A. Introduction

The Institute of Technology (IT) is the University’s second largest college with more than 6,800 students (about 4,400 undergraduates and 2,400 graduate students), and approximately 400 faculty members. The college typically produces about 800–900 bachelor’s, 400 master’s and 150–200 doctoral degrees each year. 25% of the University of Minnesota’s prestigious Regents Professors reside in IT. Twenty-seven IT faculty have been elected to the National Academy of Engineering and 12 have been elected to the National Academy of Sciences.

IT’s structure is unique among the country’s major research universities in that it includes engineering, mathematics, and the physical and computational sciences in a single unit. This is an advantageous combination, as the boundaries between pure science and engineering continue to disappear. IT’s 12 departments include seven engineering departments (counting Computer Science and Engineering), four science departments, and mathematics. In addition, there are 24 centers, including a National Science Foundation (NSF) Materials Research Science and Engineering Center, an NSF Science and Technology Center (the Center for Earth-Surface Dynamics), the NSF-funded Institute for Mathematics and Its Applications, and the Army High Performance Computing Research Center.

IT’s mission is to provide a rigorous and stimulating education for its undergraduate and graduate students; to provide programs of instruction in engineering that meet nationally accepted standards for practice of the profession of engineering; and to provide a rigorous and stimulating education for majors in other colleges for whom IT provides instruction in mathematics and physical science. IT’s basic and applied research programs sustain its educational programs, enrich modern culture, improve professional practice, and create the knowledge and know-how that are essential to our increasingly technological society and the maintenance of our desired standard of living. The college’s service and outreach programs provide expertise to the state’s industry and enhance education in science and mathematics in grades K–12. Graduate level courses are provided by University-Industry Television for Education (UNITE) to several companies and University of Minnesota Rochester.

The research productivity of IT’s faculty is high: In 2002-03, 540 grants totaling more than $71 million were awarded to the college. Research expenditures for the same year were approximately $77 million.

The Institute of Technology (“TIOT”) consists of 31 budgeted areas:
- TECHNOLOGY, INSTITUTE OF-ADM
- TECHNOLOGY, INSTITUTE OF-DEV
- TECHNOLOGY, INSTITUTE OF-SSS
- AEROSPACE ENGINEERING & MECHANICS
- ARMY HPC RESEARCH CENTER
- ASTRONOMY
- BABBAGE INST FOR HIST OF INFORMATION PROC
- CHEMICAL ENGINEERING & MATERIALS SCIENCE
- CHEMISTRY
- CIVIL ENGINEERING
- COMPUTER SCIENCE & ENGINEERING
- EDUCATIONAL PROGRAMS, IT CENTER FOR
- ELECTRICAL & COMPUTER ENGINEERING
- GEOLOGICAL SURVEY, MN
- GEOLOGY & GEOPHYSICS
- CHARACTERIZATION FACILITY
- MATH & ITS APP, INSTITUTE FOR
- MATHEMATICS, SCHOOL OF
- MECHANICAL ENGINEERING
- NANOFABRICATION CENTER
- PHYSICS & ASTRONOMY, SCHOOL OF
- SCIENCE & TECHNOLOGY, HISTORY OF
- ST ANTHONY FALLS LAB
- TECH LEADERSHIP, CTR FOR DEV
- THEORETICAL PHYSICS INSTITUTE
- UNITE
- BIOMEDICAL ENGINEERING
- U OF M MAT RSRCH SCI/ENG CTR
- INDUSTRIAL PARTNERSHIP FOR RESEARCH
- MN SUPERCOMPUTER INSTITUTE
- DIGITAL TECHNOLOGY CENTER

The compact between the Executive Vice President and Provost and the Dean of the Institute of Technology for 2003–04 includes the following:
B. Update – Major Long-Term Goals/Priorities from Previous Compacts

IT will continue working to fill the open faculty positions that develop normally each year through retirements, resignations, and deaths (the annual faculty turnover rate is typically between 3 and 4%). The goal is to maintain the ranking of chemical engineering while strengthening the other academic programs in the college. This will be accomplished by adding faculty to strategic areas for departmental balance in teaching and research. Several initiatives aimed at meeting this objective are in progress, as follows.

1. The Materials Initiative

The “Materials Initiative” is designed to strengthen materials science and engineering research and teaching across the college by hiring, over a three-year period, three entry-level faculty in materials science/engineering. The recent establishment of an NSF Materials Research Science and Engineering Center (MRSEC) at the University of Minnesota adds strength to this initiative, as does the University’s “Digital Technology Initiative” (described below).

An IT Materials Research Council was established to implement the Materials Initiative. The Council, which had representatives from every department in IT, was charged with the responsibility of developing a hiring plan designed to make the college one of the top ten centers for materials research in the country. Every department was encouraged to bid on the entry-level faculty positions included in the initiative.

Two of the three positions have been filled, both in the Department of Chemical Engineering and Materials Science, one in 2000–01 and the other in 2001–02. One of the two positions is in the area of magnetic materials and the other in the area of computational biological materials. The latter person will also contribute to the Digital Technology Initiative.

The search for the materials third position unfortunately had to be canceled during 2002–03 because of University-wide retrenchments made necessary by the State’s budget shortfall. Nevertheless, the Materials Initiative can be considered a success in that it resulted in the addition of two outstanding junior faculty, both of whom contributed significantly to the recent five-year renewal of the Minnesota MRSEC. More time will be needed to assess whether the initiative can achieve its aim of establishing IT as one of the top ten centers for materials research in the U.S.

2. The Digital Technology Initiative

The Digital Technology Initiative is a component of the University’s program to renovate Walter Library as a science and engineering library and to create a Digital Technology Center. This initiative, funded through the University’s 1998 Supplemental Request to the Legislature, will involve the hiring of 14 new faculty in various areas of digital technology by the end of 2004. The purpose of the initiative is to form a Digital Technology Center at the University to help the State of Minnesota regain its position of leadership in computer and electronic technologies. The center was administered through the Office of the Vice President for Research through June 30, 2003. Beginning in 2003–04, the center will be administered through the Institute of Technology.

Twelve of the faculty hired under the Digital Technology Initiative will be in IT, and two in the Carlson School of Management (in the area of electronic commerce). Nine of the IT faculty have been hired to date—two in the Department of Computer Science and Engineering (data mining and data analysis for genomics applications; software engineering), three in the Department of Electrical and Computer Engineering (wireless communications; telecommunications and optical electronics), and one each in the Department of Chemistry (biological chemistry), the Department of Chemical Engineering and Materials Science (biological materials), the School of Physics and Astronomy (biological physics), and the School of Mathematics (biological mathematics). The center director is also a faculty member in the School of Mathematics.

In addition to the 12 new State-funded faculty positions in IT for the Digital Technology Initiative, the college will add six new positions from internal reallocations. Five of these additional faculty have already been hired—three in the Department of Computer Science and Engineering (research specialties: visualization; software engineering; human/computer interfaces and internet technologies), one in the Department of Electrical and Computer Engineering (optical electronics), and one in the School of Physics and Astronomy (biological physics). Over time, numerous other IT faculty, staff, and students will also have the opportunity to participate in the intellectual life of the Digital Technology Center.

The remaining three IT faculty for the Digital Technology Initiative should be hired within the next two or three years. Two of the positions will be filled by senior faculty in the area of networking; the research area and level of appointment for the third position is open.
In 2001, the ADC Foundation committed to help endow five chairs in the Digital Technology Center, one at $2 million for the director, and four at $1 million each in the areas of advanced networking technologies (two chairs) and wireless telecommunications (two chairs). The ADC Foundation pledged $1 million per chair, with the director’s chair to be matched with $1 million from the Institute of Technology. When fully funded, the $1 million chairs will provide $50,000 per year of research support funds to each chair holder. The director’s chair and two of the $1 million chairs have now been filled. Bridge funding for the two $1 million chairs is being provided by the University (from the Permanent University Fund) until the ADC Foundation has completed its pledge payments.

The success of the Digital Technology Initiative—and the Digital Technology Center—will be measured by the success of its affiliated faculty and staff in competing for significant sponsored research funding. Obtaining patents and participating in the formation of spin-off companies are other important measures of success. Although the technology sector remains sluggish, the success of the initiative is becoming apparent. Its first technology focused consortium has been warmly received and is attracting industrial members. The center recently received a donation of two Unisys supercomputers. Large interdisciplinary research proposals by center faculty have recently been funded through the NSF’s Computer and Information Science and Engineering (CISE) program and the NSF/NIH Bioengineering and Bioinformatics Summer Institute (BBSI) program.

3. Coping with Enrollment Pressures—Computer Science and Engineering

From 1993 to 2000 the number of majors in computer science doubled, from about 300 to more than 600. During the same period the faculty size remained essentially constant (at about 27). The demand for computer science courses by non-majors has also increased. In the University’s 2001 legislative request, 17 new computer science faculty were requested. It was agreed that with these 17 new faculty, the Department of Computer Science and Engineering would increase the number of majors from 600 to 900 students. The result of the 2001 legislative budget was that seven new computer science faculty can be hired at $100,000 salary and fringe benefits per hire. Funding for these new positions will be available from the fiscal year 2002–03 appropriation for that purpose.

In addition to the $700,000 for the new positions funded through the appropriation, the Executive Vice President and Provost also committed $300,000 in fiscal year 2002–03 for three additional computer science positions, bringing the number of authorized new hires to 10. IT agrees to increase the number of computer science majors from 600 to 775 (a linear scaling of the agreement of 17 hires to an agreement of 10 hires).

Five of the authorized 10 new faculty positions have been filled as of the beginning of the 2003-04 academic year.

4. Coping with Enrollment Pressures—Physics

In the 2002–03 compact it was noted that the School of Physics and Astronomy has been affected by burgeoning undergraduate enrollments in the College of Biological Sciences (CBS). The department restructured the introdutory physics course most commonly taken by CBS majors (Phys 1201 Introductory Physics for Pre-Medicine and Biology I), and now also provides a spring semester offering of this course. The second course in the sequence (Phys 1202) is also offered in the spring, and last year (Summer 2002) this course was also taught during summer session to provide additional opportunities to students.

It was also stated in the previous compact that an additional physics faculty member would be hired to help meet the needs of CBS students, and that a search for this individual was in progress. That search was not successful and is being continued.

5. Nanotechnology Initiative

The Institute of Technology is well positioned in the area of nanoscience and nanotechnology. There are strong faculty in these areas in the departments of Chemical Engineering and Materials Science, Chemistry, Electrical and Computer Engineering, and Physics. Resources serving the areas include the NSF Materials Research Science and Engineering Center (MRSEC), the Microtechnology Laboratory (MTL), and the IT Characterization Facility (CharFac). The MTL and the CharFac are run as ISOs for the benefit of the University and local industrial communities. The college, together with the Office of the Vice President for Research, recently added a $1 million electron beam nanofabrication tool to MTL. The CharFac has atomic force and magnetic force microscopes, scanning and transmission electron microscopes, a state-of-the-art x-ray facility, and several other instruments needed for nanoscience research.
With a few strategic investments the college can become a national leader in nanoscience and nanotechnology. To this end, we need to add one entry level faculty member in physics, one entry level faculty member in biomedical engineering, and one research staff person in DNA nanoelectronics. As detailed below, the Office of the Executive Vice President and Provost (EVPP) has committed $335,000 in recurring funds to meet these needs, beginning in 2003–04.

Expansion in Nanophysics—Carbon nanotubes (large tubular molecules of pure carbon) and nanowires are likely to be primary materials in future electronic circuits. A single electron transistor has been made from a nanotube. Carbon nanotubes can also be used to make nanotweezers, capable of grasping and manipulating single DNA molecules and carrying out nanoscale industrial and surgical manipulations. The nanostructures can also be used in magnetic devices (such as magnetic memory and nanosensors). The key to the realization of the potential of these materials is to understand their physics. IT has outstanding theorists in the area of nanomaterials. To complete the area, an experimental physicist who specializes in making and characterizing nanomaterials is needed. $110,000 of the $335,000 committed by the EVPP for the Nanotechnology Initiative will be used to hire a physics faculty member in the area of nanotubes and nanowires. A search for this individual is in progress.

Expansion in Biomedical Nanotechnology — One of the great challenges in biomedical engineering is the integration of knowledge across varying length scales ranging from the whole body (~1 meter) to organs and tissues (~1 millimeter), cells (~1 micrometer), and molecules (~1 nanometer). Of particular importance in the current post-genomic era is to understand how the molecules identified by the human genome project cooperate to function as cells. To do so requires understanding the physics and chemistry of biological macromolecule complexes and their dynamic behaviors. These complexes are typically 10 to 100 nanometers, and so can be viewed as nanomachines, which perform sophisticated mechanical, electrical, and chemical functions to allow the emergence of biological function at the cellular level. Understanding the principles of operation and control at the nanoscale will enable us to better control cellular behaviors to achieve such goals as promoting nerve regeneration and suppressing cancer, among myriad health problems.

Nanotechnology also offers the promise of computer controlled molecular tools much smaller than a human cell that will enable, for the first time, intervention in a sophisticated and controlled way at the cellular and molecular level. For example, such nanomachines could more selectively kill cancer cells by having programmed logic for detection of a “cancer profile” upon finding a “suspect cell” and then releasing a computed dose of cytotoxin based on readings from metabolic sensors; a lethal effect could thus be guaranteed. Other examples of cell-based diagnosis and treatment by circulating nanomachines can easily be envisaged, including the replacement of function to damaged subcellular organelles.

The Department of Biomedical Engineering currently has strengths in phenomena occurring at the organ, tissue, and cellular levels. These strengths will be well complemented by addition of a faculty member in the biomedical-nanotechnology area who can connect the nanoscale to the microscale and higher. $115,000 of the $335,000 committed by the EVPP for the Nanotechnology Initiative will be used to hire such a faculty member.

Expansion in Nanoelectronics — The third addition in nanoscience and nanotechnology is in the area of nanoelectronics. A team led by a faculty member in the Department of Electrical and Computer Engineering recently received a $1 million NSF grant for research in DNA nanoelectronics. To ensure that the project goes forward and realizes its full potential, we plan to hire a research scientist whose responsibility will be to customize and maintain a new two-probe atomic force/scanning tunneling microscope (AFM/STM) used in nanoscale electrical characterization of nanostructures. This instrument and the person to manage it will add greatly to the capabilities and services offered by the Characterization Facility. In addition to serving the NSF grant, this will be useful to other researchers in IT, the Academic Health Center, and the College of Biological Sciences. The remaining $110,000 committed by the EVPP for the Nanotechnology Initiative will be used to hire the research scientist.

In 2002–03, the EVPP provided $110,000 in non-recurring funds (from the float of the $335,000) to help pay for a new AFM/STM system, which cost approximately $310,000. The balance of the cost of the system was paid jointly by the NSF grant ($100,000) and IT ($100,000). IT will bridge the salary of the research scientist until 2003–04, when the recurring funds from the EVPP become available.

6. Biotechnology Initiative

Industrial biotechnology is a promising area of economic growth, and biocatalysis is one of the key research areas that will support this growth. The
University of Minnesota can, with a modest strategic investment, become a leader in this area. Already in place is the Biotechnology Institute (BTI), which is housed in the College of the Biological Sciences and co-managed by CBS and IT. Faculty members from both CBS and IT form the core personnel of the institute. The current director of BTI, a chemical engineer, has done a good job of managing the institute. However, what is needed now is a world-class researcher who can lead BTI in landing large grants, attracting new young faculty hires in IT and CBS in the area of biocatalysis, and making collaborative connections with biotechnology companies in Minnesota and elsewhere.

The EVPP has committed $215,000 (salary plus fringe benefits) to hire a senior engineering faculty member to become the director of BTI. The current director has agreed to become the associate director and to take care of routine administrative issues to free the director to pursue research and funding initiatives. CBS and IT are planning to add a few entry-level faculty members to complement the new director and the existing faculty in the area.

7. Outreach

The Institute of Technology has several on-going programs that deal with K–12 outreach, as well as outreach to the general public. Examples in the first category include the successful “Physics Force” program, which presented shows attended by over 10,000 K–6 students during 2001–02, and the University of Minnesota Talented Youth Mathematics Program (“UMTYMP”), which is run by the IT Center for Educational Program (ITCEP). ITCEP also conducts several Summer Enrichment programs that are specifically designed for grade school and high school students.

The IT Public Lecture Series is an example of an outreach activity offered to the public at large. These lectures are typically held several times a year, depending on the availability of speakers. The most recent lecture—“Seven Warning Signs of Voodoo Science”—was given by Robert L. Park, professor of Physics at the University of Maryland and author of the book Voodoo Science: The Road from Foolishness to Fraud.

Finally, it is noted that our award-winning publication Inventing Tomorrow is a highly effective vehicle for communicating the activities of IT’s faculty, staff, and students to alumni and friends.

8. Diversity

APEXES (Academic Program for Excellence in Engineering and Sciences) provides mentoring and encouragement to enhance retention rates of underrepresented minorities in IT’s undergraduate programs. Through APEXES, we also try to find under-represented minority faculty candidates. When suitable candidates are found, we try to hire them in cooperation with the Office of the Associate Vice President for Multicultural Affairs.

The mission of the Institute of Technology’s Program for Women is to encourage, recruit, and retain women faculty and students in the physical sciences, mathematics, and engineering. The program is responsible for the IT Distinguished Women Scientists and Engineers Speakers program, numerous community and networking events including monthly lunches with women graduate students, informal meetings with the women faculty, informational meetings on graduate school and professional options, and support for the recruitment of women graduate students.

IT has initiated discussions with the Minnesota Department of Education and the Minneapolis School District concerning Project lead The Way (PLTW), a national alliance for pre-engineering programs. Four Minneapolis high schools have recently adopted the pre-engineering curriculum. The expectation is that the University will become an affiliate in the program, in which role it will provide training and professional development opportunities for high school teachers involved in PLTW. The program has the potential to foster an interest in engineering among underrepresented minorities and strengthen links of the college to city schools.

C. New Long-Term Goals/Priorities

1. Investments to Maintain Rankings of Academic Programs

The Institute of Technology has seven Ph.D. programs ranked in the 84th percentile or higher in the most recent (1995) rankings of the National Research Council. In addition to the top-ranked program in chemical engineering, these are: mechanical engineering—8th out of 110 programs, or 93%; mathematics—14/135, or 90%; chemistry—21/168, or 87%; electrical engineering—18/126, or 86%; civil engineering—13/86, or 85%; and physics—22.5/146, or 84%.
Investments are needed to maintain and, where possible, improve these rankings, particularly in view of the most recent round of retrenchments at the University. To this end, the college and the EVPP will jointly invest recurring funds of $0.63 million during 2003–04 and 2004–05 for seven faculty positions at an average cost of $90,000 per position (salary plus fringe benefits). The seven positions will be deployed as follows:

**Mechanical engineering** — two positions. The Department of Mechanical Engineering accounts for approximately one-third of all bachelor’s degrees in engineering at the University of Minnesota: an average of 242 mechanical engineering degrees per year have been awarded for the past 11 years. The department has been consistently ranked among the top five or ten mechanical engineering programs in the country for at least the past 40 years, but faces a considerable challenge in trying to improve upon this record, given that other lower ranked programs have recently made substantial investments in mechanical engineering. (The University of Illinois at Urbana-Champaign and Georgia Tech are two examples.) The two reallocated faculty positions will maintain the faculty base at its present size (42) and will allow the department to realize its plan to expand its program in industrial engineering.

**Mathematics** — two positions. The School of Mathematics accounts for approximately 25% of the total student credit hours taught in IT. During the past five years, the department has made concerted efforts to improve the quality of instruction in the introductory mathematics courses for all students. The emphasis in these courses is on group and interactive learning, and visualization of concepts using both hand-held calculators (first year) and computers (second year), which requires smaller class and recitation sizes compared with traditional classroom approaches. IT and the EVPP each contributed non-recurring funds of $150,000 in 1999–00 and 2000–01 to assist the department in these efforts, and IT subsequently strengthened the commitment by providing recurring funds of $175,000 for “special teaching needs” and also ensuring that the department’s allocation of supplemental TA funds is sufficient to continue offering comparatively small lecture and recitation sections.

The recent retrenchments threaten to reverse the progress of the past several years as well as to jeopardize the department’s high national ranking. To avoid these undesired consequences, six entry-level faculty positions will be reallocated to the School of Mathematics. Efforts will be made to attract women and underrepresented minority candidates for these positions.

**Chemistry** — one positions. The Department of Chemistry plays a key role in IT’s efforts in nano/biotechnology. The department has recently retained several of its faculty who were being recruited by other institutions, but stands to lose a position to recent retrenchments. The size of the faculty must be maintained at its current level (42) in order to compete with peer institutions and to cope with increased enrollments in introductory courses due to increased numbers of students in CBS and other program requiring basic chemistry.

**Electrical engineering** — two positions. Over the past two decades, the discipline of computer engineering has emerged as an outgrowth of the specialties of digital and computer design within electrical engineering. Over 85% of electrical engineering programs in the U.S., including ours, have changed their names to reflect this fact, and a substantial number (in a few cases the majority) of traditional electrical engineering students now opt for computer engineering degrees. As a joint program of the departments of Electrical and Computer Engineering and Computer Science and Engineering, the University of Minnesota’s Twin Cities Campus established a master’s degree in computer engineering in 1996, and a bachelor’s degree in 1998. The Department of Electrical and Computer Engineering administers both programs. Since 1998, enrollment in the Bachelor of Computer Engineering program has grown from zero to 297, with another 130 students enrolled in the MS program.

Computer engineering considers the interaction between the hardware and software aspects of computer design. While some areas of discipline such as software and compiler design are appropriately covered by computer scientists, many of the core aspects of the field require expertise in electronics and systems, particularly those related to computer architecture and hardware design. The field is growing increasingly interdisciplinary as issues related to device physics and transistor-level design impact architectural design of computers. Therefore, research and instruction in computer engineering requires core electrical engineering capabilities, including knowledge of computer architecture, circuit-level design, and device physics.

The two positions allocated to the Department of Electrical and Computer Engineering will allow the department to keep pace with its peer institutions in computer engineering and will complement the strategic investments that have been made during the past few years in computer science.

**Chemical engineering** - In addition, IT will provide bridge funding to the Department of Chemical Engineering and Materials Science for two new
faculty positions in chemical engineering to replace the next two faculty vacancies in this program. Although only one retirement is currently scheduled (in 2006), at least two others are likely within a few years. These three faculty members are all Regents Professors and members of the National Academy of Engineering so it is urgent that they be replaced. The Department of Chemical Engineering and Materials Science must be allowed the flexibility to begin hiring replacement faculty now to ensure continuity of its research productivity.

2. Strategic Investment in Biomedical Engineering

Biomedical engineering is a rapidly growing program of strategic importance to the University and the State. (On a per capita basis, Minnesota has the largest medical device industry in the country.) Since the Department of Biomedical Engineering was created three years ago, its undergraduate enrollment has soared: the sophomore and junior classes have approximately 45 students each, and 35 bachelor’s degrees will be awarded in 2002–03, compared to six in 2001–02. Within two or three more years, it is expected that the graduating class will number 75.

In order to meet these demands and help the department achieve its goal of becoming one of the top ten biomedical engineering programs in the country, additional resources are required. To this end, the number of biomedical engineering faculty will be increased by two, to a total of 10, by 2005–06. (The figure of 10 includes the position for the Nanotechnology Initiative, discussed above.) IT will pay for one of the two new positions at an estimated cost of $90,000 (salary plus fringe benefits), and the EVPP will pay for the other, also at $90,000.

3. Investment in Student Affairs

The college has engaged in several activities during the past five years to recruit and retain undergraduate students and generally improve the undergraduate experience. Specifically, we are now supporting Living and Learning Communities for our students (IT has the largest Living and Learning Community on campus); we have added a “Commitment Event” in spring semester to encourage the best new applicants to attend IT; we are participating in the Gophers Graduate summer program to try to interest inner city students in attending the university; and we have greatly expanded the opportunities in study-abroad programs for our students, with the result that participation in these programs has been steadily increasing.

We plan to build upon these successes by doubling the number of students participating in the IT Living and Learning Community (from 100 to 200) and continuing the expansion of our study-abroad program. In addition, we plan to develop a program to support transfer students (by creating cohorts of new students) in an effort to improve the educational experience for this group of students.

In order to carry out these plans a recurring investment of $75,000 is needed, $60,000 for salary and fringe benefits for an administrative person and $15,000 for supporting expenses. IT and the EVPP will each pay $37,500 of this amount.

4. The Chemical Biotechnology Initiative

The Chemical Biotechnology Initiative (“CBI”) is designed to stimulate interdisciplinary biomedical/biotechnology research, technological development, and education at the crossroads of chemistry, physics, biology, and engineering at the University of Minnesota. This effort will enhance scholarship in traditional fields such as drug design and will enable the exploration of entirely new concepts at the interface of the subject disciplines. Specific focus areas, or centers, within the CBI are: the Chemical Genetics Center (including bioprobe design, molecular modeling, synthetic chemistry, nucleic acid chemistry, and bioorganic and bioinorganic chemistry); (2) the Biomaterials Engineering Center (biomicroelectronics, tissue engineering, cellular engineering, nanobiotechnology); and (3) the Biotechnology Institute (combinatorial biosynthesis, microbial engineering, and biocatalysis). The latter organization is an existing entity managed jointly by IT and CBS.

The Chemical Biotechnology Initiative involves three colleges—IT, CBS, and Pharmacy—and will be supported for an initial three-year trial period by non-recurring funds of $400,000. Each of the three colleges will contribute $66,666 of this amount and the EVPP will contribute $200,000. The funds will be used for the following purposes: $150,000 for six graduate student fellowships; $180,000 for four postdoctoral fellowships; $20,000 to support a CBI Colloquium; and $50,000 for 50% of an administrative assistant.

The graduate student and postdoctoral fellowships are designed to support new collaborative cross-disciplinary research projects between participating groups. A steering committee composed of faculty representatives from each of the three focus areas will be responsible for evaluating fellowship applicants to ensure that they meet the new collaboration/cross-disciplinary training criteria.
The CBI Colloquium is designed to foster interactions among participants and will involve outside speakers with expertise relevant to the three focus areas, as well as University of Minnesota faculty. A colloquium featuring an outside speaker will be held about once a month during the academic year, while the summers will be devoted to talks by CBI participants.

The half-time administrative assistant will help coordinate fellowship applications, arrange the CBI Colloquium and other regular meeting of the CBI faculty participants, design and maintain a CBI web site, and assist with preparation and processing of joint proposals submitted to funding agencies.

At the end of the three-year trial period it is anticipated that a number of new collaborative projects will have been initiated that will result in joint publications and joint research proposals to federal agencies. During this period, a plan will be devised for new core research facilities and interdisciplinary research space. The hiring needs for faculty in the three CBI focus areas will also be assessed. The success of the initiative will be judged by the following measures:

1. New collaborations initiated between faculty in different departments and colleges
2. Joint publications between faculty in different departments and colleges
3. Training grant proposals submitted to NIH and NSF
4. New Program Project and Center proposals submitted to NIH and NSF
5. Other collaborative grant proposals submitted (e.g. NIH Interactive Research Project Grants)

5. Relief from 2003–04 Retrenchments for CDTL

The University’s budget plan for 2003–04 has two retrenchments that negatively affect the Center for the Development of Technological Leadership (CDTL). The two recurring retrenchments are: (1) a “prescriptive” reduction of $15,136 related to expenditures on food, travel, and conference attendance during the past three fiscal years, and (2) an “O&M/tuition swap,” which, when calculated according to the process described in the 2003–04 Phase II Budget Instructions, amounts to $125,731. The total of the two retrenchments is $140,867.

The EVPP has agreed to provide recurring O&M funds of $40,000 to IT to negate these two retrenchments on the basis that CDTL is self-supporting and does not receive a state subsidy. (The students in CDTL’s professional degree programs pay all program costs, including amounts specifically budgeted for food and travel for the Management of Technology international residency program.) In addition, CDTL’s space in the West Bank Office Building will be considered “supported” space beginning in fiscal year 2004-05, so they will no longer be separately billed for utilities.

CDTL will continue to pay the Institutional Revenue Sharing (IRS) assessment on its tuition and on transfers of funds from the University of Minnesota Foundation.


As part of its agreement with the State of Minnesota to store waste from its nuclear power plants, Xcel Energy sets aside each year for alternative energy research. The 2003 Legislature allocated $20 million from this source to the University of Minnesota – a one-time payment of $10 million plus $2 million per year for five years. Faculty from several IT departments (Chemical Engineering and Materials Science, Mechanical Engineering, Electrical and Computer Engineering, and Physics) are currently involved with this Initiative for Renewable Energy and the Environment (IREE).

IT research for IREE is mainly on fuel cells and hydrogen storage technology. Fuel cells can be used to convert wind energy to hydrogen, which will be useful if the storage technology allows economic distribution of the hydrogen. Other IREE-sponsored research in IT concerns energy efficiency of buildings, renewable chemicals, and biodiesel. We anticipate that these activities will promote new collaborative research programs involving additional faculty in IT as well as from other colleges. We hope to leverage IREE funds to initiate major interdisciplinary research programs that will make the University of Minnesota a leader in these areas.

D. Enrollment Management

The goal of the college is to hold total undergraduate enrollment at approximately 4,400 to 4,600, or 200 to 300 more than the average levels before the introduction of the undergraduate biomedical engineering program, which has a class capacity of 75. The number of computer science majors has dropped over the past two years, reflecting the weakened position of information technology in the economy, but enrollments are expected to pick up again and eventually reach the target of 775. The long-term need for well-
trained computer scientists in modern society has not diminished. Fall 2003 enrollment in IT, at 4,288, includes 250 biomedical engineering majors and 585 computer science majors. With both programs at capacity, total enrollment in the college would approach 4,600.

One- and two-year retention rates for the freshmen and sophomore years are satisfactory and are unlikely to change much. Four-, five-, and six-year graduation rates have improved significantly over the past six or seven years, with some year-to-year reversals, and these are expected to improve further. The recent increase in graduation rates probably reflects the efforts the university has taken to inculcate a sense that the standard period for earning a degree is four years—these efforts include the freshmen convocation, the four-year plan, the 13-credit policy, and increasing the number of freshmen living on campus. Also, the college has developed and refined detailed four-year plans for each major, and these are used extensively in advising. Together, these measures will likely result in further increases in graduation rates over the next few years. We expect the four- and five-year graduation rates to approach 40% and 70%, respectively, by 2005, with the four-year rate eventually reaching 50%.

In providing enrollment projections for the next four years (see the appended table from last year’s compact), we extrapolated based on patterns of intake, retention, and advancement from year to year for the past four years, with allowance made for modest increases in retention and graduation rates over the next few years. Confidence in the projections is not high, even in the short term, and the projection of overall enrollment for fall 2002 exceeded actual enrollment by about 4.5%, largely because the numbers of new freshmen and transfer students were less than anticipated. Historical retention and graduation data indicate that predictions beyond one year are problematical, even if intake levels are strictly controlled.

Overall enrollment in fall 2002 was almost the same as in fall 2001. If the intakes of freshmen and transfer students match targets (freshmen at 775 and transfers at 300), enrollments will rise to and stabilize at approximately 4,400 in the next few years.

Demographic trends in Minnesota indicate that there will be smaller increases in the college age population over the next few years than in the recent past, with a growing share of that population coming from typically under-represented groups. With a constant size incoming class of freshmen, the college will be challenged to increase the fraction of under-represented groups to match this demographic shift, because a comparatively small fraction of students from these groups have traditionally chosen to pursue careers in science and engineering.

IT is the major provider of undergraduate education in engineering, physical sciences, and mathematics in Minnesota. In the recent past, IT was responsible for delivering all engineering education in the state. Over the past 20 years, engineering programs have been started at several other institutions, such that today 30% of engineering students in the state are at these other institutions. With even more new engineering majors planned at most of the other institutions, this percentage will grow further. There is room for additional market differentiation and further expansion of engineering education in Minnesota, which ranks 39th in the nation in the number of engineering students per capita, but there will be additional competition for students. Currently, the major competition for students in IT comes from peer public institutions in the Midwest, especially the University of Wisconsin–Madison and Iowa State University.

The quality of freshmen students entering IT (as measured by ACT and SAT scores and high school rank) has remained high (with ACT scores increasing slightly and high school rank declining slightly in recent years), indicating that IT remains successful at recruiting top students in the state and region, despite the competition. Efforts to enhance recruitment are being made by the college in cooperation with the Office of Admissions. These efforts include improving the campus visits of prospective students and inviting top admitted students to a “commitment” event in the college. IT has also agreed to share equally with Admissions the cost of hiring an individual to work exclusively on the recruitment of freshmen for IT, with a focus on women. The college share of this cost is approximately $30,000.

Graduate enrollment is difficult to predict, because the responsibility for recruitment rests with the individual departments and graduate programs. Total enrollment has increased from about 1,700 four years ago to around 2,400 today, largely with an increase in the number of master’s students. Enrollments are expected to stay at this level, provided support for assistantships is not eroded.

Class size and course access problems are greatest in introductory mathematics and science, and are increasing due to the growth in enrollment in other colleges. In particular, the admission of freshmen to the College of Biological Sciences has led to no noticeable decrease in numbers of CLA students.
enrolling in IT courses, and has added 150 to 200 students to classes in mathematics, physics, and chemistry. Departmental resources are stretched to the limit in trying to accommodate the large freshman classes. Lecture room size, laboratory spaces and hours, and numbers of teaching assistants are the limiting factors; there is no extra capacity.

E. Facilities Issues

Additions to two IT buildings—Amundson Hall and Mechanical Engineering—were completed during the past few years, and the renovation of Walter Library was finished in early 2002. The latter building houses the IT Dean’s Office, the Science and Engineering Library, and the Digital Technology Center.

The fiscal year 2001–02 Capital Request included $3 million in planning funds for a science and technology classroom building. Although this portion of the request was not approved in 2002, it was reinstated in the state’s budget for 2003–05 and planning for the building will now be able to proceed.

When the science and technology classroom building is eventually constructed, it will contain much-needed new classroom space, particularly large lecture rooms. The building will also house the Department of Biomedical Engineering and the IT Characterization Facility, units that currently occupy space in Shepherd Laboratories. The Department of Geology and Geophysics will then move to Shepherd Laboratories, which will make Pillsbury Hall available for renovation. When this has been completed, the Department of English will move from Lind Hall to Pillsbury Hall. Lind Hall, when renovated, will become the new home for the Department of Computer Science and Engineering.

The existence of additional classroom space in the new science and technology classroom building will permit a systematic renovation of the Tate Laboratory of Physics without the need to relocate faculty in the School of Physics and Astronomy elsewhere on campus. This will be accomplished by first converting one of the large lecture halls in Tate Laboratory to office space and research laboratories and, when this is finished, progressively working through the rest of the building in the same manner.

The new science and technology classroom building will help to address a serious need for additional computer classrooms across the entire University. This issue is becoming critical for IT’s Lower Division programs, especially in chemistry, mathematics, and physics.

F. Financial Issues

Tuition — The agreed upon tuition revenue estimate for IT for fiscal year 2003–04 is $49,450,669.

The estimated revenues for the 2003–04 academic year derive from the following sources:

Center for the Development of Technological Leadership (4.6%): $2,274,731
UNITE (1%): 494,507
Other classes (89.8%): 44,406,700
Summer Session (4.6%): 2,274,731

The net revenues (after deducting the IRS assessment) for CDTL and UNITE are “pass-through” funds that are used to support these on-going programs.

Tuition revenue provides a substantial portion of the funding required to sustain departmental operations in the college. Gains in revenue due to increases in both tuition rates and enrollment are used for several purposes, viz. funding of portions of the annual compensation plans for faculty, staff, and students; payment of the college’s “institutional revenue sharing” taxes on O&M funds; and additional funding for supplemental teaching assistants.

ICR — The agreed upon indirect cost recovery (ICR) revenue estimate for IT for fiscal year 2003–04 is $8,489,203 (49.5% of $17,099,400, plus $25,000 of research support funding for EVPP Christine Maziar).

Twenty percent of IT’s ICR receipts are returned directly to the departments that generated the funds each year, through “effort” and “formula” distributions. The remaining ICR funds are used to provide setup packages to help departments recruit new faculty, and matches to assist faculty in competing for sponsored research funds. The amount available for these purposes in 2003–04 will be approximately $6.2 million.

G. Compact Development

This compact was developed through an iterative process involving discussions between the IT Dean’s Office and the Office of the Executive Vice President
and Provost. Input from departments was obtained from discussions with the IT Administrative Council (the deans and department heads), and the IT Consultative Committee, an elected body with faculty, P & A, civil service, and student representatives. Detailed proposals for the compact were prepared by the dean’s office staff.

H. Data Profile

For a display of planning data related to the Institute of Technology, refer to a link off the University web site managed by the Office of Institutional Research and Reporting at http://www.irr.umn.edu. This site contains standard financial, staffing and student information.

Several performance measures have been adopted to help quantify the success of IT’s programs. These are described below.

1. Retention Rate

The college is reviewing how best to implement the recommendations of the August 2001 Council of Undergraduate Deans report, “Improving our Graduation Rates.” This is being done in conjunction with central administration and other university support units.

Reviewing the data through the 2001–02 academic year, both the one-year retention rate of 89% (2001 cohort) and two-year rate of 84% (2000 cohort) are on target (the targets corresponding to the best rates of the past ten years, consistent with rates in peer institutions). For women the rates are slightly lower than the overall rates; over the ten-year span, the rates for women average 1 to 2% higher than the overall rates. These rates refer to students who began their studies in IT and are still registered within the University, but not necessarily in IT, after one and two years, respectively. The corresponding retention rates for students who remain in IT are 85% (one-year) and 70% (two-year), which are also both on target. For women, the rates are about 5% lower (over the ten-year span, the one- and two-year rates for women average 3% and 5% lower, respectively, than the overall rates).

2. Graduation Rates

Four-year graduation rates for students starting in and remaining in IT have improved significantly over a five-year period, although in the most recent two-year period they have declined, from a peak of 28% (1996 cohort) to 23% (1998 cohort). Rates for women have been about 5% higher than the overall rates in the past two years, while being very similar to the overall rates in most earlier years. Four-year rates for freshmen starting in IT and graduating in any college peaked at 33% overall and 43% for women for the 1997 cohort. Six-year graduation rates have also improved over the past five years, with rates within IT reaching 56% overall and 50% for women for the 1996 cohort. Corresponding rates for IT freshmen graduating in any college are 70% and 77% respectively. With increased encouragement for students to stay in school and on track, it is anticipated that both four- and six-year rates will continue to rise, with some fluctuation from year to year. Long-term targets of 50% and 75% for four- and six-year graduation rates for IT freshman graduating in any college seem attainable, with a closing of the gap between men and women and with a larger fraction of IT freshmen staying within the college to get their degree.

3. Accreditation of Engineering Programs

In the last cycle of accreditation of the engineering programs by the Accreditation Board for Engineering and Technology (ABET) in fall 2001, all of IT’s programs under review were successfully accredited. The new program in biomedical medical engineering will be reviewed by ABET in fall 2003.

4. Research Expenditures

Research is a crucial component of IT’s mission and is the lifeblood of its graduate programs. The college has historically been very successful in competing with other institutions for sponsored research funding, and aims to maintain its competitive position in the years ahead. As a means of quantifying this goal, we want the total annual research expenditures in the college at least to keep pace with the Consumer Price Index.
### Report and Allocation Summary

No reports to be submitted prior to next compact development cycle.

#### Historical Allocation Summary

**FY1999 through 2003 Compact Investments**

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<th>FY2001</th>
<th>FY2002</th>
<th>FY2003</th>
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<td>Physical Sciences Courses</td>
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<td>Freshmen Seminars</td>
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<td>Info. Technology Minor</td>
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<td>Digital Tech. Initiative</td>
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<td>Freshmen Seminar Positions</td>
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<td>AFM/STM System</td>
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<td>$1,523,402</td>
<td>$2,048,274</td>
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#### Central Allocation Summary – FY2003–04

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<td>Solvent Distillation Equip.</td>
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<td>(with Pharmacy)</td>
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<td>Biomedical Engineering</td>
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<tr>
<td>Grad. School/Research Support *</td>
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Total FY2003–04                  | $167,500      | $5,329,727    |

* As of October, 2003