

THE UNIVERSITY OF KANSAS

Information and Telecommunication Technology Center (ITTC)

ANNUAL
REPORT
FISCAL YEAR
2007

THE ITTC VISION

To be a global leader and strategic partner

in the creation and commercialization of innovative technologies in

- ▶ telecommunications,
- ▶ information systems,
- ▶ bioinformatics, and
- ▶ radar.

THE ITTC MISSION

- ▶ **To advance knowledge and create innovative technologies** in telecommunications, information systems, bioinformatics, and radar;
- ▶ **To educate and train students** for technology leadership;
- ▶ **To transfer knowledge and innovative technologies** to Kansas companies and national industries—

by providing an excellent interdisciplinary research and development environment.

Our Focus is Your Future!

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The Information and Telecommunication Technology Center (ITTC) is a KTEC Center of Excellence, funded in part by the Kansas Technology Enterprise Corporation. ITTC is a division of the University of Kansas, which is an entity of the State of Kansas separately managed and distinct from the Kansas Technology Enterprise Corporation.

DIRECTOR'S WELCOME



By transitioning knowledge and innovative technologies from ITTC to the private sector, the Center contributes to the economy of Kansas and the nation. Each of our commercialization efforts takes its own particular path, requiring us to exercise perseverance and patience.

By highlighting two recent ITTC technology transfer successes—Vidwatch/Veatros, and the KU RFID-Tag—we underscore the importance of a long-term perspective as well as determination.

Vidwatch/Veatros

For the past decade, ITTC supported the digital video processing technology Vidwatch and the subsequent start-up company, Veatros, formed with the goal of turning Vidwatch into a commercial success. ITTC funding allowed investigators **John** and **Susan Gauch** to develop the technology and new applications while demand grew. One of the Center's newer technologies, the KU-Tag, has attracted the attention of industry. Two companies have licensed the RFID technology, and we expect the KU-Tag will provide ITTC with additional commercialization opportunities.

In 1997 the Gauches received commercialization funding, provided by ITTC via its support from the Kansas Technology Enterprise Corporation (KTEC), to develop Vidwatch. The effort involved research, and eventually intellectual property protection, travel, and marketing. Initially the new technology focused on monitoring television broadcasts, ensuring cable stations were not using more commercial time than they had purchased.

After KU reviewed the technical disclosure, ITTC licensed Vidwatch internationally. The Center filed a U.S. patent, which was issued in the summer of 2001. Our technology commercialization staff along with the inventors developed commercialization strategies and marketing opportunities. The growing commercial interest led to the creation of the ITTC start-up company Veatros, founded in the spring of 2002. In 2005 under a Kaufman Foundation grant, Susan Gauch presented Veatros at the Larta Institute's Project T2, one of the nation's most prestigious conferences focused on technology transfer. The Larta

Institute is a nonprofit organization that brings together people, technology, and capital to drive innovation.

Veatros became the first company selected for Larta's T2 Venture Capital (T2VC). T2VC mentored the company through its acquisition by DivX, a digital media company. Veatros technology will perform enhanced video and discovery searches to help better manage users' media collections. As a result of the long-term investment in this technology, its 2007 acquisition generated substantial revenue for all involved, including ITTC and the University.

Read more about Veatros on page 33.

KU RFID-Tag

Our newest technology with great commercial potential is the KU-Tag, a radio frequency identification (RFID) system developed by ITTC Research Assistant Professor **Dan Deavours**. Deemed the next-generation bar code, RFID tags "listen" for radio queries from readers and respond with their unique ID code. RFID allows organizations to more quickly and efficiently track their assets or products—from laptops and machines to containers and metal drums.

As the Department of Defense, Wal-Mart, and other retailers began requiring RFID for inventory tracking, suppliers needed objective information about tags under real-world conditions. In 2004, ITTC teamed with Rush Tracking Systems, a Kansas-based, private RFID systems integrator, and the RFID Journal, a leading media company, to create the ITTC RFID Alliance Lab. Initially, ITTC researchers examined how well different RFID tags performed when placed on various product types and released performance reports. While conducting testing, Deavours observed that when RFID tags were attached to liquid containers or metal objects, radio communication between the tags and their readers was significantly impaired.

To address this deficiency, Deavours applied for internal commercialization funding from the Center. With this support, Deavours created one of the best-performing, least costly, and thinnest radio frequency identification (RFID) systems specifically designed to work on metal or objects containing liquid. According to Toby Rush of Rush Tracking Systems, the KU-tag provides a long-needed solution. This spring Container Technology, Inc., obtained the

DIRECTOR'S WELCOME

tag to improve monitoring of its liquid containers. The next month Kansas City-based Starport Technologies, LLC, obtained the right to manufacture and market the KU-Tag system. Starport recently signed a contract to produce 30,000 tags for a Fortune 500 company.

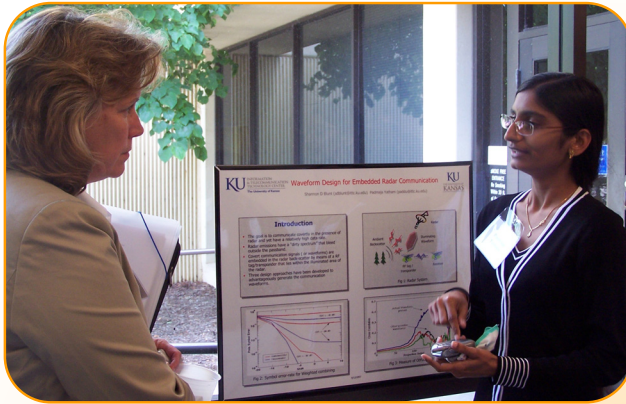
Find more about KU-RFID Tag research on page 32.

The Center not only supports the creation of innovations like those described above but also possesses the capabilities to take technologies from the lab to the marketplace.



Dr. Victor S. Frost
Dan F. Servey Distinguished Professor,
Electrical Engineering and Computer Science
Director of ITTC

Student Poster Session at ITTC Industry Advisory Board Meeting, June 2007



M.S. student Padmaja Yatham describes her research on waveform design for embedded radar communication to Terri Reintjes, of Sprint Corp. Shannon Blunt directed the project.

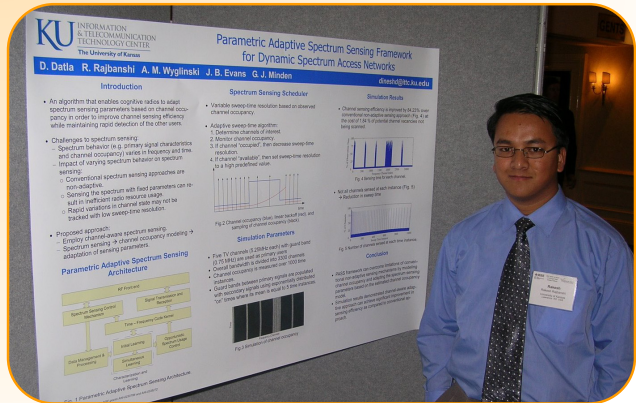


IAB member Jeffrey Fuller, of Honeywell FM&T, listens as Ph.D. student Jim Stevens describes his research, directed by David Andrews, on hybrid threads.

ITTC Research Team at Dynamic Spectrum Access Networks (DySPAN) Symposium Dublin, Ireland, April 2007



The team who attended (from left): Ph.D. student Rakesh Rajbanshi, M.S. student Ted Weidling, Professors Joe Evans and Gary Minden, Ph.D. student Tim Newman, and M.S. students Rory Petty and Jordan Guffey.



Ph.D. student Rakesh Rajbanshi stands by the poster representing his research on the Flexible Wireless Systems for the Rapid Network Evolution project, directed by Gary Minden.

ITTC OVERVIEW, FY2007

The hard work of ITTC's faculty, staff, and students resulted in a fruitful year, which in part is illustrated through our efforts in commercializing the Center's technologies. The Center's multiple licensing of the radio frequency identification (RFID) technology, the KU-Tag, marked one of our most notable technology transfer accomplishments. Our strategic direction was reaffirmed this spring with a successful peer review conducted by KTEC. Additionally, we have begun to reload our pipeline with a number of new initiatives that explore interest in research questions and promise great commercial potential.

KU-Tag Licensed

ITTC signed two licensing agreements for its RFID KU-Tag technology. In March, Container Technology, Inc., obtained the tag to better monitor its liquid containers. The following month, Kansas City-based Starport Technologies, LLC, secured an exclusive manufacturing and marketing agreement for new RFID tags that leverage the KU technology. Starport recently signed a contract to produce RFID tags that will be used by a Fortune 500 company.

KTEC Peer Review

ITTC received high marks from an independent review team assembled by the Kansas Technology Enterprise Corporation (KTEC). As ITTC is a KTEC Center of Excellence, its effectiveness with respect to its research and economic development activities is examined by IT researchers from nationally recognized institutions. KTEC

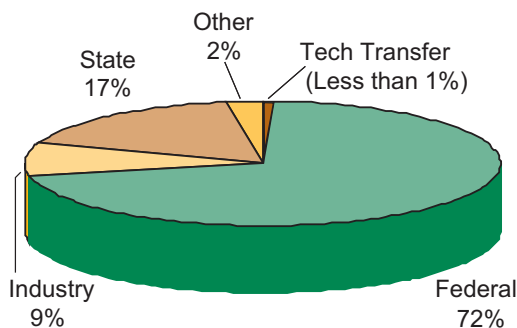
uses the review as a planning and analysis tool, which impacts allocation and management of resources. Results of the peer review also help guide ITTC in its strategic direction.

"ITTC is a significant component of the state's technology-based economic development network," the review team stated in its evaluation. "The team applauds the Center for continuing to improve its relationship to industry and its devotion to producing economic development outcomes. The question becomes one of how this resource can be leveraged for even greater contribution to the University and to the state."

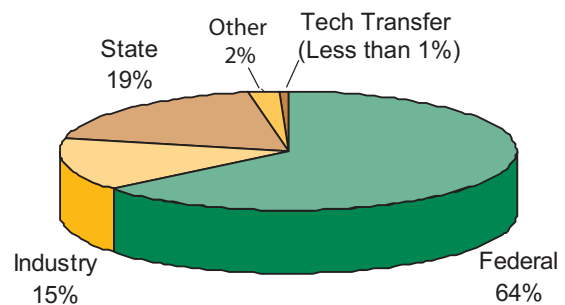
Part of the review consisted of a closed-door session in which four ITTC industry clients discussed the Center's services with the external review team. In their report, the reviewers noted that clients were pleased with ITTC services and were particularly complimentary of the staff's knowledge base, responsiveness, and ability to map out commercial opportunities. One client said that his company works with three university-based IT centers, and ITTC is the best of the group. Clients agreed that the Center was flexible, yet constrained by available resources in terms of technical manpower to greatly expand its client base.

Reviewers indicated that ITTC economic development activities would benefit significantly from the University's proposed update of commercialization and corporate-sponsored research policies. With the implementation of reviewers' recommendations and the capabilities and positive attitudes of ITTC staff, reviewers wrote that the Center's impact would grow substantially.

ITTC Research/Development & Commercialization Income by Source, FY2007



ITTC Research/Development & Commercialization Expenditures by Income Source, FY2007



ITTC FY2007 OVERVIEW

Interaction With Industry

ITTC held its annual Industry Advisory Board (IAB) meeting in June. Honored guest speaker KU Provost and Executive Vice Chancellor **Richard Lariviere** led a lengthy discussion on how to improve interactions between the University and industry. The question-and-answer session between the Provost and IAB gave each a greater appreciation of the challenges and opportunities that face the Center and its partners. ITTC Director **Victor Frost** reviewed the first ten years of activities within the Center, which accounted for more than \$55 million in research expenditures. Director of Technology Commercialization **Keith Braman** then updated IAB members on continuing research and new projects with a focus on technology commercialization opportunities. The day concluded with the student poster session. Twenty-nine posters were displayed and can be found at www.ittc.ku.edu/techreview2005/posters2007.phtml. (See also photos, page 2.)

In further support of the Center's KTEC mission, ITTC researchers assist local technology companies and regional technology organizations such as the Lawrence Technology Association (LTA), Enterprise Center for Johnson County (ECJC), Lawrence Regional Technology Center (LRTC), and ITKC (a Kansas City-based group organized to promote information technologies). ITTC assisted 23 companies in the past fiscal year. Gift Professor, LLC, was one such com-

pany that ITTC supported in FY07. The company is interested in developing an Internet-enabled application. ITTC has worked closely with the start-up to develop a software implementation specification, which will be used to build its application.

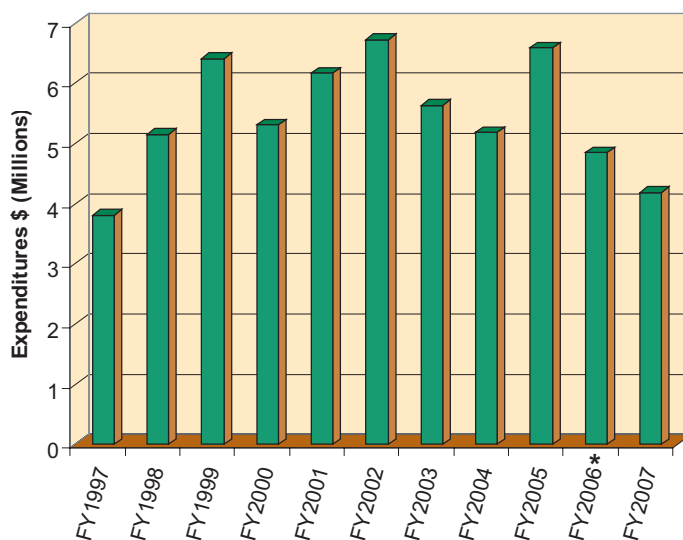
In June, ITKC and LTA sponsored a special networking event, "A Focus on ITTC at KU." The meeting, held at ITTC's home in Nichols Hall, attracted regional and local industry participants, who learned about the Center's technological innovation and commercialization.

Internal Commercialization Efforts

With the support of KTEC resources, ITTC funds a number of internal research efforts that are well positioned for commercialization. A panel of IAB members reviews each project before funding is approved. Throughout FY2007, four projects were funded, of which one has already resulted in two license agreements. The titles to the projects funded throughout FY2007 are:

- Metal-Mount UHF RFID Tag, Phase II (2 licenses);
- Abstract Interpretation of Rosetta Specifications, Phase II;
- Learning the Contents of Images for Image Retrieval; and
- Reusable Learning Object Creation and Management System. (See photo, page 5.)

ITTC R&D Expenditures From External Funding Sources, FY1997–FY2007**



*In FY2006, the NSF Center for Remote Sensing of Ice Sheets (CRISIS) was established and associated activities transitioned out of ITTC.

**Total expenditures from *all* sources for FY2007: \$4,881,681.

Other Notable Accomplishments Throughout the Year

ITTC investigators Joseph Evans and Gary Minden and their graduate research assistants attended the Dynamic Spectrum Access Networks (DySPAN) conference this April in Dublin, Ireland. They presented the KU Agile Radio and other ITTC research. (See photos, page 2.)

ComputerWorld Magazine featured ITTC investigator Joseph Evans' CogNet research in its April 16 issue. The article, "Future Watch: Wireless Wises Up," highlights the wireless communication protocols for cognitive networks being developed at ITTC as part of the National Science Foundation (NSF) Future Internet Design (FIND) initiative.

The KU-Tag was one of three KU inventions presented at the Big 12 Center for Economic Development, Innovation, and Commercialization in March.

Two licenses for Rosetta technologies were issued during FY2007 to ITTC spin-out company Cadstone.

Source Code for Biology and Medicine, a new peer-reviewed online journal, invited ITTC bioinformatics researcher **Xue-wen Chen** to serve on its editorial board.

Perry Alexander, director of ITTC's Computer Systems Design Laboratory (CSDL), has written the textbook *System-Level Design With Rosetta*, published by Morgan Kaufmann. The book examines the system-level design language (Rosetta), providing clear code examples and case studies.

Ron Hui was an invited speaker at the Nortel Networks Annual Research Review. He discussed his optical performance monitoring using coherent detection research.

Jim Miller's Reusable Learning Object Creation and Management System project was selected to receive ITTC/KTEC internal support (see page 4) because of its potentially commercializable technology. Dr. Miller is co-director of the e-Learning Design Lab (eDL), which is jointly sponsored by ITTC and KU's Center for Research on Learning (CRL). He is shown here running the Object-Based Instructional Unit (OBIU) developed under this project. The easy-to-use system allows educators to create, revise, customize, and structure content when building online courses. The content comprises instructional units stored in a searchable archive.

Each lesson can provide different multimedia presentations of course material along with activities, assessment tools, supplemental materials, and a glossary. Multiple users can collaborate on lessons, as OBIU offers personal accounts for creating, sharing, and storing the reusable learning tools. As new or modified units are created, the archive and its utility grow.



ITTC INDUSTRY ADVISORY BOARD



At the June 20, 2007, ITTC Industry Advisory Board meeting, attendees heard KU Provost **Richard Lariviere** describe KU's policies, challenges, and intentions for the future regarding research and technology transfer. IAB members responded with statements of the needs and hopes of industry in connection with those policies, challenges, and intentions.

Selected IAB members review and make recommendations on proposals submitted by KU faculty and staff for annually selected "internal" projects to develop technologies with commercialization potential.

IAB members during FY2007 were as follows:

Gary Alexander, Alexander Open Systems, Overland Park, Kan.

James Baxendale, KU Center for Research, Lawrence, Kan.

Gerard Canavan, Road9, Greenwood Village, Colo.

Kevin Carr, Kansas Technology Enterprise Corp., Topeka, Kan.

Chi-Chao Chang, Search and Marketplace, Yahoo!, Sunnyvale, Calif.

James Dahmen, Columbus Telephone Co., Columbus, Kan.

William Duncan, KC Area Life Sciences Institute, Kansas City, Mo.

Marc Epard, Horizon Analog, Lawrence, Kan.

Jeffrey Fuller, Honeywell FM&T/KCP, Kansas City, Mo.

Marshall Greenspan, Northrop Grumman Corp. Electronic Systems, Norwalk, Conn.

Bennett Griffin, Griffin Technologies, Lawrence, Kan.

John Hansen, Cerner Corp., Kansas City, Mo.

James Isaacs, ITT Aerospace/Optical Div., Ft. Wayne, Ind.

Twenty-four members of ITTC's Industry Advisory Board attended or sent representatives to the IAB meeting on June 20, 2007. Pictured here are 22 of them, along with ITTC executive staff. Left to right, continuing up the stairs:

Back row: George Wilson, Tim Johnson, Eric Mokole, Jerry White, Marshall Greenspan, Kevin Carr, Paul Timler (Nortel Networks).

Inner row: Mike Swink, Wayne Morgan, Kathy Suprenant, Chris Murrish (Cerner Corp.), Susan Norris, Tim Templeton (Sunflower Broadband), Gary Mastin, Jeff Fuller.

Front row: John Strand, Matt McClorey, Terri Reintjes (Sprint Corp.), Keith Braman, Jim Baxendale, Bennett Griffin, Victor Frost, Marc Epard, Gerry Canavan, Mike Sobek.

Photo by Wally Emerson.

Bob LaGarde, LaGarde, Inc., Olathe, Kan.

John Louis, KU Networking and Telecommunications Services, Lawrence, Kan.

Tom Lyon, Lyon About, LLC, Palo Alto, Calif.

Gary Mastin, Lockheed Martin Integrated Systems and Solutions, Litchfield Park, Ariz.

Matt McClorey, Lawrence Regional Technology Center, Lawrence, Kan.

Eric Mokole, U.S. Naval Research Lab, Washington, D.C.

Wayne Morgan, Netchemia, Lenexa, Kan.

David Nicol, Solutionary, Overland Park, Kan.

Susan Norris, Norport Technology Management Consulting, Lenexa, Kan.

Stan Pierson, Aeroflex Test Solutions, Wichita, Kan.

Brian Ruf, Ruf Strategic Solutions, Olathe, Kan.

Toby Rush, Rush Tracking Systems, Lenexa, Kan.

Stephen Schneider, Sunflower Broadband, Lawrence, Kan.

Michael Sobek, StoreFinancial, Overland Park, Kan.

Deborah Stokes, Nortel Networks, Richardson, Texas.

John Strand, Axis Solutions, Leavenworth, Kan.

Kathy Suprenant, KU Molecular Biosciences, Lawrence, Kan.

Mike Swink, Tactical Blue Laboratories, Olathe, Kan.

Ben Vos, Sprint Nextel, Overland Park, Kan.

Gerald White, EDS, Overland Park, Kan.

George Wilson, KU Center for Research, Lawrence, Kan.

LABS OVERVIEW

ITTC works to create fundamental knowledge and technologies in computing, communications, sensors, and bioinformatics. Researchers from diverse areas give the Center its breadth of activity. During FY2007, more than 51 Ph.D. candidates, 64 master's students, and 20 undergraduate students were gaining hands-on experience under the direction of 44* ITTC-affiliated faculty and staff researchers. The Center is educating the next generation of technology leaders as it focuses not only on solutions to today's complex problems but also on the technological needs of tomorrow. ITTC research is categorized under the following six research laboratories:

- Bioinformatics and Computational Life-Sciences Lab (BCLSL)
- Communications and Networking Systems Lab (CNSL)
- Computer Systems Design Lab (CSDL)
- e-Learning Design Lab (eDL)
- Intelligent Systems Lab (ISL)
- Radar Systems and Remote Sensing Lab (RSL)

The Center houses state-of-the-art facilities, including a high-speed networking lab with a fiber connection to a long-distance network. Researchers work in a digital radio laboratory that provides design and fabrication capabilities along with digital signal processing. The Center possesses an integrated, diverse networking environment and a leading-edge photonics research laboratory. Comple-

menting the hardware facilities, the Center uses some of the best-in-class design, software-development, and bioinformatics tools.

ITTC's computing cluster (new in FY2005), made up of 384 processors with 32 terabytes of storage, permits researchers to fragment computations and perform them in parallel. Such division of labor permits the analysis of genomes with billions of nucleotides, and other data-intensive computations. The multiple machines housed in one location on a high-speed network make the ITTC computing cluster a powerful, integrated platform for researchers.

The Center places great emphasis on realizing the commercial potential of the technologies and expertise developed in its laboratories. As a KTEC Center of Excellence, ITTC has transferred numerous technologies to companies, and it supports companies in their technology development efforts. For example, radio frequency identification (RFID) technology developed by researchers in ITTC's Communications and Networking Systems Laboratory (CNSL) has been licensed to two companies. (See pages 3 and 32.) The Center has spun out additional technologies to create start-up companies and continues its successful development of internally funded commercialization efforts. To date, 16 U.S. patents have been granted as a result of ITTC research.

*Includes 43 faculty principal investigators and 1 staff PI.

In the RFID Alliance Lab at ITTC, Federal Communications Commissioner Michael Copps (right) observes as ITTC Director Victor Frost explains features that make the KU RFID Tag unique. Copps visited the Center in August 2007 while at KU to attend the Rural Broadband Round Table Summit. The RFID Alliance Lab—jointly sponsored by ITTC, RFID Journal of New York, and Rush Tracking Systems of Lenexa, Kan.—is part of ITTC's CNSL. Copps also reviewed other ITTC research projects, including Joe Evans' Quantifying the Impact of Unlicensed Devices on Digital TV Receivers, another CNSL project.



LAB DETAILS

Bioinformatics and Computational Life-Sciences Lab (BCLSL)

Lab Director (Interim): Victor Frost



The Bioinformatics and Computational Life-Sciences Laboratory (BCLSL) advances methods and tools geared to biological, biochemical, and medical applications. BCLSL investigators work with collaborators in the life sciences to identify, research, develop, and apply key computational approaches. These efforts directly involve the biological and medical domains in areas of modeling, analysis, and data management. In addition, concomitant research in traditional computational methods such as algorithm optimization, data- and compute-intensive methodologies, and statistical methods are pursued to meet the specialized needs of these problem domains. This interdisciplinary work in applied and basic research involves investigators from computer science, electrical engineering, mathematics, and life-science and medical disciplines.

Lab resources:

In addition to extensive software architecture including applications widely used in the public domain, the BCLSL provides:

Artificial intelligence development tools and languages
Massively parallel computer clusters, large-memory-capacity computer, terabyte storage systems, reconfigurable floating-point gate arrays
Databases and data-management systems for genomics data (GUS) and microarray data

Laboratory-data retrieval and management infrastructure
Parallel development tools including MPI, High Performance Fortran, and Pfortran compilers
Parallel molecular dynamics programs
Parallel BLAST Web server for sequence alignment

Communications and Networking Systems Lab (CNSL)

Lab Director: Gary Minden



The Communications and Networking Systems Laboratory (CNSL) advances knowledge of systems interconnected via radio and other technologies, as well as increasing the performance and protection of Internet-based systems. CNSL also seeks to develop technologies to deliver reliable information to support end-user applications independent of the access technology.

Lab resources:

DSP rapid prototyping system
Logic analyzers
Network analyzers
Spectrum analyzers
Oscilloscopes and function generators
Prototype PC board fabrication tools and facility
RF signal generators
Variety of DSP platforms and evaluation tools
Extensive high-speed networking infrastructure: connected to high-speed, wide-area networks; fiber connection to the Sprint backbone network; cable connection to Sunflower Broadband's cable modem and TV network; Internet2; wide variety of routers, switches, and network interfaces
Extensive wireless LAN (Wi-Fi) networks

30 km of fiber installed for systems-level testing
Tunable laser sources and optical filters
Electro-optic modulators, WDM multiplexers, demultiplexers
High-speed photodetectors to 40Gb/s
Commercial WDM systems at OC192 and OC48 data rates
40Gb/s and 12Gb/s BERTs
RFID performance benchmarking facilities
Bluetooth evaluation facilities
High-speed workstations
Hardware and software design experience: developed network testing and measurement tools, network simulation and modeling tools, Web applications and servers, and integrated wireless mobile systems with fixed networks; designed and implemented software-defined radios

Computer Systems Design Lab (CSDL)

Lab Director: Perry Alexander



The Computer Systems Design Laboratory (CSDL) focuses on the design, implementation, and verification of systems whose primary components include computers. CSDL research addresses the design of computing systems ranging from small, embedded elements to large, distributed computing environments covering all aspects of the system life cycle from requirements analysis through testing and validation.

Lab resources:

Equipment:

Xilinx FPGA prototyping systems, reconfigurable distributed computing cluster, wireless radio testbed

Hardware and software design experience:

Rosetta system-level specification language and analysis

tools; KU Real Time (KURT) Linux; hybrid threads; reconfigurable computing platforms; real-time, secure, embedded systems; protocols for ad hoc sensor networks; agile software radios

e-Learning Design Lab (eDL)

Lab Directors: James Miller, Ed Meyen



The e-Learning Design Laboratory (eDL) responds to the emerging challenges and opportunities in e-learning. eDL studies and develops new learning environments and tools for students of all ages, with a focus on postsecondary and professional development. Particular attention is given to learners with diverse backgrounds whose attributes warrant consideration in the development of e-learning tools, instruction, and environments. This includes the study, development, and research of new designs, principles, practices, and policies.

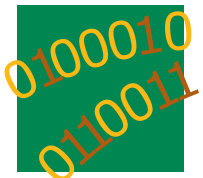
Lab resources:

Module creation tools
e-Learning instructional design
Authoring tools

Online assessment tools
e-Learning evaluation tools

Intelligent Systems Lab (ISL)

Lab Director: Arvin Agah



The Intelligent Systems Laboratory (ISL) advances knowledge in artificial intelligence, intelligent agents, information retrieval, data mining, and robotics. ISL is customizing IT services, creating smarter and more user-friendly environments and devices.

Lab resources:

Multiagent development tools:

ACCS, C++, CORBA, Java

Information retrieval and Web tools:

KUIR Information Retrieval Library, Php, XMLSpy, MySQL, Perl

Data Mining tools:

SNOB, Cobweb, ID3, C4.5, statistical analysis packages

Artificial intelligence development tools and languages:

Lisp, CLOS, CLIPS, Prolog, GBB, OPS, MEM-1

Image processing and computer vision tools:

KUIM image processing library, high-speed video, and data cable/fiber link

Human-intelligent system interaction tools:

Mobile robots, VR user interface, head-mounted display, force feedback joysticks

PeopleBot, two Nomad Scouts, three Kheperas, one Pioneer robot

Software packages for virtual prototyping, kinematics modeling, and dynamics modeling (such as VisualNastran 4D and Working Model)

Radar Systems and Remote Sensing Lab (RSL)

Lab Director: James Stiles



The Radar Systems and Remote Sensing Laboratory (RSL) conducts research in radar and other electromagnetic sensing problems, including advanced system concepts, radar image formation, adaptive radar signal processing, and radar simulation.

Lab resources:

50 GHz microwave network analyzer

40 GHz digital oscilloscope

Logic analyzers

Network analyzers

Spectrum analyzers, oscilloscopes, and function generators

Prototype PC board fabrication tools and facility

RF signal generators

Automated ground penetrating radar (GPR) test facility

Outdoor antenna test facility

RECENT STUDENT SUCCESSES



Current radars offer an either-or proposition: providing image mapping, such as Google Earth, or target detection and tracking. Ph.D. student and U.S. Air Force Major **Geoff Akers** seeks to enable radar systems to perform both functions simul-

taneously. To create the dual-purpose radar system, Akers will use radars in multiple locations that are able to transmit different waveforms. He anticipates his research will influence future designs of Department of Defense radar architectures.

After graduation in the spring of 2009, Akers will head the radar curriculum and research at the Air Force Institute of Technology (AFIT), in Dayton, Ohio. AFIT provides defense-focused graduate and professional programs in engineering, management, and systems and logistics. In

2000, Akers earned an MSEE degree in Electromagnetics from AFIT. He chose KU based on the combination of recent contributions of the Radar Systems and Remote Sensing Laboratory (RSL), the broad range of radar and signal processing courses, and the proximity of KU to his hometown of Eminence, Missouri. **Jim Stiles**, RSL director, serves as advisor for Akers' dissertation research.

The second-year doctoral student says the quality of EECS instructors and students in radar systems is among the highlights. When asked about challenges, Akers says the Air Force has given him a strict timeline to complete his degree and that meeting that deadline will be a challenge.

Akers recently won first place in the Ph.D. division of the School of Engineering's student poster contest with his "Simulated Radar Data and Moving Target Indication" poster.



Charley Chan saw graduate school as a natural progression. She excelled at the master's courses she took as an undergrad and enjoyed her work as a research assistant at ITTC. The breadth of research and faculty expertise and the flexibility within the

program led Chan to stay at her alma mater for her graduate degree. EECS Assistant Professor **Shannon Blunt** serves as her academic advisor and research mentor.

Blunt and Chan have developed an algorithm that is achieving unprecedented accuracy and resolution in functional brain mapping. When people undergo magnetoencephalography (MEG) or electroencephalography (EEG) scans, electrical and magnetic activity is elicited in the brain by different stimuli. Sensors, either in the machine or

on the person's head, collect the brain's responses. The ITTC-developed algorithm, denoted as Source AFFine Image Reconstruction (SAFFIRE), unravels the assembled data to pinpoint brain activity in conjunction with each stimulus. Blunt and Chan are helping life-sciences researchers in their effort to understand the nature of functional disorders, such as epilepsy.

ITTC has filed for a U.S. patent for the algorithm. Chan says it is a highlight of her time at ITTC. She continues working on the project and is also involved with developing a related algorithm to be used for the determination of the angles-of-arrival of received radio frequency (RF) signals on an antenna.

The Hong Kong native is planning to graduate in May 2008 and has applied to Ph.D. programs at several universities.

RECENT STUDENT SUCCESSES



First-year Ph.D. student **Brian Quanz** chose KU because of its strong program in artificial intelligence (AI) and its research focus. He believes it is important to consider and develop practical applications in addition to conducting essential basic

research. Quanz wants his work to be able to reach outside the laboratory and notes ITTC and the University provide critical support for developing research.

Quanz graduated with a bachelor's in Electrical Engineering from the University of Illinois in the spring of 2007. He knew he would eventually seek a Ph.D. in computer science, so he decided to continue his studies at KU straight through to his doctorate via the "Fast Trac," which is available to exceptionally well qualified students and bypasses the master's degree.

In his short time at ITTC, Quanz says the biggest challenge has been adapting to life as a graduate student. While graduate work includes classes, its primary focus is research. Quanz recognizes that it takes much more individual effort and study compared to his undergraduate experience.

Under the direction of ITTC faculty researcher **Costas Tsatsoulis**, Quanz is conducting research in intelligent agents for transport security. Quanz is part of a research team working to bestow decision-making abilities on physical objects, specifically cargo on a train. Equipped with sensors and processors, packages monitor their environment and communicate with other freight. Thus, packages would be able to determine their own security and be able to request help when threatened.

Quanz is affiliated with ITTC's ISL.

Ph.D. students Daniel Fokum and Eric Howell (foreground) explain ITTC technology being evaluated for the SensorNet project, directed by Victor Frost. Fokum holds two Sun SPOTs, instruments that contain accelerometers as well as light and temperature sensors. Work is currently under way to integrate them into the SensorNet architecture used by SmartPort. SmartPort is a Kansas City-based group developing a secure inland shipping port and international distribution center in the KC area. Tags, like the one held by Howell, could provide real-time data as goods travel through the supply chain.



ITTC EXECUTIVE STAFF



Victor S. Frost
Director, ITTC
Dan F. Servey Distinguished
Professor, EECS

Victor Frost has performed research for many corporations, including Sprint, NCR, BNR, NEC, Telesat Canada, AT&T, McDonnell Douglas, DEC, and COMDISCO Systems. He has been principal investigator on 31 research projects and has published more than 100 journal and conference articles. Frost has served as a guest editor for the *IEEE Communications Magazine* and *IEEE Journal on Selected Areas in Communications*. He is currently an area editor for *ACM Transactions on Simulation and Modeling of Computer*

Systems. His research interests are in the areas of network quality of service, integrated communication networks, and high-speed networks; they have included projects such as MAGIC and AAI high-speed, wide-area testbeds.

Frost is a Fellow of the IEEE and received the Presidential Young Investigator Award from NSF in 1984. He has served on State of Kansas NSF EPSCoR and DoD DEPSCoR committees, as well as the Kansas Inc. Telecommunications Task Force. He has made four presentations to committees of the Kansas Legislature. He is a member of the Board of Trustees for KU's Center for Research, Inc., and was a member of the Board of the Lawrence Technology Association.



Keith Braman
Director of Technology
Commercialization

Keith Braman was promoted to director of technology commercialization in July 2007 from his former position as associate director for applied technology. Braman manages ITTC's technology transfer, intellectual property, and state-affiliated economic development activities.

Before joining ITTC in 2000, he was a senior manager of information systems and regulatory affairs for the Kansas Department of Social and Rehabilitative Services, Division of Health Care Policy. He has been vice president of operations and general counsel for KVA Product Development Group, LLC, in Topeka, which provided engineering consulting services for the design and manufacture

of medical devices. Prior to working for KVA, Braman practiced law as a solo practitioner for several years, focusing on criminal, intellectual property, and corporate transactional law. He also has worked for McDonnell Douglas Helicopter Co. as a flight controls engineer and technical area chief of flight dynamics. As a serial entrepreneur, and in addition to operating his own law office, Braman has worked as an engineering consultant in the area of flight-test research, software development, computer-aided design, and program management and has held founding positions in construction, real estate, and retail companies.

Braman holds a juris doctorate from Washburn University and B.S. and M.E. degrees in aerospace engineering from KU. He is a member of the Kansas and Nevada state bars, the American Bar Association, the American Intellectual Property Law Association, the Association of University Technology Managers (AUTM), and the engineering honor society Sigma Gamma Tau.

ITTC TECHNICAL STAFF



Daniel DePardo
Research Engineer

Dan DePardo directs the RF Design and Evaluation facilities at ITTC, providing support for the Communications and Networking Systems Lab (CNSL), and other Center electronic hardware needs. His areas of expertise include radio-frequency hardware design, construction, testing, and measurement, with transceiver and antenna design as his primary area of research interest. Secondary areas of expertise include printed circuit board design, layout, pho-

tolithography, and assembly. He has designed, constructed, and successfully demonstrated hardware prototypes in support of numerous defense programs and academic research projects, ranging from airborne military surveillance systems to NASA-funded sea ice measurement radars. DePardo holds a U.S. patent for a novel wide-band antenna design, and he is a Senior Member of the Institute of Electrical and Electronics Engineers (IEEE). His current research efforts include investigation of television band secondary device operation and digital television interference issues, development of software-defined transceivers, spectrum mapping, and the effects of weather events on E-band and millimeter wave wireless networks.



Adam Hock
Senior Network Systems
Administrator, Bioinformatics

Adam Hock is the senior systems administrator for ITTC's integrated bioinformatics information infra-

structure. He oversees system integration, administration, and maintenance for the computer cluster as well as the development of new software tools. Before joining ITTC, Hock was an engineer at Atipa Technologies, a provider of information technology solutions based on the Linux computer operating system.



Michael Hulet
Senior Network Systems
Administrator

Michael Hulet is the senior network system administrator for ITTC. He provides advanced computer hardware, software, and network support for the operational and research needs of the Center. Hulet

joined ITTC as a computer systems administrator in 1998. He has a bachelor's degree in electrical and electronics engineering from North Dakota State University and a master's degree in systems management from the University of Southern California. He was employed as an electronics engineer for the Naval Warfare Assessment Division in Norco, Calif., before joining ITTC.



Ed Komp
Research Engineer

Ed Komp has more than 15 years' experience in designing, implementing, and managing commercial software products. His primary interests include specialized computer language design for application-specific domains, functional programming, software development environments, and net-

working. He joined the Center in 1998. He received his B.A. in mathematics and his M.S. in computer science from KU in 1976 and 1979, respectively. He was the primary software architect for the Block Oriented System Simulator (BOSS) and helped found a local company to commercialize this tool. He also was the primary software architect and manager for the Block Oriented Network Simulator (BONeS), a second commercial product success.

ITTC TECHNICAL STAFF



Danico Lee
Senior Software Engineer

Danico Lee joined ITTC in 2002 and is now a lead software engineer. She manages and works on multiple, select ITTC applied research and development projects. One of the projects she is working on has led to a registered copyright and a pend-

ing U.S. patent. Lee provides technical leadership for requirements, specification, design, implementation, and testing on software projects. Her areas of expertise include applied artificial intelligence, three-tier systems engineering, object-oriented software design, relational database modeling, and Web application development. She also meets with Kansas companies and provides technical assistance. Lee has a B.S. and an M.S. in computer science from the University of Kansas.



Wesley Mason
Network Specialist

As a network specialist and system administrator with ITTC, Wesley Mason is responsible for the design, operations, and installation of the Center's server infrastructure and net-

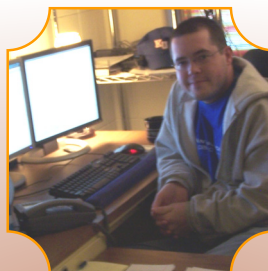
work. Mason has focused his efforts on network security. Before coming to ITTC, he worked for Atipa Technologies as a cluster engineer. He managed hardware and software cluster integration along with onsite installation. He spent nine months as an ITTC student system administrator before joining the Center as a full-time network specialist in the summer of 2005.



Leon Searl
Software Research Engineer

Leon Searl works on multiple projects as a software and hardware engineer at ITTC. He is working on the Agile Radio and related projects. Searl worked at TISL (Telecommunications

and Information Sciences Lab, a predecessor of ITTC) while he was an electrical engineering student at KU. Before returning to KU, Searl worked with TRW Space and Defense Group and Cadence Design Systems. He owned his own ultralight aircraft company. He received his B.S. and M.S. degrees from KU in 1985 and 1987, respectively.



Sysadmins to the rescue! ITTC's team of well trained and experienced system administrators, always ready to answer a call for help, effectively keep the Center's computer systems running smoothly. Clockwise, from lower left: Adam Hock maintains ITTC's computer cluster. Student system administrator Phil Regier assists Pam Heimerich with a software problem. Wes Mason monitors system servers from his office. Michael Hulet works on a testbed in the "Cold Room." Tim Nelms, student system administrator, helps Paula Conlin solve a glitch in her e-mail.



POSTDOCS AND VISITING SCHOLARS

POSTDOCTORAL RESEARCHERS AND VISITING SCHOLARS NEW FOR FY2008



Junfeng Jiang
Postdoctoral Researcher

Junfeng Jiang is working with ITTC investigator and EECS Associate Professor **Ron Hui**. They are investigating polarization mode dispersion

(PMD) monitoring in live optical systems. PMD causes corruption errors when data are sent across fiber-optic lines at speeds above 10 gigahertz. Jiang, a post doctoral researcher at ITTC, is an associate professor in the College of Precision Instrument and Optoelectronics Engineering at Tianjin University in China.



Helmut Keller
Visiting Scholar

Visiting scholar Helmut Keller is a professor at the Federal Institute of Technology (TGM Vienna) in Austria where he participates in several high-speed image processing projects.

Keller teaches digital signal processing and embedded systems courses at TGM Vienna as well. Keller is collaborating with researchers in ITTC's Computer Systems and Design Lab. Additionally, he taught an EECS graduate course, Operators for Embedded Signal Processing, during his August–December 2007 visit at KU.



Meng Liang
Visiting Scholar

Meng Liang, an associate professor at Xi'an Institute of Post and Telecommunications in China, is at ITTC working with researcher and

EECS Associate Professor **Ron Hui**, to develop technologies to minimize interference in optical-fiber communications. They are examining orthogonal frequency-division multiplexing (OFDM), which splits signals into several narrow-band channels at different frequencies.



Enno Luebbbers
Visiting Scholar

University of Paderborn Ph.D. student Enno Luebbbers spent October 2007 at ITTC, with EECS Professor and ITTC researcher **David Andrews** as his

mentor. ITTC and Paderborn are working on creating tools to reduce the cost and development-to-market time for embedded systems. Luebbbers said his visit had strengthened the collaboration, and he was proud of what they had accomplished.

RECENT FACULTY ACHIEVEMENTS

In May, RSL investigator **Chris Allen** earned a **Center for Teaching Excellence award for graduate teaching**.

RSL investigator **Shannon Blunt** has received a **U.S. Air Force Young Investigator Award**. Blunt will receive \$100,000 annually for three years in support of his radar-embedded communications project, which will enable a new form of high-speed covert communication. Blunt's intra-pulse radar-embedded communication system will allow soldiers behind enemy lines to send secure messages using existing radio signals. Dispatches will "piggy-back" on primary transmissions from high-powered radar that also hide the covert messages. Intended receivers will be able to recover the hidden signal, while eavesdroppers will be unaware of the signal's existence.

In May, CNSL Director **Gary Minden** was named a **Bellows Scholar** for the 2007–2008 academic year. The School of Engineering honor recognizes overall achievement in teaching, research, and service. Scholars receive a cash award.

CNSL investigator **Jim Roberts** received a **Distinguished Service Award for University Outreach and Continuing Education** from KU Continuing Education in April. Additionally in the spring, he was elected **treasurer and member of the Board of Directors Executive Committee** of the National Institute for Pharmaceutical Technology and Education, Inc. (NIPTE).

CNSL researcher **David Petr** won the **Harry Talley Excellence in Teaching Award**. Graduating seniors vote on the EECS faculty member who has contributed significantly to their education and developed a strong rapport with them. Petr has received numerous accolades for his teaching including the W.T. Kemper Fellowship for Teaching Excellence in 2005 and the 2003 Talley Award.

CNSL investigator **Erik Perrins** will serve as an **editor for IEEE Transactions on Communications**. He will review articles within his area of expertise, modulation and signal design. In August, Perrins was named a **senior member of IEEE**.

As noted on page 5, ITTC researcher **Joseph Evans'** CogNet research was **featured in** the April 16 issue of **ComputerWorld Magazine**. To read the article, "Future Watch: Wireless Wises Up," online, go to www.ittc.ku.edu/news.phtml.

The New America Foundation, a non-profit, non-partisan think tank, commissioned Evans to conduct a **feasibility study on unlicensed devices operating in the TV bands**. This spring New America cited the ITTC study in comments it submitted to the Federal Communications Commission's *Proceedings on Unlicensed Operation in the TV Broadcast Bands*. The study, "Quantifying the Impact of Unlicensed Devices on Digital TV Receivers," found that low-power unlicensed devices could transmit over unoccupied television channels without interfering with television viewing on other channels. Researchers suggested emission limits for secondary devices to protect DTV receivers.

See page 35 for more on this research regarding use of TV spectrum by unlicensed devices.

CSDL Director **Perry Alexander** has written the **textbook System-Level Design With Rosetta**, published by Morgan Kaufmann. The book examines the system-level design language, providing clear code examples and case studies. A review of the book by *Electronic Design* can be found online at www.elecdesign.com/Articles/Index.cfm?AD=1&ArticleID=14417.

In the last two years, BCLSL researcher **Xue-wen Chen** has **co-chaired three conferences** and will also **co-chair the International Workshops on Machine Learning in Biomedicine and Bioinformatics** to be held in Cincinnati in December 2007. The Association for Machine Learning and Applications is one of the key organizers of the conference. Chen is also notably a **2007 recipient of the NSF CAREER Award**.

ITTC RESEARCH INVESTIGATORS

FACULTY INVESTIGATORS AFFILIATED WITH ITTC DURING FY2007

Arvin Agah

Associate Professor and
Associate Chair for Graduate
Studies, EECS

RESEARCH INTERESTS:

- Autonomous mobile robots for harsh environments
- Biomedical robotics
- Distributed robotics
- Multi-agent systems
- Software engineering



Education:

Ph.D., Computer Science, University of Southern California, 1994
M.S., Biomedical Engineering, University of Southern California, 1993
M.S., Computer Science, Purdue University, 1988
B.A., Computer Science, University of Texas, 1986

Teaches artificial intelligence, software engineering, robotics.

Honors and Awards include KU Miller Scholar Award, 2007; KU EECS Cerner Teaching Award, June 2004; KU Center for Teaching Excellence Celebration of Teaching Award, May 2004; KU Miller Faculty Development Award, June 2001; Engineering Expo 2001 Educator Award, February 2001; KU Henry E. Gould Award for Outstanding Teaching, 2000.

W. Perry Alexander

Professor, EECS

RESEARCH INTERESTS:

- System-level design
- Formal specification and verification
- IP reuse
- Specification and programming languages



Education:

Ph.D., Electrical Engineering, University of Kansas, 1992
M.S., Electrical Engineering, University of Kansas, 1988
B.S., Electrical Engineering, University of Kansas, 1986
B.S., Computer Science, University of Kansas, 1986

Teaches digital systems design, programming language semantics, formal methods.

Honors and Awards include KU Center for Teaching Excellence Honoree, spring 2007; Kemper Teaching Fellow, 2003; ASEE Midwestern Region Dean's Award for Teaching Excellence, 2003; KU Miller Faculty Development Award, 2002–2003; KU EECS Harry Talley Teaching Award, 2002; Center for Teaching Excellence Honoree, 2002; KU Engineering Expo EECS Department Teaching Award, 2000; Senior Member of IEEE; University of Cincinnati (UC) College of Engineering Neil A. Wandmacher Teaching Award, 1998; UC ECECS Department Teaching Award, 1996–1997; UC Engineering Tribunal Professor of the Quarter, winter 1994, fall 1998; UC ECECS Department Research Award, 1993–1994; UC Electrical and Computer Engineering and Computer Science (ECECS) HKN Professor of the Year, 1992–1993, 1996–1997.

Christopher Allen

Professor, EECS

RESEARCH INTERESTS:

- Microwave remote sensing
- Radar system design and analysis



Education:

Ph.D., Electrical Engineering, University of Kansas, 1984
M.S., Electrical Engineering, University of Kansas, 1982
B.S., Electrical Engineering, University of Kansas, 1980

Teaches electronic circuits, high-speed digital circuit design, microwave remote sensing, radar systems.

Honors and Awards include Center for Teaching Excellence award for graduate teaching, May 2007; Bellows Scholar, 2005; Eta Kappa Nu; Phi Kappa Phi; Tau Beta Pi; Sharp Teaching Professorship, 2002–2005; KU Miller Faculty Development Award, 2001; W.T. Kemper Fellowship Award for Excellence in Teaching, 2001; Ned N. Fleming Trust Award for Excellence in Teaching, 2001; KU Miller Professional Development Award for Research, 1999; KU EECS Harry Talley Excellence in Teaching Award, 1998; Center for Teaching Excellence honoree, 1998.

ITTC RESEARCH INVESTIGATORS

David Andrews

Professor, EECS

RESEARCH INTERESTS:

- Computer architecture
- Distributed and parallel systems
- Embedded and real-time systems
- Reconfigurable computing



Education:

Ph.D., Computer Science, Syracuse University, 1992
Computer Engineering Degree, Syracuse University, 1990
M.S., Electrical Engineering, University of Missouri, Columbia, 1984
B.S., Electrical Engineering, University of Missouri, Columbia, 1983

Teaches digital design, computer architecture, reconfigurable computing, embedded systems.

Honors and Awards include KU Miller Scholar, 2004; Senior Member of IEEE, 2001; Who's Who in Science and Technology, 2001; Outstanding Service Award, Electrical Engineering, University of Arkansas, 1996–1997; Outstanding Researcher Award, Electrical Engineering, University of Arkansas, 1995; General Managers Award, General Electric Co., 1990.

Ronald Aust

Associate Professor, Teaching and Leadership, Education

RESEARCH INTERESTS:

Designing and developing—

- Multi-state educational networks (including UNITE system and Explorer database)
- Network technologies to support collaborative learning and community publishing of educational resources



Education:

Ph.D., Curriculum and Instruction, University of Washington, 1984
M.S., Education, Western Washington University, 1979
B.S., Education, Western Washington University, 1975

Teaches designing multimedia learning environments, instructional design.

Shannon Blunt

Assistant Professor, EECS

RESEARCH INTERESTS:

- Radar and communications signal processing
- Adaptive pulse compression
- Space-time adaptive processing (STAP)
- Statistical signal processing
- Estimation and detection theory
- Optimization theory
- Electronic circuits



Education:

Ph.D., Electrical Engineering, University of Missouri, Columbia, 2002
M.S., Electrical Engineering, University of Missouri, Columbia, 2000
B.S., Electrical Engineering, University of Missouri, Columbia, 1999

Teaches digital signal processing, detection and estimation theory, electronic circuits.

Honors and Awards include U.S. Air Force Young Investigator Award, 2007; NRL Alan Berman Research Publication Award, 2004; Outstanding Graduate Student Award in Electrical Engineering, University of Missouri, 2001; First Place, Electrical Engineering Lab Exhibit, MU Engineers' Fair, 2001, 1999; Donald K. Anderson Graduate Student Teaching Assistant Award, 2000.

ITTC RESEARCH INVESTIGATORS

Swapan Chakrabarti

Associate Professor, EECS

RESEARCH INTERESTS:

- Designing hardware and software for True 3-D display systems
- High-speed computation of mathematical functions using analog neural networks
- Digital signal processing



Education:

Ph.D., Electrical Engineering, University of Nebraska, Lincoln, 1986
M.S., Computational Physics, University of Nebraska, Lincoln, 1982
M.S., Physics and Electronics, Calcutta University, India, 1976
B.S., Physics, Calcutta University, India, 1976

Teaches digital logic design, algorithmic problem solving, microcomputer applications, computer architecture, graphics in engineering research, computer vision, digital signal processing (including adaptive systems, neural networks, fuzzy systems).

Honors and Awards include honorary member, Golden Key National Honor Society, 1996; KU Ned N. Fleming Teaching Award for Outstanding Classroom Teaching, 1992.

Xue-wen Chen

Assistant Professor, EECS

RESEARCH INTERESTS:

- Bioinformatics
- Machine learning
- Statistical modeling
- Data mining
- Human-computer interaction



Education:

Ph.D., Electrical and Computer Engineering, Carnegie Mellon University, 2001
M.S., Opto-electronics, Sichuan University, Chengdu, China, 1992
B.S., Theoretical Physics, Sichuan University, Chengdu, China, 1986

Teaches bioinformatics, computer science.

Honors and Awards include KU Miller Professional Development Award for Research, 2007; National Science Foundation CAREER Award, 2007; Senior Member IEEE, 2004.

Terry Clark

Assistant Professor, EECS

RESEARCH INTERESTS:

- Modeling nucleosomes using bioinformatics and computational biology
- Linguistic methods in genome analysis
- Parallel computing



Education:

Ph.D., Computer Science, University of Houston, 1996
M.S., Computer Science, University of Houston, 1988
M.S., Chemistry, University of Houston, 1985
B.S., Chemistry, Western Washington University, 1982

Teaches—Graduate level: bioinformatics, scientific parallel computing, computational genomics; Undergraduate level: programming language paradigms, compiler construction.

Daniel Deavours

Research Assistant Professor,
ITTC

RESEARCH INTERESTS:

- RFID tag-interrogator systems
- Microstrip antennas for passive UHF RFID
- RFID performance evaluation



Education:

Ph.D., Electrical Engineering, University of Illinois at Urbana-Champaign, 2001
M.S., Electrical Engineering, University of Illinois at Urbana-Champaign, 1997
B.S., Computer Engineering, University of Illinois at Urbana-Champaign, 1994

ITTC RESEARCH INVESTIGATORS

Kenneth Demarest

Professor, EECS

RESEARCH INTERESTS:

- Computational electromagnetic techniques
- Lightwave systems



Education:

Ph.D., Electrical Engineering, The Ohio State University, 1980
M.S., Electrical Engineering, The Ohio State University, 1976
B.S., Electrical Engineering, John Brown University, 1974

Teaches circuits, fiber optic engineering, electromagnetics, microwave systems, noise reduction in electrical systems, antennas, radar engineering, laser engineering.

Honors and Awards include Eta Kappa Nu.

Tyrone Duncan

Professor, Mathematics

RESEARCH INTERESTS:

- Stochastic adaptive control
- Stochastic optimal control
- Mathematics of finance
- Stochastic analysis
- Telecommunications
- Mathematics education



Education:

Ph.D., Electrical Engineering, Stanford University, 1967
M.S., Electrical Engineering, Stanford University, 1964
B.E.E., Electrical Engineering, Rensselaer Polytechnic Institute, 1963

Teaches stochastic analysis and its applications, stochastics of mathematical finance, stochastic control, stochastic adaptive control, fractional Brownian motion and its applications, probability theory.

Honors and Awards include *Special Issue Dedicated to 65th Birthday of Tyrone Duncan, Communications in Information and Systems Journal*, Vol. 7(1, 2), 2007; IEEE Fellow, 1999; KU Olin K. Petefish Award in the Basic Sciences, 1999.

Joseph B. Evans

Deane E. Ackers Distinguished Professor, EECS;
Director of Research Information Technology, KU

RESEARCH INTERESTS:

- Mobile networking and wireless systems
- High-performance networks
- Pervasive computing systems
- System implementations



Education:

Ph.D., Electrical Engineering, Princeton University, 1989
M.S., Electrical Engineering, Princeton University, 1986
M.S., Engineering, Princeton University, 1984
B.S., Electrical Engineering, Lafayette College, 1983

Teaches networking implementation, DSP implementation, computer systems design, integrated circuit design, electronics, programming.

Honors and Awards include Deane E. Ackers Distinguished Professor of Electrical Engineering and Computer Science, 2005; Program Director, Computer and Information Science and Engineering Directorate, National Science Foundation, 2003–2005; Eta Kappa Nu; Tau Beta Pi; KU Spahr Professor, 2000–2003; KU Miller Professional Development Award for Research, 1996; AT&T Bell Laboratories Ph.D. Scholarship, 1984–1988; Garden State Graduate Fellowship, 1983–1987.

Jianwen Fang

Research Assistant Professor, ITTC

RESEARCH INTERESTS:

- Bioinformatics and computational biology
- Machine learning
- Data mining
- Database and software development
- Drug discovery



Education:

Ph.D., Chemistry, Wayne State University, Michigan, 2002
M.A., Computer Science, Wayne State University, Michigan, 2000
B.S., Applied Chemistry, Peking University, Beijing, China, 1990

ITTC RESEARCH INVESTIGATORS

Victor Frost

Dan F. Servey Distinguished
Professor, EECS;
Director, ITTC

RESEARCH INTERESTS:

- Internet quality of service
- Traffic management
- Integrated broadband communication networks



Education:

Ph.D., Electrical Engineering, University of Kansas, 1982
M.S., Electrical Engineering, University of Kansas, 1978
B.S., Electrical Engineering, University of Kansas, 1977

Teaches communication networks, optical networks, signal analysis, communications systems.

Honors and Awards include Visiting Erskine Fellowship, University of Canterbury, Christchurch, New Zealand, 2006 (for 2007); KU Bellows Scholar, 2005; KU Miller Faculty Development Award, 2002; IEEE Fellow, 1998; Dan F. Servey Distinguished Professor of Electrical Engineering and Computer Science, 1996; KU Miller Professional Development Award for Service, 1991; KU Miller Professional Development Award for Research, 1986; National Science Foundation Presidential Young Investigator Award, 1984.

John M. Gauch

Associate Professor, EECS

RESEARCH INTERESTS:

- Digital image processing (segmentation, enhancement)
- Computer vision (stereo, motion tracking)
- Multimedia processing



Education:

Ph.D., Computer Science, University of North Carolina at Chapel Hill, 1989
M.S., Computer Science, Queen's University at Kingston, Ontario, Canada, 1982
B.S., Computer Science, Queen's University at Kingston, Ontario, Canada, 1981

Teaches algorithmic problem solving, structured programming, computer vision, image processing, computer graphics, digital image processing, multimedia systems.

Honors and Awards include KU Miller Faculty Development Award, 2000, 2003; KU Bellows Scholar, 1999, 2002; Archie and Nancy Dykes Award for Undergraduate Teaching and Mentoring, 2001.

New Location (August 2007): Professor, Department of Computer Science and Computer Engineering, University of Arkansas, Fayetteville.

Susan E. Gauch

Professor, EECS

RESEARCH INTERESTS:

- Multimedia databases
- Intelligent search agents
- Personalized search
- Conceptual search



Education:

Ph.D., Computer Science, University of North Carolina at Chapel Hill, 1990
M.S., Computer Science, Queen's University at Kingston, Ontario, Canada, 1982
B.S., Mathematics and Computer Science, Queen's University at Kingston, Ontario, Canada, 1981

Teaches programming, information retrieval, database systems, software engineering.

Honors and Awards Kemper Award for Excellence in Teaching, 2004; KU Bellows Scholar, 2004; KU Miller Faculty Development Award, 1999, 2000, 2003; KU Miller Professional Development Award for Research, 1998; Office of Naval Research Fellowship, 1988; QU N.F. Dupuis Prize in Mathematics, 1978.

New Location (August 2007): Chair, Department of Computer Science and Computer Engineering, University of Arkansas, Fayetteville.

ITTC RESEARCH INVESTIGATORS

Jerzy Grzymala-Busse

Professor, EECS

RESEARCH INTERESTS:

- Data mining
- Knowledge discovery
- Machine learning
- Expert systems
- Reasoning under uncertainty
- Rough set theory



Education:

Doctor Habilitatus, Engineering, Technical University of Warsaw, Poland, 1972

Ph.D., Engineering, Technical University of Poznan, Poland, 1969

M.S., Mathematics, University of Wroclaw, Poland, 1967

M.S., Electrical Engineering, Technical University of Poznan, Poland, 1964

Teaches data mining, expert systems, computer architecture, computer organization, computability, automata theory, discrete structures.

Honors and Awards include Kemper Award for Excellence in Teaching, 2004; KU Miller Faculty Development Award, 2002.

Donna Haverkamp

Assistant Professor, EECS

RESEARCH INTERESTS:

- Image processing and computer vision
- Artificial intelligence
- Applying artificial intelligence techniques to image interpretation problems



Education:

Ph.D., Electrical Engineering, University of Kansas, 1997

M.S., Computer Engineering, University of Kansas, 1992

B.S., Computer Engineering, University of Kansas, 1990

Teaches artificial intelligence, databases, information retrieval.

Honors and Awards include Ahrens Scholar, 1997; NASA Global Research Fellow, 1993–1996; NASA GSRP Fellow, 1990–1993; Watkins-Berger Scholar, 1986–1990; State of Kansas Scholar, 1986–1990; Distinguished Alumnus Scholar, 1986–1990.

New Location (August 2007): Senior research scientist with Science Applications International Corp. (SAIC), Boulder, Colorado; continues to do research in computer vision arena, working with both video and still imagery.

Jun “Luke” Huan

Associate Professor, EECS

RESEARCH INTERESTS:

- Data mining: algorithms, systems, and applications
- Bioinformatics: structural bioinformatics, functional genomics, and systems biology



Education:

Ph.D., Computer Science, University of North Carolina, Chapel Hill, 2006

M.S., Computer Science, Oklahoma State University, 2000

B.S., Biochemistry, Peking University, Beijing, China, 1997

Teaches introduction to bioinformatics, introduction to database systems, mining biological data.

Honors and Awards include Scholar of Tomorrow Fellowship, UNC, 2005; Alumni Fellowship, UNC, 2001.

Rongqing Hui

Professor, EECS

RESEARCH INTERESTS:

- Fiber-optic communications
- Photonic devices
- Optical sensors



Education:

Ph.D., Electronics Engineering, Politecnico di Torino, Italy, 1993
M.S., Lightwave Technology, Beijing University of Posts and Telecommunications, China, 1988

B.S., Microwave Communications, Beijing University of Posts and Telecommunications, China, 1982

Teaches fiber-optic communication systems and networks, optical measurements, microelectronic circuits, semiconductor

materials and devices, general electric circuits.

Honors and Awards include KU Miller Professional Development Award for Research, 2002.

During FY2007, on a two-year leave from ITTC/EECS to serve as Program Director for the Photonics and Device Technologies Program within the National Science Foundation.

Gerald Lushington

Director of Labs, Structural Biology Center

RESEARCH INTERESTS:

- Structure-based drug design
- Quantitative structure-activity relationships as applied to bio-activity and toxicology predictions and chemical library refinement
- Molecular dynamics analysis of proteins
- Quantum chemical and mixed quantum-classical prediction of enzyme activity



Education:

Ph.D., Theoretical Chemistry, University of New Brunswick, Fredericton, Canada, 1996

B.S., Chemistry and Mathematics, University of New Brunswick, Fredericton, Canada, 1991.

Honors and Awards include first-class honors with B.S. from University of New Brunswick, 1991.

Ed Meyen

Professor, Special Education

RESEARCH INTERESTS:

- Online instructional design
- Web-based instructional tools
- Intellectual property issues
- Online instructional applications for students with disabilities
- Emerging instructional technologies



Education:

Ph.D., Education, University of Iowa, 1968

M.A., Special Education, University of Northern Colorado, 1959

B.A., Education, University of Northern Colorado, 1958

Teaches curriculum design, instructional design, instructional technology, graduate seminars.

Honors and Awards include School of Education Faculty Achievement Award, 2006.

ITTC RESEARCH INVESTIGATORS

James Miller

Associate Professor, EECS

RESEARCH INTERESTS:

- Visualization
- Geometric and solid modeling for computer-aided design
- Computer graphics
- Technology in education
- Object-oriented technology
- Web-based client-server processing and arrays



Education:

Ph.D., Computer Science, Purdue University, 1979
M.S., Computer Science, Purdue University, 1976
B.S., Computer Science, Iowa State University, 1975

Teaches programming I and II, introduction to computer graphics, advanced computer graphics, geometric modeling, visualization.

Honors and Awards include Boeing Company A.D. Welliver Faculty Summer Fellowship, 2004; KU Center for Teaching Excellence (CTE) Excellence in Teaching Award, 2000; Phi Beta Kappa, 1975; Phi Kappa Phi, 1974; Pi Mu Epsilon, 1974.

Gary J. Minden

Professor, EECS

RESEARCH INTERESTS:

- Digital systems
- Wireless networks
- Software-defined radios
- Large-scale networks



Education:

Ph.D., Electrical Engineering, University of Kansas, 1982
B.S., Electrical Engineering, University of Kansas, 1973

Teaches digital systems design, computer architecture, computer engineering system design.

Honors and Awards include KU School of Engineering Bellows Scholar, 2007–2008; KU Miller Professional Development Award for Service, 2002; KU Miller Faculty Development Award, 1999, 2000.

Richard K. Moore

Distinguished Professor Emeritus, EECS

RESEARCH INTERESTS:

- Radar systems
- Radar remote sensing
- Radio wave propagation
- Radar oceanography
- Microwave radiometers



Education:

Ph.D., Electrical Engineering, Cornell University, 1951
B.S., Electrical Engineering, Washington University, Missouri, 1943

Teaching Duties: Advises graduate students.

Honors and Awards include Australia Prize (for remote sensing), 1995; Italian Center for Remote Sensing Award, 1995; Fellow AAAS, 1993; National Academy of Engineering, 1989; KU Irvin Youngberg Award in the Applied Sciences, 1989; KU Louise E. Byrd Graduate Educator Award, 1984; IEEE Centennial Award, 1984; IEEE Geoscience and Remote Sensing Society Distinguished Achievement Award, 1982; IEEE Council on Oceanic Engineering Outstanding Technical Achievement Award, 1978; Alumni Achievement Award, School of Engineering and Applied Science, Washington University, 1978; Life Fellow IEEE (Fellow in 1962).

R. Douglas Niehaus

Associate Professor, EECS

RESEARCH INTERESTS:

- Real-time and embedded systems
- System and network performance evaluation
- High-performance simulation of computer systems and networks
- Concurrent and distributed programming tools and environments



Education:

Ph.D., Computer Science, University of Massachusetts at Amherst, 1994

M.S., Computer, Information, and Control Engineering, University of Michigan, 1981

B.S., Computer Science, Northwestern University, 1980

Teaches introduction to operating systems, advanced operating systems, real-time and embedded system implementation, concurrent and distributed systems.

Bozenna Pasik-Duncan

Professor, Mathematics

RESEARCH INTERESTS:

- Identification and adaptive control of stochastic systems
- Science, engineering, and mathematics education for K–12
- Stochastic analysis and its applications to finance, manufacturing, biomedicine, and telecommunications



Education:

Doctor Habilitatus, Mathematics, Warsaw School of Economics, Poland, 1986

Ph.D., Mathematics, Warsaw School of Economics, Poland, 1978
M.S., Mathematics, Warsaw University, Poland, 1970

Teaches probability theory, stochastic processes, mathematical statistics, stochastic modeling, stochastic adaptive control, calculus, stochastic calculus, differential equations, randomness in the modern world.

Honors and Awards include appointed member of IEEE Women in Engineering Committee/elected IEEE Control Systems Society Liaison, 2006; elected Chair of Control Education Committee of American Automatic Control Council, 2005–2006; elected KU Distinguished Professors Committee member, 2006–2009; Louise Hay Award, Association of Women in Mathematics, 2004; KU Honor for an Outstanding Progressive Educator (HOPE) Award, 2003; Mortar Board Outstanding Educator Award, 2003; Frank B. Morrison Teaching Award, 2002; IEEE Fellow, 2001; IEEE Control Systems Society Distinguished Member Award, 2000; IEEE Third Millennium Medal for Outstanding Achievements and Contributions, 2000; Leader, China Control Systems Delegation, 2000; Tau Beta Pi; G. Baley Price Award for Excellence in Teaching, 1999; Kemper Fellowship for Teaching Excellence and Advising in Public Outreach, 1996; NSF Career Advancement Award, 1991–1993; International Research Experience (IREX) Fellowship to the United States (Berkeley, Harvard, MIT), 1982; several Chancellor's Awards for research and teaching, Warsaw School of Economics, Poland, 1977–1978; Ministry of Higher Education and Sciences Award for Excellence in Teaching and Research, Poland, 1975.



Gary Minden, EECS professor and director of ITTC's CNSL, explains a procedure using a signal generator and a spectrum analyzer as students in his senior computer engineering design class prepare to take radio frequency measurements on an automobile. The fall semester class gathered in Nichols Hall lobby for the demonstration.

ITTC RESEARCH INVESTIGATORS

Erik Perrins

Assistant Professor, EECS

RESEARCH INTERESTS:

- Digital communication theory
- Advanced modulation techniques
- Channel coding
- Synchronization in wireless modems
- Complexity reduction in receivers
- Multiple-input, multiple-output (MIMO) communications
- Effective implementation architectures for communication systems



Education:

Ph.D., Electrical Engineering/Communication Theory, Brigham Young University, Utah, 2005
M.S., Electrical Engineering/Communication Theory, Brigham Young University, Utah, 1998
B.S., Electrical Engineering/Signals and Systems, Brigham Young University, Utah, 1997

Teaches digital communications, error control coding, signals and systems.

Honors and Awards Best Paper Award (with T. Nelson and M. Rice), International Telemetry Conference, 2005; Best Graduate Student Paper Award, International Telemetry Conference, 2003, 2004; BYU Electrical Engineering Department Research Fellowship, 1997–1998.

David Petr

Professor and Associate Chair for Undergraduate Studies, EECS

RESEARCH INTERESTS:

- Performance analysis
- Traffic integration
- Congestion control and resource management
- Quality of service for communication networks
- Educational motivation and assessment
- Music signal processing and visualization



Education:

Ph.D., Electrical Engineering, University of Kansas, 1990
M.S., Electrical Engineering, Stanford University, 1978
B.S., Electrical Engineering, Southern Methodist University, 1976

Teaches circuit analysis, signals and systems, communications, random processes, network performance analysis, optimization.

Honors and Awards include KU EECS Harry Talley Excellence in Teaching Award, 2007, 2003; Kemper Fellowship, 2005; Ben Dasher Best Paper Award for the ASEE/IEEE Frontiers in Education conference, October 2000; KU School of Engineering Sharp Teaching Professorship, 2000–2003; Visiting Erskine Fellowship, University of Canterbury, Christchurch, New Zealand, 2000; Excellence in Teaching Award, KU Center for Teaching Excellence, 1999; Member of Sigma Xi, 1992; Senior Member of IEEE, 1991; KU nominee for NSF Presidential Faculty Fellow, 1991.

Glenn Prescott

Professor, EECS

RESEARCH INTERESTS:

- Software radio systems
- Spread spectrum and military communication systems
- Radio and radar signal processing
- DSP applications of field-programmable gate arrays
- Design and implementation of wireless communication systems



Education:

Ph.D., Electrical Engineering, Georgia Institute of Technology, 1984
M.S., Electrical Engineering, University of Missouri, 1976
B.S., Electrical Engineering, Georgia Institute of Technology, 1974

Teaches linear systems, electronics design laboratory, senior design laboratory, digital signal processing, digital communications, DSP for communications and radar, advanced modulation and coding.

Honors and Awards include NASA Special Service Award, 2000; NASA Terra Award, 2000; KU School of Engineering Sharp Teaching Professorship, 1998–2001.

James Roberts

Professor, EECS

RESEARCH INTERESTS:

- Wireless communication systems
- CDMA and spread spectrum systems
- Coding and information theory



Education:

Ph.D., Electrical Engineering, Santa Clara University, 1979
 M.S., Electrical Engineering, Massachusetts Institute of Technology, 1968
 B.S., Electrical Engineering, University of Kansas, 1966

Teaches digital communications, information theory and coding, wireless communications, detection and estimation theory and electromagnetics.

Honors and Awards include elected treasurer, National Institute for Pharmaceutical Technology and Education, Inc., June 2007; KU Distinguished Service Award for University Outreach and Continuing Education, April 2007; Ronald J. Schmitz Award for Outstanding Service to the Frontiers in Education Conference, 2004; appointment to the Board and Executive Committee of Kansas BIO, Inc., 2004; Member of the Joint Steering Committee for the Ft. Leavenworth/KU Partnership, 2004; IEEE Fellow, 2002; Tau Beta Pi; Eta Kappa Nu; Sigma Xi; Federal Government Distinguished Station Award (team award), 1987.

Hossein Saiedian

Professor and Associate Chair,
 EECS

RESEARCH INTERESTS:

- Software engineering, including
- Software process improvement
 - Formalism in software development
 - Object-oriented software development
 - Software engineering education
 - Software architecture



Education:

Ph.D., Computing and Information Sciences, Kansas State University, 1989
 M.S., Mathematics, Emporia State University, 1984
 B.S., Information Systems, Emporia State University, 1981

Teaches software engineering; develops and expands software engineering program, EECS; expands EECS programs at Regents Center for Kansas City (KC) metropolitan audience.

Honors and Awards include IEEE Certified Software Development Professional, 2002; IEEE Senior Member, 2001; Excellence in Teaching Award, University of Nebraska at Omaha, 2000; Distinguished Research Award, University of Nebraska at Omaha, 2000; top 10 software engineering scholars list, *Journal of Systems and Software*, 1998.

K. Sam Shanmugan

AT&T Distinguished Professor,
 EECS

RESEARCH INTERESTS:

- Smart antenna systems
- Signal (image) processing
- Random signals and communications theory
- Wireless and adaptive communication systems and networks
- Communication systems simulation and analysis



Education:

Ph.D., Electrical Engineering, Oklahoma State University, 1970
 M.S., Electrical Engineering, Indian Institute of Science, Bangalore, India, 1966
 B.S., Electrical Engineering, Madras University, India, 1964

Teaches communication systems, simulation, probabilistic analysis, signals, and systems.

Honors and Awards include EECS Acting Chair, July 1, 2002–July 31, 2003; Visiting Erskine Fellowship, University of Canterbury, Christchurch, New Zealand, 2000; HOPE Award Finalist, 1994; KU Higuchi Award for Research, 1990; Burlington-Northern Outstanding Teaching Award, 1987; KU Henry E. Gould Award for Distinguished Service to Undergraduate Engineering Education, 1982; Amoco Foundation Outstanding Teacher Award, 1982; Society of Automotive Engineers Ralph R. Teetor Outstanding Young Engineer Award, 1979.

ITTC RESEARCH INVESTIGATORS

Trevor Sorensen

Associate Professor, Aerospace Engineering

RESEARCH INTERESTS:

- Student-designed, -built, and -operated satellites
- BalloonSats
- Space environment (Earth and planetary)
- Lunar missions and science
- Remote sensing satellites and missions
- Improvement of spacecraft operations
- Autonomous spacecraft operation
- Long-lived space missions



Education:

D.E., Aerospace Engineering, University of Kansas, 1979
M.S., Aerospace Engineering, University of Kansas, 1976
B.S.A.E., Aerospace Engineering, University of Kansas, 1973

Teaches orbital mechanics, spacecraft systems, space system design, spacecraft attitude dynamics and control.

Honors and Awards include AIAA Distinguished Service Award, 2005; Chair, AIAA Space Operations and Support

Technical Committee, named Most Outstanding Technical Committee in AIAA Space and Missiles Group, 2005; American Astronautical Society Fellow, 2003; NASA/ASEE Summer Faculty Fellowship, 2001, 2003, 2004; AlliedSignal Aerospace Bold Thinking Award, 1997–1998; University of Kansas Aerospace Engineering Alumni Honor Roll, 1997; NASA Medal for Exceptional Scientific Achievement, 1994; Engineer of the Year nominee, *Design News Magazine*, 1994; AlliedSignal Technical Service Corp.'s Special Recognition Award, 1994; NRL Certificate of Appreciation for contribution to SDIO/LACE Program, 1991; McDonnell Douglas Certificate of Merit for contribution to Shuttle Program, 1985; NASA Group Achievement Award (STS-41C Rendezvous and Proximity Operations), 1984.

New Location (August 2007): Systems engineer, Hawai'i Space Flight Laboratory, University of Hawai'i at Manoa, Hawai'i Institute of Geophysics and Planetology, Honolulu.

James Sterbenz

Associate Professor, EECS

RESEARCH INTERESTS:

- Survivable, resilient, and disruption-tolerant networking
- Mobile wireless networking for ubiquitous personal computing
- High-speed (bandwidth), low-latency networking and communication
- Programmable, active, and cognitive networks



Education:

D.Sc., Computer Science, Washington University, Missouri, 1991
M.S., Computer Science, Washington University, Missouri, 1986
B.S., Computer Science, Washington University, Missouri, 1980
B.S., Electrical Engineering, Washington University, Missouri, 1980
A.B., Economics, Washington University, Missouri, 1980

Teaches communication networks; high-performance, mobile wireless, and resilient and survivable networking; introduction to digital logic design.

James Stiles

Associate Professor, EECS

RESEARCH INTERESTS:

- Radar signal processing
- Applications of information and estimation theory in remote sensing
- Radar remote sensing of vegetation
- Propagation and scattering in random media
- Ground-penetrating radar



Education:

Ph.D., Electrical Engineering, University of Michigan, 1996
M.S., Electrical Engineering, Southern Methodist University, 1987
B.S., Electrical Engineering, University of Missouri, 1983

Teaches electronics, electromagnetics, radar, microwave engineering.

Honors and Awards include KU School of Engineering Sharp Professorship, 2004–2007; Interactive Session Prize Paper Award, IEEE Geoscience and Remote Sensing Society, 2002; KU Miller Professional Development Award for Research, 2001; KU EECS Harry Talley Teaching Award, 2000.

Costas Tsatsoulis

Professor and Chair, EECS

RESEARCH INTERESTS:

- Multiagent systems
- Case-based reasoning
- Machine learning
- Intelligent image analysis



Education:

Ph.D., Electrical Engineering, Purdue University, 1987
M.S., Electrical Engineering, Purdue University, 1984
B.S., Electrical Engineering, Purdue University, 1983
B.A., German, Purdue University, 1987

Teaches computer system software, artificial intelligence, knowledge-based systems, case-based reasoning, multiagent systems, introduction to database systems.

Honors and Awards include KU Spahr Professor, 2000–2003; KU Bellows Fellowship, 1999; Senior Member of IEEE, 1998; Big-12 Faculty Fellowship, 1997; State of Kansas AT&T Engineering Education Excellence Award, 1995; KU Miller Professional Development Award for Research, 1994; Sigma Xi honorary research society, 1992.

Victor L. Wallace

Professor Emeritus, EECS

RESEARCH INTERESTS:

- Interactive graphics, scientific visualization, and human interface design
- Queuing theory for modern computer networks and systems
- Analytical performance modeling



Education:

Ph.D., Electrical Engineering, University of Michigan, 1969
B.S., Electrical Engineering, Polytechnic Institute of Brooklyn, 1955

Teaching Duties: Advises graduate students.

Honors and Awards include Computer Graphics Pioneer Award, ACM SIGGRAPH, 1984; Irving Faye Memorial Award, Polytechnic Institute of Brooklyn, 1955; Senior Life Member, IEEE; Eta Kappa Nu; Upsilon Pi Epsilon; Tau Beta Pi; Sigma Xi; Who's Who in Science and Technology; Who's Who in America.

Weichao Wang

Assistant Professor, EECS

RESEARCH INTERESTS:

- Information privacy protection in wireless networks
- Key distribution and update
- Representation and visualization of security data
- Self-organized intrusion detection



Education:

Ph.D., Computer Science, Purdue University, 2005
M.S., Computer Science, Purdue University, 2002
M.S., Computer Science, Tsinghua University, Beijing, P.R. China, 2000
B.S., Computer Science, Tsinghua University, Beijing, P.R. China, 1998

Teaches: Cryptography, information security.

Honors and Awards include Zhongchuang Communication Ltd. Scholarship, 1999; Graduated with honor from Tsinghua University, China, 1998; Seagate Scholarship, 1996, 1997.

New Location (August 2007): Assistant professor, Dept. of Software and Information Systems, University of North Carolina at Charlotte; teaching network security and information assurance and conducting research in related areas.

ITTC RESEARCH INVESTIGATORS

Alexander Wyglinski

Research Assistant Professor,
ITTC

RESEARCH INTERESTS:

- Signal processing for digital communications
- Wireless communications
- Cognitive radios
- Ad hoc wireless networks



Education:

Ph.D., Electrical Engineering, McGill University, Montreal, Quebec, Canada, 2004

M.S., Electrical Engineering, Queen's University, Kingston, Ontario, Canada, 2000

B.E., Electrical Engineering, McGill University, Montreal, Quebec, Canada, 1999

Honors and Awards include McGill Alma Mater Student Travel Award, 2003; Motorola Foundation Graduate Award in Electrical and Computer Engineering, 2002; Province of Quebec "Nature and Technologies" Scholarship (doctorate level), 2002–2003; McGill Majors Fellowship, 2002 (declined by recipient); Natural Sciences and Engineering Research Council of Canada (NSERC) Postgraduate Scholarship, 2000–2002; Province of Ontario Graduate Scholarship, 2000 (declined by recipient); Province of Quebec "Nature and Technologies" Scholarship (master's level), 1999–2000; Queen's Graduate Award, 1999, 2000.

New Location (August 2007): Assistant professor, Electrical and Computer Engineering, Worcester Polytechnic Institute, Worcester, Mass.

Ya "Anne" Zhang

Assistant Professor, EECS

RESEARCH INTERESTS:

- Bioinformatics and computational biology
- Machine learning
- System biology
- Statistical learning
- Data mining/text mining



Education:

Ph.D., Information Sciences and Technology, Pennsylvania State University, University Park, 2005

B.S., Biological Sciences and Biotechnology, Tsinghua University, Beijing, China, 2000

Teaches introduction to bioinformatics, bioinformatics and machine learning methods.

Honors and Awards include Best paper award, IEEE Workshop on Computer Vision Methods for Bioinformatics, 2005; Third Prize, Challenge Cup Science & Technology Contest, Tsinghua University, China, 1998; Excellent Students Scholarship, Tsinghua University, China, 1997.

New Location (August 2007): Working with Yahoo! Inc., Applied Research Division, Sunnyvale, Calif.

FACULTY INVESTIGATORS NEW FOR FY2008

Prasad Kulkarni

Assistant Professor, EECS

RESEARCH INTERESTS:

- Static and dynamic/adaptive compilers
- Computer architecture
- Embedded systems



Education:

Ph.D., Computer Science, Florida State University, 2007

M.S., Computer Science, Florida State University, 2003

B.E., Computer Engineering, Poona University, India, 2001

Teaches computer systems: compilers, operating systems, computer architecture, embedded systems, virtual machines.

Honors and Awards include IBM Ph.D. Fellow, 2006–2007; Florida State Featured Student, November 2006; Finalist in Florida State University Research and Creativity Awards, April 2006.

FY2007 PROJECT SPONSORS

FEDERAL AGENCIES

Department of Defense (DoD)

- **Department of the Air Force**
Test Resource Management Center, Edwards AFB
(funds directed through U.S. Army White Sands office)
- **Department of the Army**
Edgewood Chemical Biological Center (ECBC)
Army Research Office (ARO)
- **Department of the Navy**
Office of Naval Research (ONR)

Department of Energy (DoE)

- **Oak Ridge National Laboratory (ORNL)**

National Aeronautics and Space Administration (NASA)

- **NASA Goddard Space Flight Center**
- **NASA Experimental Program to Stimulate Competitive Research (NASA-EPSCoR)**

National Institutes of Health (NIH)

- **NIH Center for Research Resources**

National Science Foundation (NSF)

- **NSF Computer and Information Science and Engineering (CISE)**
- **NSF Experimental Program to Stimulate Competitive Research (NSF-EPSCoR)**

INDUSTRY

BBN Technologies (flow-through from Defense Advanced Research Projects Agency [DARPA])

Cadstone, LLC

Fundamental Technologies, LLC

Hill's Pet Nutrition, Inc.

Honeywell FM&T, LLC (flow-through from DoE)

International Business Machines Corp. (IBM)

MacDermid, Inc.

M&A Technology, Inc.

Micro Security Devices, Inc.

Nortel Networks

Porter McGuffie, Inc.

Praxair, Inc.

RT Logic

Science Applications International Corporation (SAIC)
(flow-through from U.S. Air Force)

Sprint/Nextel

STATE OF KANSAS

Kansas Technology Enterprise Corporation (KTEC)

Kansas Department of Transportation (KDOT) (flow-through from U.S. Department of Transportation, Federal Highway Administration)

UNIVERSITIES

University of California, Riverside (flow-through from NSF)

University of Kansas Medical Center Research Institute, Inc. (KUMCRI) (flow-through from NIH)

University of North Carolina, Chapel Hill (flow-through from NIH)

OTHER: NOT-FOR-PROFIT AGENCIES, OTHER STATES, ETC.

Iowa Department of Transportation

New America Foundation

The Carmen Trust

RFID TAG TECHNOLOGY ANSWERS INDUSTRY NEEDS

Dan Deavours, an ITTC research assistant professor, has developed a radio frequency identification (RFID) system whose performance is independent of its mounting surface. Prior to the KU-Tag, trace amounts of metal or liquid would distort radio transmissions between tags and readers.

Multiple companies have licensed ITTC's innovative solution to the metal/liquid problem. Container Technology, Inc., will be able to more closely monitor its receptacles, which transport hazardous materials, fuels, and other liquids. The KU-Tag system will improve the rate of return on the reusable containers. RFID readers replace time-consuming manual scans, reducing warehouse and labor costs.

Another licensee, Starport Technologies, is manufacturing and marketing RFID tags that leverage the KU technology. The Kansas City-based company recently signed a contract to produce RFID tags for a Fortune 500 company.

"The KU-Tag is another important tool in our expanding range of RFID solutions," says **Jeff Nedblake**, managing partner of Starport Technologies. "ITTC researchers found an innovative solution to address the metal/liquid problem, which is a common problem we keep hearing from customers."

To be embraced by industry, the KU-Tag maintains a size and thickness similar to those of current popular tags, and uses standard tag manufacturing techniques. It employs four U.S. patent-pending technologies and can be read from up to 30 feet away. The KU-Tag is one of the best-performing, least costly, and thinnest RFID tags specifically designed to work on metal or objects containing liquid.

Located in warehouses, hospitals, etc., RFID readers request the identity of nearby tagged items. Tags respond with a unique serial number and other information contained on a microchip within them. Multiple tags can be scanned simultaneously without readers' needing to "see" the tags, since tags and readers communicate through radio waves. RFID also has longer read ranges than barcodes.

"KU has a mission to move innovations stemming from our research into the marketplace," said **Jim Roberts**, KU's vice provost for research. "These licenses stem from ITTC investigator Dan Deavours' RFID research and are tremendous examples of the process."

The KU-Tag system contains four U.S. patent-pending technologies that make it one of the best-performing, thinnest, least costly RFID tags specifically designed to work near metal or liquids.

Photo by KU University Relations.



Dan Deavours, ITTC research assistant professor, explains how he developed the innovative antenna and system, known as the KU-Tag. The specialized radio frequency identification (RFID) tag tracks high-value assets through communication between electronic readers and tags that contain data on microchips.

Photo by KU University Relations.



VEATROS, “THE LITTLE START-UP THAT COULD”

ITTC investigators **John** and **Susan Gauch** spent a decade developing “the little start-up that could.” Veatros, LLC, reached its peak this spring when its assets were acquired by the digital media company DivX, Inc. Assets include the patented real-time digital video processing technology named “VidWatch.”

“Veatros benefited from incubating the technology with support from ITTC,” says John Gauch. “We were able to focus on development and new applications for our inventions for several years while the market for our technologies developed. Now we are thrilled to work with DivX on a mature implementation.”

DivX is a California-based company that markets software and equipment that enable people to create and share high-quality videos. VidWatch will conduct enhanced video searches and discovery services for DivX users, according to **Kevin Hell**, acting chief executive officer of DivX. For example, users will be able to easily and quickly add the cover art, director, and actors to their video titles.

Veatros software will be integrated into hundreds of DivX-enabled products—from DVD players to mobile phones—and services that allow users to produce and exchange highly-compressed, high-quality media. DivX software is downloaded 6 million times a month, according to its fact sheet.

During its uphill climb, the little start-up received funding and support from ITTC and the Larta Institute, a nonprofit leader in technology commercialization sponsored in part by the Kauffman Foundation. Early on, ITTC saw the excellent potential in VidWatch, which was initially developed to monitor commercial time on foreign cable stations to ensure broadcasters didn’t use more time than

they had purchased. The University spun out the technology, leading to the creation of Veatros in 2002. ITTC continued to fund the start-up as it matured.

“ITTC originally invested in John’s VidWatch concept in 1998,” says **Keith Braman**, ITTC director of technology commercialization. “Since then we have been able to patent, mature, and commercially demonstrate the technology through a license agreement with Turner Broadcasting Systems. Once John’s technology was ready, we spun it off to Veatros, John’s company. Vidwatch is a good example of the types of projects ITTC is uniquely positioned to support to an ultimate commercialization outcome.”

Veatros was the first company selected for Larta’s venture capital affiliate, T2 Venture Capital (T2VC). According to **Victor Hwang**, managing director of T2VC, the program focuses on companies at the cutting edge of technology and with tremendous commercial potential. Hwang, who became the chief strategy officer of Veatros, mentored the company through its recent growth and acquisition by DivX.

Rohit Shukla, CEO of Larta Institute, named Veatros “the little start-up that could.” He adds that the Institute is proud to work closely with companies like Veatros who are at the intersection of research and enterprise.

In spring 2007, Susan Gauch accepted a position as department head and Rodger S. Kline Endowed Chair in Computer Science and Computer Engineering at the University of Arkansas. John Gauch accepted a position as professor in the same department.

ITTC’s Keith Braman (right) discusses technology transfer with KU’s Vice Provost for Research James Roberts at the Entrepreneurship Fair held at the Burge Union in February 2007. Braman served as the ITTC point person for the Veatros acquisition and worked closely with DivX to ensure the successful outcome.



CADSTONE, ITTC START-UP, GROWS IN SIZE AND PROFITS

ITTC and its start-up company Cadstone have formed a reciprocal relationship. Founded in 2003, the young enterprise received critical expertise and commercialization funding from the Center. In addition, ITTC helped with the formation of Cadstone, helped negotiate license agreements with KU, and provided invaluable business expertise. Now a profitable and growing business, Cadstone funds more than \$200,000 in sponsored ITTC research.

Continued ITTC research has helped Cadstone develop a beta version of its electronic design automation (EDA) tools that analyze designs written in Rosetta, a system-level design language developed at ITTC. Rosetta specifications allow different models, such as functionality and power, to interact with one another during the building of complex systems. Different vocabulary and engineering processes make communication between different disciplines involving complex electronics difficult. Each individual model from each design domain must be consistent with all other system models. Rosetta enables interaction between disparate system models, enabling tools to find errors that appear only in considering multiple perspectives simultaneously. Cadstone's tools streamline detection of such design defects, allowing superior products to reach consumers sooner.

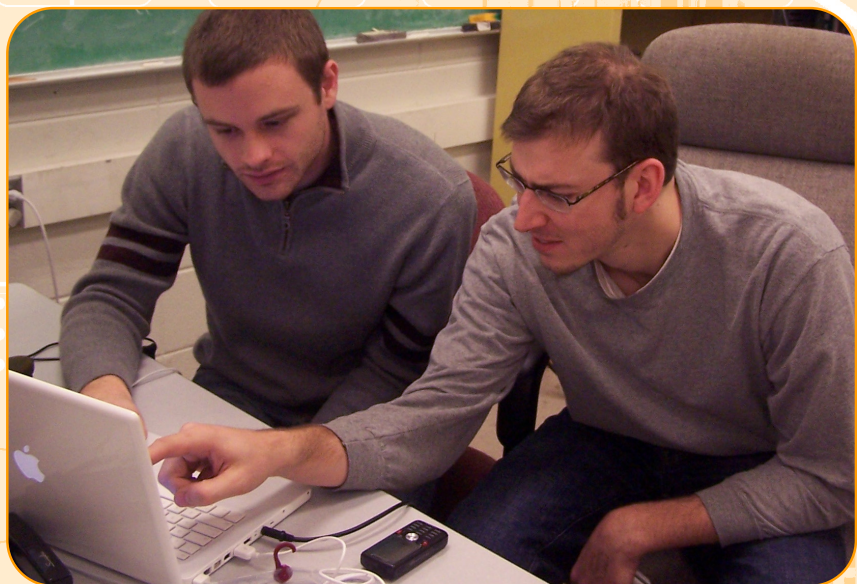
Scheduled for release in the fall of 2007, the beta version of Cadstone's Rosetta tools will be evaluated by cus-

tomers and Cadstone's Board of Managers. The beta tool suite features a full Rosetta parser, a type checker, and a capability for synthesizing analysis models from specifications. Users can write specifications, check their syntax and static semantics, and synthesize simulatable specifications that reflect system behavior. Following beta evaluation, Cadstone will update the tool set and prepare for a full commercial release. Cadstone founder **Perry Alexander** hopes to have a commercially available product within a year from this initial review.

"Without ITTC, we would not have a product," says Alexander, who is also the director of ITTC's CSDL. "They gave us the opportunity to get Cadstone off the ground. Although we have the technical expertise, ITTC provided business expertise and helped us recognize the business opportunity."

At ITTC, Alexander spearheaded a global effort to develop the Rosetta system-level design language and currently serves as the Rosetta Working Group chair. Rosetta is being standardized as an electronic design automation language by IEEE under project P1699. It is hoped that within 18 months a full Rosetta standard will be available for industry adoption. When the standard becomes available, Cadstone will be there with tools to support authoring and analyzing specifications.

Ph.D. students Nicolas Frisby (left) and Garrin Kimmell address a detail in their research on the system-level design language Rosetta. Under the direction of EECS Professor Perry Alexander, an international team of researchers have developed tools that allow different subsystems in complex electronics to communicate with one another. Alexander and ITTC have spun out the technology to create Cadstone, which is preparing to release a beta version of its electronic design automation (EDA) tools.



MORE SPECTRUM FOR WIRELESS DEVICES

Today's ubiquitous use of laptops, PDAs, and other wireless devices has created an artificial scarcity in the radio wave spectrum assigned by the Federal Communications Commission (FCC) to transmissions by television, mobile phones, MRIs, wireless networking services and devices, and amateur radios. The limited airwave allotment for wireless services does not support current applications, let alone the demand for better and faster wireless services. Currently, the FCC grants licensees exclusive rights to their assigned spectrum, but proposed regulatory changes could allow wireless devices to access "white spaces" (i.e., unassigned spectrum and/or spectrum not in use at a given moment) within the TV band. The underutilized TV spectrum, especially, possesses white spaces that could provide additional capacity to spur on wireless development and enable affordable broadband service in rural areas. In the prime spectrum allocated to TV, transmissions travel greater distances and better penetrate buildings than do current wireless frequencies.

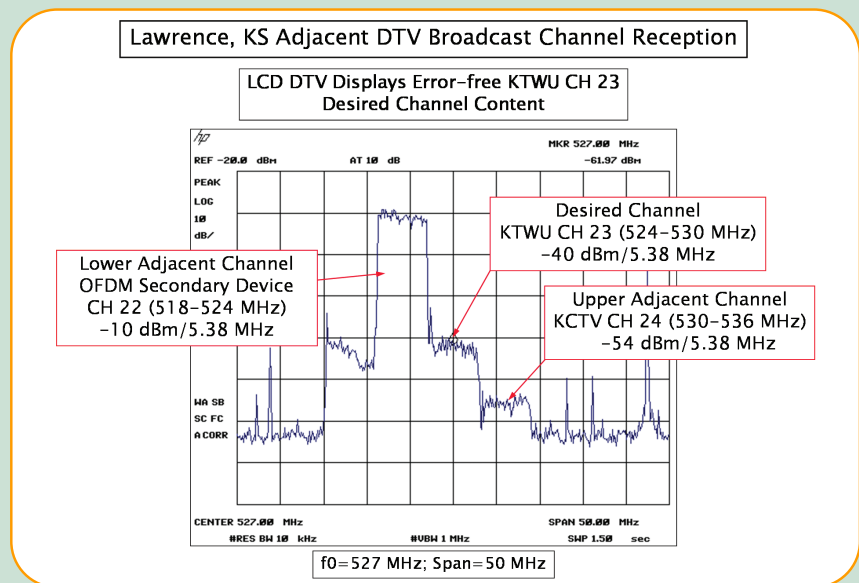
ITTC researchers have examined the feasibility of wireless devices transmitting signals in the television band without causing interference to digital TV transmissions. The New America Foundation, a non-profit, non-partisan think tank, commissioned the ITTC study in response to the FCC's *Proceedings on Unlicensed Operation in the TV Broadcast Bands*. The ITTC study found that low-power

unlicensed devices, such as WiFi-enabled laptops, could transmit over unoccupied television channels without interfering with television viewing on other channels. (The FCC defines unlicensed devices as those that generate and emit radio frequency [RF] energy, which includes everything from cordless phones to wireless local area networks [WLANS].) ITTC investigators **Dan DePardo** and **Joe Evans** focused on whether unlicensed devices interfere with digital TV reception and what rules must exist for devices operating in bands adjacent to digital TV transmissions. New America cited the ITTC research in comments submitted to the FCC hearing in spring 2007.

Additionally, ITTC researchers have built and tested a prototype white-space device (WSD) transmitter, successfully demonstrating WSD transmissions can be structured to avoid causing interference to licensed broadcasts. When wireless transmissions operate in close proximity to one another, signals have the potential to interact and disrupt transmissions. However, WSDs monitor the spectrum for unoccupied channels upon which to transmit data and ensure secondary signals do not interfere with television reception. The nimble navigators can jump from one available channel to another without service disruption.

To read the ITTC study sponsored by New America, log on to www.newamerica.net/files/NAF%20Spectrum%20Technical%20Report%20_FINALSUBMITTED_0.pdf.

The graphic shows results of testing by ITTC researchers, indicating the compatibility of digital television with transmissions by unlicensed devices.



PROJECTS ACTIVE DURING FY2007

Adaptive Distributed Radio Open-Source Intelligent Network (ADROIT)

G. Minden; J. Evans, A. Agah, A. Wyglinski
BBN Technologies (flow-through from Defense Advanced Research Projects Agency [DARPA])

(An) Adaptive, Negotiating Multi-Agent System for Sensor Webs

C. Tsatsoulis
National Aeronautics and Space Administration (NASA),
Goddard Space Center

Advanced Technology Lab (ATL): Wireless Quality of Service Assessment

V. Frost
Sprint/Nextel
(Gift managed through KU Endowment Association [KUEA])

Advanced Technology Lab (ATL): Wireless Video Quality Assessment

J. Gauch
Sprint/Nextel
(Gift managed through KUEA)

Assessing the User-Base and Expanding the Usability/Reach of the Analytical Sciences Digital Library Through Developmental Workshops

T. Kuwana; J. Gauch
Univ. of California, Riverside (flow-through from National Science Foundation [NSF])
(Collaborative with KU Chemistry and Univ. of Illinois, Urbana)

Bridging Security Primitives and Protocols: A Digital LEGO Set for Information Assurance Courses

W. Wang
NSF
(Collaborative with Univ. of North Carolina, Charlotte)

CAREER: Machine Learning Approaches for Genome-Wide Biological Network Inference

X.-w. Chen
NSF

Center for Excellence

T. Johnson, K. Braman; V. Frost
Kansas Technology Enterprise Corporation (KTEC)

Collaborative Research: A Virtual Reality Laboratory and Curriculum for Undergraduates

J. Miller
NSF
(Collaborative with Univ. of the Pacific, Stockton, Calif.)

Computational Proteomics: Protein Interaction Prediction

X.-w. Chen; J. Fang
National Institutes of Health (NIH), Center for Research Resources
(Sub-project under Protein Structure and Function project, of KU Higuchi Biosciences Center)

Context-Based Networking

J. Sterbenz
Sprint/Nextel
(Gift managed through KUEA)

CRI: Next Generation CiteSeer

S. Gauch
NSF
(Collaborative with Penn State Univ.)

CRI: Reconfigurable Computing Cluster

R. Sass; D. Andrews, X.-w. Chen
NSF
(Collaborative with Arizona State Univ.)

CSR-EHS: Semantic Domain Integration for Embedded and Hybrid Systems

D. Niehaus
NSF
(Collaborative with Washington Univ., St. Louis; and Univ. of Missouri, Rolla)

CT-ISG: Non-bypassable Kernel Services for Execution Security

D. Niehaus
NSF
(Collaborative with Washington Univ., St. Louis, Mo.)

Development of a High Altitude Balloon Experiment System (HABS) to Fly Standard Interface Payloads Under Controllable Flight Conditions

M. Ewing; T. Sorensen, G. Prescott
Fundamental Technologies, LLC

Development of an Integrated Bioinformatics Information Infrastructure

V. Frost; G. Lushington, G. Minden, S. Gauch, T. Clark
U.S. Army Edgewood Chemical Biological Center/Dept. of Defense

Effects of Conductivity, Thickness, and Width on UHF RFID Tag Antenna Efficiency

D. Deavours
MacDermid, Inc.

EHS: Dynamic Hardware Reconfiguration to Accelerate Java-Based Embedded Systems

R. Sass; D. Andrews
NSF

Evaluation of Rapid Deployment Mesh Networking for Work Zones

S. Schrock; W. Wang, T. Mulinazzi
Iowa Dept. of Transportation
(Collaborative with KU Dept. of Civil, Environmental, and Architectural Engineering)

Executing Computational Fluid Dynamics Code (ITTC Service Agreement)

V. Frost
Porter McGuffie, Inc.

Extending the Thread Execution Model for Hybrid CPU/FPGA Architectures

D. Andrews; D. Niehaus
NSF

(The) Future of Spectrum: Technologies and Policies Workshop

G. Minden; J. Evans
NSF

Graduate Scholarship in Electrical Engineering and Computer Science; Student: Suyang Ju

J. Evans
The Carmen Trust

ITR: Computation and Communication in Sensor Webs

D. Andrews; J. James
NSF

ITR: Enabling the Science Environment for Ecological Knowledge

J. Beach; A.T. Peterson, S. Gauch, D. Vieglais
NSF/KTEC
(Collaborative with KU Biodiversity Research Center/Natural History Museum)

ITTC Industrial Affiliates: Support of RFID Alliance Lab

D. Deavours
Micro Security Devices, Inc.
(Gift managed through KUEA)

Kansas Universities' Technology Evaluation Satellite—The MIST Mission

T. Sorensen; G. Prescott
NASA Experimental Program to Stimulate Competitive Research (NASA-EPSCoR)

K-INBRE Cellular Pathogen Gene Identification via Graph Data Mining

J. Huan
KU Medical Center Research Institute (KUMCRI) (flow-through from NIH)

K-INBRE: Web Server Tracker, an Automated Literature, Protein/DNA Sequence and Domain Tracking System

KUMCRI (flow-through from NIH)
J. Fang; G. Lushington

Learning From Small Samples With High Dimensionality

X.-w. Chen
U.S. Army Research Office

Modular Wireless Avionics System for Autonomous UAVs

R. Colgren; X.-w. Chen
Kansas NASA-EPSCoR/KTEC

National Radio Networking Research Testbed (NRNRT)

G. Minden; J. Evans, J. Roberts
NSF

NeTS-FIND: CogNet—An Experimental Protocol Stack for Cognitive Radio Networks and Its Integration With the Future Internet

J. Evans
NSF
(Collaborative with Carnegie-Mellon Univ. and Rutgers Univ.)

NeTS-Find: Collaborative Research: Postmodern Internetwork Architecture

J. Sterbenz
NSF
(Collaborative with Univ. of Kentucky; and Univ. of Maryland, College Park)

NeTS-NR: Collaborative Research: High-Speed Self-Configuring Networks Based on Cost-Effective Plug-and-Play Optical (PPO) Nodes

V. Frost; R. Hui
NSF
(Collaborative with Univ. of Texas, Dallas)

New Forward Error Correction (FEC) Schemes for Aeronautical TM

E. Perrins
U.S. Air Force (USAF) Test Resource Management Center
(through U.S. Army White Sands Contracting Officer)

Non-destructive PMD Monitoring in Live WDM Optical Systems

R. Hui; C. Allen
Sprint International Comm.

(An) Online Clearinghouse for Bioinformatics Software Sharing and Evaluation

G. Lushington; J. Fang
KUMCRI (flow-through from NIH)

Optical-Domain Performance Monitoring for Next Generation Optical Networks

R. Hui
Nortel Networks

Optimal Space-Time Waveform Design for Adaptive, Multi-Mode Radar

J. Stiles
Science Applications International Corporation (SAIC)
(flow-through from USAF)

Parallel Processing for DNA Sequence Alignments (ITTC Service Agreement)

V. Frost
Hill's Pet Nutrition, Inc.

PMD Monitoring in Live DWDM Optical Networks

R. Hui; C. Allen
Sprint International Comm.

Portable and Wavelength-Tunable Two-Photon Microscopy

R. Hui; C. Johnson, L. Stehno-Bittel
NIH
(Collaborative with KU Dept. of Chemistry and KU Medical Center [KUMC])

PROJECTS ACTIVE DURING FY2007

Proposal to Complete, Upgrade, and Enhance Data Handling in the Analytical Proteomics Laboratory

G. Lushington; J. Fang, T. Williams
KUMCRI (flow-through from NIH)
(Collaborative with KU Molecular Structures Group)

Protein Structure-/Function-Specific Packing Motifs

J. Huan
Univ. of North Carolina, Chapel Hill

Quantifying the Impact of Unlicensed Devices on Digital TV Receivers

J. Evans; J. Roberts
New America Foundation

Quantifying the Temporal Characteristics of Congestion Events in the Internet

V. Frost; T. Duncan
NSF-Computer and Engineering Science and Engineering
(NSF-CISE)

Rapid Integration of Genomic Data From Multiple Sources

T. Clark
Kansas NSF-EPSCoR

RFID Tag Performance Analysis

D. Deavours
Honeywell FM&T, LLC (flow-through from U.S. Dept. of Energy)

RICE—Radio Ice Cerenkov Experiment

D.Z. Besson; D. Andrews, D. Niehaus, D. Seckel
NSF
(Collaborative with KU Dept. of Physics and Astronomy)

Robust Millimeter Wave Metropolitan Mesh Network

V. Frost; G. Minden, J. Sterbenz, A. Wyglinski, D. Tucker
Sprint Corp.
(Collaborative with KU Dept. of Geography)

SGER: Index Switchable III-Nitride Planar Lightwave Circuits for Optical Communications

V. Frost; R. Hui
NSF

Simulation of Rosetta Representations and Evaluations

D. Andrews
Cadstone, LLC

Stochastic Analysis and Applications

T. Duncan; B. Pasik-Duncan
NSF

Stochastic Systems and Control

T. Duncan; B. Pasik-Duncan
NSF

Support for Wireless Networking Workshop and PI Meeting

G. Minden
NSF

Testing of Commercial Passive UHF RFID Tags on Metal Cylinders (Phase 1)

D. Deavours
(Sponsor anonymous)

TRI 2006 Research Program Research Initiation (RI Award): A Realistic Driving Simulator Based on Parallel Computing

A. Agah
KUCR/KDOT (flow-through from U.S. Dept. of Transportation [DoT], Federal Highway Administration [FHA])
(Collaborative with KU Transportation Research Institute [TRI])

TRI 2006 Research Program Research Team Partnership (RTP Award): Development of Technologies for Trusted Corridors

V. Frost; G. Minden, C. Tsatsoulis, J. Gauch, D. Deavours, J. Evans
KU Center for Research (KUCR)/KDOT (flow-through from U.S. DoT, FHA)
(Collaborative with KU TRI and Oak Ridge National Laboratory [ORNL])

Understanding and Forecasting Ecological Change: Causes, Trajectories, and Consequences of Environmental Change in the Central Plains

V. Frost; E. Perrins
NSF/KTEC
(Collaborative with KU Biodiversity Institute)

(A) Unified Architecture for SensorNet With Multiple Owners

G. Minden; D. Deavours, V. Frost, J. Evans
ORNL

Unified Data Format for Mass Spectrometry Analysis (UDF)

G. Lushington; J. Fang, J. Gauch
KUMC (flow-through from NIH)
(Subproject under Kansas IDeA Network of Biomedical Research Excellence Bioinformatics Core Facility; collaborative with KU Molecular Graphics & Modeling Lab)

(A) VHDL-Based Telemetry Waveform Generator

E. Perrins
RT Logic

Waveform-Diverse Sensors

S. Blunt
Office of Naval Research

Workshop on Mobile Wireless Technology and the Impacts on Future Internet

J. Evans; A. Wyglinski
NSF

ITTC-AFFILIATED PUBLICATIONS FY2007

BOOKS AND BOOK CHAPTERS

Published:

Laboratory Support for MIPS-Style Processor Design in CDROM Addendum.

D.L. Andrews, P. Alexander; *Computer Organization and Design: The Hardware/Software Interface*, 3rd ed. (ed. Patterson, Hennessy); Morgan Kaufmann, 2006.

Linear Stochastic Equations in a Hilbert Space With a Fractional Brownian Motion.

T.E. Duncan, B. Maslowski, B. Pasik-Duncan; *Stochastic Processes, Optimization, and Control Theory: Applications in Financial Engineering, Queueing Networks and Manufacturing* (ed. H. Yan, G. Yin, Q. Zhang); Springer Science + Business Media, 2006, pp. 201–222.

Ontology-Based User Profiles for Personalized Search.

S. Gauch, M. Speretta, A. Pretschner; *Ontologies: A Handbook of Principles, Concepts and Applications in Information Systems* (ed. R. Kishore, R. Ramesh, R. Sharman); Springer-Verlag, ch. 24, September 2006.

Personalized Search on the World Wide Web.

A. Micarelli, F. Gasparetti, F. Sciarone, S.E. Gauch; *Adaptive Web* (ed. P. Brusilovsky, A. Kobsa); Springer-Verlag, ch. 6, 2007, pp. 195–230, ISSN: 0302-9734.

Protein Local Structure Comparison: Methods and Future Directions.

J. Huan, W. Wang, J. Prins; *Advances in Computers* (ed. T. Chau-Wen); Elsevier, 2006.

Rough Set Strategies to Data With Missing Attribute Values.

J.W. Grzymala-Busse; *Foundations and Novel Approaches in Data Mining, Series: Studies in Computational Intelligence* (ed. T.Y. Lin, S. Oshuga, C.J. Liao, X. Hu); Springer-Verlag, Vol. 9, 2006, pp. 197–212.

Some Bilinear Stochastic Equations With a Fractional Brownian Motion.

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Teaching Exceptional Children and Youth in Today's Schools: What Beginning Teachers Need to Know.

E.L. Meyen, Y.N. Bui; 4th ed., Love Publishing, Denver, Colo., January 2007.

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S.E. Gauch, M. Speretta, A. Chandralmouli, A. Micarelli; *Adaptive Web* (ed. P. Brusilovsky, A. Kobsa); Springer-Verlag, ch. 2, 2007, pp. 54–89, ISSN: 0302-9734.

Waveguides and Resonators.

K. Demarest; *Fundamentals of Engineering Electromagnetics* (ed. R. Bansal); Taylor & Francis, 2006, pp. 227–253.

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Deriving Belief Networks and Belief Rules From Data: A Progress Report.

J.W. Grzymala-Busse, Z.S. Hippe, T. Mroczek; *Trans. Rough Sets*, part of the *Lecture Notes in Comput. Sci.* book series, Springer-Verlag, Vol. 7 (to appear).

OFDM-Based Cognitive Radios for Dynamic Spectrum Access Networks.

R. Rajbanshi, A.M. Wyglinski, G.J. Minden; *Cognitive Radio Communications Networks* (ed. V. Bhargava, E. Hossain); Springer-Verlag, February 2007 (in press).

Peak-to-Average Power Ratio Reduction of Multicarrier Transceivers.

R. Rajbanshi, A.M. Wyglinski, G.J. Minden; *Encyclopedia on Wireless and Mobile Communications* (ed. B. Furht); CRC Press, April 2007 (in press).

JOURNALS

Published:

Advanced Signal Processing Techniques for Bioinformatics.

X.-w. Chen, S. Kim, V. Pavlovic, D. Casasent; *EURASIP J. Appl. Signal Process.*, Vol. 2006, 2006, article ID: 51090 (editorial).

(An) Agile Radio for Wireless Innovation.

G.M. Minden, J.B. Evans, L. Searl, D. DePardo, R. Rajbanshi, J. Guffey, Q. Chen, T. Newman, V.R. Petty, F. Weidling, M. Peck, B. Cordill, D. Datla, B. Barker, A. Agah; *IEEE Commun. Mag.*, May 2007.

(An) Algorithm for Fitting MMPP to IP Traffic Traces.

S. Bali, V.S. Frost; *IEEE Commun. Lett.*, Vol. 11(2), February 2007, pp. 207–209.

Anti-Endotoxin Agents. 3. Rapid Identification of High-Affinity Lipopolysaccharide-Binding Compounds in a Substituted Polyamine Library.

S.J. Wood, K.A. Miller, G.H. Lushington, M.R. Burns, S.A. David; *Combinatorial Chemistry & High Throughput Screening*, Vol. 9(10), December 2006, pp. 27–36.

Are Item-Level Tags Up to the Job?

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Miller, J.R.; *IEEE Comput. Graph. Appl.*, Vol. 27(3), May/June 2007, pp. 57–69.

ITTC-AFFILIATED PUBLICATIONS FY2007

Combined Multistatic Adaptive Pulse Compression and Adaptive Beamforming for Shared-Spectrum Radar.

K. Gerlach, A.K. Shackelford, S.D. Blunt; *IEEE J. Sel. Topics in Signal Process.*, Vol. 1(1), June 2007, pp. 137–146.

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B. Pasik-Duncan (guest ed.); Vol. 7(1–2), parts III & IV, 2007.

Comparative Kinetics of Cofactor Association and Dissociation for the Human and Trypanosomal S-Adenosyl-Homocysteine Hydrolases. 1. Basic Features of the Association and Dissociation Processes.

Q.S. Li, S. Cai, R.T. Borhardt, J.W. Fang, K. Kuczera, C.R. Middaugh, R.L. Schowen; *Biochemistry*, Vol. 46(19), 2007, pp. 5798–5809.

Comparison of Four Approaches to a Rock Facies Classification Problem.

M. Dubois, G. Bohling, S. Chakrabarti; *J. Comput. & Geosci.*, Vol. 33(5), May 2007, pp. 599–617.

Comparison of One-Class SVM and Two-Class SVM for Fold Recognition.

A. Senf, X.-w. Chen, Y. Zhang; *LNCS: Neural Inform. Process.*, Vol. 4233, 2006, pp. 140–149.

(A) Conformational Transition in the Adenylyl Cyclase Catalytic Site Yields Different Binding Modes for Ribosyl-Modified and Unmodified Nucleotide Inhibitors.

J.L. Wang, J.-X. Guo, Q.-Y. Zhang, J.J.Q. Wu, R. Seifert, G.H. Lushington; *Bioorganic & Medicinal Chemistry*, Vol. 15(8), April 2007, pp. 2993–3002.

CpG Island Identification With Higher Order and Variable Order Markov Models.

Z. Liu, D. Chen, X.-w. Chen; *Data Mining in Biomedicine, Series: Springer Optimization & Its Applicat.*, Vol. 7, 2007, pp. 47–58.

Data-Dependent Kernel Machines for Microarray Data Classification.

H. Xiong, Y. Zhang, X.-w. Chen; *IEEE/ACM Trans. Computational Biology & Bioinformatics*, Vol. 4(4), June 2007.

Degree-of-Polarization and Eye-Closure Penalty Associated With Optical Signals With Orthogonal Polarizations.

W. Shieh, R. Hui, X. Yi; *IEEE Photonics Technol. Lett.*, Vol. 18(10), 2006, pp. 1122–1124.

Deriving Belief Networks and Belief Rules From Data: A Progress Report.

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Design of WDM Cross Connect Based on Interleaved AWG (IAWG) and a Phase Shifter Array.

Y. Wan, R. Hui; *IEEE/OSA J. Lightwave Technol.*, Vol. 25(6), 2007, pp. 1390–1400.

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Y.M. Ahn, L. Vogeti, C.J. Liu, H.K.R. Santhapuram, J.M. White, V. Vasandani, L.A. Mitscher, G.H. Lushington, P.R. Hanson, D.C. Powell, R.H. Himes, K.F. Roby, Q.-Z. Ye, G.I. Georg; *Bioorganic & Medicinal Chemistry*, Vol. 15(2), January 2007, pp. 702–713.

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J.R. Unruh, E.S. Price, R.G. Molla, R. Hui, C.K. Johnson; *Microscopy Research & Technique*, Vol. 69(11), 2006, pp. 891–983.

(An) Experimental Comparison of Three Rough Set Approaches to Missing Attribute Values.

J.W. Grzymala-Busse, W.J. Grzymala-Busse; *Trans. Rough Sets, Lecture Notes in Comput. Sci. J. Subline*, Vol. 6, May 2007, pp. 31–50.

(The) Factored-SVD Formulation and an Application Example.

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GENI Design Principles.

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(A) Highly Adaptable Architecture View Description Language.

J. Ryoo, H. Saiedian; *J. Syst. & Software*, Vol. 79(8), August 2006, pp. 1180–1206.

Identification and Characterization of Insect-Specific Proteins by Genome Data Analysis.

G. Zhang, H. Wang, J. Shi, X. Wang, H. Zheng, G.K.-S. Wong, T. Clark, W. Wang, J. Wang, L. Kang; *BMC Genomics*, Vol. 8(93), April 2007.

(An) Intelligent Information Retrieval System Using Automatic Word Sense Disambiguation.

P.G. Ramasubramanian, A. Agah, S.E. Gauch; *J. Intelligent Syst.*, Vol. 16(2), February 2007, pp. 135–166.

Machine Learning and Its Applications to Biology.

A. Tarca, V. Carey, X.-w. Chen, R. Romero, S. Draghici; *PLoS Computational Biology*, Vol. 3(6), June 2007, p. e116.

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K.A. Suprenant, N. Bloom, B. Hendricks, K.E. Huffman, D.P. Corey, J. Fang, G.H. Lushington; *J. Experimental Biology*, Vol. 210, 2007, pp. 946–955.

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R.J. Haasl, J.W. Fang; *Current Bioinformatics*, Vol 1(2), 2006, pp. 197–205 (review).

Multi-Class Feature Selection for Texture Classification.

X.-w. Chen, X. Zeng, D. van Alphen; *Pattern Recognition Lett.*, Vol. 27(14), 2006, pp. 1685–1691.

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S.D. Blunt, K. Gerlach; *IEEE Trans. Aerosp. Electron. Syst.*, Vol. 42(3), July 2006, pp. 1043–1057.

(A) Network-Based Analysis of Polyanion Binding Proteins Utilizing Human Protein Arrays.

N. Salamat-Miller, J.W. Fang, C. Seidel, A. Smalter, Y. Assenov, M. Albrecht, C.R. Middaugh; *Biological Chemistry*, Vol. 282(14), 2007, pp. 10153–10163.

(A) Network-Based Analysis of Polyanion Binding Proteins Utilizing Yeast Protein Arrays.

N. Salamat-Miller, J.W. Fang, C. Seidel, A. Smalter, Y. Assenov, M. Albrecht, C.R. Middaugh; *Molecular & Cellular Proteomics*, Vol. 5(12), December 2006, pp. 2263–2278.

Non-Blocking PMD Monitoring in Live Optical Systems.

R. Hui, R. Saunders, B. Heffner, D. Richards, B. Fu, P. Adany; *Electron. Lett.*, Vol. 43(1), 2007, pp. 53–54.

(A) Novel Planar Microstrip Antenna Design for UHF RFID.

M. Eunni, M. Sivakumar, D.D. Deavours; *J. Systemics, Cybernetics & Informatics*, Vol. 5(1), January 2007, pp. 6–10.

One-Step Synthesis of Oxazoline and Dihydrooxazine Libraries.

P. Chaudhry, F. Schoenen, B. Neuenswander, G.H. Lushington, J. Aube; *J. Combinatorial Chemistry*, Vol. 9(3), 2007, pp. 473–476.

Plug-and-Play Optical (PPO) Nodes: Network Functionalities and Built-in Fiber Characterization Techniques.

I. Cerutti, A. Fumagalli, R. Hui, P. Monti, A. Paradisi, M. Tacca; *OSA J. Optical Netw.*, Vol. 6(6), 2007, pp. 642–653.

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E. Perrins, M. Rice; *IEEE Trans. Aerosp. Electron. Syst.*, Vol. 43(1), January 2007, pp. 286–300.

Solution-Phase Parallel Synthesis of a Library of D2-Pyrazolines.

S. Manyem, M.P. Sibi, G.H. Lushington, B. Neuenswander, F. Schoenen, J. Aubé; *J. Combinatorial Chemistry*, Vol. 9(1), 2007, pp. 20–28.

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Cognitive Engine Implementation for Wireless Multicarrier Transceivers.

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J.W. Fang, Y.H. Dong, N. Salamat-Miller, C.R. Middaugh; *Nucleic Acid Research*, 2007 (accepted).

Developing an Interpretability Scale for Motion Imagery.

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I TTTC SUPPORT STAFF

ITTC support staff members handle daily administrative details to help keep the Center functioning smoothly.

Below, in reverse alphabetical order, are the FY2007 (and current) support staff and their responsibilities.

Michelle Ward, Public Relations and Marketing Coordinator. Manages publicity with local news media and state and industry contacts, composes and publishes ITTC's newsletters, writes press releases and the text for *Annual Report*, creates other publicity materials for the Center.

Robin Hinman, Research Administration Specialist. Manages payroll, accounts payable, and purchasing; tracks finances on all Center projects and performs budget projections.

Pamela Heimerich, Program Assistant. Acts as assistant to the director of ITTC; coordinates and manages recruitment activities; manages and tracks ITTC accounts; prepares and files immigration and visa documents for staff; organizes workshops, conferences, symposia, and other presentations.

Nancy Hanson, Program Assistant. Acts as assistant to ITTC director of technology commercialization, for KTEC-related functions; maintains records of Center proposals and awards; calculates annual income and expenditures; designs and executes layout and edits text for *Annual Report* and other publications; coordinates events involving Industry Advisory Board.

Annie Francis, Office Specialist. Manages new-student check-ins and appointments; maintains student information database; maintains ITTC space-assignment database; provides word processing and proofreading for faculty and staff; coordinates hospitality for workshops, conferences, and events; arranges travel for faculty and staff.

Paula Conlin, Nichols Hall Facilities Coordinator. In charge of building maintenance requests, key maintenance, telephone administration, conference room scheduling, courier/mail services/express shipments, and other facility matters.



The smiling faces of the Support Staff who are at your service at ITTC belong to, from left to right:
Back row: Pamela Heimerich, Paula Conlin;
Middle: Robin Hinman;
Front row: Nancy Hanson, Michelle Ward, Annie Francis.

Colors used in this report are from the Secondary Palette officially designated in KU's *Graphic Identity Standards* (issued in September 2005), as appropriate for use in and with the new KU "signature" and the logos assigned by the University for departmental use. The Pantone colors are green 348, terra cotta 1605, and gold 130.

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❖
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Information and Telecommunication Technology Center (ITTC)

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