

CCITT



Moving Research to Realization
in Surface Transportation



NORTHWESTERN
UNIVERSITY

Annual Report
2008



Contents

Center Theme	3
Education Program	4
Center Staff	4
Center Accomplishments	5
Technology Transfer Program	6
Advisory Board - External	7
Advisory Board - NU	7
Research Program	8
Funding Sources	9

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The theme of CCITT is to foster the commercialization or implementation of innovative technologies for multiple modes of surface transportation including, but not limited to, railways, mass transit, highways and waterways.

Center Theme

The transition of research ideas generated in a university research environment, to implementation in the commercial sector, has long-plagued inventors, universities and government communities.

A necessary step in the transition is the development stage. Yet, this stage typically lacks adequate funding because it falls between the cracks of government research grants and private-sector capital investment reserved for commercialization.

Further complicating the process is the reality that outcomes of university-based research projects often do not result in a proven concept that is suitable for licensing, or forming a company. Therefore funding projects in-between those two stages of development, termed the *innovation gap*, is the hallmark of this Center.

CCITT at Northwestern University fosters the commercialization and implementation of innovative technologies for multiple modes of surface transportation. In a model that is different from many campus transportation centers, CCITT draws from all science and

technology disciplines researched at Northwestern. It is our aim to enhance the University's status as a role model for the transfer of transportation technology and innovation.

CCITT does this by providing Northwestern researchers, from many disciplines, another resource to transition research to the market-place. The Center competitively awards Northwestern faculty members with funding for late-stage or translational research projects.

The Center also provides undergraduate and graduate students with additional opportunities to enrich their educational experience at Northwestern through internships, in a practical environment.

Education Program

In 2008 CCITT implemented an internship program for Northwestern University undergraduates. The program seeks applicants from a broad range of academic majors and minors, and is designed to involve students interested in the transportation industry and also students who might not otherwise consider it.

Through this internship initiative CCITT seeks to provide an opportunity for students to have an internship in marketing or industry research in the field of transportation. Consistent with our theme of commercialization, our interns conduct market research and explore technology commercialization paths for the *innovation gap* research projects that CCITT sponsors.

CCITT looks to four Northwestern undergraduate programs for its interns: the Business Institutions Program in Weinberg College of Arts and Sciences; the Business Enterprise Certificate program and

CCITT Internship Initiative



the Transportation Logistics Minor in McCormick School of Engineering and Applied Sciences; and the Kellogg School of Management's Certificate Program for Undergraduates. Although most intern candidates will come from engineering, arts, or science programs, CCITT will consider interns from any undergraduate field of study at Northwestern.

The Center's ultimate goal is to generate exposure to, and interest in, the

transportation industry as a career possibility. The corollary benefit of our education program is to tap the ingenuity of students to help move research to realization.

While the transportation field may not initially seem as exciting as information technology or management consulting to many undergraduates, it remains one of the core foundations of the United States and a tried and true economic engine. Moreover the new U.S. presidential administration will target funding for rebuilding transportation infrastructure, and from that job opportunities may arise.

Indeed there may never be a better time for students to have transportation on their résumés, and look to an established industry for new opportunities. The CCITT internship program has two goals --- to give students an opportunity to get involved in the transportation industry while gaining practical work experience; and to uncover market information that will be useful to faculty members and Northwestern's Technology Transfer Program. Thus far the program is accomplishing both objectives.

Center Staff

CCITT operates within Northwestern University's Office for Research as a multi-disciplinary research center. The Center is managed by Breton "Bret" Johnson, who reports to the Associate Vice President for Research Operations. Director Johnson also manages the Homeland Security Innovation and Entrepreneurship Center at Northwestern, a program that provides specialized homeland security business consulting services to entrepreneurs and small businesses, through a grant from the Illinois Department of Commerce and Economic Opportunity. In 2000 he joined a start-up technology commercialization program at

Northwestern that provided consulting services to Northwestern faculty and local technology businesses.

Director Johnson is responsible for the day-to-day operations of CCITT including:

- Oversight of the research selection process consistent with the Center's strategic plan;
- Developing and managing the Center's annual budget;
- Consulting with the principal investigators on technology transfer (commercialization) strategy;
- Leading an educational internship program;
- Collaborating with university departments, research centers and

institutes, transportation agencies and industry partners.

CCITT employed another administrator during its second year. Claudia Youakim supported marketing and communications for the Center as its Project Coordinator. In addition she provided assistance with research project administration.

CCITT receives research administration and operations support from Mary Tobin, Director of Administration and Resource Planning, and Damien Trimuel, Business Coordinator, both from the Office for Research Planning, Finance and Communications.

Center Accomplishments

Research Updates

In its first round of grant funding CCITT reviewed, approved and awarded three late-stage research projects. Principal Investigators were notified of awards in January 2008. A common theme was observed from the awards; each proposal addressed an issue impacting transportation system resiliency. Consistent with the the national strategy for surface transportation, the research projects selected will address congestion, environmental impact and safety issues. This is in line with our goal at CCITT -- moving research to realization in surface transportation.

Super-Tough Steel for Bridges and Other Infrastructure Applications

PI: Semyon Vaynman

Co-PIs: Morris E. Fine, Yip-Wah Chung

Department: Materials Science and Engineering

Impact: Safety

In the search for a new steel, deemed more desirable for infrastructure applications like bridges and tank cars, a research team has sought to develop an appropriate steel with high fracture toughness at low temperatures. Semyon Vaynman and Professor Emeritus Morris Fine, along with Yip-Wah Chang, have taken charge of the task, building on their experience developing the A710 Grade B high-strength steel. The current research team of Vayman, Fine and Professor Yip-Wah Chung proposes to design a next-generation steel with much higher fracture toughness.

In the last quarter of 2008, a 50 lb. sample of steel was produced at Sophisticated Alloys, Inc. and mechanical properties were tested at Northwestern University. The strength of the steel exceeded the target of 60-ksi-yield and Charpy specimens did not fracture down to -60°F. The properties of the steel were summarized in a report that was disseminated to steel producers and steel consumers, including a number of Northern State DOTs. Thus far they have received a positive response from Montana DOT.

Union Tank Car Company (UTLX) has expressed interest in the 50 lb. sample test results. Further collaboration included sharing with UTLX the cost of a 300-lbs heat at Sophisticated Alloys. UTLX will include the steel in a puncture test program. If the testing meets expectations, UTLX may order enough steel to manufacture one or two tank cars.

Video Traffic Analysis for Abnormal Event Detection

PI: Aggelos K. Katsaggelos

Co-PIs: Sotirios A Tsafaris, Ying Wu

Department: Electrical Engineering and Computer Science

Impact: Congestion, Environmental Impact, Safety

The team of Katsaggelos, Wu and Tsafaris are working to provide the foundations of a system that will allow the off-line analysis of video data. As there is no prior knowledge given for patterns of unusual video events, the researchers aim to analyze all the trajectories extracted from existing videos and differentiate unusual trajectories from normal ones automatically.

To date they have collected video data from various sources, implemented a vehicle tracking algorithm, and initiated trajectory analysis and classification into abnormal and normal categories. According to the team, the Next Generation Simulation (NGSIM) aerial traffic video dataset (accessible at - <http://ngsim.camsys.com/>) of the Federal Highway Administration provides the most viable option for acquiring clean, usable data.

From this source the researchers have highway traffic videos from multiple cameras, with limited compression and good resolution. Used during the course of investigation is an algorithm the team developed, which detects objects entering the video, generates a statistical background model of the scene from a few early frames of the video, and then identifies objects --- such as vehicles or people --- from the surrounding areas. The team has been able to demonstrate the ability to "map" clusters of normal

traffic trajectories and then detect and map unusual trajectories. The team will ultimately investigate two main challenges for the model in detecting abnormal events that lead to congestion: time and the interaction of simultaneous objects.

Providing Reliable Route Guidance

PI: Yu "Marco" Nie

Co-PI: Peter Nelson, UIC

Department: Civil and Environmental Engineering

Impact: Environmental Impact, Congestion

The goal of the Nie team's commercialization project is to develop the "Chicago Testbed for Reliable Routing" or CTR. A prototype Windows-based software application is currently available upon request for download. The prototype application provides visualization and analysis of Gary-Chicago-Milwaukee (GCM) corridor data, the ability to generate travel time distributions, and reliable routing guidance.

To arrive at this stage, the team first tested and evaluated several approximation algorithms for the reliable- route problem. Then they mapped geographic information data from the GCM dataset to the Chicago regional road network model developed by the Chicago Metropolitan Agency for Planning. At the conclusion of the project Nie, Nelson and Wu expect to make CTR available on the Internet through the Artificial Intelligence Laboratory at the University of Illinois at Chicago.



Tech Transfer Program

Bridging the Gap

CCITT provides a sound platform for technology transfer and implementation of market-driven opportunities. In addition to fostering the transfer of information through the traditional academic means of papers and presentations, CCITT seeks to foster direct relationships with transportation practitioners. Our program encourages collaboration with public or private-sector transportation practitioners, and public or private-sector transportation data sources.

CCITT is successful if it enables the transfer of technology innovations in 36 months, or less, after a project is launched. A CCITT project is also considered successful if it produces tangible solutions (i.e. hardware, software, proven methodology) to real-world problems.

CCITT has implemented a commercialization process to enhance the likelihood of achievement. At the outset of a funded project, we hold a kick-off meeting with the principal investigators, a representative from Northwestern's Technology Transfer Program, and selected Advisory Board members. The group discusses a variety of factors impacting implementation, such as expected project outcomes, resources or end-user relationships needed, intellectual property strategy, and potential barriers to adoption. Industrial researchers may also attend the kick-off meeting, or participate in an additional project-launch discussion. As part of this

process, Principal Investigators are required to submit a mid-term progress report and identify problems encountered and further resources or contacts needed. At the conclusion of a project, the research team will deliver a final report and presentation to a diverse group of project stakeholders.

As part of the technology transfer process CCITT student interns conduct market research and competitive analyses during the course of the projects. Interns contact potential end-users, manufacturers of complimentary products, and public and private sector experts to assess opportunities for market entry or market expansion. This information aids the investigators during the course of a project and provides potential actionable information for the technology transfer program.

2008 Intern Contributions:

Steel Project

Identified additional target market opportunities, interested state departments of transportation and steel manufacturers.

Route Guidance Project

Completed industry analysis of primary market value chains; confirmed market interest in reliable routing algorithms; and identified practitioners at IDOT and City of Chicago to provide product feedback.



Furthermore, CCITT has established an Advisory Board of Northwestern and community stakeholders who provide valuable insight, guidance, and feedback to Center staff and Principal Investigators. Their complete biographies follow this synopsis.

Our external advisors of transportation professionals include **David Boyce**, Adjunct Professor of Industrial Engineering at the McCormick School, **Thomas Ewing**, Associate Division Director of Argonne National Laboratory, and **Michael Shiffer**, Clinical Associate Professor of Urban Planning and Policy at the University of Illinois at Chicago.

Members of the Northwestern community on the Board are **Jeff Coney**, Director of Economic Development for Northwestern University, **Aaron Gellman**, Professor of Transportation and Industrial Engineering in the McCormick School and Adjunct Professor of Management of Strategy in the Kellogg School, and **Michael Marasco**, Director of the Center for Entrepreneurship and Innovation in the McCormick School.

Advisory Board

External Advisors

David Boyce

During 41 years of academic research and teaching, Professor Boyce has addressed key methodological issues related to metropolitan transportation and land use planning. His early monograph, *Metropolitan Plan Making*, critically examined the experience with the land use and travel forecasting models during the 1960s. Recognizing that these methods lacked an adequate scientific basis, he devoted his career to the formulation and solution of urban travel and location forecasting models. Boyce is currently a professor at Northwestern University in the Department of Civil Engineering.

Thomas Ewing

Ewing has a broad background in applied physics, mathematics, and computing. His three decades of experience span fields such as nuclear power research, software design and development, mathematical modeling and simulation, and technical project development and management.

Currently Ewing is a senior scientist and Associate Division Director of Nuclear Engineering. He has line-management responsibility for the national security programs, and lab-wide responsibility for developing and coordinating transportation and border security initiatives for Argonne's program in homeland security. He holds Ph.D and Master's degrees in Nuclear Engineering from the University of Wisconsin (Madison), and a B.S. in Engineering Physics with honors from the University of Toledo.

Michael J. Shiffer

Shiffer is a Clinical Associate Professor of Urban Planning and Policy at the University of Illinois at Chicago. He was formerly the Vice President for Planning and Development at the Chicago Transit Authority. For over six years at the CTA, Shiffer led the strategic and operations planning efforts of the second largest

public transit system in the U.S. During his time there, ridership grew by nearly 40,000 trips per average weekday, with much of the growth on new and improved routes. His academic research has focused on how information technologies can better inform deliberation, decision-making and public debate with a focus on spatial (geographic) information.

Before returning to his native Chicago in 2000, Shiffer served for nine years on the MIT faculty where he was Principal Research Scientist and a Lecturer in the Department of Urban Studies and Planning. There he directed the Urban Planning Computer Research Lab and researched how new technologies (such as GIS, wide-area networking and new models of multimedia) could inform planning processes. While he was at MIT, Shiffer also taught courses related to transportation and urban planning methods. Shiffer received a Ph.D. in Regional Planning and Master's of Urban Planning from the University of Illinois at Urbana-Champaign. Shiffer has a B.A. in Geography from DePaul University.

Northwestern Advisors

Jeff Coney

Coney serves as Director of Economic Development at Northwestern University, a position he was appointed to in September 2007. Coney joined Northwestern in 2000 as Director of New Business Initiatives. In that role, he was responsible for day-to-day operation of the Illinois Technology Enterprise Center (ITEC) in Evanston, which delivered a variety of technology commercialization services to local early-stage tech companies. The Center served over 350 entrepreneurs and assisted in the formation of over 50 ventures. ITEC clients raised over \$85 million in venture capital and grant funding, and created several hundred jobs.

Prior to joining the University, Coney spent 14 years as a software entrepreneur. He co-founded Facility Management Systems Inc., a local software company, which was sold to a publicly traded company. He also held positions with Arthur Andersen, Metropolitan Structures and The City of Chicago. He is a founding member of the

Midwest Research Universities' Network. Mr. Coney holds both B.A. and M.B.A. degrees from Northwestern and is a Certified Public Accountant.

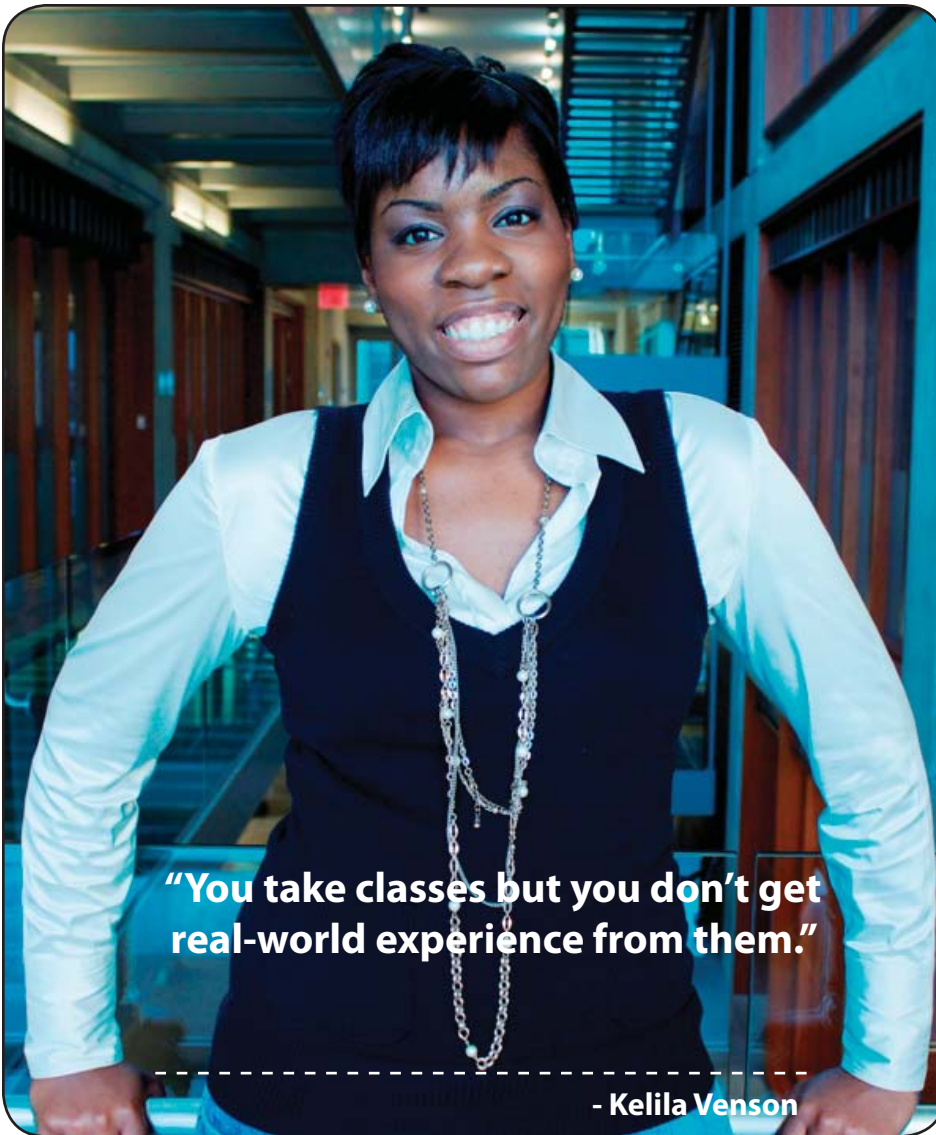
Aaron Gellman

Gellman joined the faculty of the Kellogg School of Management in 1992 as a professor of management and strategy. He also holds an appointment as professor of industrial engineering at the Robert R. McCormick School of Engineering and Applied Science at Northwestern University. Dr. Gellman was the Director of the Transportation Center at Northwestern University from 1992 through 2000. He founded and was formerly president of Gellman Research Associates Inc., a consulting firm. Prior to joining the faculty at Northwestern, he served 24 years as an adjunct professor at the University of Pennsylvania.

Professor Gellman is a member of the American Economic Association, Transportation Research Forum, Transportation Research Board, American Railway Engineering Association, and the Pennsylvania Conference of Economists. He is also a Fellow of the American Association for the Advancement of Science.

Michael A. Marasco

Marasco joined the faculty of Northwestern University McCormick School of Engineering and Applied Sciences as a clinical associate professor and director of the Center for Entrepreneurship and Innovation. CEI is dedicated to evolving engineering beyond the application of the sciences to the creation of businesses that capitalize on innovations. Marasco has been teaching entrepreneurship and intrapreneurship for the past thirteen years. He received his BS in Accountancy with high honors from DePaul University and an MBA from the Harvard Business School.



“You take classes but you don’t get real-world experience from them.”

- Kelila Venson

Kelila Venson is a senior in the Business Institutions Program and serves as CCITT’s current intern. She began her internship in September and will stay on through the spring 2009 quarter. Venson is performing market research for professors who have developed an algorithm to predict travel times based on historical data for the Gary-Chicago-Milwaukee corridor.

Venson’s day-to-day tasks include research and conducting phone interviews to ascertain who would want this data, how they would collect it, and why. Venson said the real-world experience she has gained will give her an advantage

over other students because she has practical market research experience. Before she began her internship, Venson had no particular interest in transportation but she saw that the internship was open to Business Institutions Program students and liked that it had a connection with Northwestern. Most important though, she thought it would be a good experience.

Venson said she is happy that CCITT internship was made available to students in any field, not just engineering students, and that it has exceeded her expectations.

Student Intern Gets Award

Phillip Reich was CCITT’s first intern and worked during the summer quarter of 2008. Reich is a senior majoring in economics and international studies while earning a minor from the Business Institutions Program. Reich was named as student intern of the year in 2008 and received a scholarship award.

He lauded the CCITT internship program for providing him with an opportunity to use the skills he learned in the Business Institutions Program curriculum and connect them with real-world experiences. During his summer-long internship, Reich first learned about the new technology he was researching --- a type of steel that is particularly weather-resistant and durable --- and then determined some unexplored markets for the product.

As part of his research, Reich talked to Northwestern professors with expertise in steel production and a local steel company to get a sense of how steel production is done. He also contacted representatives of state departments of transportation, particularly in Northern states, to garner interest in the product. Reich’s research culminated in a presentation he gave to the principal investigators, where he presented them with his findings and a marketing strategy for their product.

Reich believes the real-world experience that he gained from the CCITT internship will help him land a job quickly in a stagnant hiring market. He values most the experience he gained in market research and said he also gained more knowledge and interest in the transportation industry as a whole.

Funding Sources and Expenditures

CCITT is reporting Sources of Funding and Expenditures cumulative from the beginning of the grant (i.e. the sums of Year 1 and Year 2).

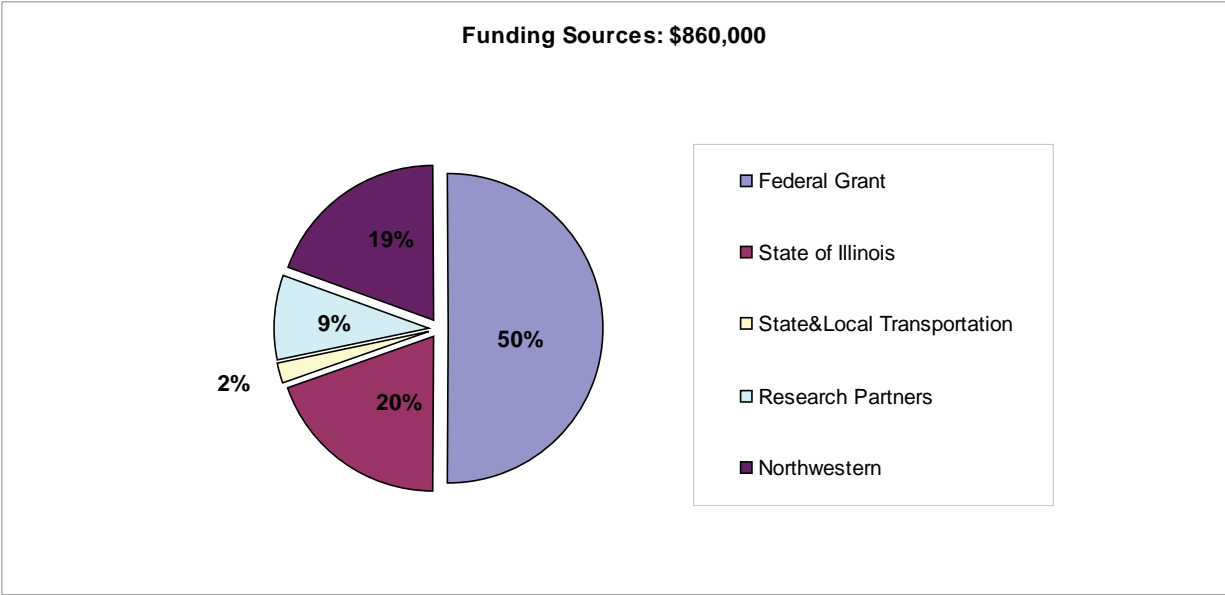


Figure 1. CCITT Sources of Funding

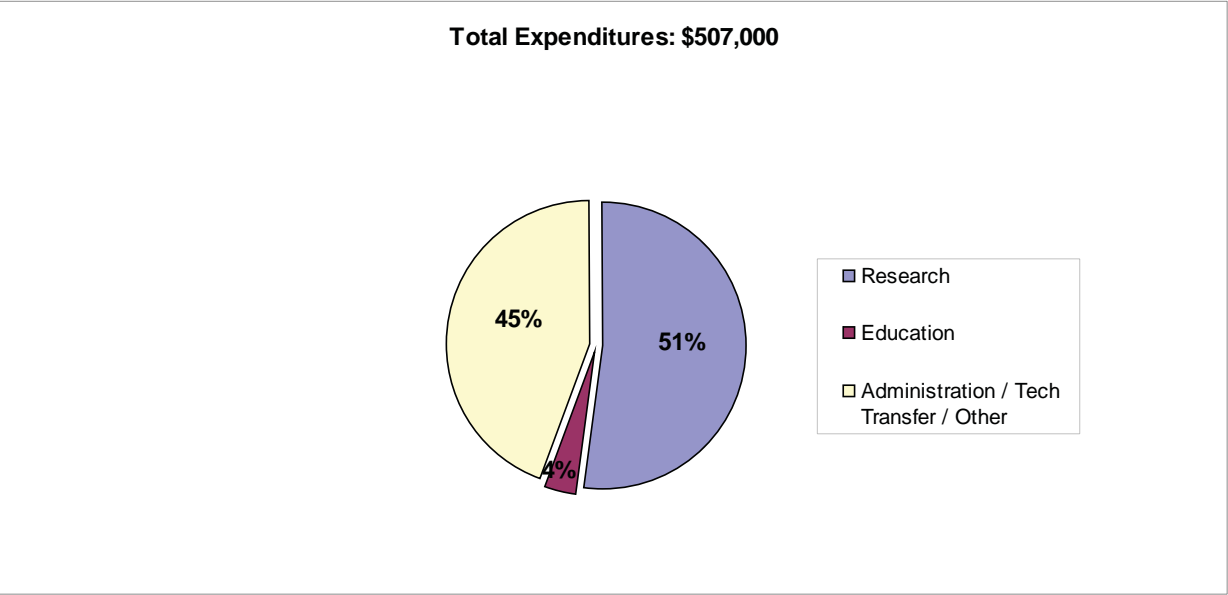


Figure 2. CCITT Categories of Expenditures



Center for the Commercialization of Innovative Transportation Technology

For more information about CCITT please visit our webpage:

<http://www.ccitt.northwestern.edu>

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