate for a program of the size that is being anticipated. If enrollment were to be higher than a dozen students, NJIT administrators have indicated a willingness to add more faculty members to the program.

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 existing support personnel in the IMSE department will suffice in running the proposed program.

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.).

As the program is consistent with NJIT's long-term strategy, NJIT is providing support and commitment. The faculty and support personnel allocated to the program are appropriate.

NJIT has also provided start-up funds of $20,000 to develop new courses and promote the new program. If student enrollment is more than the 10-12 anticipated, NJIT administration will provide resources to hire a new faculty member.

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

There is no such need for funds from the State.

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.

Laboratory and equipment are already in place and used by students enrolled in other programs. These are adequate to also support the proposed program.

2. Comment upon the adequacy of classroom facilities.

They are fine and in place and being used.

3. Comment upon any evidence to suggest that an existing program at the university will be adversely affected in terms of resources by the implementation of the program under review.

There is no likelihood of any other program at NJIT being adversely affected by the proposed MSPSM program. The new program complements the pharmaceuticals engineering (PhEn) program offered by the Department of Chemical Engineering; that program is focused on manufacturing. The MSPSM program focuses on engineering systems and operations. There is some overlap; two required core courses are common to both but the two programs are very different in their educational emphasis and student target population. My discussions with the director of the PhEn program validated this conclusion.

4. Comment upon the accessibility to program facilities by the handicapped.

As a well-established institution of higher education, NJIT's facilities, including those of the proposed program, are handicap-accessible.

I.   Library
Discuss the adequacy of library holdings and other library resources available to support the program and indicate if they are consistent with offering a program of high quality.

As a well-established institution, NJIT already has very good library resources which will be adequate for offering a high quality program in pharmaceuticals systems management.

J.   Computer Facilities
Discuss the adequacy of computer facilities and other computer resources available to support the program and indicate if they are consistent with offering a program of quality.

The computer facilities and resources already available are quite extensive and perfectly adequate for the new program. These resources have long been in place to cater to a variety of programs currently on offer.

K.   Administration
1. Comment upon the administrative structure of the program and indicate if it is sufficiently defined and reasonable.

The proposed program will be offered by a well-established department and within the existing administrative structure. It is sufficient for the effective running of the new program.

2. If inter-institutional or intra-institutional cooperation is involved, describe whether or not the administrative and budgetary responsibilities for the program are clearly defined and adequate.

Two required courses (from among six) and three electives (from among eleven), are currently offered by two other academic units at NJIT. Both have the capacity to take on the additional students from the proposed MSPSM program. The inter-institutional cooperation is limited to students taking classes across departments; it works within the current structure and practices and does not require any additional administrative and budgetary responsibilities.

L.   Evaluation
In what way has an appropriate mechanism been developed to evaluate the success or failure of the program?

The IMSE department is planning to look at the number of students that enroll and their success in placing students in jobs as indicators of success.

May 20, 2008

RESPONSE TO CONSULTANT'S REPORT FOR M.S. PHARMACEUTICAL SYSTEMS MANAGEMENT

Degree Name(s): Master of Science in Pharmaceutical Systems Management

Consultant's Name: Prof. Gaurab Bhardwaj, Faculty Director, Bio-Pharma Program, Babson College, Wellesley, MA 02457

Consultant's Visit Date: April 24, 2008

Date of Consultant's Report: May 14, 2008

Institute's Response:

We would like to thank Prof. Gaurab Bhardwaj for his detailed evaluation of the proposed MS in Pharmaceutical Systems Management (MSPhM). Prof. Bhardwaj has been closely involved with the prestigious MBA in Bio-Pharma program at Babson College, and his insights and observation were very valuable. During his visit he met with a panel of pharmaceutical industry experts at NJIT, and made a presentation on the Babson program.

We are very pleased that his report is so positive. The MSPhM program straddles the technology and management aspects of the pharmaceutical industry. The program at Babson is focused on the management side, and is complementary to NJIT's existing strength on the technology side. In light of Prof. Bhardwaj's close experience and involvement with both biotechnology and pharmaceutical companies, his enthusiastic comments are even more heartening. As he indicated in his report, there is a strong demand for graduates in this field. Additional feedback received from industry has also been enthusiastic, and we anticipate that this new degree will be very popular at NJIT.

The MSPhM consultant's reports makes the following suggestions for enhancing the success of the program. Our program proposal includes each of these.

- *Flexibility for research oriented students to do an applied project-* the curriculum now includes an option whereby students may do a 3 or 6 credit applied research project or in lieu of 1 or 2 electives.

- *Allocation of additional faculty resources as the program grows beyond 10-12 –* as per the program development plan, additional resources will be assigned to the new program as the enrollment grows.

- *Include courses that will be taught by adjunct faculty members who will be industry professionals. –* this strategy has been used in our Engineering Management program and we plan to continue this for the MSPhM program.

The consultant also reviewed the objections raised by the Rutgers MBA in Pharmaceutical Management program. He notes that the MSPhM program "prepares students for careers in an important aspect of the pharmaceuticals business that is not covered by programs offered by business schools", further he finds that "in targeting engineers and people with technical degrees who have an interest in managing the technical side of a pharmaceuticals business, the program is different from those offered at business schools, such as the one at Rutgers". He concludes by stating that "besides granting a valuable degree to students, the program also provides an important service to the New Jersey economy and pharmaceutical industry (a dominant part of the New Jersey economy) by developing skills and knowledge essential to the industry's continued health and growth and thus the state economy's".

PROF. GAURAB BHARDWAJ

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SUMMARY

Gaurab's research, teaching, and consulting expertise are in strategy, innovation, and entrepreneurship in science-based companies, especially those in biotechnology, pharmaceuticals, medical devices and diagnostics, agriculture, healthcare, and chemicals.

The National Science Foundation and the Eleutherian Mills – Hagley Foundation have funded his on-going research program on the "Management of Distant Returns" where he is investigating how people make decisions that are highly uncertain and ambiguous, and whose outcomes take shape over many years. His research, writing, and professional presentations are on discovery processes of corporate scientists, science and strategy for achieving long-term corporate growth, and anticipatory innovation and entrepreneurship.

His work has involved scientists and managers in pharmaceutical, agriculture, and biotechnology businesses. He is currently working, along with the founder of a biotechnology company, on a new way to innovate that anticipates markets.

Gaurab's research has been published in the journals *Management Science, Expert Opinion on Drug Discovery, Chemical Heritage, BioExecutive International,* and as a chapter in the book *Innovating Strategy Process*.

Gaurab is the faculty director of Babson's executive education program "Bio-Pharma: Mastering the Business of Science" for bio-pharma scientists and managers. In addition to teaching competition and strategy in this program, he teaches in the MBA program and in custom programs for Dana Farber Cancer Institute, EMC, and Lucent Technologies

EDUCATION

- PhD, University of Pittsburgh, Pittsburgh, USA

- MBA, Northeastern University, Boston, USA

TEACHING

Foundation strategy course to Evening MBA students

Bio-Pharma: Mastering the Business of Science – Babson's Bio-Pharma program covers the core business and management concepts that are particularly relevant to the biotechnology and pharmaceutical industries. It is targeted to managers in marketing, research, development, finance, business development, human resources, and manufacturing. The intensive program is of key significance to bio-pharma scientists who want to enhance their managerial effectiveness to navigate their company's strategic, financial, marketing, and leadership issues. The program uses a variety of learning approaches, including interactive lectures, panel discussions, case studies, and group exercises. Each session is designed to actively involve participants in the classroom discussion, exploring present and future business and individual development issues in the bio- pharma industry. At the end of the program, participants complete a group project and present their findings regarding the future of the industry.

RESEARCH INTERESTS

Strategy, entrepreneurship, technology management, and innovation issues in science- and technology-based companies, especially biology-driven or life sciences businesses

PEER-REVIEWED ACADEMIC PUBLICATIONS

- Bhardwaj, Gaurab (2007). "From Pioneering Invention to Sustained Innovation: Herbicides at DuPont", *Chemical Heritage*, vol. 25, no. 1, pp. 34-36.

- Bhardwaj, Gaurab (2006). "How the Antihypertensive Losartan was Discovered", *Expert Opinion on Drug Discovery*, vol.1, no. 6, pp. 609-618.

- Bhardwaj, Gaurab, John C. Camillus, and David Hounshell (2006). "Continual Corporate Entrepreneurial Search for Long-Term Growth", *Management Science*, vol.52, no.2, pp. 248-261 (issue focused on entrepreneurship)

- Bhardwaj, Gaurab and Vinay Chowdhry (2005). "The Method of Anticipatory Entrepreneurship", **Frontiers of Entrepreneurship Research**, p.39.

- Bhardwaj, Gaurab, John C. Camillus, and David A. Hounshell (2005). "The Search Process and Dimensions of Long-Term Growth". Ch. in *Innovating Strategy Process*, eds., Steve W. Floyd, Johan Roos, Claus Jacobs, and Franz W. Kellermanns, pp.213-226. Blackwell Publishing, Oxford, UK.

- McCarthy, Daniel J. and Gaurab Bhardwaj (1997). "Nypro, Inc.: Strategy for Globalization", *Case Research Journal*, winter issue, pp. 49-70. (Reprinted in Michael D. Hutt and Thomas W. Speh, 2001, Business Marketing Management, pp. 538-559, 7th edition, South-Western College Publishing.)

- Prescott, John E. and Gaurab Bhardwaj (1995). "Competitive Intelligence Practices: A Survey", *Competitive Intelligence Review*, vol. 6, no. 4, pp. 4-14

WORKING PAPERS & ONGOING PROJECTS

Bhardwaj, Gaurab. "A Process Model of Search in Distant Returns Settings – Studies in Corporate Science".

Bhardwaj, Gaurab and Vinay Chowdhry. "Anticipatory Entrepreneurship".

Bhardwaj, Gaurab and Vinay Chowdhry. "Discovering Latent Needs".

Bhardwaj, Gaurab. "The Empty Corporate Labs"

Bhardwaj, Gaurab. "Growth Possibilities Found, Taken, and Lost".

Bhardwaj, Gaurab. "Pioneering Biotechnology at DuPont, 1902-1925".

Asner, Glen and Gaurab Bhardwaj. "The History of Thermoelectric Materials Research: 180 Years of Moving, Anchored Search".

PH.D. DISSERTATION RESEARCH

"Search for Distant Returns: A Decision Making Process Model from Choices at DuPont for Invention, Entrepreneurship, and Growth"
Unpublished Ph.D. Dissertation, University of Pittsburgh, December 2000.

GENERAL PUBLICATIONS

Bhardwaj, Gaurab (2006). "Anticipatory Entrepreneurship." In 'Promising New Ideas Emerging in Business Today: Observations and Commentary from Babson Professors', *Babson Insight e–Magazine*, November 2006.

Cohen, Allan R., Gaurab Bhardwaj, and Ken Matsuno. (2005). "The Uncertain Future", *BioExecutive International*, May issue, pp. 18-20.

RESEARCH GRANTS

National Science Foundation
Eleutherian Mills – Hagley Foundation

MEDIA COVERAGE

"Interview: Gaurab Bhardwaj", *Effective Executive* magazine, April 2007 issue, pg. 46-48.
"Schools Tackle Bio Exec Shortage", *Mass High Tech: The Journal of New England Technology*, April 23, 2004.

RUTGERS

NEWARK

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14 February 2008

Dr. Priscilla P. Nelson
Provost
New Jersey Institute of Technology
University Heights
Newark, NJ 07102

Dear Provost Nelson,

We appreciate the clarifications that were provided when we met last week regarding the proposals for an MS in Healthcare Systems Management and an MS in Pharmaceutical Systems Management.

MS in Healthcare Systems Management

From our meeting, we understand that the proposal for an MS in Healthcare Systems Management will be revised. The program title and course titles will then fully reflect the program's focus on engineers and engineering skills. The engineering focus will clearly differentiate the program from the currently existing Master's in Public Health (in which Rutgers University–Newark partners with the University of Medicine and Dentistry of New Jersey) with its focus on healthcare management and administration.

Without the emphasis on engineers and engineering, the proposal includes learning objectives and curricula that significantly overlap with the existing MPH program. It also has an identical focus on health care management and is designed for a similar target audience, namely BS qualified health professionals who seek leadership positions in hospitals or other health-related organizations. The objectives of the proposed program would thus overlap with the objectives of the MPH in substance, the emphasis on costs and methods, and in skills-oriented learning outcomes. The objectives of the Rutgers-UMDNJ MPH to train leadership in "the development, implementation, management and evaluation" of health care organizations and programs would be duplicated by the proposed NJIT program which specifies skills in "planning, implementation, project management and evaluation".

The potential areas of duplication are outlined in the chart below:

RUTGERS
NEWARK

Proposed NJIT Ms in Healthcare Systems Management	Existing Rutgers University-UMDNJ Master of Public Health *(Core ©, Required ® and Elective (E) classes)*
Introduction to Healthcare Delivery Systems (proposal for a new course – not existing)	Introduction to Health Systems and Policy ©
Healthcare Information Systems (proposal for a new course – not existing)	Epidemiology © and Computing I, II & III ®, Research Design®; Advanced Informatics and Dental Public Health (e) Radiology Informatics I
EM 602 Management Science	Healthcare Management ®; Management Techniques in Health Administration (e)
EM 636 Project Management	Strategic Planning and Management (e)
HRM 601 Organizational Behavior	Public Organizations (e); Organizational Behavior(e) Human Resources Administration (e)
IE 672 Industrial Quality Control	Environmental Health ©
Technical Electives:	
Healthcare Performance and Quality Modeling (proposal for a new course – not existing)	Performance Measurement (e); Survey of Issues in Quality of Health Care (e)
Legal Aspects of Healthcare Delivery (proposal for a new course – not existing)	Law and Public Health in the United States (e)
Pharmaceutical Product Management	Pharmacoeconomics (e)
EM 637 Project Control	
IE 604 Advanced Engineering Statistics	Biostatistics ©;
IE 650 Advanced Topics in Operations Research	Quality Assurance (e) Human Environmental Risk Assessment (e)

RUTGERS
NEWARK

MS in Pharmaceutical Systems Management

The proposal for an MS in Pharmaceutical Systems Management also appears to duplicate the Rutgers MBA in Pharmaceutical Management. In this case, the core courses duplicate courses already offered at Rutgers. The two courses that NJIT is developing for the new program (Introduction to Healthcare Delivery Systems and Pharmaceutical Product Management) are duplicative of two courses already offered at Rutgers: U.S. Healthcare Systems & Managed Markets, and Pharmaceutical Product Management.

That the proposed NJIT program expects students to have an engineering background was not clear from the proposal. Further discussion is also needed to see if 'course sharing' might be possible. Courses could be taught at Rutgers through a contribution in resources from NJIT, teaching responsibilities could be shared by the two institutions, or the teaching of core courses could rotate between the two institutions. Developing a joint program where qualified NJIT students would enroll in the Rutgers Pharmaceutical concentration is another avenue to explore, since this would create an even more logical use of scarce state resources and expertise.

Section C of the proposal (the list of similar programs in the state) should be corrected to state that the Rutgers Pharmaceutical MBA is sponsored by seven major pharmaceutical companies in New Jersey (not four). The Rutgers program provides training in the broad area of pharmaceutical management, with a secondary specialization in Finance, Marketing, Supply Chain, and IT (not in Operations Management and Marketing, as stated in the proposal).

In sum, we look forward to closer collaboration with you in these respective curriculum areas.

Sincerely,

Dr. Gary Roth
Vice Provost
Academic Programs and Services

c: NJIT: Dana Knox
       Rutgers Business School: Rosa Oppenheim, Mahmud Hassan
       School of Public Affairs and Administration: Marc Holzer, Evan Stark
       Office of Institutional Planning: Jim Burkley

NJIT
New Jersey's Science & Technology University

August 22, 2008

Dr. Gary Roth
Vice Provost, Rutgers Newark
Rutgers, The State University
123 Washington St.
Newark, NJ 07102

Dear Dr. Roth:

It has recently come to my attention that we may have inadvertently neglected to share with you our response to your February 14, 2008 letter regarding our proposed MS in Pharmaceutical Systems Management. I apologize for that oversight and am pleased to attach the response to the concerns raised as well as a revised program announcement. Note – the changes made to our program announcement are indicated in red.

Among the revisions that have been made are to clearly show that our MS in Pharmaceutical Systems Management is designed for students with an undergraduate degree in a technical discipline such as engineering, computer science, information technology, or physics etc. We also acknowledge that the Rutgers Pharmaceutical MBA is sponsored by seven pharmaceutical companies in New Jersey, not four, and that change has also been made.

We hope our response addresses your concerns. We look forward to continued collaboration between our two schools.

Sincerely,

Priscilla P. Nelson
Provost

cc: D. Knox
       S. Saigal
       S. Das

Response to Objections on the M.S. Pharmaceutical Systems Management (MSPSM) program relative to the Rutgers MBA in Pharmaceutical Management

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Following the discussions of our meeting (first week of February) and reviewing the letter of February 14, we have evaluated all the points raised and responded with the following changes. We believe these address and resolve the objections stated in the February 14 letter.

1. The Pharmaceutical industry has a large presence in NJ and is an important part of the states economy. Within this industry, there is a need for managers with skills unique to the pharmaceutical industry. These range from the classical MBA focus to those with a strong engineering management and process operations knowledge focus. The focus of the NJIT program is primarily in the latter category, and for which there is currently an unmet need. While there is some overlap in the middle area, that is to be expected and potentially we could collaborate on these.

    The Rutgers Pharma MBA program website states there is *a new demand for talented, motivated individuals with a special knowledge of the healthcare and pharmaceutical industry. Designed to answer this need, the Rutgers Pharma MBA is a unique gateway to one of America's most respected and socially beneficial industries.* The February 14 letter states that the program provides training in the broad area of pharmaceutical management with secondary specialization in *Finance, Marketing, Supply Chain, and IT.*

    To emphasize the differentiation of the NJIT program with its strong focus on systems engineering and management, and process operations knowledge we have **revised** our program description as follows:

    MS in Pharmaceutical Systems Management - Designed to train and educate professionals for careers in the pharmaceutical industry by providing them with skills in the areas of quantitative systems analysis, pharmaceutical process operations planning and design, and project management and implementation, relative to all technology intensive operations in this highly sophisticated industry. Application areas will include manufacturing operations, systems automation, packaging and distribution, quality control and regulatory compliance, process and product validation, and supply chain management. The curriculum integrates expertise in systems engineering and management methods with pharmaceutical processes knowledge.

    Further, to emphasize the differentiation we have **made revisions** to highlight that the MSPSM program is designed *for students with a BS degree in a technical discipline (e.g., Engineering, Computer Science, Informational Technology, Physics etc.).* Note that several of the process oriented course require this as a prerequisite.

2. The letter indicated that there is course duplication between the two programs. The table below reviews the curriculum for the two programs. We find that the strong focus on systems engineering and management methods and pharmaceutical processes knowledge in the NJIT program is quite clear from the curriculum. This clearly differentiates it from the Rutgers Pharma MBA. These differences are noted as follows and we will **revise** our program documentation to highlight these:

Rutgers Pharma MBA	NJIT MSPSM
CORE & Foundation COURSES • Financial Management • Managerial Economics • Marketing for Decision Making • Accounting for Managers • Operations Analysis • Ethics, Business and Society • Managing People • International Business Environment • Information Technology for Managers • Strategic Management • Law and Legal Environment	**CORE COURSES** • Management Science • Project Management • Total Quality Management • Engineering Costs & Production Economics • Principles of Pharmaceutical Engineering • Validation and Regulatory Issues in the Pharma Industry
ELECTIVE COURSES • U.S. Healthcare System & Pharmaceutical Managed Markets • Pharmaceutical Industry: Issues, Structure & Dynamics • Legal, Regulatory, And Ethical Issues In The Pharmaceutical Industry • Pharmaceutical Marketing Research • Pharmaceutical Product Management • Managing the Pharmaceutical Sales Organization	**ELECTIVE COURSES** • Legal, Ethical and Intellectual Property Issues for Engg Mgrs • Management of Pharmaceutical Technology R&D • Project Control • Pharmaceutical Product Management • Introduction to Healthcare Delivery Systems • Systems Analysis and Simulation • Supply Chain Engineering • Manufacturing Systems • Pharmaceutical Facility Design • Pharmaceutical Packaging Technology • Organization Behavior

- The Rutgers program includes **a single core course** (*Operations Analysis*) that provides a classical aggregated view of operations management, while in the elective set there are none with an operations focus. The NJIT program on the other hand includes two core courses (*Management Science, Total Quality Management*) and two in the elective set (*Systems Analysis and Simulation, Supply Chain Engineering*) all with a strong technical oriented operations management focus.

- The NJIT program provides students with training in advanced pharmaceutical production processes and includes two core courses (*Principles of Pharmaceutical Engineering, Validation and Regulatory Issues in the Pharma Industry*) and three in the elective set (*Manufacturing Systems, Pharmaceutical Facility Design, Pharmaceutical Packaging Technology*) all with a strong technical focus. **There are no equivalent courses in the Rutgers program.**

- The Rutgers program includes one core course (*Marketing for Decision Making*) and three elective courses (*Pharmaceutical Marketing Research, Pharmaceutical Product Management, Managing the Pharmaceutical Sales Organization*) with a sales and marketing focus. The NJIT program on the other hand includes **only one course** (*Pharmaceutical Product Management*) with a similar focus.

- There is some duplication in foundation courses (e.g., i. *Managing People vs. Organizational Behavior or ii. Managerial Economics vs. Engineering Costs),* but that is to be expected in a graduate level program related to management.

3. There are two courses in the elective pool where there is significant duplication in content (*Pharmaceutical Product Management, Legal Regulatory & Ethical Issues*). The letter of February 14 mentions "course sharing" and we are very **interested in exploring this possibility** and would be amenable to our students taking the identified courses at Rutgers.

4. We will **revise** our program proposal to correctly state that the Rutgers Pharmaceutical MBA is sponsored by seven pharmaceutical companies in New Jersey and not four.

5A. Enrollment Update

5B. Status of Gateway Plan and Greek Village

5C. NCAA Certification

5D. Operating Statement
Year to Date

A

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

| | RESTRICTED YEAR TO DATE | | (17%) | | | | UNRESTRICTED YEAR TO DATE | (17%) | |
| | AMOUNT | | % OF BUDGET | | | | | % OF BUDGET | |
BUDGET	2008/2009	2007/2008	2008/2009	2007/2008		BUDGET	AMOUNT	2008/2009	2007/2008
					REVENUES				
					Education and General				
					Tuition and Fees	$ 105,586 $	56,831	54%	53%
$ 67,830 $	7,565 $	8,129	11%	13%	Appropriations, Contracts, Gifts	80,685	11,877	15%	16%
					Other sources	7,595	988	13%	17%
					Allocated Balances	2,375	451	19%	24%
67,830	7,565	8,129	11%	13%	TOTAL	196,241	70,147	36%	35%
					Auxiliary Enterprises	12,260	5,347	44%	46%
67,830	7,565	8,129	11%	13%	TOTAL REVENUES	208,501	75,494	36%	36%
					EXPENDITURES				
					Educational and General				
	95	2,144			Instruction	71,800	9,071	13%	12%
	6,440	4,886			Research	8,500	931	11%	17%
	67	61			Public Service	3,300	380	12%	18%
	14	41			Academic Support	20,700	2,483	12%	13%
	641	613			Student Services	13,700	1,973	14%	16%
	22	41			Institutional Support	27,900	3,774	14%	13%
					Operation and Maintenance of Physical Plant	17,734	2,327	13%	13%
	286	343			Financial Aid to Students	18,197	291	2%	2%
67,830	7,565	8,129	11%	13%	TOTAL EDUCATIONAL & GENERAL	181,831	21,230	12%	12%
					TRANSFERS	14,410	2,342	16%	15%
67,830	7,565	8,129	11%	13%	TOTAL	196,241	23,572	12%	12%
					Auxiliary Enterprises	6,948	1,251	18%	18%
					Auxiliary Transfers	5,312	885	17%	17%
					TOTAL AUXILIARY	12,260	2,136	17%	18%
67,830	7,565	8,129	11%	13%	TOTAL EXPENDITURES & TRANSFERS	208,501	25,708	12%	13%
					EXCESS OF REVENUES OVER				
$ 0 $	0 $	0			EXPENDITURES AND TRANSFERS	$ 0 $	49,786		

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

	CURRENT MONTH AMOUNT	YEAR TO DATE ACTUAL	BUDGET	ACTUAL YEAR TO DATE	17% PERCENT OF BUDGET INCLUDES ENCUMBRANCES PRIOR YEAR	CURRENT YEAR
ACADEMIC						
Salaries & Fringe Benefits	$ 13,163	$ 13,163	$ 103,323	13%	82%	82%
Equipment Purchases	174	174	2,816	6%	21%	31%
Financial Aid to Students	291	291	18,197	2%	2%	2%
Other Operating Expenses:						
Materials & Supplies	188	188	1,600			
Travel & Development	239	239	2,050			
Library Collections	1	1	1,064			
Other General Operating	809	809	8,686			
Total Other Operating	1,237	1,237	13,400	9%	38%	33%
TOTAL ACADEMIC	14,865	14,865	137,736	11%	66%	65%
SUPPORT						
Salaries & Fringe Benefits	4,146	4,146	26,289	16%	84%	100%
Equipment Purchases	12	12	417	3%	25%	7%
Utilities	1,451	1,451	9,005	16%	97%	98%
Other Operating Expenses:						
Materials & Supplies	102	102	920			
Travel & Development	12	12	489			
Other General Operating	191	191	4,600			
Total Other Operating	305	305	6,009	5%	56%	67%
TOTAL SUPPORT	5,914	5,914	41,720	14%	81%	94%
TRANSFERS	2,342	2,342	14,410	16%	100%	100%
TOTAL ACADEMIC, SUPPORT & TRANSFERS	23,121	23,121	193,866	12%	72%	74%
Auxiliary Enterprises	1,251	1,251	6,948	18%	88%	80%
Auxiliary Transfers	885	885	5,312	17%	100%	100%
TOTAL OPERATING EXPENSES	25,257	25,257	206,126	12%	73%	75%
EXPENSES FROM ALLOCATED FUNDS	451	451	2,375	19%	100%	100%
TOTAL UNRESTRICTED EXPENSES	25,708	25,708	208,501	12%	72%	74%
RESTRICTED	7,565	7,565	67,830	11%	13%	11%
TOTAL EXPENSES AND TRANSFERS	$ 33,273	$ 33,273	$ 276,331	12%	57%	59%

5E. Schedule of Short Term Investments

NEW JERSEY INSTITUTE OF TECHNOLOGY

SCHEDULE OF INVESTMENTS
AS OF AUGUST, 31 2008

DATE PURCHASED	MATURITY DATE	RATE	TYPE	WACHOVIA BANK	CITY NATIONAL BANK	MERRILL LYNCH	JP MORGAN CHASE	TOTAL
--	OVERNIGHT	1.37	CMA*			$ 4,240,427		$ 4,240,427
7/25/2008	1/23/2009	2.96	CD		$ 500,000			500,000
--	VARIES	2.43	PRIME MONEY MARKET				$ 2,258,203	2,258,203
--	VARIES	2.56**	MONEY MANAGER	$ 11,318,199				11,318,199
--	OVERNIGHT	2.45**	MONEY MARKET	476,707				476,707
--	OVERNIGHT	2.59	REPO*	18,444,000				18,444,000
				$ 30,238,906	$ 500,000	$ 4,240,427	$ 2,258,203	$ 37,237,536
							Crossfoot	$ 37,237,536

INVESTMENT AS OF AUGUST, 31,2007 WERE $32,605,439
* MONIES IN THIS ACCOUNT ARE INVESTED IN GOVERNMENT SECURITIES
** NET OF FEES

5F. Report of Gifts and Fund Raising Activities

Summary - 2006 (7/1/2005 to 6/30/2006) vs 2007 (7/1/2006 to 6/30/2007) vs 2008 (7/1/2007 to 6/30/2008)

Comparison of Total Giving Year to Date:

	2006	2007	2008
All Sources:	$7,159,033	$8,205,298	$13,318,420
All Sources without Gifts in Kind:	$5,253,015	$7,106,235	$11,247,382
Matching Gifts:	$142,221	$185,195	$164,364

Comparison by Donor Type Year to Date for 2006, 2007 and 2008

Category	2006 $ Giving	2006 %	2006 # Donors	2007 $ Giving	2007 %	2007 # Donors	2008 $ Giving	2008 %	2008 # Donors	% Donors	% Dollars
Alum	$1,652,738	23.09	4,602	$1,902,347	23.31	4,564	$2,959,300[1]	22.19	4,606	+1	+55
Corp	$3,932,086	54.92	316	$3,332,288	40.61	404	$4,125,668[2]	31.07	435	+8	+24
Foundations	$663,541	9.27	25	$1,384,605	16.87	25	$3,147,561[3]	23.60	33	+32	+127
Friends	$612,562	8.56	524	$850,645	10.25	564	$2,765,218[4]	20.74	806	+43	+225
Other	$298,106	4.16	23	$735,413[5]	8.96	26	$320,672	2.40	20	-23	-56
Totals:	$7,159,033	100.0	5,490	$8,205,298	100.0	5,583	$13,318,420	100.0	5,900	+6	+62

Year End Totals

	Total Dollars	% of FY06 Funds Raised	% of Year Elapsed
2006	$7,159,033	100%	100%
2007	$8,205,298	115%	100%
2008	$13,318,420	186%	100%

[1] Alumni – Spatz $1M, Burt $192K, Saporito $100K, Stark $90K
[2] Corporations – Anonymous GIK $1.9M
[3] Foundations – Stabile $1.5M, Kessler $474K, Leir $400K
[4] Friends – Maurawski $1.7M, Metz $202K, Nudenberg $179K, Schnack $150K
[5] Other – Student Senate $300K, Vanguard (Dow) $200K

5G. Update on Celebration '08

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 NOVEMBER 6, 2008 AT 9:30 AM, EBERHARDT HALL NJIT ALUMNI CENTER BOARD ROOM.