



The FedEx Institute of Technology  
at the University of Memphis

**2006/07**  
ANNUAL REPORT

*FedEx Corporation  
Gift-Sponsored Accomplishments*



THE UNIVERSITY OF  
**MEMPHIS**<sup>®</sup>

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# 2006/2007 Annual Report

## *FedEx Corporation Gift-Sponsored Accomplishments*



<b>FROM THE CHAIRMAN</b> The FedEx Institute of Technology at the University of Memphis	<b>Page 2</b>
<b>PROGRAMMING</b> Innovation, Integration, Ideas	<b>Page 3</b>
<b>FEATURED RESEARCH CENTERS</b> Center for Active Nanosystems Center for Advanced Robotics FedEx Center for Supply Chain Mangement Systems Testing Excellence Program	Page 5 Page 6 Page 7 Page 8
<b>FEDEX CORPORATION</b> 2006/07 Gift Allocations	<b>Page 9</b>

## The FedEx Institute of Technology at the University of Memphis *(It's not your ordinary red brick college building)*

Rob Carter, FedEx's Executive VP and CIO, expressed the vision for the Institute in the fall of 2002 when he said,

***"It should be a place where business people can go and build out their ideas and take them forward."***

One year later, on November 19, 2003, the FedEx Institute of Technology (FIT) officially opened its doors to the campus, community, nation, and world. And now, in 2007, with visions realized, we recognize that the FedEx Institute of Technology is vital to Memphis, the MidSouth, and beyond for its contributions to

### **Technology-driven research through**

- corporate and community partnerships
- focused, interdisciplinary innovation in science and technology

### **Technology intensive learning exemplified in**

- student learning and research skills
- workforce development

### **Technology transfer and commercialization designed to**

- realize commercial potential from UM research
- catalyze entrepreneurship and business development

Carter explained FedEx's vision for this joint venture as "a project that focuses on creating a collaborative environment—one that would reach beyond a conventional research curriculum, but in fact integrate teaching and research in collaboration with the business community." The Institute's technologically advanced facilities are designed to encourage research and technology innovations that address issues of regional, national and global interest. From the earliest discussions, the Institute was not to be just another University building.

The Institute is housed in a 95,000-square-foot facility on the University of Memphis campus. The building is equipped with state-of-the-art technology capabilities, including high speed wireless data, a voice-over Internet protocol (VoIP) voice network, a 200-seat multimedia amphitheater, research labs, training rooms, and technology-equipped teaching and meeting spaces. Everything about the Institute is designed to create an environment where our students learn from and work along side leading researchers and scientists. The FIT is where University research teams form collaborative partnerships with business and government to solve real world problems.

The Institute is, however, more than just a building. It reaches across the campus, bringing together researchers from diverse science, technology, engineering, and business departments to form interdisciplinary research centers with the common goal of developing and applying innovative technology solutions to meet real needs.

More than 150 of UM's leading researchers, scientists, students and staff members are currently part of the Institute. In a typical semester, more than fifty classes meet in the Institute's facilities, covering subjects as diverse as modern languages, mathematics, computer science and business management. In 2007, Institute research teams were working in such diverse areas as advanced robotics, supply chain management, multimedia arts, intelligent systems, sustainable housing design, systems testing, information assurance and security, workforce development, nanotechnology/thin films sensors, and bioinformatics.

And 2008 promises to be even more exciting. In this unique atmosphere, visionary and creative thinking is mandatory. Nothing ever stands still at the Institute, because technology innovation demands continual change, just as business challenges in our city and region necessitate flexibility, responsiveness, and proactive thinking.

FedEx viewed its involvement in the Institute as an investment: one it believes will pay off in the form of great research innovations, creative problem solving, new ideas, leading-edge research, and a technologically sophisticated student body from which any Fortune 500 company would hope to recruit.

The FedEx Institute of Technology is all of this and more. The FIT is the center of technology innovation and research in Memphis, making the Institute an indispensable engagement point for students, faculty, industry, and government. The Institute actively engages with the City and region to develop and support the creation, transfer, and commercialization of new knowledge. It works closely with local organizations such as Emerge Memphis, BioWorks Foundation, InMotion, as well as the Cabinet for Economic and Community Development and ORNL in TN, and Federal departments including NSA, NSF, and the Department of Defense in support of economic and workforce development in Memphis, the MidSouth, and beyond.

***There's nothing "ordinary" about the Institute— it's as vibrant and dynamic as the world we live in today. The FIT is where our scientists and researchers bring the future to the MidSouth. Come see the results for yourself!***

Dr. Douglas Hurley, Chairman  
FedEx Institute of Technology  
VP-Information Technology & CIO,  
The University of Memphis



## Innovation, Integration, Ideas

**The FedEx Institute of Technology (FIT) is the gateway to the University of Memphis. Here is where you will find the essence of collaboration and teamwork with interdisciplinary research centers transforming ideas into reality.**

FIT's programs provide a fresh and interesting view into the FIT researcher's world, while furnishing an equally inviting forum to leaders, experts and other researchers from around the world. Over the past three years, the FIT has hosted a broad range of programs. From feature lectures and symposia to workshops and in-residence programs, FIT programming focuses on advancing the culture of innovation and interdisciplinarity that is the hallmark of the Institute. Some examples follow.

### Vision Speaker Series

June 2006, the FIT brought Kevin Warwick to campus—the world's first cyborg. A professor of cybernetics at the University of Reading, England, Warwick conducts research in artificial intelligence, control, robotics, and biomedical engineering. This event was co-sponsored with the Philosophy Graduate Student Association.

In April 2006, the FIT joined the Memphis Zoo and the National Geographic Society to present Greg Marshall's "Cittercam" to the MidSouth community. This event gave students, faculty, and the public front-row access to a remote imaging expert who has revolutionized the way wildlife is studied. At the same time, it brought people from the community to the FIT who might otherwise not have had an opportunity to experience the FIT.

Other speakers and guests included Michelle Feynman, who compiled the letters of her Nobel Prize winning father, physicist Dr. Richard Feynman, and UM alumnus Dwight Fryer, author of *The Legend of Quito Road*.

### Honors Program

A key feature of the intellectual environment at the Institute is honors program students working as research assistants in various research centers. This is a select group of undergraduate students with keen interests and abilities in highly specialized areas of technology and research. To date, at least ten of the University's top honors students have taken part in this program.

### Business Plan Competition

Each year in January, the FIT sponsors its Business Plan Competition, which encourages students, researchers, and entrepreneurs in the MidSouth community to work together to develop business plans that could lead to the startup of new business ventures. The competition culminates in May with the awards to the top three plans as judged by a national team of judges. This competition, modeled after nationally successful programs, has grown each year. EmergeMemphis is a close working partner and participating sponsor of the competition.

In its two years, the Competition has grown to include student teams from the MidSouth region and beyond, including Arizona, Alabama, Georgia, Michigan, and New Jersey. More business leaders and entrepreneurs, who seek involvement as both competitors and judges, have volunteered to work with the Competition next year, offering additional incentives to the prizewinners.

In 2007, twenty teams entered the Competition. In the Executive Summary phase, the number of entrants increased by 50% over last year. Additionally, there were more than thirty community and regional business professionals who facilitated educational workshops and served as judges.

This year's grand prize winner, Impulsys, was a local group lead by a UM doctoral student who also is a FedEx employee. Pierce-Safe Technologies, second place winners, were a combined team of students from the University of Southern Mississippi and the University of Mississippi. Third place winners, Trio Web Consulting, were UM students.

As the FIT's Business Plan Competition continues to grow, it will become an integral part of the entrepreneurial and economic development fabric in the Memphis area. And working with the Fogelman College of Business and Economics, it will add to the many entrepreneurial success stories from the MidSouth.

FIT Business Plan Competition  
2007 Winners



## PROGRAMMING CONTINUED

## Innovation, Integration, Ideas

### In Residence Programs

The Institute's in residence programs are designed to integrate leaders from industry and the arts into the FIT, the UM student body, and the community.

The CEO and entrepreneur in residence programs have allowed distinguished business leaders to share practical knowledge with students, researchers, and the community. During their residencies at the Institute, these professionals develop a personal project that utilizes the Institute's resources and facilitates educational opportunities through student participation.

Recent CEOs in residence:

- Scott Messmore (CEO in Residence, 2005-2006) owner and president of MBI (Memphis Business Interiors) and a former vice president of Steelcase Corp.
- Barney DuBois (CEO in Residence, 2005-2006) is the former editor of the Memphis Business Journal.

Recent Entrepreneur in residence:

- Marc Diaz (Entrepreneur in Residence, 2005-2006), a local attorney who has been successful in launching and operating several small businesses.



The FIT also sponsors an Artist-in-Residence program in cooperation with the College of Communication and Fine Arts. This program showcases the confluence of art and technology through artistic works created and exhibited locally by nationally prominent multimedia artists. These artists have used technology in innovative and creative ways as an integral component of their art. While the artists have opportunities to interact with the community at large, the primary goal is for them to work directly with UM art and technology students, so students can better imagine possibilities for their own careers. This event has been sponsored in conjunction with Lantana Projects, a local non-profit international artist residency program.

Artists who have served in residence are:

- Barbara Bickart (Artist in Residence, Spring 2007), an interdisciplinary artist whose work is project-based. Her work takes on the form of video installation, multimedia video performance, and experimental documentary.
- James Clar (Artist in Residence, Spring/Summer 2006), an international artist whose work focuses on the study of light and its properties to design information systems with ground level control to create an experiential art form.

***The FIT looks forward to another packed year of programming, further extending its valued presence in the University, City, and the MidSouth region.***

## FEATURED RESEARCH CENTER

## Center for Active Nanosystems

*Research at the single atom layer but with global business potential*

The Center for Active Nanosystems was formed in March 2006 to develop functional nanoscale devices and related enabling technologies. The center is a joint effort of the FedEx Institute of Technology, the Institute of Nanomaterials Development and Innovation at the University of Memphis (INDIUM), and the departments of Chemistry, Biomedical Engineering, and Physics.

"Chemistry is about changing materials or creating new materials that haven't existed before," explains Eugene Pinkhassik, Director of INDIUM. Pinkhassik, an associate professor of chemistry, is an expert in nano-materials design and fabrication, creating technologies that facilitate their application in sensors and related media.

Nanotechnology is a broad field of applied science and technology focused on controlling and exploiting the structure of substances and materials on a scale below 100 nanometers (nm). One nanometer is one billionth, or  $10^{-9}$  of a meter.

Nanotechnology, a general-purpose technology, will have an impact on almost all industries and all areas of society. It offers better built, longer lasting, cleaner, safer, and smarter products for the home, communications, medicine, transportation, agriculture, and for industry in general. Nanotechnology cuts across many disciplines, including colloidal science, chemistry, applied physics, biology, and other scientific fields.

Pinkhassik won the National Science Foundation (NSF) CAREER award, one of the most prestigious NSF awards for young faculty, and he was chosen as one of the Memphis Business Journal's Top Forty Under 40. He and his team, NanoTect, won the grand prize in the FedEx Institute of Technology's inaugural Business Plan Competition last year, with a technology for protecting corrodible exposed metal surfaces with a nano-thin film that self-assembles and adheres to the metal surface.

Pinkhassik's current research looks at nanomaterials that will respond to external impulses and that can be used in sensing-devices. Recent success in nanomaterials and nanofabricated sensor design within the University of Memphis' nanomaterials program created a unique and time-bound opportunity to make a breakthrough in the development of a new generation of lightweight and reliable sensors—specifically a new method for nanothin film fabrication in a collaborative project supported by the FedEx Institute of Technology (FIT).

Pinkhassik and the Center for Active Nanosystems (CAN) at the FIT are working on materials that can carry a device that uses very little power while being fast, accurate and robust. In collaboration with FedEx, CAN explores transportation sensors that have the ability to indicate temperature and/or light changes. Looking ahead, these sensors could one day be part of every FedEx package, indicating if perishable goods in a box are getting too warm or too cold.

Current market technologies perform poorly, are unstable, and exceed power requirements and size limits. CAN ultimately aims to develop a device that eliminates the power requirement for the sensing units, ensuring a long shelf life.

Eleven research groups and approximately forty graduate students and postdocs comprise the nanotechnology program at UM. Four faculty are actively involved in the transportation related sensors research.

With the support of the FedEx Institute, CAN developed a method for creating robust organic nanothin films on inorganic surfaces. This technological achievement has far reaching fundamental and practical significance. It provides a unifying technology for the development of a standard nanofabricated sensor platform that can be adapted to monitor a variety of external conditions such as temperature, light, and the presence of chemical or biological agents in the air. The newly developed films are robust, and the devices using them will have a long shelf life, which is critical for practical applications. Since these materials are a nanometer thin, one gram of base material can coat one million square inches of surface. This means that add-on costs to the fabrication of disposable sensors will be minimal. Additional weight of sensors in a fully loaded airplane would be a few milligrams, which is obviously negligible. These coatings are also likely to have a broad impact on the development of molecular electronics, chemical and biosensors, and protective coatings.

The immediate goals of Pinkhassik's efforts are to create a patterned surface coating, which will bring him and his colleagues closer to the development of a unified sensor platform, and to ensure efficient signal amplification. Recent successes include the award of a competitive user access grant to conduct research at the recently built, state-of-the-art Center for Nanophase Materials Sciences at Oak Ridge National Laboratory, where three members of Pinkhassik's group will soon take residence for two and a half months.

<http://www.chem.memphis.edu/INDIUM/>

Dr. Evgueni "Eugene" Pinkhassik,  
Director  
Institute of Nanomaterials  
Development and Innovation  
Associate Professor, Chemistry  
The University of Memphis



## FEATURED RESEARCH CENTER

## Center for Advanced Robotics

*Technology for real-world environments—today and into the future*

The Center for Advanced Robotics (CAR) at the University of Memphis' FedEx Institute of Technology (FIT) formed in early 2006 as a collaboration between the FedEx Technology Innovation Lab and the FIT. Through a public review process, the center chose its first major project—FedEx's Tugs—and began work that summer. The project's goal is to replace the Tug drivers with autonomous vehicles (AV) that have the capability to function without a driver. However, in the past year and a half, the Center has grown beyond the scope of a single research project. CAR's mission has expanded into human-centered robotics, with particular focus on how autonomous robots may optimally coexist with humans in complex work, health, shopping, and living environments.

CAR's primary objective is to improve education and research within the area of human-centered robotics. This field of robotics and the application areas of retail, health care, and hub-based systems provide a niche for the unique competencies within the core group of robotics researchers at the University of Memphis. Five faculty researchers, five graduate students, and three undergraduates comprise CAR's staff—providing excellent opportunities for student engagement in research for advanced career training. CAR will further strengthen robotics education at the University of Memphis by implementing an ongoing robotics seminar and by creating a curriculum for a Masters of Applied Computer Science in Robotics.

Twice each year the Center invites prospective collaborators and industry partners to a brainstorming session at the FIT to cultivate new research and funding opportunities. CAR will also focus on ways in which robotic technology can help in community development, using activities such as robotics related competitions and distinguished speaker events. CAR will become a model of industry and academic research partnerships, advancing robotics technology that will be beneficial in real-world environments of today and the future.

CAR's first-year focus was on establishing a context for robotics research. This effort resulted in studies, conference presentations, a Master's thesis, and successes in the development and testing of robotic navigational & obstacle handling functionality.

The Center is now ready to establish robotics as a significant focus throughout the University with new degree offerings and faculty positions. In five years, CAR plans to be internationally recognized in the area of human-centered robotics and making significant contributions to the economy of Memphis and the MidSouth.

The field of human-centered robotics offers great opportunities for potential partnerships with local corporations, which in turn will promote an even stronger collaboration between industry and academia.

<http://fitcar.memphis.edu/>

Brian Stuart  
Instructor, Computer Science  
The University of Memphis  
Senior Research Developer,  
FedEx Technology Innovation Lab



## FEATURED RESEARCH CENTER

## FedEx Center for Supply Chain Management

### *Setting the Pace for Successful Industry Partnerships*



**FedEx** Center  
for **Supply Chain  
Management**

The FedEx Center for Supply Chain Management was established in 1993 as the FedEx Center for Cycle Time Research. The Center was re-named in 2003 to better reflect the nature of its work as it integrated into the FedEx Institute of Technology (FIT). 2003 was also an important year because the Tennessee State Board of Regents recognized the FedEx Center for its applied supply chain management research with the Academic Excellence Award.

Nearly fifteen years since its inception, the FedEx Center continues to succeed in its recognized areas of expertise, conducting applied research that focuses on effective supply chain management (SCM) practices. To-date, the Center has conducted over sixty-five research projects which have addressed a wide range of SCM topics including strategic sourcing practices, facility location studies, international SCM issues, inventory management practices, new product development processes, outsourcing, supply chain process integration and improvement, returned materials/reverse logistics practices, the human resources "supply chain," and others. Research projects result in a report for the funding organization and academic publications. The FedEx Center's research has been published in a number of top journals, including *Strategic Management Journal*, *Journal of the Academy of Marketing Science*, *Academy of Management Journal*, *Decision Sciences*, and many others.

The FedEx Center also provides customized educational programs. Its most successful offering has been the Innovation Management and New Product Development (IM & NPD) program created for FedEx Global Marketing. This unique program features two weeks of intensive classroom study at the FIT, technical and conceptual training, analytical tools, teamwork experiences, and a comprehensive case study. Nine IM & NPD programs have been conducted since 2004 and over 200 FedEx professionals have completed this program. The FedEx Center is particularly proud of the IM & NPD program, because it is the largest educational program provided by the University of Memphis for FedEx to date.

The Center utilizes the expertise of its director, two associate directors, and fifteen faculty members and seven graduate students from five departments: Anthropology, Computer Science, Management, Marketing and SCM, and MIS. And building on its strong operations research capabilities, it opened the Enterprise Simulation and Optimization Laboratory (eSOL) in cooperation with the Navy Personnel Research Studies and Technology group to advance the study of simulation and optimization technologies. (<http://fedex.memphis.edu/esol/>)

The 2006/2007 academic year brought several accomplishments, notably the completion of two research projects: *Technology Adoption and Use Characteristics—The Case of EMR Technology* at Methodist Healthcare System and *Supply Chain and Optimization Issues in Naval Personnel* for the Navy Personnel Research Studies and Technology (NPRST) group. Additionally, two offerings of the Innovation Management and New Product Development program were conducted for FedEx Global Marketing; two public programs were offered at the FIT: Simulation and Optimization for Improved Business Solutions and Managing "Human" Supply Chains; and technology adoption research continued at Methodist Healthcare.

Looking ahead to 2007/08, the FedEx Center will continue working with the FedEx Industrial Marketing group on their joint research project addressing SCM challenges faced in the electronics and automotive industries. And in July, the Center is launching its Supply Chain Management Challenges Research (SCMC) program. A primary component of the SCMC research program will be an annual, online survey that asks participants to identify the major SCM challenges currently facing their organizations as well as challenges they foresee when they look five years into the future. Also this coming year, eSOL projects will be conducted with the Navy Personnel Research Studies and Technology (NPRST) group and the Urban Child Institute. Furthermore, two offerings of the Innovation Management and New Product Development educational program are planned, and a public SCM program will be held at the FIT.

The FedEx Center for Supply Chain Management represents a decade and a half of productive industry and academic collaboration between FedEx Corporation and the University of Memphis. As such, this center serves as an exemplar to new UM faculty, new centers, and their potential industry and community partners. With so much accomplished since 1993, just imagine what the next fifteen years will bring.

<https://umdrive.memphis.edu/g-cscm/www>

Dr. Ernest L. Nichols, Jr., Director  
FedEx Center for Supply  
Chain Management

Associate Professor,  
Marketing Supply Management  
The University of Memphis



## FEATURED RESEARCH CENTER

## Systems Testing Excellence Program

### *Innovative research with national impact*

Corporations and businesses of the 21st Century are defined as much by their IT as they are by the products or services they sell. Think Amazon, Google, Starbucks, Continental Airlines—think FedEx. What would happen to these corporations if their IT systems were to fail?

“Their revenue for that period of time would drop down to zero as their total operations are driven by technology,” says Dr. Jasbir Dhaliwal, Director of the Systems Testing Excellence Program (STEP) at the FedEx Institute of Technology (FIT) and Chair of the Department of Management Information Systems (MIS) in the University of Memphis’ Fogelman College of Business & Economics.

To prevent such a disaster, companies spend millions on business systems testing, trying repeatedly to achieve reliable computer software performance within an equally reliable computer infrastructure. While flawless software performance within an unerring computer infrastructure may be promising too much, systems testing best practices do form a continuous process that is designed to detect software flaws before they lead to a systems failure and irreversible losses.

STEP was established to review, test, optimize, and augment these best practices, because systems testing did not keep pace with the advances in software engineering and development that occurred in the last twenty years. By bringing these best practices into the 21st Century, STEP can help FedEx further achieve its goal of becoming a “World-class” testing organization.

STEP’s mission, therefore, focuses on advancing the theory & science of testing and on developing industry best practices that are based in rigorous methods of research and analysis.

STEP defines systems testing as a strategic and interdisciplinary area of interest, which includes all aspects of the testing of business systems, including hardware, software, and requirements testing as well as the evaluation of business rules. STEP integrates three technology disciplines—computer science, management information systems, and computer engineering—all dedicated to the science of systems testing.

And as an interdisciplinary research program, STEP engages fifteen faculty members, designated Systems Testing Research Fellows of the FedEx Institute of Technology. These fellows are top research professors from the Fogelman College of Business and Economics, the College of Arts and Sciences, and the College of Engineering. STEP now boasts the largest and most integrated group of systems testing researchers at any institution in the country. And key research relationships with leading researchers at Carnegie-Mellon University, the University of Illinois and the University of South Florida, have made UM’s STEP a national leader in establishing a rigorous science of testing. Furthermore, there is no other interdisciplinary program, proactively focused on systems testing with such a complement of expertise, anywhere in the world, making Memphis the center of cutting-edge research and best practices in systems testing.

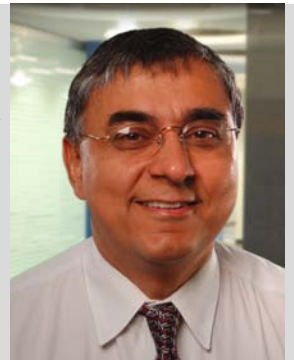
The research work of STEP translates into important educational advantages for UM students, providing industry in Memphis and the MidSouth with further expertise in systems testing. Seven doctoral students and eight master students are fully engaged in the program, learning from the benefit of both theory and experience. STEP’s educational mission also extends outwards, serving as a key research and training partner for FedEx’s Global Testing Center of Excellence. The program has also developed a research-based industry certification for testers that is helping the discipline develop as a distinct profession in the information technology sector. STEP has also developed curricular innovations that included software testing offered as a recognized focus area for selected undergraduate and graduate courses in 2007. STEP developed proposals for both a graduate certificate and an undergraduate minor in systems testing, which are currently under review at the University. In May 2007, STEP successfully organized its first national research workshop on advances and innovations in systems testing. This event featured fourteen paper presentations by STEP researchers and was attended by leading academic researchers as well as technology vendors and testing practitioners. Work is also underway to offer an advanced variation of STEP’s industry certification program for practitioners who seek research-based competencies.

STEP has developed a close working relationship with FedEx Corporation that involves collaboration on twelve research projects covering testing issues pertinent to FedEx’s plans for excelling at business systems testing. The goal is to stream a steady flow of best-practice ideas and competencies into FedEx’s testing organization as it moves up to the next level of operational excellence.

STEP will continue to expand and strengthen its research base in 2008 as it hosts another research competition to identify projects that are scientifically rigorous, involve interdisciplinary groups, and engage leading researchers at other institutions. Another national research workshop will also be organized in 2008 to establish the FedEx Institute of Technology as the primary focal point for national discourse about the state of the science of testing.

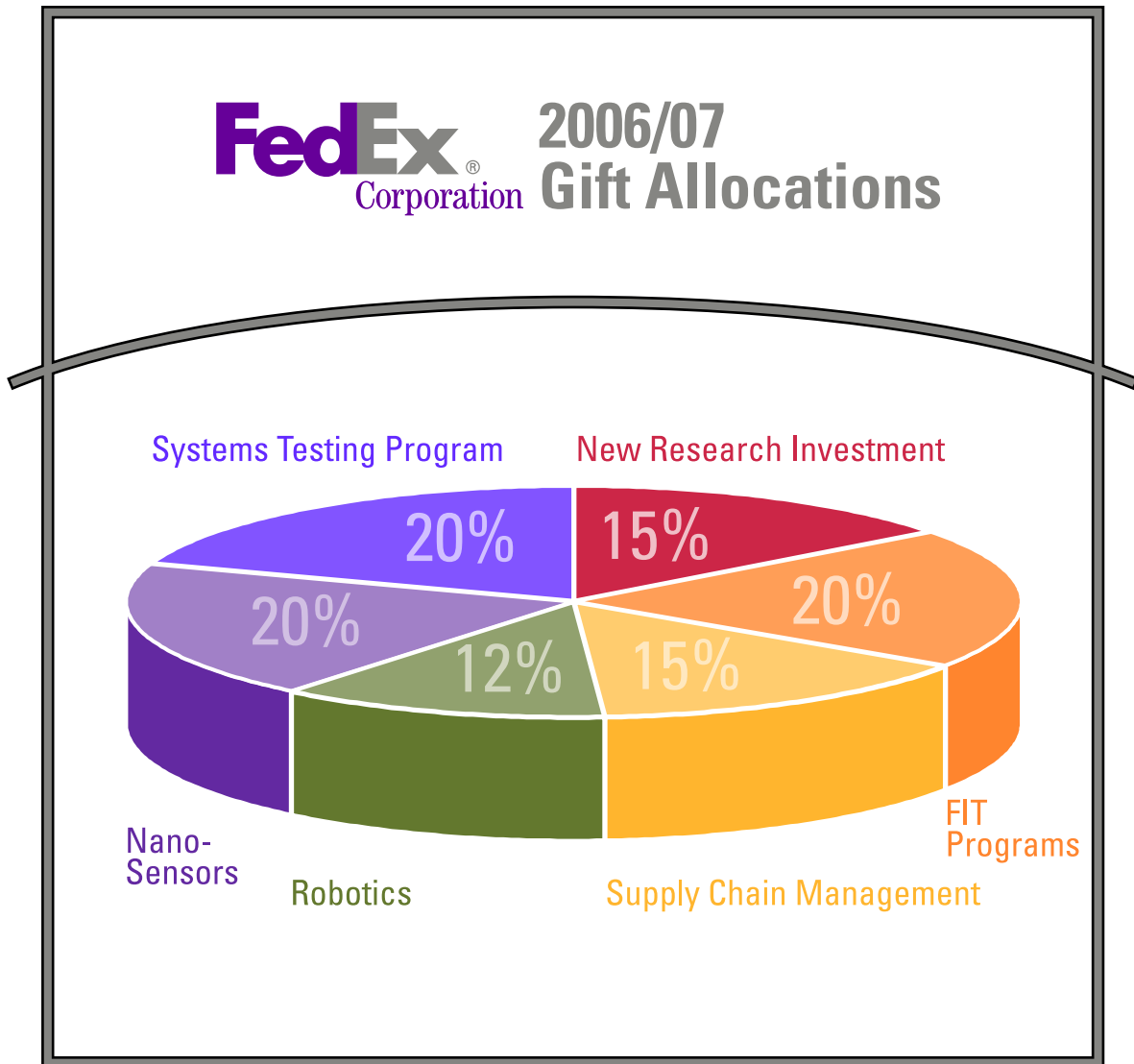
<https://umdrive.memphis.edu/g-mis/www/memphis/step/default.htm>

Dr. Jasbir Dhaliwal, Director  
Systems Testing Excellence Program  
Chairman,  
Management Information Systems  
The University of Memphis



## 2006/07 Gift Allocations

The accomplishments shared on the preceding pages were all made possible by the generous support of the FedEx Corporation. The diagram below explains how the FedEx gift for 06/07 was distributed across the FedEx Institute of Technology to initiate and extend the exemplary work of the FIT's researchers and programs.



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