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## I

# INTRODUCTION

The Newark Technical School was founded in 1881 to educate apprentices in local industries. Ninety students were enrolled in the tuition-free evening program that taught mathematics, basic sciences and drawing. In 1919, bachelor's programs in three engineering fields were introduced, and in 1930, the institution was renamed the Newark College of Engineering.

From these beginnings as a small, single-purpose, commuter institution, New Jersey Institute of Technology has evolved into the State's comprehensive technological research university. It serves approximately 7,500 undergraduate and graduate students in four colleges: the Newark College of Engineering, the School of Architecture, the College of Science and Liberal Arts, and the School of Industrial Management, on a modern, increasingly residential, urban campus. Throughout its history, the institution has provided a broad-based education with a strong focus on technology, embraced public service as part of its mission, and anticipated and responded to changes in the educational, economic, scientific and social environment. Within the context of these consistent themes, there have been many changes over time. The evolution was steady but relatively slow in the early years. In recent decades, the pace has quickened.

At the time of the 1972 Middle States visit, a planning document addressed the anticipated transition from an engineering college to a technological university. By 1982, New Jersey Institute of Technology had emerged as such a university. Degree programs in architecture, computer science and other non-engineering fields had been introduced. Graduate studies were expanding. And research activities had taken on greater importance. A

Separately Budgeted Research program was initiated to provide seed money for promising projects and, in some cases, for the establishment of interdisciplinary research centers.

In 1985, then-Governor Thomas Kean, recognizing NJIT's "unprecedented" development, challenged the university to achieve new levels of excellence. The momentum picked up partly as a result of this challenge and the significant State financial support that accompanied it. The difference was apparent not only in the pace, but in the scope and magnitude of the changes. Important targets were set and rapidly exceeded. As a result, NJIT enjoys a growing national reputation. A review of the major developments over the last five years is provided here not only as evidence of the university's progress, but as a context for the analysis and plan that follow.

## Teaching and Learning

- Since 1987, more than a dozen new degree programs were initiated, all consistent with NJIT's mission and in response to identified needs: B.S. degrees in applied physics, applied mathematics, computer engineering, and science, technology and society (STS); B.S. and M.S. degrees in management and manufacturing engineering; M.S. degrees in biomedical engineering, and occupational safety and health engineering; M.S. and Ph.D. degrees in transportation and environmental science; and the Ph.D. in computer science. Also consistent with the university's mission and changing needs, significant changes were made to several existing programs, and the B.S. program in surveying and the pre-associate degree certificate programs were eliminated.

- The School of Industrial Management, NJIT's fourth college, was established in 1988, with a focus on industrial competitiveness and the Management of Technology.
- An Honors Program was established and presently enrolls nearly 170 academically talented students; graduates of this rigorous program have gone on to some of the nation's most prestigious graduate schools and corporations. In 1990, a new component was added which allows honors students to participate in accelerated B.S./M.D. and B.S./D.D.S. programs offered in conjunction with the University of Medicine and Dentistry of New Jersey.
- The faculty developed General University Requirements constituting core learning for all students. Concurrently, procedures were simplified for revising a curriculum so that departments in rapidly changing fields can modernize offerings as necessary.
- Beginning in 1985, NJIT provided all incoming freshmen with microcomputers and extensive software for their personal use while enrolled, becoming the first public higher education institution in the nation to do so; in 1987, students began to assemble their computers as part of the pre-registration process; and in 1990, they were provided with PC/AT's.
- A Master Teacher program was established that enables faculty to work in pairs to observe and strengthen one another's skills. An annual Excellence in Teaching program was also initiated to recognize and reward outstanding faculty.
- The position of Dean of Freshman Studies was created and filled to provide a support system for incoming students. The dean works closely with teachers of freshman classes, coordinates academic advising for the university and has developed an early warning and intervention system for at-risk, first-semester students.

- The U.S. Department of Education (DOE) awarded NJIT a five-year \$850,000 grant to expand and enhance the university's Cooperative Education program. By 1990-91, 375 students were participating in co-op programs at 204 organizations throughout the State and region.
- Established in 1988, NJIT's Center for Distance Learning utilizes cable television, instructional television fixed service (ITFS), satellite broadcast, VHS tape circulation, computerized conferencing and other media to provide credit and non-credit instruction on a statewide and nationwide basis. In 1990, NJIT joined the National Technological University (NTU) and offered its first graduate course via satellite.

## Research and Graduate Studies

- Externally funded research increased more than 100% in five years; from \$6.8 million in 1985-86 to \$13.7 million in 1990-1991.
- Research activities in the critical area of environmentally hazardous substance management have expanded significantly. A U.S. EPA-supported research center for federal regions I and II and a State-funded Technical Assistance Program were added to the existing NSF Industry/University Cooperative Research Center and the New Jersey Commission on Science and Technology Advanced Technology Center. According to 1991 NSF data, support for the NJIT center was more than double that of any of the forty-five other Industry/University Cooperative Research Centers in the nation. The program at NJIT now serves as an international model, working closely with centers in Lyons, France and Belfast, Ireland.
- The Center for Manufacturing Systems was established in 1987 and designated as an Advanced Technology Center of the New Jersey Commission on Science and Technology. A cadre of strong research faculty serve as fellows of the Center, and a technology transfer component is rapidly expanding.

- Additional research centers were established in microelectronics, transportation, microwave and lightwave engineering, and communications and signal processing. Each of these was developed by faculty bringing together a core of researchers to focus on areas of common critical concern.
  - A \$100 million building program included three major new research facilities: The Otto H. York Center for Environmental Engineering and Science; the Microelectronics Research Center, housing a Class 10 Clean Room and a Molecular Beam Epitaxy facility; and the William Guttenberg Information Technologies Center, the largest building on campus, which houses departments and programs related to advanced computing technologies, including a flexibly automated manufacturing laboratory.
  - An 80,000 square foot building to house a new library, the School of Industrial Management, and Admissions, and an Electrical Engineering Building addition are currently under construction. The new library will expand current shelf space by 30%, incorporate the latest in advanced library technologies, and make possible extensive future expansion.
  - Graduate enrollment increased from less than 20% of the total in 1985 to approximately one-third in 1991. Most of the growth was among master's degree students, but the number of doctoral students has also shown steady growth in the last several years.
  - An Assistant Vice President for Academic Affairs-Graduate Studies was engaged as part of a reorganization designed to improve administration of the greatly expanded graduate unit.
- Student Diversity**
- Minority full-time undergraduate enrollment increased more than fourteen percent between 1986 and 1991. There were 643 Black and Hispanic undergraduates in 1986, comprising 20.1% of the total. The comparable figures five years later were 735 minority students representing 22.6% of the total full-time undergraduate population. Much of the growth occurred during a period of generally declining minority enrollments statewide and nationwide.
  - Project CAP, a comprehensive career advancement plan for women and minorities, was established by the Office of Co-operative Education and Internships. More than 200 undergraduates benefit from this program of career counseling, corporate mentoring, and work opportunities.
  - The position of Assistant Vice President for Enrollment Planning was created and filled in 1987 to address the increasingly important roles of marketing and student recruitment.
  - The Newark Scholars Program was established in 1989 to provide scholarships and academic support for promising graduates of Newark high schools. A similar program was established the following year in conjunction with NJIT's Black Engineering and Technology Alumni Association (BETAA); BETAA Scholars are graduates of public high schools in Newark and surrounding communities perceived to be at greater academic risk than the typical Newark Scholar. BETAA members serve as mentors to the participants.
  - Owing largely to the increasing graduate population, the student profile has become more international. In an effort to combat racism and celebrate NJIT's rich cultural diversity, World Week was initiated in 1988. Five days of guest lectures, workshops, performances, craft and food festivals, and more are shared by the entire university community and, for the past two years, by our neighbors at the Newark Campus of Rutgers University.

### Faculty and Staff

- Six State-funded chairs were established and filled by distinguished scholars in

microelectronics, biotechnology, computer science, manufacturing productivity, management of technology, and architecture and building science. Two NJIT Foundation chairs in optoelectronics and applied mathematics were similarly created.

- Nearly 100 new tenure-track faculty were hired over the last five years, the majority in fields identified by the New Jersey Commission on Science and Technology as critical to the State's economic future.

- The position of Vice President for Human Resources was created and filled in recognition of the importance of this function.

- A comprehensive set of employee support programs was introduced in 1990-91. It includes retirement and benefits seminars, a wellness program, and an employee assistance program (EAP) headed by an EAP Director.

### **Campus Life**

- Cypress Residence Hall was opened in September 1990, doubling the residential student body and contributing significantly to a sense of campus community. This eight-story, 432-bed facility is another component of the university's major building program.

- An addition to the Entwisle Physical Education Building and a major rehabilitation of the existing building were completed in 1990. The new facilities are designed in large measure to serve the needs of a growing women's population on campus.

- Police and security staff have been significantly expanded and, with a \$600,000 grant from the State, all campus security systems are in the process of being upgraded.

- NJIT has become one of the most computing intensive campuses in the nation. In 1986, there were one mainframe, twelve minicomputers, 21.7

megabytes of memory, 6.6 gigabytes of disk capacity, 280 terminals and several hundred microcomputers. Comparable 1991 figures are three mainframes, thirty minicomputers and more than 200 workstations, over 4.0 gigabytes of memory, 100 gigabytes of disk capacity, 320 terminals and 4,200 microcomputers. In 1989, the campus became fully networked, linking all university computers with more than 2,500 nodes offering financial, human resource, alumni and student information systems and electronic mail.

### **Public Service**

- Participation in pre-college programs has tripled since 1985, with NJIT's Center for Pre-College Programs now recognized as a national model. Approximately 3,000 4th to 12th graders and their teachers participate in more than thirty programs annually. The mostly minority students are often economically and educationally disadvantaged. The vast majority go on to college, most often pursuing careers in science and technology.

- Initiated in 1990, NJIT's Service Corps involves students, faculty and staff in academically integrated and extracurricular community service activities. More than 200 students participate in such projects as the design and development of low cost housing, preparation of an advertising plan for a Newark-based food distribution center, and research for a social service agency on teen drug use and suicide.

- An Unemployed and Dislocated Workers Program was initiated in 1991. More than fifty unemployed New Jersey professionals are enrolled in NJIT courses in order to improve their skills. The program is offered on a tuition free, space available basis.

### **Economic Development**

- A Vice President for Economic Development was added to the administrative structure

specifically to implement university mission-related approaches to advancing local and statewide economic activity.

- In cooperation with the other public colleges and universities in Newark, NJIT was instrumental in planning for the development of University Heights, the neighborhood in which the institutions are located. Construction of more than 1,600 units of low, moderate and market rate housing and related commercial facilities is in progress.

- Plans have been completed for the development of a University Heights Science Park to attract private investment in new office and laboratory facilities in close proximity to the universities. As much as \$200 million to create 1.4 million square feet of space is envisioned.

- In 1988, NJIT established the Enterprise Development Center, a small business incubator, to assist technology-based firms start up and grow with the aid of university resources. The facility houses sixteen businesses and four non-profit organizations. Four of the businesses are owned by minorities and two by women.

- In 1986, NJIT established the Procurement Technical Assistance Center with funding from the U.S. Department of Defense to assist small and medium-sized firms in competing for federal contracts. The Center presently serves a base of more than 1,500 companies, aiding them in securing \$18 million in contracts annually.

- Technology transfer centers in computing and information technologies, manufacturing, and hazardous substance management also serve hundreds of businesses and organizations throughout the State.

## Resource Development

- In 1990, the completion of a five-year \$34 million fundraising campaign was announced, one year ahead of schedule and more than \$7

million over the original goal.

- The first three \$1 million individual gifts were received in 1990 and 1991. An endowment campaign was initiated in 1991.

- Annual contributions from corporations, alumni and friends surpassed seven million dollars for the second consecutive year; a record of \$7.2 million was reached in 1990-1991.

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The challenge from Governor Kean was for NJIT "to take its place among the nation's top comprehensive technological universities." There is considerable evidence that significant progress has been made toward this goal as measured by the preceding list of accomplishments, as well as by the success of NJIT's students and graduates. Since 1987, students have won regional and national competitions in chemical engineering, computer science, mechanical engineering design, and marketing, received awards for their outstanding work from professional engineering and management societies, and been named to the Academic All-American Team. And in 1990, a graduating senior became the first NJIT student to receive a National Science Foundation Graduate Fellowship; he is presently enrolled in the doctoral program at Stanford University.

Alumni of NJIT, who comprise about 25% of New Jersey's engineering workforce, are employed in significant numbers by such major corporations as AT&T, General Electric, Public Service Electric & Gas, Digital Equipment Corporation, and IBM. More than forty percent of employed NJIT alumni hold managerial or supervisory positions, including ten percent who are presidents or owners of companies. Federal and State government agencies also employ many NJIT alumni; one graduate was recently nominated by President Bush to the Nuclear Regulatory Commission.

Perhaps the most compelling measures of progress, however, are the increasing indications of NJIT's positive recognition well beyond New

Jersey. The recent growth in research support includes several large grants from the National Science Foundation. Collaborative research relationships now involve Cornell, Penn State, Tufts and Princeton Universities, as well as Massachusetts Institute of Technology and California Institute of Technology. NJIT is the lead institution in several of these consortia. Major equipment gifts from industry and an increase in the size of individual donations constitute yet another strong statement of NJIT's growing reputation. Faculty recruitment efforts have also been increasingly successful, with recent additions from MIT, Rensselaer, Purdue, Northwestern, the University of Paris and AT&T Bell Laboratories.

Meeting the challenge to achieve national status, however, was never viewed as an end in itself. It is rather an important means of achieving what has always been NJIT's most important goal — educating students for fulfilling professional and personal lives. How this is accomplished continues to change. As a result of a carefully designed and developed model, NJIT is now a comprehensive technological research university. As the institution has evolved, the students have also changed. They are not only more diverse, but anticipate entering a wider range of professions with greater needs in terms of the responsibilities they are likely to assume in the decades ahead.

NJIT has made extensive efforts in recent years to prepare its graduates for a rapidly changing professional environment. We have offered students the opportunity to develop advanced computing skills, to gain hands-on industrial experience through cooperative education, to participate in applied research and technology transfer projects, and to study management in the context of technological developments. We have also identified a core of general knowledge which every student is expected to acquire. This broad-based approach reflects the philosophy of Allan Cullimore, head of the Newark College of Engineering from 1920 to 1947, who asserted that the engineer bears a duty as a citizen perhaps greater than that of

other professionals as a result of a specialized education in both rational and creative thought.

It is this same approach that will guide the university as it moves into the next century. Individuals who understand the new technologies and their implications, who can apply their knowledge broadly — in diverse settings and in rapidly changing environments — will surely be the leaders of the future. Educating these leaders is the essence of NJIT.

In the decade ahead, the university will further focus its efforts on preparing professionals for leadership in a global economy. The intent is to provide a solid foundation of knowledge within each field, but also to impart to graduates a number of critical characteristics that transcend the disciplines. These include an understanding of what is learned in broader context, including the urban, regional and, especially, global implications of new knowledge; a code of ethics; the ability to communicate effectively; a commitment to lifelong learning; and the flexibility to accept ambiguity and change, including the possibility of altered career directions.

To achieve these ends requires, at a minimum, three kinds of resources: strong students, committed faculty and appropriate levels of funding. To garner these resources calls for ever wider recognition of who we are, what we do and how effectively we do it. Gaining national status thus enhances NJIT's ability to reach its goals.

In large measure, NJIT accomplished what it set out to do five years ago and, in the process, laid a solid foundation for what is now proposed. But progress did not occur without problems or with comparable success in all areas. Four major areas of concern have been identified. Steps have been taken to address each, with still more planned.

1. The increase in graduate enrollments has had a positive impact on NJIT's ability to recruit faculty and on the array of courses offered, but it also significantly escalated demands on the administration. While staffing was expanded,

adequate systems and safeguards commensurate with the rate of growth were not instituted in a timely fashion. As a result, quality control was impeded for a period of time. Selected personnel were subsequently asked to leave, and the former Graduate Division was reorganized in 1990. The following year, an external reviewer reported positively on the administrative changes, reinforcing particularly the newly instituted quality control measures.

2. The development of the library did not keep pace with the needs of a rapidly growing research university. The recent appointment of a University Librarian, current construction of a new library, enhancement of the consortial relationship with Rutgers University, and rapid advances in technological access to information are designed to address this concern.

3. The enrollment of women has levelled off at about fifteen percent of full-time undergraduates over the last five years. The percentage is slightly less in engineering. This pattern is reflective of national trends although a little lower than the average, owing, in part, to NJIT's location. The two newest NJIT programs directed at this problem are a National Science Foundation-funded project to increase the number of women transfers from community colleges and a regularly scheduled series of interviews with freshman women to explore perceptions, identify areas of concern and address needs.

4. The recruitment of minority and women faculty has been disappointing. With the limited pool of Blacks, Hispanics and women in scientific and engineering fields, this is a common concern of technological institutions and one with which we continue to grapple.

As we plan for the next five years and beyond, our central theme will be the education of professionals for the 21st century. A related theme will be the institutionalization of what has been gained over the past decade of rapid development. We will also continue to focus attention on the four problem areas and their continued improvement.

The foreseeable future will be characterized by the integration of NJIT's new resources and programs to further strengthen its place as a comprehensive technological research university. Prioritization and more effective use of resources are necessary, especially because of the economic downturn in New Jersey that has resulted in significant cutbacks in State support for higher education. The vision for NJIT is in no way diminished. The university's goals remain ambitious, although progress may be less dramatic for some period of time.