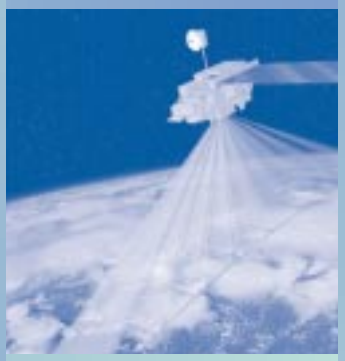

# INFORMATION AND TELECOMMUNICATION TECHNOLOGY CENTER

## Annual Report
## Fiscal Year 2000

*Annual Report FY2000 covers the period July 1, 1999, through June 30, 2000.*



# ITTC's Vision and Mission

## *The ITTC Vision:*

**To be a global leader in, and catalyst for,**
the unification of computing, communication,
and sensor technologies
while being a strategic partner for their commercialization

## *The ITTC Mission:*

- **To create the fundamental knowledge and technologies** required to realize the convergence of computing, communications, and sensors for the expansion of our economy and the improvement of the quality of life
- **To educate the next generation of technology leaders** who will drive this convergence
- **To transfer to industry the knowledge and technology** that will enable this convergence

*"Our focus is your future!"*

# Directors' Report

The 1999-2000 year was one of transition: a few long-standing projects came to a close, while exciting new ones came on board. New faculty and staff joined us, and several who had been away on sabbatical returned. The Center itself went through a transition of leadership. In July 1999, Joe Evans assumed the role of acting director, while Victor Frost took a sabbatical year to work within industry. Victor returned as ITTC's director in August 2000, and so this joint directors' report is both a look at what happened this past year and what the Center looks forward to in 2000-2001.

A three-year, $1.4 million Adaptive Computing System (ACS) project from the Defense Advanced Research Project Agency (DARPA), wrapped up, as did another major effort, the Rapidly Deployable Radio Network (RDRN) project. After six years and more than $3 million in funding, RDRN went through its final test this September in Monmouth, N.J. Funded by DARPA, with additional support from Sprint, RDRN had been a vital part of the Center. Because of its success, it put KU on the map for mobile wireless networking. Its accomplishments directly led to another project with the National Aeronautics and Space Administration (NASA) to develop an architecture for space-based Internets (SBI); we expect RDRN to spawn other exciting efforts.

*Victor Frost, Director (left), and Joe Evans, Acting Director during FY2000.*

In summer 1999, the National Science Foundation (NSF) funded our Ambient Computational Environment (ACE) effort. This July, DARPA contracted for $1.46 million over 2.5 years to complement the NSF investment. NSF is funding the equipment to develop the computational environment, while DARPA will fund the research into the architecture, implementation, and performance of the system. This is a research effort to make computers easy to access from anywhere, integrating such items as cell phones, laptops, and video displays into the computational environment. ACE puts ITTC in the starting gate of what will be an explosion of interest in personalized computing space.

This summer also brought news that Sivaprasad Gogineni, Deane E. Ackers distinguished professor of electrical engineering and computer science, was one of seven researchers whose work appeared in the prestigious journal *Science*. We are pleased that Gogineni's ongoing and substantive research into changes in the Greenland ice sheet has been recognized. He and RSL director Chris Allen are currently working on developing the next generation of radar for measuring the accumulation rate of ice sheets.

In the last year, the Center has expanded to include six new faculty—Perry Alexander, Jerry James, Steve Lohmeier, David Andrews, Hossein Saiedian, and Scott Hinton, the chair of the Electrical Engineering and Computer Science (EECS) Department. We welcome their fresh ideas and strengths in such areas as software development, radars, optics, and system languages.

In addition to Frost, three other investigators returned after sabbatical leaves: Glenn Prescott spent a year at NASA, and Dave Petr and Sam Shanmugan were both in Christchurch, New Zealand, each as a Visiting Erskine Fellow. They all bring fresh experiences and ideas to their classrooms and a broader awareness of the workings of industry and funding agencies.

This year ITTC also is exploring joint-effort projects with both KU's School of Education and the School of Engineering's Department of Aerospace. We are pleased to be working in close partnership with other KU units.

ITTC's technology transfer efforts continued to grow this year, with the total return on investments increasing to more than $317,000 for the year. Locally, we have worked with a number of Kansas companies on technologies and activities that have had significant economic benefit to Kansas. Internationally, we have developed our relationship with Turner Broadcasting Systems, Inc. (TBS), wherein they are evaluating an ITTC-developed, real-time video processing technology, VidWatch, which provides the ability to monitor and verify broadcast content internationally through the Internet.

As we look ahead, we are certain that the future will bring a convergence of computers, communications, and sensors supported by increases in speed, mobility, personalized computer access, and an ever-increasing access to more capacity. At ITTC we are poised to meet those challenges and needs. Through our research projects and expertise we will keep a step ahead so that our efforts can continue to shape the future.

Victor S. Frost
Dan F. Servey Distinguished Professor of EECS
Director

Joseph B. Evans
Charles E. Spahr Professor of EECS
Acting Director

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# Information Technology—Critical Thrust for the Nation, Kansas, and KU

*"[Research in information technology] is not a national initiative, it's a national imperative. It's a classic example of a long-term investment in fundamental research that will work for the common good, in fact, the global good."*

—Rita Colwell, Director of the National Science Foundation

*"[Information technology] has begun to alter, fundamentally, the manner in which we do business and create economic value, often in ways that were not readily foreseeable even a decade ago."*

—Alan Greenspan, Chairman of the U.S. Federal Reserve Board, September 1999

Information technology is a hot topic on Wall Street, in America's boardrooms, and in state- and national-level discussions about where Kansans and Americans should invest their research dollars. Economic statistics offer strong support for the idea that information technology is critically important to the nation's future and to its continued economic growth. Information technology—or IT as it is often called—generates one-third of the nation's economic growth. It has created more than seven million jobs with wages that are 60 percent higher than the private sector average. The burgeoning realm of E-commerce shows that information technology clearly fuels the white-hot burn in the U.S. economy.

**Information Technology** has been identified as—

- a **critical technology** for the State of Kansas
- a **major research focus** for the University of Kansas
- a **strategic science and technology area** to U.S. Sen. Pat Roberts' Advisory Committee on Science, Technology, and the Future.

According to the Kansas Technology Enterprise Corporation's (KTEC) *Kansas Innovation Index, 1999*, in Kansas, IT is the state's fastest growing economic sector and its second largest high-tech industry. IT also ranked third among industries in the state that pay the highest average annual wages, with IT jobs averaging $45,781.

So it shouldn't surprise anyone that leaders within Kansas have identified IT not only as an essential technology to the state and its universities, but also as a current, critical strength. Based on the economic data, Kansas has identified IT as one of its four critical technology thrusts—the other three being aircraft and aerospace, materials, and value-added agriculture.

At KU, the research community also has identified information technology as one of its three or four megathemes or niche areas. As part of its niche strategy, KU will focus its resources in those areas and make financial decisions based on these themes.

"Information technology has been identified as a major thrust area by the state of Kansas and by KU," says ITTC director Victor Frost. Research centers, he notes, are the most important factor in the development of high-tech industries. "As the only Kansas Center of Excellence devoted to IT research, ITTC is well-prepared to take a leadership role in the development of IT research and the expansion of IT capabilities in the state as well as the region."

ITTC faculty investigators have participated on committees and projects that have helped heighten awareness about the importance of IT to the state and the region. They have spread the word about the role ITTC can play in helping to make Kansas an IT leader.

The importance of IT has not been lost on the leaders of the state and its universities. Shortly after he was elected, U.S. Senator Pat Roberts, R. Kan., formed an Advisory Committee on Science, Technology, and the Future. The committee identified IT as one of seven areas of science and technology considered strategic to the development of Kansas' universities and the state's economy.

Seven task forces were formed—one for each of the seven strategic areas identified by the senator's advisory committee. Jim Roberts, an ITTC faculty investigator and vice president for KU's Center for Research, chaired the Information, Telecommunications, and Computing Task Force. This 13-member committee, which also included ITTC's director Victor Frost and chief technologist Gary Minden, called for the creation of a center for IT research. The center, it said, would serve not only the state, but also the region and the nation; and it would bring together IT professionals from universities, industry, and government. "It would," Roberts says, "provide a collaborative environment where researchers in various fields could think big about IT and its applications."

In its annual report to Senator Roberts, the committee acknowledged that IT also plays an integral role in the other six technology areas it identified as critical: agriculture and the environment, aviation, biotechnology, energy, manufacturing, and materials. So the center the IT task force proposed would help focus the work of the entire Roberts committee.

In 1999, KTEC (Kansas Technology Enterprise Corporation) named KU and ITTC as the state's leaders in the information technology field. As the IT leader, ITTC has proposed a regional research program to spread the IT focus throughout Kansas, including its rural areas.

That December, Gary Minden (ITTC chief technologist) headed a proposal effort to create the Kansas Information Technologies Enterprise (KITE). This broad-based regional IT collaboration between companies and other institutions in Kansas sought to place Kansas in the ranks of places like California's Silicon Valley and North Carolina's Research Triangle. Those areas have enjoyed success because they have attracted, nurtured, and expanded high technology-based industry.

The state's budget could not support the $4.25 million proposal that would have supported outreach activities, collaborative research projects, an increase in the number and size of federal/industrial research projects, and technology investments. But Minden plans to resubmit the proposal during the FY2002 budget session. Even without funding, Minden's and ITTC's work on the proposal stimulated activity and ideas among those committed to creating an IT research environment to benefit business and the universities.

For example, some ITTC faculty have started researching parts of the plan. Scott Hinton, EECS chairman, has been investigating distance learning; and several companies have been interested in developing rural Internet access.

An advocate for science, engineering, and high-technology research in Kansas universities, Senator Roberts has urged Kansas' state legislators to invest in high-tech research. "If Kansas cannot compete in the technologies that will prove vital to this new century, it will not prosper," he says.

*"Technology plays an increasingly important role in the lives of our citizens, and it is a critical component to the future of Kansas' economy…."*

—Kansas Governor Bill Graves

# Fiscal Year 2000 Overview

*"Information Technology (IT) has become an engine of economic growth. Information Technology is so important at this point in time that we feel as though we cannot afford to not make a major move toward increasing our 'market share' in the many fields that this strategic technology affects."*

—Dr. James A. Roberts, Assoc. Vice Chancellor, KU Center for Research (KUCR)

Information Technology (IT)—the electronic exchange of information—is an essential component in every aspect of education, business, and daily life. KU, its Center for Research, Inc. (KUCR), and ITTC all believe that the University and its researchers must make a major move toward increasing KU's and Kansas' market share in the many fields that this strategic technology affects. The importance of IT development places ITTC at the forefront of economic growth considerations for Kansas, the Midwest, the nation, and the world.

ITTC represents the leading advanced information and telecommunication technology research, development, and commercialization within the entire Midwest region and is recognized for its

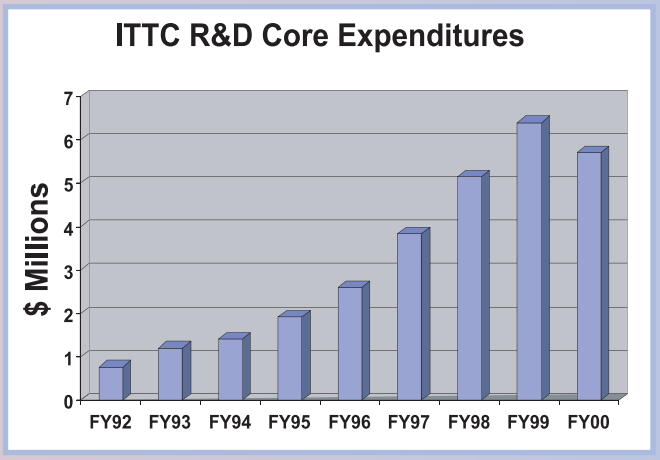
- World-renowned faculty
- Interdisciplinary campus
- Successful track record in attracting research funding
- Internationally recognized academic and research programs in IT
- Proven history of working with the leaders of the telecommunications industry
- Excellent record of successfully developing and commercializing IT technologies
- Unique facilities secured by substantial internal and industry-based investments

ITTC's faculty researchers number more than 30. The Center employs more than 20 staff members—executive, technical, and office support—and approximately 130 student researchers.

ITTC continues to support Kansas companies of all sizes, from small ones like DiscoverMe, LLC; and ProFusion, LLC, to major supporters such as Sprint and Turner Broadcasting System (TBS). The market segments related to our technology base are substantial, as reflected in our own growth over the years. In addition, regionally based information/computer-based market segments benefit from ITTC-developed communication and information technologies that have application in almost all industry segments.

## FY2000 Accomplishments

During FY2000, ITTC continued to be successful in partnering with local industry and other nationally recognized universities and agencies to obtain funds for key cutting-edge research projects in our core technology areas. ITTC had another exceptional year, attracting leveraged funds of ~$6.44 million dollars, yielding a leveraging ratio of about nine to one. More than $2.6 million (40%) of those funds came from industry (primarily Kansas companies), and $3.8 million were awards from federal and other sources. This well exceeded our objective of obtaining $5.8 million in FY2000 leveraged funds. It is anticipated that continued success will lead to yet another strong year in terms of research funds attracted in FY2001. Other activities included the transfer and patenting of technologies resulting from Kansas-industry-funded research projects within ITTC. Most projects will involve cooperative development and investment by both ITTC and Kansas business.




## Research Highlights

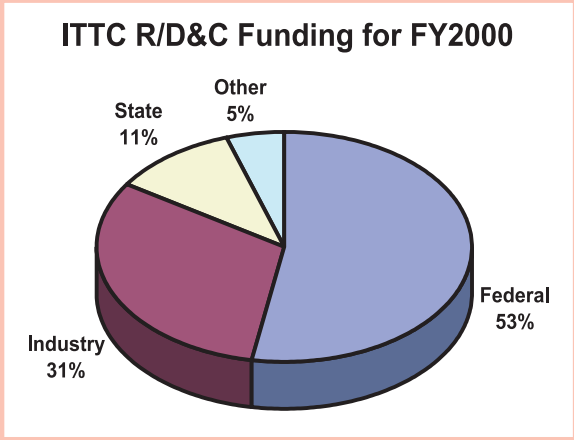
**"ACE" Program Finalized**: ITTC was awarded a $1.2-million, three-year National Science Foundation (NSF) project award for "Ambient Computational Environments" (ACE). This infrastructure-based program sets ITTC at the forefront of intelligent environments and will leverage the strengths of 15 faculty members, and numerous related technical projects, to successfully demonstrate real-time human identification, contextual mobility, and intelligent distributed systems.

**"ANTS" Program Awarded**: ITTC's Intelligent Systems and Information Management Laboratory (ISIML) was awarded a three-year, $1.2-million contract from Defense Advanced Research Projects Agency (DARPA) for "Autonomous Negotiating Teams" (ANTS). The goal of this program is to develop agents capable of intelligently negotiating priority and utilization of resources, specifically in the areas of logistics, dynamic planning, and reactive weapons control.

Several major additional projects were awarded and/or funded to strengthen ITTC's lead position in the ambient computing (i.e., "smart room") environments (ACE) arena. DARPA awarded ITTC a two-year, million-dollar ACE program to improve associated networking protocols (including "smart packets") and intelligent room technologies. This program carries the potential for several add-ons, which could total $5 million over an additional three- to four-year period.

NASA has awarded ITTC a one-year, $300,000 program to improve further the networking technologies associated with the Center's Rapidly Deployable Radio Network (RDRN) system. NASA also continued to fund research and development (R&D) for ITTC's hybrid RF/laser radar program. This program explores advanced RF and optical technologies to improve the resolution and time response for remote sensing applications. ITTC is currently filing for patent protection on this novel, advanced sensing technique. ITTC's world-renowned Remote Sensing Laboratory (RSL) has been involved with microwave-based remote sensing for the past 30 years, and carries the distinction of having contributed hardware to every major NASA launch.

An additional award from NSF drives ITTC into the realm of new photonic device technologies, including the development and application of blue (GaN) lasers for advanced telecommunications. This award involves multi-disciplinary collaboration between KU, K-State, and industry. Finally, Sprint continues to fund critical telecommunications and networking R&D through several $300,000 to $400,000, single-year projects. Prior research and development collaborations have produced key technologies deployed within Sprint for its advanced networking thrust.




## Outreach Highlights

During FY2000, ITTC was privileged to give a tour of ITTC and to brief House Majority Leader Kent Glasscock, State Representative Tom Sloan, and US Representative Dennis Moore. Similarly, ITTC hosted 50 enlisted and civilian members of Fort Leavenworth with a tour and technical discussions regarding ITTC technologies.

In concert with the Kansas Department of Commerce, ITTC hosted a delegation from Hanan, China, to discuss IT research and commercialization at ITTC/KU and within the KTEC organization. Similarly, we hosted NATO technology transfer members from Romania. The 1999 meeting of the Program for Arctic Regional Climate Assessment (PARCA) investigators was sponsored by ITTC's Remote Sensing Laboratory (RSL), where approximately 30 renowned scientists from the United States and Europe presented their research results and discussed future collaborative efforts.

KU recently formed a formal strategic partnership with the Midwest Research Institute (MRI), of Kansas City, Mo., to explore avenues of research and development collaboration in many areas including sensors, robotics, automation, video processing, wireless communications, and bio-based IT applications.

ITTC presented its technological strengths and expertise to community leaders as part of an information session sponsored by the OZ Entertainment Group (OEG). Finally, ITTC showcased its technologies at this year's Yellow Brick Road event at the Topeka Capitol and in Kansas City at this year's Energizing Entrepreneur Expo.

## The Future

IT advances enhance not only business opportunities, efficiency, and effectiveness, but also the quality of life for all citizens. Furthermore, IT can vastly improve the economic condition of Kansas through the education of its students and collaborations with local industry and the government. ITTC renews its goals to

- Make strides in the area of telecommunication and information technologies through basic and applied research and development
- Satisfy the need for IT professionals by training undergraduate and graduate students
- Provide a point of focus for expertise in all IT-related research
- Develop high-impact commercial IT technologies
- Transfer critical technologies to industry
- Help companies use appropriate IT technologies to their benefit
- Serve as a state resource for applications of IT to improve Kansans' quality of life
- Diversify ITTC's funding base for IT research and development
- Position ITTC on a strategic growth trajectory to double its funding within five years.

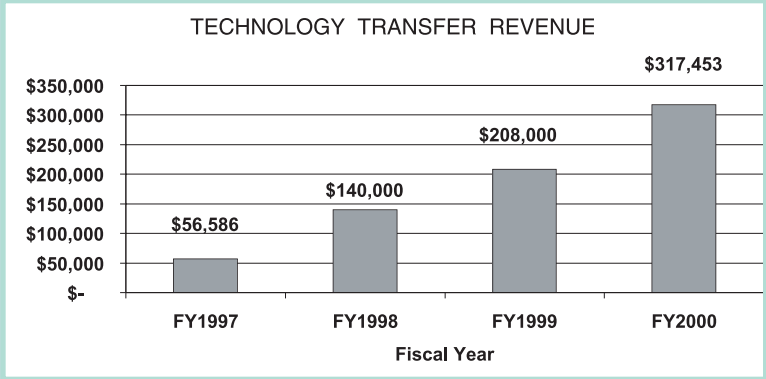
# Technology Transfer

Intellectual property development, technology transfer, and commercialization are key Center objectives. These objectives are well aligned with the KTEC mission, "to support technology advancement, technology transfer, and commercialization." ITTC also is committed to increasing its emphasis on technology transfer in the next decade. By taking a leadership role in this technical area, ITTC will improve the impact of IT on the local and state economy and support the Center's long-range objective to double its current funding level over the next five years.

## Technology Transfer Objectives

In the area of technology transfer, ITTC focuses on achieving the following:

- Develop a solid intellectual property (IT) foundation
- Provide IP expertise and support to faculty, staff, and students
- Transition high-impact technologies to industry
- Promote knowledge, understanding, and ITTC's visibility through community outreach.




Technology transfer inherently involves applied technology development, as well as the mining of technological advances from the Center's extensive research portfolio. Technology development involves close collaboration and investment by ITTC and the business community alike. Such projects may take the form of joint collaborative development or internally funded technology development projects. Consistent with ITTC's mission, most technology licenses are awarded to Kansas entities when suitable. During FY2000, ITTC's royalty and licensing fee receipts increased approximately 50 percent over the prior year, to $317,453.

With typical innovation-to-commercialization cycles of 10 years, ITTC believes its current technology portfolio will continue to produce strong returns on investment (ROI) over the next decade. Augmenting this portfolio, new advances are being made through current projects in key areas such as networking hardware and data routing protocols, high-speed wireless data hardware, intelligent information retrieval and analysis, video processing, advanced radar imaging, and agent-based applications. Such technology development is expected to produce significant returns to the Center over the next decade and beyond. This activity also improves the Center's ability to attract external government and industry funding in its core competency areas.

Such opportunities also are supported by KTEC and KU's Center for Research, Inc. (KUCR), a not-for-profit foundation that manages the University's sponsored-research and technology-transfer agreements. ITTC's technology-transfer process typically concludes with a formal technology license or assignment agreement. These agreements may include sponsored-research support, significant cost sharing, royalty and other compensatory payments, and noncash positions of equity and/or debt. The technology-transfer activities at ITTC seek a "win-win" solution for all affiliated parties.

In FY2000, ITTC greatly increased its intellectual property (IP) portfolio, providing key technologies for future licensing and assignment. One patent was issued during the year, two additional patents were filed, and three other technologies are currently at the patent application development stage. During the year, ten new technologies were created and four were transferred to Kansas commercial entities.

## Technology Transfer Achievements for FY2000

| | |
|---|---|
| New Technologies Developed | 10 |
| Technologies Commercialized in Kansas | 4 |
| Patents/Copyrights Filed or Issued | 13 |
| Companies Assisted | 17 |
| Technology Transfer Revenue | $317,453 |

Here are some highlights of the Center's technology-transfer achievements this fiscal year:

- **ITTC continued to work with Kansas companies on technologies and activities that have potential for significant and sustainable economic benefit to Kansas.** FY2000 has been the Center's most successful year in terms of licensing return from the transfer of ITTC-developed technologies. KU received over $317K in ROI realized from large international companies such as Turner Broadcasting System International, Inc. (TBS) and small Kansas companies such as ProFusion, LLC; Accelerated Care Plus; and Helios Environmental Modeling Institute, LLC.
- **A technology-transfer agreement was finalized between ITTC and ProFusion, LLC** (Lawrence, Kan.) for the transfer and commercialization of two critical web-based search technologies developed by faculty investigator Susan Gauch. Subsequent to the signing of this agreement, the company entered into and concluded a negotiated merger with a larger, VC-funded Internet company. The development group from ProFusion remained in Lawrence at the time.
- **ITTC signed another technology-transfer agreement, assigning ITTC developed leading-edge client/server technologies to DiscoverME, LLC**, a local, small company specializing in online recruitment and assessment via personality profiling and matching. DiscoverME, LLC celebrated its selection as a finalist in Silicon Prairie Technology Association's Technology of the Year award.
- **ITTC has received a notice of allowance for a patent and filed a Patent Cooperation Treaty, international patent application, for its internally developed, real-time video processing technology, VidWatch**, which is currently under evaluation by Turner Broadcasting Systems, Inc., and deployed in several Latin American countries.
- **In addition, ITTC continues to transfer technologies to companies resulting from sponsored research agreements.** One patent was issued during FY2000 for "Method and Apparatus for Controlling an Optical Signal." The following are a few of the ITTC-developed technologies being evaluated for possible patent application: "Subcarrier Optical Modulation System" and "Reed-Solomon Code Erasure Recovery." In addition, the following patents were filed as a result of ITTC-developed technologies and licenses: "Method and Apparatus to Compensate for Polarization Mode Dispersion," "Real-time Feature-based Video Stream Distortion Analysis System," and "Method and Apparatus for Recovering an Optical Clock Signal."

### *Patents*

*Swept-Step Radar System and Detection Method Using Same*
*Method and Apparatus for Controlling an Optical Signal*

### *Patents Pending*

*ATM Reference Traffic System*
*Real-Time Feature-Based Video Stream Distortion Analysis System*
*Processing and Delivery of Audio-Video Information (2)*
*Three-Dimensional Display Apparatus*
*Self-Configuring CAC for AAL2 with Load Estimation (SCALE)*
*Method and Apparatus for Recovering an Optical Clock Signal*
*Method and Apparatus to Compensate for Polarization Mode Dispersion*
*Real-time Feature-based Video Stream Distortion Analysis System*

### *Registered Copyrights*

*Reed-Solomon Code Erasure Recovery*
*LCA: Local Characterization Agent*
*LBA: Local Browsing Agent*
*RCA: Regional Characterization Agent*
*RBA: Regional Browsing Agent*
*ARKTOSViewer*
*ARKTOS-GUI*
*ARKTOS-NT*
*ARKTOS-UNIX*
*ARKTOS-OP*
*MEM-1, Lucid Common, DECStation*
*MEM-1, Golden Common, PC*
*MEM-1, Allegro Common, IBM*
*RS6000 MEM-1, Sun*
*Common, LISP MEM-1, MacIntosh*
*Common, LISP Remote Pump Controller*
*Remote Pump Monitoring*
*Voice Band HF Channel Config. Editor for Windows*
*Voice Band HF Channel Simulator*
*Voice Band HF Channel Simulation Designer for Windows*
*KTRAC*
*RTSS, Admin Tool*
*RTSS, Patient Care*
*RTSS, Training Tool*
*Web-Based Personality Assessment and Recruitment System*
*VidWatch System*
*Data Extraction from RDD-100 DVF Run*
*Rapid Prototyping Tool, RDD-100*
*Information Provider Guide*
*Operational Concept Doc for KICIN*
*Initial Requirements for KICIN*
*Dynamic Enterprise Modeling*
*VISION*
*ProFusion Meta-Search Engine*
*ASIS*
*ARKTOS*
*TopoView*
*Helios*
*PHOENIX*

# Industry Advisory Board

ITTC's Industry Advisory Board for FY2000 comprised the following members. They represent more than 35 companies, organizations, and U.S. Government agencies and come from 14 U.S. states and two foreign countries.

**Phil Anderson**, Kantronics, Lawrence, Kan.
**Bob Boaldin**, Elkhart Telephone Co., Inc., Elkhart, Kan.
**Darren S. Braun**, PMC-Sierra, San Jose, Calif.
**Chris Brown**, TRW, Inc., Redondo Beach, Calif.
**Gerard J. Canavan**, MSHOW.com, Littleton, Colo.
**Steve Chaddick**, Ciena Corporation, Linthicum Heights, Md.
**Simon Crosby**, CPlane, Inc., Los Altos, Calif.
**Jim Dahmen**, Columbus Telephone Co., Inc., Columbus, Kan.
**Marc Epard**, Netopia, Inc., Lawrence, Kan.
**Andrew J. Ernstein**, Lucent Technologies InterNetworking Systems, Overland Park, Kan.
**Charles Holt**, Midwest Research Institute, Kansas City, Mo.
**Andy Hopper**, AT&T Laboratories, Cambridge, England, U.K.
**James Isaacs**, ITT Aerospace Optical Division, TAC, Ft. Wayne, Ind.
**Gordon Johnston**, NASA Headquarters, Washington, D.C.
**Ali S. Kazeroonian**, Active Research, Inc., San Francisco, Calif.
**John R. LaLonde**, GE Medical Systems, New Berlin, Wis.
**Leland Langston**, Texas Instruments Corporate Research, Dallas, Texas
**Tom Lyon**, Nokia, Sunnyvale, Calif.
**Jake Maczuga**, Kansas Innovation Corporation, Lawrence, Kan.
**Mike Mallory**, AlliedSignal FM&T, Kansas City, Mo.
**Gary A. Mastin**, Lockheed Martin Mgmt. & Data Systems, Reconnaissance Systems, Litchfield Park, Ariz.
**Rodler F. Morris**, Center for Army Lessons Learned, Ft. Leavenworth, Kan.
**David Nicol**, Illuminet, Overland Park, Kan.
**Susan Norris**, Sprint PCS, Overland Park, Kan.
**Maurice O'Sullivan**, Nortel Broadband Networks, Ottawa, Ont., Canada
**Joe Ozorkiewicz**, Netopia, Inc., Lawrence, Kan.
**Robert Parker**, USC-IC, Arlington, Va.
**David M. Purvis**, AlliedSignal, Inc., Olathe, Kan.
**Brian Ruf**, RUF Corporation, Olathe, Kan.
**Robert Sansom**, FORE Systems, Inc., Warrendale, Pa.
**Daniel Sershen**, Sprint Corporation, Overland Park, Kan.
**David Smith**, Public Networks Group, NEC, Irving, Texas
**Michael F. Sobek**, Information Control Systems, Inc., Overland Park, Kan.
**Arun Sobti**, Third Generation Cellular Systems Development, Motorola, Schaumburg, Ill.
**Jerry White**, Black & Veatch, Overland Park, Kan.
**Gregory G. Williams**, SBC Technology Resources, Inc., Austin, Texas
**Mike Wojcicki**, Kansas Technology Enterprise Corporation, Topeka, Kan.
**Ken Young**, Telcordia Technologies, Morristown, N.J.
**Bob Zerwekh**, KU Engineering Management, Overland Park, Kan.

# ITTC Industry Affiliates Program

In the rapidly changing world of information technology (IT), theory and hardware can quickly become obsolete. IT industries need to keep current, and this need has generated fertile interactions between industry and the academic community. ITTC has a successful record of understanding and being responsive to industry needs, having commercialized several technologies and worked closely with industry on many joint research and development projects.

To further this collaborative interaction, ITTC has an ongoing Affiliates Program. The goal of this program is to develop a practical and functional relationship between ITTC and the industrial community. The program offers many benefits, including annual workshops, periodic seminars, special courses, and an open dialogue about research areas of mutual interest. Affiliates also gain access to research results and to faculty, staff, and students.

Other benefits include periodic exchanges between faculty and their business counterparts, improved contact with students for recruitment and internships, enhanced participation in joint proposal and project activities, and increased communications between the Center and its affiliates.

Sprint Corporation and NEC America are founding members of the ITTC Affiliates Program.

# Labs Overview

ITTC comprises five major research laboratories:

- Intelligent Systems & Information Management Lab
- Lightwave Communication Systems Lab
- Networking and Distributed Systems Lab
- Radar Systems and Remote Sensing Lab (RSL)
- Wireless Communications & Digital Signal Processing Lab

Each of these well-equipped labs investigates some aspect of information technology.

Information technology (IT) breaks into three main levels. At the most basic level, IT includes the wires and chips in computers—the bitways of IT. Next, IT encompasses software, networks, telecommunication products, and electronic transactions. Beyond these technical IT "things," information technology at the highest level includes the applications of the equipment and knowledge.

ITTC—unlike many centers—researches all these aspects of IT. Together the Center's labs run research "from soup to nuts"—in everything from fiber optics and wireless systems to high-level applications. This multi-discipline approach gives ITTC an advantage over other IT centers and is one of its greatest strengths.

Adding to this multi-disciplined approach to IT research is ITTC's unique advantage of having faculty, students, and staff from a variety of disciplines—electrical engineering, computer engineering, computer science, chemical engineering, mechanical engineering, and mathematics—work in its labs. Few research centers include both the breadth of IT activity and the diversity of disciplines that can be found at ITTC.

This diversity of interests and disciplines contributes to the collaborative and supportive environment found in ITTC's labs. This synergistic environment also helps to stimulate advances in information and telecommunication technologies, and it creates an environment that attracts students from around the world.

ITTC's success also comes from its state-of-the-art lab facilities, which are capable of performing the technology-based research and development that will form the next generation of communications systems. Among other things, these facilities include a high-speed networking lab with a 2.4Gb/s SONET connection; DSP and digital radio lab; integrated, diverse networking environment; and a leading-edge lightwave research lab. Complementing the hardware facilities, the Center uses some of the best-in-class design and development tools, such as Signal Processing Workstation (SPW). Much of ITTC's work requires the development of new software, so ITTC uses CORBA, C++, Java, and Lisp among others to ensure that it uses industry-established solutions to smooth the technology transfer process.

In addition to its research function, ITTC develops and markets the commercial potential of the technologies and expertise developed within the labs. So, many of the software and hardware facilities used in ITTC's research labs are also used when the Center collaborates with industry and entrepreneurs or when it transfers a technology into the commercial sector.

A full description of each lab, its facilities and current sponsors follows, on pages 12-13.

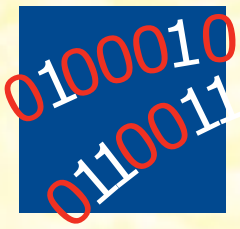
*Students from Arvin Agah's computer systems design class apply what they've learned to design and build robots. Agah is an assistant professor affiliated with the Intelligent Systems and Information Management Lab.* Photo by Wally Emerson.

*Dan DePardo, RF Electronics Engineer, and graduate student Karthik Mahalingam program laptop computers as part of the RDRN project, a wireless high-speed communications system.*

# Lab Details

## Facilities

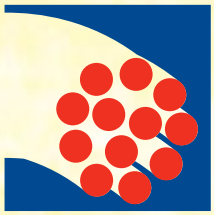
### Intelligent Systems & Information Management Lab (ISIML)




Lab Director: Costas Tsatsoulis

- AI Development Tools
- CATV Link
- CORBA
- Data Mining Tools
- KU Image Analysis Program (KUIM)
- KU Information Retrieval (KUIR)
- KU Real Time (KURT)
- NT PCs and Linux Workstations
- Proportional Time/Real-Time Network Testbed
- Robotics Assembly Shop
- Video Recording/Transmission Systems
- 2.4 Gbps Fiber Terminal

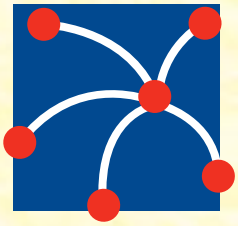
### Lightwave Communication Systems Lab (LCSL)



Lab Directors: Christopher Allen, Kenneth Demarest

- Ciena Multiwave 1600 16-λ WDM system
- Direct fiber link to Sprint facility in Kansas City
- Erbium-doped fiber amplifiers
- Fiber-optic polarization analyzer
- Fiber-optic recirculating loop
- Hundreds of kilometers of assorted optical fiber
- Lucent FT-2000 8-λ WDM system
- Optical clock recovery system
- Optical spectrum analyzer
- Soliton generator
- Tunable lasers
- 12-Gb/s BERT
- 50-GHz sampling oscilloscope
- 100-fs pulsed laser sour

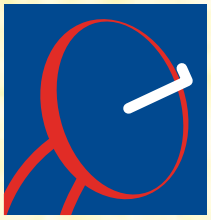
### Networking & Distributed Systems Lab (NDSL)



Lab Director: Joseph Evans

- ATM switches and concentrator
- Direct access to SprintLink, Internet2, CAIRN
- Direct fiber link to Sprint facility in Kansas City
- Extensive high-speed networking infrastructure
- Linux PC array and Sun workstation testbeds
- Miscellaneous routers, switches, and network interfaces
- High-speed WANs
- Network system software and configuration servers
- Several carrier-class Cisco IP routers
- Sprint testbed connections at 40 & 2.4 Gbps
- 2.4 Gbps SONET fiber terminal

### Radar Systems & Remote Sensing Lab (RSL)



Lab Director: Christopher Allen

- Antenna measurement range
- Field-programmable logic
- High-speed oscilloscope
- Variety of high-end workstations and personal computers
- 20-GHz frequency synthesizer
- 22-GHz spectrum analyzer
- 40-GHz network analyzer

### Wireless Communications & Digital Signal Processing Lab (WDSPL)

Lab Director: Glenn Prescott

- FPGA prototype facility
- Circuit board fabrication facility
- DSP rapid prototyping facility
- Eagleware RF design
- EESof RF design
- High-speed digital T/R rooftop antenna
- MATLAB / Simulink
- Power meters
- Protel PCB Layout
- Signal processing workstation
- Synopsys FPGA design tools
- 2 GHz digital sampling scope
- 20 GHz synthesizer
- 22 GHz spectrum analyzer
- 25 Mbps wireless communications system
- 40 GHz, 6 GHz network analyzers

| Description | Current Sponsors |
|---|---|
| ISIML studies theoretical and applied technology in the areas of artificial intelligence, intelligent agents, and agent-based applications. The Lab also investigates information retrieval from distributed and heterogeneous sources and data mining. ISIML's researchers develop advanced methodologies for automated characterization of data sources, dynamic routing, soft- or auto-bots, information fusion and enhanced visualization, image and video processing, knowledge-based systems, and development tools. | Defense Advanced Research Projects Agency (DARPA)<br>National Institutes of Health (NIH)<br>National Science Foundation (NSF)<br>Naval Research Laboratory (NRL)<br>Sprint<br>Turner Broadcasting Systems (TBS) |
| LCSL explores lightwave technologies, specifically in the areas of photonic devices—including components and fiber, and network flexibility and protocols of existing optical networks. Such research and development is performed in conjunction with government agencies and industry partners to optimize performance, cost, and reliability of such networks and related technologies. Experts within LCSL investigate lightwave systems and networks, wavelength division multiplexing (WDM) and dense wavelength division multiplexing (DWDM), network performance improvements, reduction or elimination of deleterious transmission effects such as polarization mode dispersion (PMD), new fiber technologies, and advanced photonic devices. | KTEC<br>Lucent Technologies<br>National Science Foundation (NSF)<br>NEC America<br>Nortel Networks<br>Sprint |
| NDSL engages in analytical research, advanced simulations, and testbed measurements of large-scale networks and network technologies. It emphasizes networking issues, performance, testing, modeling and enhancements, network control and signaling, and integration of advanced lightwave and wireless communication technologies. Such efforts have had a critical impact on the telecommunication industry, networking community, and information service providers (ISPs). NDSL has produced world-recognized achievements in distributed performance measurement and modeling, network control and management systems, self-configuring networks, optimal data transfer protocols, architectures, reliability, robustness, ubiquitous systems, improved distributed networking routing, management tools, and cost models. | Adaptive Broadband<br>Defense Advanced Research Projects Agency (DARPA)<br>National Science Foundation (NSF)<br>National Aeronautics and Space Administration (NASA)<br>Sprint |
| RSL develops, evaluates, and applies new radar systems and other related sensing technologies for remote sensing of land, sea, ice, and atmosphere. A broad range of laboratory activities is involved, including sensor development, data collection, data analysis and modeling, and data dissemination. Remote sensing areas where RSL has made significant contributions throughout the years include remote sensing of the ocean, atmosphere, sea ice, polar ice sheets, vegetation, soil moisture, subsurface, and snow. | California Institute of Technology<br>Jet Propulsion Lab (JPL)<br>National Aeronautics and Space Administration (NASA)<br>University of Copenhagen<br>U.S. Air Force<br>U.S. Army |
| WDSPL serves as ITTC's focal point for leading-edge research in wireless communications and digital signal processing applications in communications and radar. Well integrated with the other laboratories within ITTC, WDSPL performs design, implementation, testing, measurement, and commercialization of wireless systems and components. Innovative digital communication system design bridges the gap between the simulation world and real-life applications. WDSPL performs both basic and applied research in these areas in collaboration with the government and international industrial leaders. The lab has been successful in demonstrating intelligent wireless communication systems for the government and commercial applications. It is currently engaged in employing digital signal processing technology to the problem of radio and synthetic aperture radar signal processing through the use of rapid prototyping techniques. | Air Force Office of Scientific Research (AFOSR)<br>Defense Advanced Research Projects Agency (DARPA)<br>National Science Foundation (NSF)<br>Sprint<br>U.S. Air Force Research Laboratories (USAF) |

# Students at ITTC

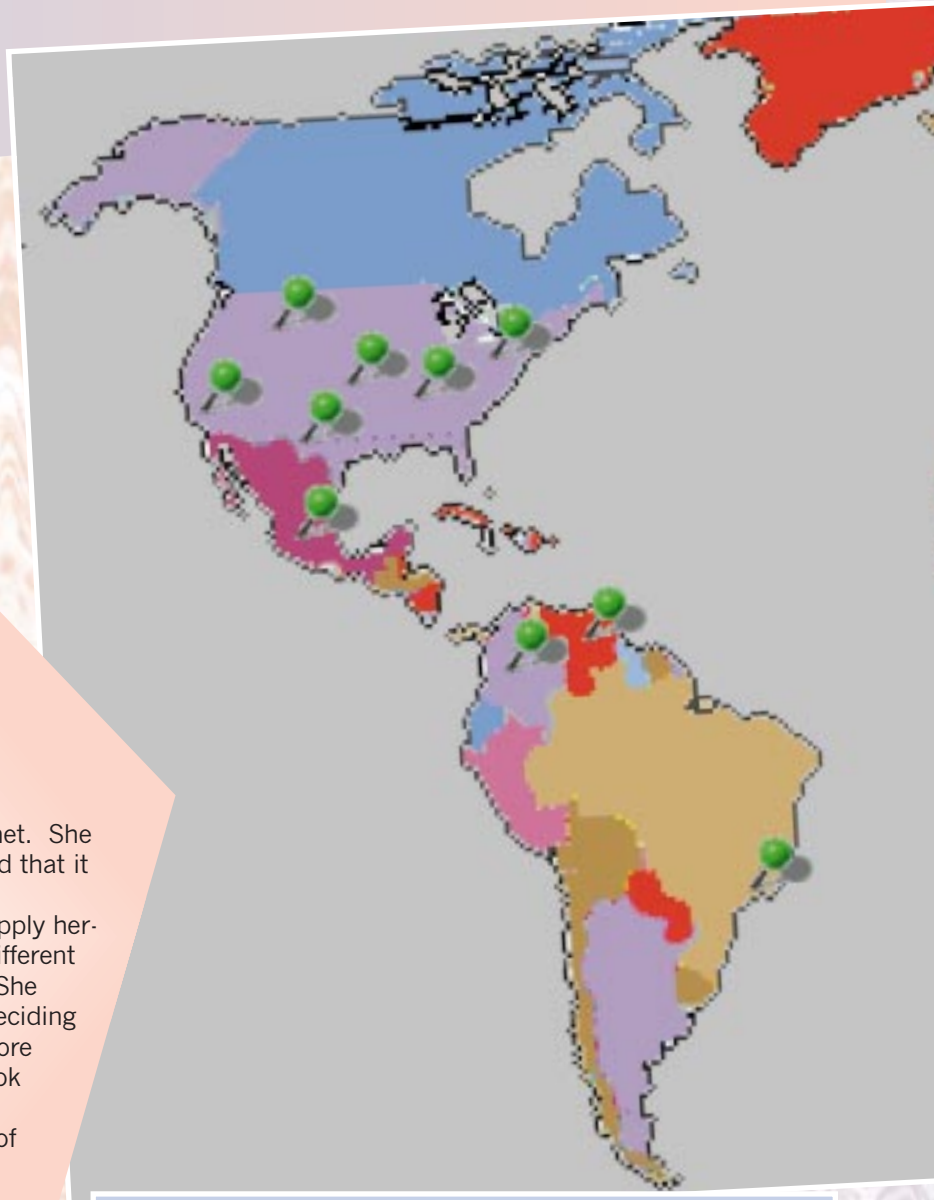
More than 100 students work at ITTC each semester. Some of the most common student positions are research assistants, programmers, and system administrators. Graduate students who work at ITTC usually conduct research that coincides with their theses.

ITTC's student employees gain valuable experience through their work at the Center, giving them a head start when looking for jobs. By working on a variety of projects, students learn a broad range of skills. They can also decide upon which area to focus their future work.

A number of ITTC's student employees have gone on to find major successes in industry. Former students are well equipped to succeed in their jobs, and some students may use their ITTC training to create their own start-up companies. Many, who have taken the risk, have gained big profits from the sale of their companies. One student was among the first participants in an optical networking company that sold for $3.25 billion. Another group of students sold their Web gaming enhancement company to Microsoft.

**Towela Nyirenda** is a Ph.D. student in electrical engineering with an emphasis on telecommunication networks. She began working at ITTC in 1995 as a master's student because she wanted to gain experience in her field. In the past five years, she has worked on a variety of projects, including performance evaluation of an ATM switch, the GFR service, and quality of service on the Internet. She didn't think she'd enjoy doing research but has found that it satisfies her need to keep learning.

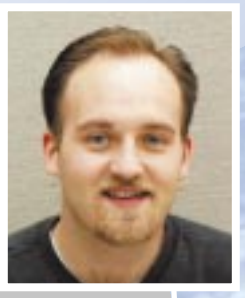
Nyirenda says researching has enabled her to apply herself to a problem and to see a project through its different phases of planning, implementation, and delivery. She says her advisor gives her plenty of latitude when deciding how to approach a problem, helping her become more resourceful. Her job at ITTC has also given her a look into the telecommunications industry. Internships with Sprint Corp. have helped her balance her view of how research and industry work together. Nyirenda wants to continue researching, but she also wants to move into university teaching. In the spring she taught introduction to communications networks as an EECS graduate teaching assistant. She says teaching was challenging but also very fulfilling. Nyirenda's country of origin is Malawi.

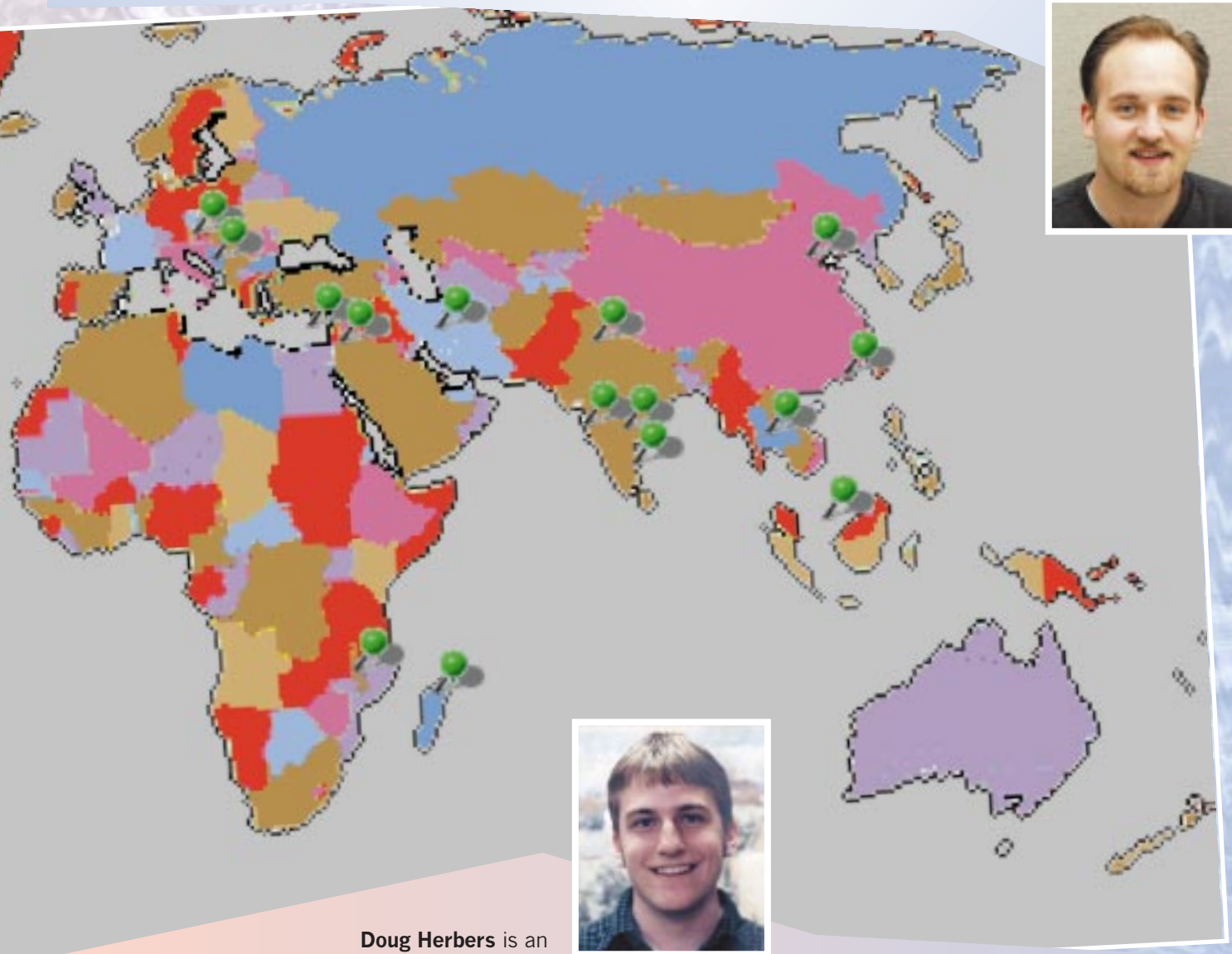


*ITTC's student employees come from many different nations. Students travel to Kansas to study at KU's Department of Electrical Engineering and Computer Science and to learn at the Center. ITTC attracts international attention because of its wide breadth of research areas and expertise.*
*Map used with permission from www.theodora.com.*

**Sean House** is a master's student in electrical engineering. During the senior year of his undergraduate program, a professor asked him to work at ITTC as a programmer. Subsequently, that same professor convinced House to stay at KU to pursue a master's degree. As a graduate research assistant at ITTC, House's work focused on a project called Proportional Time Emulation and Simulation (ProTEuS). The project developed a framework for performance simulations of real-time distributed communication, like a network. The ProTEuS project—in relation to networking and operation systems—is the topic of his master's thesis. He finished his master's classes and defended his thesis on Dec. 8, 2000.

House says his experiences at ITTC have made a significant impact on his skills and abilities. The hands-on learning combined with a professional working atmosphere allowed him to gain valuable experience before choosing a job. While at ITTC, he learned things like project management, Linux, ATM networking, system administration, and PC hardware. He says his research enabled him to determine what he did and did not like. House currently works for Microsoft Corp. as a software design engineer. He is originally from Endicott, N.Y







**Doug Herbers** is an undergraduate student studying computer engineering. He was hired in 1998 as ITTC's Webmaster. His duties include maintaining ITTC's external and internal Web sites, as well as general system administrative tasks. Herbers first got involved with Web design during a summer internship in 1997. When he started at ITTC, he didn't have much experience, but he was willing to learn. While working at ITTC, he has become proficient in Web site design, coding, and maintenance; but he still challenges himself to experiment with graphic elements and new scripting languages.

As the Internet and intranets have become vital parts of today's businesses, the Webmaster has become an important player for most businesses. Because ITTC provided him with a solid foundation of experience, Herbers says he expects a variety of job offers when he graduates in May 2001. But he plans to continue his education by pursuing a master's degree in business administration, with an emphasis in finance. Herbers hails from Holton, Kan.,

# Executive Staff

## *Victor S. Frost, Director; Dan F. Servey Distinguished Professor , EECS*

Victor Frost has performed advanced research for many corporations, including Sprint, NCR, BNR, NEC, Telesat Canada, AT&T, McDonnell Douglas, DEC, and COMDISCO Systems. He has published more than 45 journal articles and has served as a guest editor for the *IEEE Communications Magazine* and *IEEE Journal on Selected Areas in Communications*. He is an associate editor for the *IEEE Communications Letters* and the *ACM Transactions on Simulation and Modeling of Computer Systems*. His current research interests are in the areas of integrated communication networks, high-speed networks, communication systems analysis, and simulation and have included projects such as MAGIC and AAI high-speed, wide-area testbeds.

He received his B.S., M.S., and Ph.D. degrees from KU in 1977, 1978, and 1982, respectively. In 1982 he joined KU's Electrical Engineering and Computer Science Department. From 1987 to 1996, he directed the Telecommunications and Information Sciences Laboratory (TISL) at KU. He became ITTC's acting director in January 1998 and officially its director in January 2000.

He is a member of Eta Kappa Nu and Tau Beta Pi and a Fellow of the IEEE. He has served on State of Kansas NSF EPSCoR and DoD EPSCoR committees, as well as the Kansas Inc. Telecommunications Task Force. He is a member of the Board of Trustees for KU's Center for Research, Inc. In 1984 he received a Presidential Young Investigator award from the National Science Foundation.

During the 1999-00 academic year, he was on sabbatical, working with Sprint Corp. He returned to ITTC in August 2000.

## *Joseph B. Evans, Acting Director FY2000; Charles E. Spahr Professor, EECS*

Joseph Evans served as ITTC's acting director from August 1999 through July 2000. A professor of electrical engineering and computer science, he holds a B.S.E.E. degree from Lafayette College (1983) and M.S.E., M.A., and Ph. D. degrees from Princeton University (1984, 1986, and 1989, respectively). In 1989 he came to KU and has been involved in a variety of networking projects, ranging from the MAGIC gigabit networking testbed, the ACTS ATM Internet, and the Rapidly Deployable Radio Network project to a collaborative Internet effort with the KU School of Education.

Before coming to KU, Evans held a postdoctoral position in the Network Systems Research Department of AT&T Bell Laboratories in Holmdel, N.J. where he was involved in the design of a high-performance integrated network. While at Princeton, he was awarded an AT&T Bell Laboratories Graduate Fellowship for 1984-1988 and also worked part time with Bell Labs, in speech processing algorithms for packet networks.

His current research interests include high-speed (gigabit) networks, special-purpose computer architecture, adaptive signal processing, digital speech processing, and VLSI implementations.

## *Tim Johnson, Executive Director for Applied Technology*

Tim Johnson has more than 14 years of experience in the management and design of engineering and software projects and has conducted, presented, and supervised research in communications and digital signal processing. His engineering career includes work with Kansas Power and Light Co. in Topeka, Kan., and work as a senior associate division engineer with Computer Sciences Corp. in Falls Church, Va., where he researched the performance of defense satellite communication systems.

He received a B.S.E.E. from Memphis State University in 1982 and a M.S.E.E. in 1985; he pursued doctoral studies in electrical engineering at Kansas State University. While at K-State, he was an electrical engineering instructor and performed research funded by Motorola, Inc., Government Electronics Group. From 1989 to 1990, he was an assistant professor of electrical engineering at the University of Wyoming (UW) in Laramie, Wyo., where he conducted signal-processing research.

In August 1991, he joined KU's Center for Excellence in Computer-Aided Systems Engineering (CECASE), becoming its associate director in December 1993 and its executive director in August 1996. He's a former vice president of Lawrence Applied Research Corp. (LARC) in Lawrence and has served on various corporate boards of directors. He serves on the Kansas Innovation Center's (KIC) Operations committee, Silicon Prairie's Information Technology committee, and KTEC's Telecommunications committee. He is an IEEE member.

## Gary J. Minden, Chief Technologist; Professor, EECS

Gary Minden received his B.S.E.E. degree in 1973 and his Ph.D. in 1982, both from KU. He joined the Electrical Engineering and Computer Science Department in 1981.

From 1971 through 1978, he was a research engineer at KU's Center for Research, Inc., where he focused on image processing systems, multi-processor computer systems, and general systems theory. From 1978 to 1980 he was vice president of CHILD, Inc., where he was a co-designer of the LIGHT-50 computer graphic terminal. From 1983 to 1989, he led the implementation of a new computer engineering degree program within the (then) Electrical and Computer Engineering Department at KU.

In 1991, he completed a sabbatical at Digital's renowned System Research Center, researching gigabit local area networks. He was a principal investigator on the MAGIC gigabit testbed and the Rapidly Deployable Radio Network (RDRN) projects at ITTC. From June 1994 through June 1996, he was on leave at the Defense Advanced Research Projects Agency (DARPA) Information Technology Office. He served as a program manager in the area of high performance networking systems. While at DARPA, he formulated and initiated a new research program in Active Networking.

His research interests are in the area of large-scale distributed systems, which encompasses high performance networks, computing systems, and distributed software systems. He is a member of IEEE and the Association of Computing Machinery.

## Keith B. Braman, Associate Director for Applied Technology

Keith Braman, associate director for applied technology, manages ITTC's technology transfer, intellectual property, and state-affiliated economic development activities. He has a juris doctorate from Washburn University in Topeka and B.S. and M.S. degrees in aerospace engineering from KU.

Before joining ITTC in July, 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, where he provided engineering consulting services, and operational protocols for the design and manufacture of medical devices. He has worked as an aerospace engineer for McDonnell-Douglas Helicopter Co. and as an engineering consultant in the area of flight test research, software development, computer-aided design, and program management. He has practiced corporate and intellectual property law.

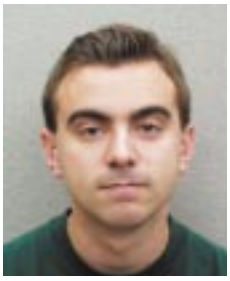
He is a member of the Kansas and Nevada bars, the American Bar Association, and Sigma Gamma Tau, the engineering honor society.

## Mark S. Wdowik, Director for Applied Technology, through April 2000

Mark Wdowik was ITTC's director for applied technology from December 1998 through April 2000. He brought more than 15 years of industry experience to this position. That experience included managing multi-million dollar technology-based companies, establishing business relationships, contract negotiations, government contracts, intellectual property (IP) development, and technology transfer. He left ITTC for the University of North Carolina-Charlotte where he is now the director for technology transfer.

# Technical, Postdoctoral, and Support Staff

## Brett Becker, Network Specialist



Brett Becker joined ITTC as an undergraduate assistant in quality service and high-speed networks. After completing his B.S. degree at KU in electrical engineering in 1999, he accepted a full-time position as a network specialist. His duties include involvement in a variety of projects, including network design and upgrades and supervision of installation. He is interested in becoming more involved with the Center's research.

## Tim Buller, Network Specialist

Tim Buller joined ITTC on July 20 as a network specialist. Buller first started working with computers during college while working with an Internet service provider. Over the next few years he learned more about networks and taught himself the UNIX operating system. Before coming to ITTC, he worked as a system administrator for KU's Department of Mathematics. At ITTC, he will help to make the network as seamless as possible. He received his B.A. in religion and German from Bethel College in Newton in 1996.

## Enlian Chong, Senior Software Engineer

Enlian Chong joined ITTC in May 1996 as a Graduate Research Assistant. He received his bachelor's degree in computer science at KU in 1996, and his Master's degree in computer science at KU in 1999. His areas of expertise include client/server systems engineering, object-oriented software design, relational database modeling, and Web application development. As a software engineer at ITTC, he is working on projects related to technology transfer, and the development of Web database applications using the latest enterprise Web technology integrated with back-end SQL Server.

## Paula Conlin, Secretary/Receptionist

Paula Conlin became an official ITTC employee in October 1999 after 18.5 years as the building receptionist and secretary to the manager of research facilities for Nichols Hall. Paula continues to handle the all-building-related issues, such as faxes, mail, key checkout, and maintenance reporting. She is also responsible for all Nichols Hall conference room scheduling and updates on the building's Web site. She has more than 25 years of office experience with positions at a local real estate office and other departments at KU.

## Daniel DePardo, RF Electronics Engineer

Dan DePardo studied at the U.S. Army Intelligence Center and graduated from the Aerial Surveillance Sensors School, while co-attending the University of Arizona. During his tours of duty, he supported various airborne electronic warfare systems and provided technical support for the Army's Electronic Proving Ground. After his discharge, he worked for a variety of defense electronics organizations. At ITTC he supports the Center's Wireless Communications and Digital Signal Processing Lab. His areas of expertise include radio frequency and microwave circuit design and testing, SAW (surface acoustic wave) technologies, photolithography, prototype fabrication, hybrid and surface mount device technologies, environmental testing, mil-spec soldering and assembly, as well as RFI (radio frequency interference) and EMI (electro-magnetic interference) suppression techniques.

## Judith Galas, Public Relations and Marketing Manager

Judith Galas has been a journalist for more than 20 years. As a reporter and editor she worked for Knight-Ridder Financial News and covered the commodity and futures markets from bureaus in Kansas City, New York, and London. She has worked as a promotional writer at KU and has worked closely with such KU-related agencies as K*STAR/EPSCoR, University Relations, and KU's alumni and endowment offices. Galas has taught journalism at the University of Missouri-Kansas City and teaches technical and business writing seminars to area businesses. She received her master's degree in journalism from KU and her bachelor's degree in English from Temple University.

## Donnis Graham, RSL Office Manager

Donnis Graham has been with the Radar Systems and Remote Sensing Lab (RSL) since 1987. She manages general office tasks, coordinates lab purchasing and payroll, plans travel, organizes conferences, and edits all published articles and technical reports. She has also assisted faculty with the editing of an international professional newsletter and a conference-related special issue of a geophysics journal. She has been a technical editor for more than 35 years. Her career has included coordinating marketing for the subsidiary of a large corporation, managing the office and teaching religious school for a small synagogue, and editing positions including ones at a research division of Yale University and at The Johns Hopkins University Press. She received a bachelor's degree in social work from KU after completing more than 90 hours toward a bachelor's degree in English.

## Sash Guha, Software Development Manager

With more than a decade of experience in the IT industry, Sash Guha joined the Center in December 1998. Before coming to ITTC, she was a principal in a multi-billion-dollar systems management company and managed the technical architecture of major multi-million-dollar projects involving hundreds of people. Her ITTC responsibilities include managing the Center's industry-based software projects and ITTC's Intranet requirements. She has a master's degree in computer science from KU and a bachelor's degree in engineering from the Jadavpur University in India.

## Nancy Hanson, Office Manager and Operations Secretary

Nancy Hanson joined CECASE (Center for Excellence in Computer Aided Engineering—a predecessor of ITTC) in January 1993 after several years as secretary for KU Center for Research's Flight Research Laboratory. At ITTC she coordinates office procedures and handles purchasing records. She also manages ITTC publications, including work with layout, graphics, and copy editing for the annual report. She has a B.A. in Spanish from Washburn University, in Topeka, and has studied art and design at KU.

## Michael Hulet, Systems Administrator

Mike Hulet joined ITTC as a computer systems administrator in July 1998. He manages the Center's network and computer infrastructure. He holds a B.S. degree in electrical and electronic engineering from North Dakota State University and a M.S. degree in systems management from the University of Southern California. Before joining ITTC, he was employed as an electronics engineer for the Naval Warfare Assessment Division in Riverside, Calif.

## Roel Jonkman, Senior Network Engineer

Roel Jonkman earned his bachelor's degree in computer engineering from the Hogeschool Enschede in the Netherlands. While pursuing a master's degree in computer engineering at KU, he researched network performance analysis and developed a tool called NetSpec. His work in this area led to his joining ITTC as its systems and network "wizard." He is chiefly responsible for setting goals and planning the future of the Center's computing infrastructure. His personal computing interests include computer security, firewalls, the science and psychology of hacking, intrusion detection, and network performance.

## Jason Keimig, Research Engineer

Jason Keimig (not pictured) received his B.S. and M.S. degrees in electrical engineering from KU in 1996 and 1998, respectively. From 1995 to 1996, he was involved in an ISP startup that has become a successful network provider throughout much of the Midwest. In 1997, he joined the Sprint Corp., where he was involved in integrating Sprint's ATM and IP networks into one common infrastructure. As a staff researcher at ITTC, he worked on advanced IP/ATM/QoS networking research topics, designing new low-cost networking technologies. He left the Center to help begin a local start-up company.

## Namseong Kim, Research Engineer

Namseong Kim (not pictured) joined ITTC's Lightwave Lab in November 1999. He helped develop the PMD Compensation, a link quality monitoring device, and a WDM link simulator. His research interests include WDM link systems and sub-components for optical fiber communications, WDM channel monitoring and simulations, and optical amplification using Er-doped fiber amplifier and Raman fiber amplifiers. Before joining ITTC, he was a postdoctoral researcher at the University of Electro-Communications in Japan and the University of Oxford. He received his Ph.D. and M.S. from the Korea Advanced Institute of Science and Technology in 1995 and 1989, respectively, and his B.S. from Seoul National University in 1987.

## Ed Komp, Research Engineer

Ed Komp 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. He joined ITTC in September 1998. He 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 networking.

## Artur Leung, Research Engineer

Artur Leung joined ITTC in May 1997 as a graduate research assistant. He received his bachelor's degree in electrical engineering at KU in 1996 with highest distinction and his master's degree in electrical engineering at KU in 1998. His master's research focused on the design and implementation of an UHF wireless channel simulator for performance evaluation of wireless communication systems. He became a full-time research engineer at the Center after graduation. Leung's research focuses on the design of wireless communication systems. His areas of expertise include RF and digital circuit design, and code development for DSP and FPGA.

## Wendy Prescott, Secretarial Assistant

Wendy Prescott became an official ITTC staff member in January 2000. Before that—since July 1993—she had worked with the Center as a student office assistant. Her duties include assisting administrative staff in various clerical and data processing tasks. She has five years of prior experience in administrative assistant duties at office supply stores. She graduated from KU with a bachelor's degree in geography in December 1999.

## Betsy Schnorenberg, Public Relations Assistant

Betsy Schnorenberg joined ITTC in October 1999. Her duties include writing press releases and newsletter articles, designing the newsletter, updating the ITTC bulletin boards, attending trade shows, and taking photos. She has two years of experience working for KU's daily student newspaper. She will graduate in May 2001 with a bachelor's degree in journalism, with an emphasis in business communications.

## Leon Searl, Information Specialist

Leon Searl returned to a familiar place when he accepted the position of information specialist at ITTC. Searl worked at TISL (Telecommunications and Information Sciences Lab, a predecessor of ITTC) while he was an electrical engineering student. Before returning to KU, Searl worked with TRW Space and Defense Group and Cadence Design Systems. He even owned his own ultralight aircraft company. He is working on two ITTC projects: the Rapidly Deployable Radio Network (RDRN) project and the Ambient Computational Environment (ACE) project. He received his M.S. and B.S. degrees from KU in 1987 and 1985, respectively.

## Leen-Kiat Soh, Postdoctoral Research Scientist

After receiving his Ph.D. with honors from KU in 1998, Leen-Kiat Soh joined ITTC as a research scientist. He works with Costas Tsatsoulis in the Intelligent Systems and Information Management Lab. His research interests include machine learning, image processing, computer vision, data mining, expert systems, multi-agent negotiations, and classification methodologies. He hopes to teach at the university level and to continue researching advanced technologies.

## Yishu Wang, Postdoctoral Research Engineer

Yishu Wang joined ITTC on May 1 as a postdoctoral research scientist. He is working in the Lightwave Communication Systems Lab, managing finances and conducting research experiments. He's currently working with students on optical system link quality monitoring for Nortel. He is also interested in numerical simulation of optical fiber communication systems and polarization mode dispersion compensator development. He received his Ph.D. and M.S. degrees from Yamagata University in Japan. He received his B.S. degree from the Harbin Institute of Technology in the People's Republic of China.

## Peggy Williams, Research Secretary

Peggy Williams joined ITTC in March 1997 and is the Center's key resource person for personnel and research-related documentation, office supplies, travel arrangements, and hospitality. She has held positions with the NSF EPSCoR program; Merck & Co., Inc.; KU Center for Research administrative offices; and KU.

# ITTC Faculty Investigators

## *Arvin Agah, Asst. Professor, EECS*

**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** computer systems design, software engineering, introduction to artificial intelligence, theory and practice of robotics, applied artificial intelligence for mobile robots, intelligent agents.

**Honors and Awards** include the KU Henry E. Gould Award for Outstanding Teaching, 2000.

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***Research Interests:***

- ***Human interactions with intelligent systems***
- ***Distributed autonomous systems (robots and agents)***

## *W. Perry Alexander, Assoc. Professor, EECS*

**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** software engineering, digital systems design, formal methods and modeling in software and hardware systems development.

**Honors and Awards** include KU Engineering Expo EECS Department Teaching Award; senior member of IEEE; University of Cincinnati (UC) College of Engineering Neil A. Wandmacher Teaching Award; UC ECECS HKN Professor of the Year, 1992-93 and 1996-97; UC Engineering Tribunal Professor of the Quarter, winter 1994 and fall 1998; UC ECECS Department Research Award; UC ECECS Department Teaching Award.

**alex@ittc.ukans.edu**
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***Research Interests:***

- ***Formal specification, synthesis, and verification***
- ***Systems-level design***
- ***Systems-level description languages***
- ***System architectures***
- ***Component retrieval***

## *Christopher Allen, Assoc. Professor, EECS*

**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** circuits, electronic circuits, senior design laboratory, fiber optic communication systems, high-speed digital circuit design, microwave remote sensing.

**Honors and Awards** include Eta Kappa Nu, Phi Kappa Phi, Tau Beta Pi; recognized by the Center for Teaching Excellence for excellence in the classroom; KU EECS Harry Talley Excellence in Teaching Award; KU Miller Award for Research, 1999.

**callen@eecs.ukans.edu**
**http://www.rsl.ukans.edu/~eecs501/callen/**

***Research Interests:***

- ***Microwave remote sensing***
- ***Radar design and analysis***
- ***Synthetic aperture radar***
- ***High-speed digital circuits and applications***
- ***Fiber-optic communication systems***
- ***Photonic systems and devices***

## Swapan Chakrabarti, Assoc. Professor, EECS

**Education:** Ph.D., Electrical Engineering, University of Nebraska-Lincoln, 1986
M.S., Computational Physics, University of Nebraska-Lincoln, 1982
M.Sc., Physics and Electronics, Calcutta University, India, 1976
B.Sc., 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).

***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***

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

**chakra@eecs.ukans.edu**

## Kenneth Demarest, Professor, EECS

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

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

**Honors and Awards** include Eta Kappa Nu.

***Research Interests:***

- ***Lightwave communication systems***
- ***Electromagnetic theory***
- ***Antennas***

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## Tyrone Duncan, Professor, Mathematics

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

**Teaches** stochastics of mathematical finance, stochastic analysis and its applications, stochastic adaptive control of linear partial differential equations, differential equations, fractional Brownian motion and its applications, probability theory.

**Honors and Awards** include IEEE Fellow, 1999; KU Olin K. Petefish Award in the Basic Sciences, 1999.

***Research Interests:***

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

**duncan@math.ukans.edu**

## Joseph B. Evans, Charles E. Spahr Professor, EECS

**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 ETA Kappa Nu; Tau Beta Pi; KU Spahr professorship, 1999-2001; KU Miller Award for Research, 1996; AT&T Bell Laboratories Ph.D. Scholarship, 1984-1988; Garden State Graduate Fellowship, 1983-1987.

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***Research Interests:***

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

## Victor S. Frost, Dan F. Servey Distinguished Professor, EECS

**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 and systems.

**Honors and Awards** include Dan F. Servey Distinguished Professor of Electrical Engineering and Computer Science, 1996; keynote address, 18th Biennial Symposium on Communications, Kingston, Ontario; KU Miller Award for Distinguished Service to Engineering, 1991; KU Miller Award for Distinguished Service to Engineering Research, 1986; IEEE Fellow; National Science Foundation Presidential Young Investigator Award, 1984.

**frost@ittc.ukans.edu**
**http://www.ittc.ukans.edu/~frost**

***Research Interests:***

- ***High-performance networks***
- ***Network measurement, modeling, control, and simulation***

## John M. Gauch, Assoc. Professor, EECS

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

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

**Honors and Awards** include KU Millers Scholar, 2000; KU Bellows Scholar, 1999.

**jgauch@eecs.ukans.edu**
**http://www.ittc.ukans.edu/~jgauch**

***Research Interests:***

- ***Multimedia systems (digital video processing, creation and navigation of video libraries)***
- ***Digital image processing (segmentation, enhancement)***
- ***Computer vision (stereo, motion tracking)***

## Susan Gauch, Assoc. Professor, EECS

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

**Teaches** algorithmic problem solving, structured programming, information retrieval, software engineering, intelligent agents

**Honors and Awards** include KU School of Engineering Miller Research Award, 1998; ONR Fellowship, 1988; NF Dupris Prize in Mathematics, 1978.

***Research Interests:***

- ***Multimedia databases***
- ***Intelligent search agents***
- ***Information discovery on the World Wide Web***
- ***Corpus linguistics***

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## Sivaprasad Gogineni, Deane E. Ackers Distinguished Professor, EECS

**Education:** Ph.D., Electrical Engineering, University of Kansas, 1984
M.Sc., Engineering, Kerala University, Trivanfrum, India, 1976
B.E., Mysore University, Mysore, India, 1973

**Teaches** senior design lab, electronics design lab.

**Honors and Awards** include NASA Group Award to Antarctic Mapping Mission, 2000; KU Miller Award for Outstanding Service, 2000; IEEE Fellow, 1999; NASA Terra Award, 1998; Best-of-Session Award from the Third International Airborne Remote Sensing Conference, 1997; KU Miller Award for Engineering Research, 1991; Taylor and Francis Best Letter Award, 1991.

***Research Interests:***

- ***Radar systems***
- ***RF and microwave engineering***
- ***Radar remote sensing***
- ***Microwave radiometers***

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## Jerzy W. Grzymala-Busse, Professor, EECS

**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** expert systems, knowledge acquisition, artificial intelligence, con-currency models, Petri nets, data structures, computer architecture and networking, computer organization, theory of computing, switching theory, automata theory, computability, discrete structures, and probabilistic analysis.

***Research Interests:***

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

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## H. Scott Hinton, Distinguished Professor & Chair, EECS

**Education:** M.S., Electrical Engineering, Purdue University, 1982
B.S., Electrical Engineering, Brigham Young University, 1981

**Teaches** circuits, semiconductor devices, optical fiber communications.

**Honors and Awards** include Hudson Moore, Jr., Professor of Electrical Engineering, University of Colorado in Boulder 1994-1999; BNR-NT/NSERC Professor of Photonic Systems, McGill University 1992-1994; IEEE LEOS Distinguished Lecturer 1993-1994; Fellow of IEEE; Fellow of Optical Society of America (OSA).

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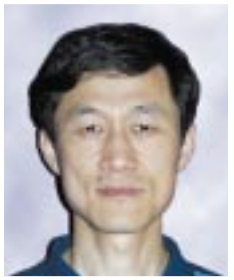
***Research Interests:***

- ***Photonic switching systems***
- ***Free-space optical interconnects***
- ***Optical backplanes***
- ***Technology-enhanced learning environments***

## Rongqing Hui, Asst. Professor, EECS



**Education:** Ph.D., Electronics Engineering, Politecnico di Torino, Torino, Italy, 1993
M.Sc., Lightwave Technology, Beijing University of Posts and Telecommunications, Beijing, China, 1988
B.Sc., Microwave Communications, Beijing University of Posts and Telecommunications, Beijing, China, 1982

**Teaches** electronic devices and properties of materials, fiber-optic communication networks, fiber-optic communications, microelectronic circuits and general electric circuits.

**hui@eecs.ukans.edu**

***Research Interests:***

- ***Fiber-optic communication systems***
- ***Photonic devices***

## Jeremiah James, Asst. Professor, EECS

**Education:** Ph.D., Computer Science, University of California at Santa Barbara, 2000
M.S., Computer Science, Brigham Young University, 1993
B.S., Computer Science, Brigham Young University, 1992

**Teaches** advanced operating systems, programming.

**Honors and Awards** include UC-SB Computer Science Department Travel Scholarship, 1995, 1996, and 1998; UC Trustee's Fellowship (4-year), 1993; NSF Fellowship, Honorable Mention, 1993; Phi Kappa Phi National Honor Society, 1991; Golden Key National Honor Society, 1990.

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***Research Interests:***

- ***Distributed systems***
- ***Concurrent objects***
- ***Data consistency***
- ***Fault tolerance***
- ***Middleware***

## Stephen P. Lohmeier, Asst. Professor, EECS

**Education:** Ph.D., Electrical Engineering, University of Massachusetts, 1996
M.S., Electrical Engineering, University of Massachusetts, 1992
B.S., Electrical Engineering, Kansas State University, 1989

**Teaches** control systems, electromagnetics, adaptive arrays.

**Honors and Awards** include Tau Beta Pi.

**lohmeier@rsl.ukans.edu**

***Research Interests:***
- ***Radar sensing of clouds and precipitation***
- ***Multimedia-wave radar***
- ***Polarimetric radar***
- ***Bistatic radar***

## Gary J. Minden, Professor, EECS

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

**Teaches** introduction to digital logic design, information security, active networking.

**Honors and Awards** include KU Millers Scholar, 1999 and 2000.

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**http://www.ittc.ukans.edu/~gminden**

***Research Interests:*** ***Large-scale systems, including***
- ***Wide-area distributed systems***
- ***Mobile communication systems***
- ***Adaptive computational systems***
- ***Active networking***

## Richard K, Moore, Distinguished Professor Emeritus, EECS

**Education:** Ph.D., Electrical Engineering, Cornell University, 1951
B.S., Electrical Engineering, Washington University, 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).

**rmoore@sunflower.com**

***Research Interests:***
- ***Radar systems***
- ***Radar remote sensing***
- ***Radio wave propagation***
- ***Radar oceanography***
- ***Microwave radiometers***

## Douglas Niehaus, Assoc. Professor, EECS

**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** software engineering, concurrent and distributed software development, introduction to operating systems, compiler construction, distributed operating systems, advanced operating systems topics.

**Honors and Awards** include a U.S. Patent issued for ATM reference traffic system, 2000.

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***Research Interests:***

- ***High-performance networks***
- ***Network simulation and performance evaluation tools***
- ***Real-time systems***
- ***Distributed and operation systems***

## Karen J. Nordheden, Assoc. Professor, Chemical & Petroleum Engr.

**Education:** Ph.D., Electrical Engineering, University of Illinois, 1988
M.S., Electrical Engineering, University of Illinois, 1984
B.S., Physics, Michigan, 1982

**Teaches** introduction to semiconductor processing, introduction to computers in engineering, heat transfer, engineering mathematics, control systems, and semiconductor physics.

**Honors and Awards** include KU Gould Award for Distinguished Teaching in the School of Engineering, 1999; KU H. Bernerd Fink Award for Excellence in Teaching, 1998; KU EECS Harry Talley Excellence in Teaching Award from the local chapter of Eta Kappa Nu, 1997.

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**http://www.ittc.ukans.edu/~plasmala**

***Research Interests:***

- ***Plasma processing of semiconductors***
- ***Fabrication of III-nitride and III-V based semiconductor devices***

## Bozenna Pasik-Duncan, Professor, Mathematics

**Education:** Ph.D., Habilitation, Mathematics, Warsaw School of Economics, 1978
Habilitation degree, Mathematics, Warsaw School of Economics, 1986
M.S., Mathematics, Warsaw University, 1970

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

**Honors and Awards** include Fellow of IEEE; NSF Career Advancement Award for Excellence in Teaching; Ministry of Higher Education and Sciences, Poland; Several Chancellor's Awards for research and teaching, Warsaw School of Economics; IREX Scholar to the United States, 1982; Kemper Fellowship for Teaching Excellence and Advising in Public Outreach; G. Baley Price Award for Excellence in Teaching; IEEE Third Millennium Medal for Outstanding Contributions to IEEE Control Systems Society.

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**/ksacg/bozenna.html**

***Research Interests:***

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

## David Petr, John & Winfred Sharp Assoc. Professor, EECS

**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** integrated telecommunication networks, analysis of communication networks, random signal theory, optimization with communication applications, introduction to communication systems, signal analysis, circuits.

**Honors and Awards** include KU School of Engineering Sharp Teaching Professorship, 2000-2002; Visiting Erskine Fellowship, University of Canterbury, 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; IEEE Frank A. Cowan Scholarship, Graduate Studies in Communications, 1987.

***Research Interests:***

- ***High-speed, wide-area networks***
- ***Network traffic and congestion management***
- ***Traffic integration for networks***
- ***Performance analysis and simulation***
- ***Evaluation of students' confidence in answers***

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## Glenn E. Prescott, John & Winfred Sharp Professor, EECS

**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 KU School of Engineering Sharp Teaching Professorship (1998-2001), NASA Terra Award (2000).

***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***

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## James A. Roberts, Assoc. Vice Chancellor, Professor, EECS

**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** wireless communication systems, information theory, and communication system planning and design.

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***Research Interests:***

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

## W. M. Kim Roddis, Professor, Civil Engineering

**Education:** Ph.D., Civil Engineering, Massachusetts Institute of Technology, 1989
M.S., Civil Engineering, Massachusetts Institute of Technology, 1987
B.S., Civil Engineering, Massachusetts Institute of Technology, 1977

**Teaches** structural steel design, structural analysis, knowledge-based expert systems.

**Honors and Awards** include KU Docking Scholar, 1999; KU School of Engineering Bellows Fellow, 1999; American Society of Civil Engineers Fellow, 1997; KU School of Engineering Miller Award for Research, 1997; Fannie and John Hertz Fellow, 1986-1988; American Institute of Steel Construction Fellowship, 1987; American Society of Civil Engineers O.H. Ammann Research Fellow, 1986.

**kroddis@ukans.edu**
**http://civil-env.ce.ukans.edu/fac roddis.html**

***Research Interests:***

- ***Design, fabrication, and construction engineering processes***
- ***Applications of artificial intelligence to civil and structural engineering***
- ***Design of computer-aided tools for civil engineering***
- ***+++***

## K, Sam Shanmugan, S.W. Bell Distinguished Professor, EECS

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

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

**Honors and Awards** include H.O.P.E. 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.

**shanmugan@ittc.ukans.edu**

***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***

## James M. Stiles, Asst. Professor, EECS

**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 the KU EECS Harry Talley Teaching Award, 2000.

**jstiles@rsl.ukans.edu**

***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***

## Costas Tsatsoulis, Charles E. Spahr Professor, EECS

**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, image processing and computer vision, case-based reasoning and distributed AI, introduction to database systems, structured programming.

**Honors and Awards** include KU Spahr professorship, 2000-2001; Big-12 Faculty Fellowship; State of Kansas AT&T Engineering Education Excellence Award; KU Miller Award for Research Excellence.

**tsatsoul@eecs.ukans.edu**
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***Research Interests:***

- ***Multiagent systems***
- ***Data mining***
- ***Case-based reasoning***
- ***Knowledge-based systems***
- ***Intelligent image analysis***

## Victor L. Wallace, Professor, EECS

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

**Teaches** computer operating systems, interactive graphics, programming languages, and other computer science subjects.

**Honors and Awards** include Computer Graphics Pioneer Award, 1984; ACM SIGGRAPH Faye Memorial Award, Polytechnic Institute of Brooklyn, 1955; Eta Kappa Nu; Upsilon Pi Epsilon, Tau Beta Pi, Sigma Xi.

**wallace@eecs.ukans.edu**

***Research Interests:***

- ***Interactive graphics, virtual reality, and human interface design***
- ***Distributed and real-time systems (scheduling and load balancing)***
- ***Network performance modeling (analytical models of correlated traffic and queues)***
- ***Queuing theory for wide-band and multimedia computer networks***
- ***Operating systems theory***

## New Faculty Investigators, FY2001

### David L. Andrews, Assoc. Professor, EECS

David Andrews comes to KU from the University of Arkansas, where he chaired the combined departments of computer science and computer engineering. He has a Ph.D. from Syracuse University (1992) and a master's from the University of Missouri (1984). He worked for eight years as a senior systems engineer and research engineer for General Electric. He has co-authored three books on topics related to computer-aided engineering and design, multiprocessor memory resource allocation, and the C* programming language. His research interests include computer architecture, distributed and parallel systems, and embedded and real-time systems.

### Hossein Saiedian, Professor, EECS

Hossein Saiedian was most recently at the University of Nebraska-Omaha, where he headed the University Committee on Research. In 2000, he received the UNO Excellence in Teaching Award and the Excellence in Research Award. In 1998, the Journal of Systems and Software included him on its list of the top 10 software engineer scholars. He has a Ph.D. in computer science from Kansas State University (1989) and a master's in mathematics from Emporia State University (1984). His research interests are in software engineering: process improvement, formalism, and object-oriented software development.

# Measurement of the Thickness of the Greenland Ice Sheet and High-Resolution Mapping of Internal Layers

**Sponsor:** National Aeronautics and Space Administration (NASA)

**Principal Investigator:** Sivaprasad Gogineni

**Co-Investigator:** David Braaten

**Student Research Assistants:** Pannirselvam Kanagaratnam (NASA Fellow), Dilip Tammana, Kuok-Wai (Wilson) Wong, Ryan Eakin, Kok Lin Tee, Greg Rosen, and Bharath Parthasarathy

As part of a long-term study, researchers from the Radar Systems and Remote Sensing Laboratory (RSL) travel north to Greenland almost every year to measure the ice sheet thickness. RSL's research in Greenland began in 1993 and is part of a large NASA project involving scientists from NASA centers, other universities, and institutes in Denmark and the United Kingdom. The objective of the project is to determine the mass balance of the Greenland ice sheet with an ultimate goal of directly linking ice sheet variations to changes in global sea level.

Sea level has been rising about 2 mm/year during the last century. The factors contributing to this increase are the thermal expansion of the ocean, melting of mountain glaciers, and changes to the great ice sheets in Antarctica and Greenland. However, there is a large uncertainty in the relative contribution of each component. Since the great ice sheets lock up about 80 percent of the world's fresh water, their potential contribution to sea level can be large. If the Greenland ice sheet were to melt completely, it would cause sea level to rise about 7 m with devastating consequences to coastal regions.

Sivaprasad Gogineni, Deane E. Ackers Distinguished Professor of Electrical Engineering and Computer Science, and David Braaten, KU associate professor of physics and astronomy, are working on the most recent aspect of this ongoing project. Gogineni has co-authored a study that appeared July 21, 2000, in the journal *Science*. The KU team acquired ice thickness data for this study, which concluded that interior regions of the ice sheet are not changing, whereas ice sheet margins in the southeast are showing dramatic decreases in ice volume. Gogineni and Braaten said that long-term observations coupled with glaciological and atmospheric models are required to explain and understand the significance of these observed changes. Ice thickness is a key variable in understanding and modeling glacier dynamics.

In 1995, KU undergraduate students developed for a senior design project the prototype of RSL's radar for measuring ice thickness using Radio Frequency Integrated Circuits (RFICs). This radar-Coherent Radar Depth Sounder, or CoRDS-has been flown on a NASA P-3 aircraft, providing precise ice thickness data over vast areas of the Greenland ice sheet.

Jon Bamber at the University of Bristol, United Kingdom, has combined new ice thickness data from KU with previous data sets to generate a more complete thickness and bed topography map of the entire ice sheet. These maps are now being used in modeling studies of the dynamics of the ice sheet and its response to climate change.

The KU team continues to be involved in future ice sheet measurements and is now developing a new high-resolution, aircraft-based ice penetrating radar for obtaining unique snow accumulation measurements over the ice sheet.

**For more information, contact Sivaprasad Gogineni, gogineni@ittc.ukans.edu, (785) 864-7734.**

*Above right: A glacier flows between two mountain peaks. The swirls in the snow and ice show the glacier's movement.*

*In 1998, KU students and NASA Fellows Pannirselvam Kanagaratnam (center) and Justin Legarsky (right) worked in Greenland with Lars Larsen of the University of Copenhagen. The two graduate students with ITTC's RSL used depth-sounding radar mounted on a red track-master. They obtained data to determine the glacier's thickness to a depth of about 300 meters. The data from the ice cores will help researchers better understand global climate change.*

# Ambient Computational Environments (ACE)

**Sponsors:** Department of Defense Advanced Research Projects Agency (DARPA), National Science Foundation (NSF), Sprint Corp.

**Faculty Investigators:** Gary Minden and Joe Evans; and Arvin Agah, Perry Alexander, Allen Ambler, Frank Brown (EECS Dept.), John Gauch, Susan Gauch, Jerzy Grzymala-Busse, Jerry James, James Miller (EECS Dept.), Doug Niehaus, Thomas Schreiber (Psychology Dept.), Costas Tsatsoulis

**Student Research Assistants:** Eric Ackers, Condor Chou, Renzo Hayashi, Julie Johnson, Franklin Jones, Rama Kalicut, Satyavathi Malladi, Aditya Mandapaka, James Mauro, Sandeep Misra, Sivaprasath Murugeshan, Ramu Naraparaju, Sreenivas Penumarthy, Balaji Rajagopalan, Prasanna Ramasubramanian, Vidyaraman Sankaranarayanan

**Technical Staff:** Dan DePardo and Leon Searl

In a computational environment, access to equipment such as computers, cameras, video players, projectors, or cell phones is embedded into a room through a network that links them to one another and to other rooms or buildings on the network. These tools can then be controlled or accessed from anywhere along the network. So, instead of carrying a laptop, cell phone, and pager to a meeting, a person could access his or her files and phone messages from equipment found anywhere along a network.

"We're starting with the idea that computation resources—in the broadest sense—are readily available in our offices, conference rooms, auditoriums, and even hallways," said Joe Evans. Any authorized person can then access those computer resources for his or her own use in a variety of ways.

"For example," said Evans. "imagine that the computer you've been working at for 497 days is going to be swapped out for a newer model." The very thought, he noted, would panic most people. Will all the files transfer? Will the software work right? Will the changeover cost valuable time?

"But if your computer is linked to an ACE network, a technician arrives with your new equipment and unplugs your display, keyboard, and computer. He ignores the fact that your desk computer is running, because that computer simply is a port to the larger network. When the installer leaves and you identify yourself to your new machine, you continue on with your work. Tomorrow your computer will show 498 working days." A long-lived and robust ACE network, not a piece of hardware, becomes the computational heart of an office.

As part of their DARPA project, Minden and Evans will also study the impact ACE will have on high-performance networking systems. "ACE will create a different type of traffic along the networks," said Minden. "We need to know what must be done to secure the transmission of ACE content over widely distributed, next generation Internets."

*Above: Julie Johnson tests one of the newly mounted pan-tilt-zoom cameras in an upgraded ITTC conference room.*

**(785) 864-4830.**

**For more information contact**
**Gary Minden, gminden@ittc.ukans.edu,**
**(785) 864-4834;**
**or**
**Joe Evans, evans@ittc.ukans.edu,**

*Eric Akers, an ACE student, checks the power supply cables to the ACE computational unit. The unit is one of many computers that will link the ACE network.*

# Systems Level Design Language (SLDL) Development ("Rosetta Project")

**Sponsors:** U.S. Air Force Research Labs (AFRL)
Accellera System-Level Design Language Committee
Department of Defense Advanced Research Projects Agency (DARPA)
European Chips and Systems Initiative/Semiconductor Industry Council

**Principal Investigator:** Perry Alexander

**Student Research Assistants**: Srinivas Akkipeddi, Cindy Kong, Rangarajan Murali, Makrand Patil, Krishna Rananathan, David Schonberger

The efforts of Perry Alexander and his colleagues indicate that a requirements- or constraints-specification language for systems on chips (SOC) is possible. Until now, the systems industry has cobbled together existing, but less suitable languages. Dubbed the Rosetta Project—after the tablets that cracked the code of Egyptian hieroglyphics—the group's undertaking in system language development parallels a time in the 1980s when hardware complexity had outstripped the language that tested it. Then along came Verilog in 1983 and VHDL in 1987, two sophisticated hardware languages that stimulated the now multi-billion-dollar ASIC (application specific integrated circuits) industry.

In "Get a Handle on Design Languages," the June 5, 2000, cover story of *EDN Access*, the technical editor writes that "Rosetta is a constraints-description language that looks similar to VHDL. It allows system architects to describe the system's requirements from various points of view, or 'facets.'"

Alexander also describes Rosetta in terms of a diamond's facets. Just as one diamond has many facets, a SOC is made up of many components. "Rosetta is capable of describing all facets of a system and of understanding how those facets interact with each other," he said.

Alexander is collaborating with AverStar, Inc., in Vienna, Va., and EDAptive, Inc., of Dayton, Ohio; and his work takes ITTC into the new and promising area of investigation—the discipline of language development. Although others in industry and academia are working in this area, Alexander notes that Rosetta is working at a much higher level of abstraction and is integrating existing tools and languages into the work.

*EDN Access* also notes that the Rosetta team "showed that impressive progress has been made" in developing a requirements- or constraints-specification language.

**For more information about Rosetta, visit the project Web site at www.ittc.ukans.edu/Projects/SLDG/rosetta.**
**You can contact Perry Alexander at (785) 864-7741 or by email at alex@ittc.ukans.edu.**
**Alexander's article, "Rosetta Provides Support for System-Level Design," that appeared in *EETimes.com*, can be found at www.eet.com/special/special_issues/2000/techtrends/rosetta.html.**

*In 1799, Napoleon's troops found a basalt slab inscribed by priests of Ptolemy V in hieroglyphic, demotic, and Greek. Found near the city of Rosetta in northern Egypt, the slab became known as the Rosetta Stone. Now in the British Museum, it helped scholars crack the code to Egyptian hieroglyphics.*

# High-Resolution, Optical Spectrum Analyzer for Optical System Link Quality Monitoring

**Sponsor:** Nortel Networks

**Principal Investigator:** Ron Hui

**Student Research Assistants:** Surya Chikkam, Demin Yao, Yishu Wang, Renxiang Huang

Increasing bandwidth in optical networks brings both greater system capacity and the challenge to carry that capacity at good quality over long distances. This increasing stress on quality has put greater importance on optical network management. The need for consistent quality monitoring, however, comes at a time when the networks themselves are more complex and more difficult to manage.

To check the quality of each channel's laser light and modulation, traditional electronic domain performance monitoring needs opto-electronic conversion for each individual wavelength channel.

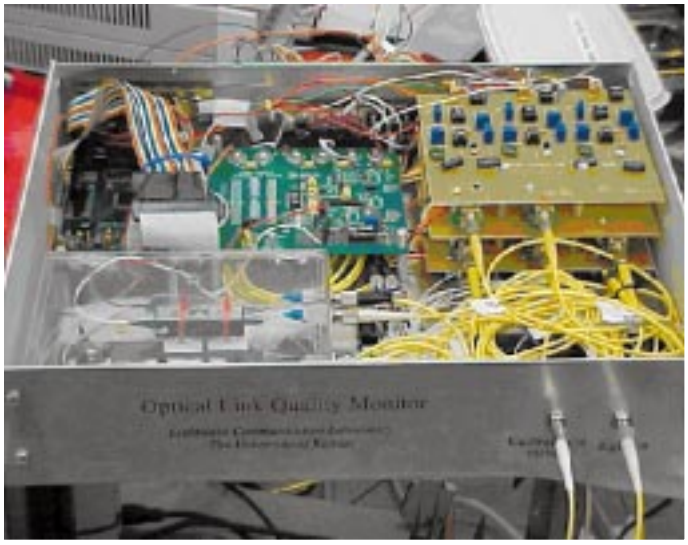
For WDM (wavelength division multiplexed) optical networks with a large number of wavelength channels, optical domain performance monitoring is more efficient and cost effective compared to its electronic domain counterpart. An optical spectrum analyzer is efficient for this purpose because it can scan through all the wavelength channels simultaneously and save carriers both time and money.

But when it comes to checking a channel's modulation and data rate, most analysis systems cannot distinguish frequency components within a resolution bandwidth of 10 GHz (gigahertz), so they are unable to see the modulation performance and data rate of optical signal.

During this yearlong project, Hui's team investigated various ways to build an ultra high-resolution, optical spectrum analyzer that had both good resolution and a wide spectrum range. Conventional optical spectrum analyzers that use defraction gratings may have wide spectrum range, but they have relatively poor resolution. To achieve good spectral resolution and wide optical bandwidth at the same time, Hui combined the excellent spectral resolution of Febry-Perot interferometer and the wide bandwidth of thin film WDM optical demultiplexers.

Hui sees a good commercial application to the analyzer developed at ITTC. His team made the analyzer box both smaller and significantly cheaper than other systems, and it will fit into the transmission system rack.

**For more information, contact Ron Hui at hui@ittc.ukans.edu, (785) 864-7740.**



*This photo shows the hardware of the optical spectrum analyzer. The size can potentially be made much smaller than the version seen here. The electrical amplifiers (top right) and micro processor (top left) can be integrated into IC chips.*

# Architecture for Space-Based Internets (SBI)

**Sponsor:** National Aeronautics and Space Administration (NASA)

**Co-Principal Investigators:** Joe Evans and Gary Minden

**Student Research Assistants:** Sujit Baliga, Sandhya Rallapalli, Karthik Thyagarajan, Pooja Wagh

This three-year NASA project is an extension of ITTC's longstanding work and reputation in the area of Rapidly Deployable Radio Networks (RDRN). The techniques and data ITTC researchers gleaned from this wireless, high-speed communication system for moving military units in the field will now be applied to satellites orbiting in space.

A space-based Internet (SBI) might suggest email traffic from Darth Vader or ET, but SBI focuses on reality not fantasy. An Internet system will become part of the standard infrastructure of future satellites, and this project's goal is to learn through emulation how that system will operate. On Earth, the ever-growing Internet is reliable, robust, adaptable, and reprogrammable—attributes that make SBI a desirable communication option in space.

Communicating with satellites now requires detailed and time-consuming scheduling. Transmissions must be timed to when a satellite will pass over a particular area, and satellite downtime disrupts the schedules and may interrupt communications for long periods of time.

In comparison, the Internet on land flexes with disruptions and breakdowns by rerouting data along other pathways. With Internet protocols (IP) in space, satellites could originate or terminate traffic and—most importantly—could reroute traffic traveling between other satellites and the ground.

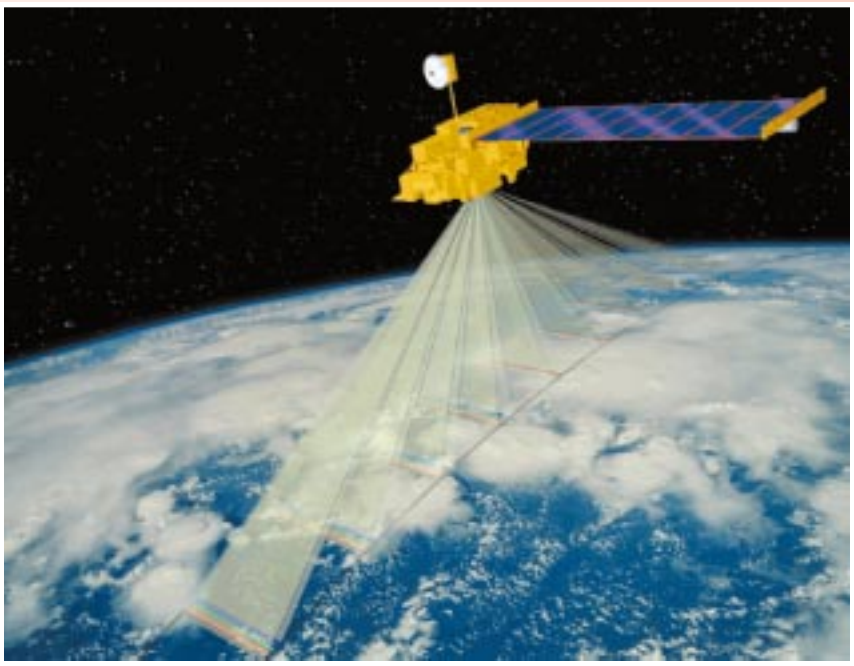
On a mission to Mars, for example, where many satellites orbit the red planet gathering data and photos, SBI would enable communication between the satellites and between the satellites and Earth. Using IP, the satellites could easily form a local service network related to the Mars orbit.

"To achieve a SBI," says Evans, "each observation satellite would carry a communication system with several channels or beams—either high-speed radio frequency or optical laser to form a high-speed path—and a network control processor to switch traffic between the several communications channels and local payload."

The team will research the design, development, and initial prototype implementation of an architecture for SBI and evaluate it on an emulation testbed. This testbed will use actual network software, application programs, and scenarios and will incorporate satellite orbital mechanics into its emulation-based system.

Evans' and Minden's work builds on the Center's increasing expertise in IP and further strengthens ITTC's research capabilities.

**For more information, contact**
**Gary Minden, gminden@ittc.ukans.edu,**
**(785) 864-4834;**
**or**
**Joe Evans, evans@ittc.ukans.edu,**
**(785) 864-4830.**



*Satellites orbiting Earth send and receive data using radio frequencies. The SBI project will develop Internet access in space, using satellites.*
*Graphic compliments of NASA.*

# Projects Active, FY2000

**AAL2 Call/Connection Control Signalling**
Sprint Corp. (United Management Co.)
Joseph B. Evans, with V. Frost, D. Petr

**Acquisition of Testing and Measurement Equipment at Kansas in Conjunction with the RICE Neutrino Astrophysics Experiment**
NSF Office of Polar Programs (OPP)
David Z. Besson, with C. Allen, T. Christopher

**Advanced ATM Research**
NEC America
Victor S. Frost, with J. Evans, R.D. Niehaus, D. Petr

**Advanced Semiconductor Research Group in the State of Kansas**
Kansas State University
Karen J. Nordheden, with R. Hui

**Ambient Computational Environments**
NSF Computer & Information Science & Engineering (CISE)
Gary J. Minden, with A. Agah; A. Ambler, J. Evans, S. Gauch, C. Tsatsoulis

**Bi-directional Optical Recirculating Loop for Multi Channel WDM Applications**
Nortel Broadband Networks
Rongqing Hui

**Broadband Wireless Local Loop**
Kansas Technology Enterprise Corp.
Joseph B. Evans, with V. Frost

**Broadband Wireless Local Loop**
Sprint Corp. (United Management Co.)
Joseph B. Evans, with V. Frost, G. Prescott, J. Roberts, James A; K.S. Shanmugan

**Case-Based Reflective Negotiation Model**
U.S. Air Force Research Laboratory (ROME)
Constantinos P. Tsatsoulis, R. D. Niehaus

**CDMA Capacity Assessment for Personal Wireless Communications**
Sprint International
James A. Roberts, with V. Frost, G. Prescott, K.S. Shanmugan

**Characterization of a Cooperative Target for Ground Penetrating Radar**
Vermeer Manufacturing
Christopher T. Allen

**Computer Generation of True 3-D (T3D) Views for Medical Images**
BioComp Systems
John M. Gauch

**Conclusion: Ground Penetrating Radar**
Kansas Electric Utilities Research Program
Richard G. Plumb

**Cooperative Agents for Conceptual Search and Browsing of World Wide Web Resources**
NSF Computer & Information Science & Engineering (CISE)
Susan E. Gauch

**Determination of the Impact of Advanced Traffic Controls on the Performance of Edge/Core ATM Network Architectures**
Sprint Corp.
Victor S. Frost, with J. Evans, R.D. Niehaus, D. Petr

**Determining Fiber Plant Characteristics Using Measurement and Modeling**
Sprint Corp. (United Management Co.)
Kenneth R. Demarest, with C. Allen, R. Hui

**Development and Evaluation of a Range-Gated Step-Frequency Radar**
NASA, Jet Propulsion Laboratory
Sivaprasad Gogineni

**Development of a Hybrid RF/Laser Radar**
NASA Headquarters
Christopher T. Allen, with S. Gogineni

**Development of Data Acquisition System for Europa Radar Test Bed**
National Aeronautics & Space Administration
Sivaprasad Gogineni

**Development of Radar System for Accumulation Measurements**
National Aeronautics & Space Administration
Sivaprasad Gogineni

**Development of Radar System for Accumulation Measurements: Fellowship for Panniselvam Kanagaratnam**
NASA Headquarters
Sivaprasad Gogineni

**Development of Scanning Laser Ophthalmoscope for Low Vision Rehabilitation**
Dept. of Veterans Affairs
John M. Gauch

**Engineering the Next Generation of Communications Networks: Proposal for Sabbatical Support**
Sprint Corp. (United Management Co.)
Victor S. Frost (sabbatical project)

**Enhancement of the KU PNNI Performance Evaluations Tools**
Sprint Corp. (United Management Co.)
R. Douglas Niehaus, with J. Evans, V. Frost

**Establishment of a Lightwave Laboratory for Applications Focused Research**
Kansas Technology Enterprise Corp.
Victor S. Frost, C. Allen, K. Demarest, J. Evans, K. Nordheden

**Evaluation of Fatigue Performance and Repair Strategies for Light Standards**
Kansas Dept. of Transportation
Steven L. McCabe, with K. Roddis

**Exploiting Open Control of ATM Networks**
Sprint Corp. (United Management Co.)
Joseph B. Evans

**Fabrication error Indexed eXamples and Solutions (FIXS)**
Kansas Dept. of Transportation
Kim Roddis

**Feasibility Study of Compact Soliton Source Using Dual-Mode Highly Gain-coupled DFB Laser Diodes**
Nortel Broadband Networks
Rongqing Hui

**Functional Programming Environment for Design and Implementation of High Performance Radio and Synthetic Aperture Radar Processing Functions, A**
Defense Advanced Research Project Agency
Gary J. Minden, with J. Evans, R.D. Niehaus, G. Prescott

**Generating a Rule-Base for Sea-Ice Classification**
Naval Research Laboratory
Constantinos P. Tsatsoulis, J. Gauch, L.K. Soh

**Grant to Support Research**
ITT Defense
Glenn E. Prescott

**Ground-Penetrating Radar: A Tool for the Next Generation of Outcrop Studies**
NSF Geosciences (GEO)
Evan K. Franseen, with J. Stiles

**High Resolution Optical Spectrum Analyzer for Optical System Link Quality Monitoring**
Nortel Advanced Technology
Rongqing Hui

**High Speed WDM Sub-Carrier Multiplexed Optical Fiber Communication Systems**
Sprint Corp. (United Management Co.)
Rongqing Hui, with C. Allen, K. Demarest

**High-Resolution Radar Characterization of Ice in the Search for Extra-Terrestrial Life, A**
National Aeronautics & Space Administration
Sivaprasad Gogineni

**Improved Information Retrieval and Value-added Automated Search Based on Closed Caption Text and Customer Profile**
Worldwide Broadcasting Network, Inc.
Susan E. Gauch

**Improved Video Processing System**
Worldwide Broadcasting Network Inc.
John M. Gauch

**Informatics Techniques for Medical Knowledge Building**
Duke University Medical Center
Jerzy W. Grzymala-Busse

**Information Systems Technologies for the Earth Science Technology Office**
National Aeronautics & Space Administration
Glenn E. Prescott

**Innovative Active Networking Services**
U.S. Air Force Research Laboratory (ROME)
Gary J. Minden, with J. Evans

**Integrated Evaluation of Network System and Application Software Architecture and Performance Issues in ATM Networks**
Sprint Corp. (United Management Co.)
R. Douglas Niehaus, C. Tsatsoulis

**Intergovernmental Personnel Act (IPA Agreement)**
National Aeronautics & Space Administration
Sivaprasad Gogineni

**Interworking and Traffic Management for Advanced Networks**
Sprint Corp. (United Management Co.)
Victor S. Frost, with R. D. Niehaus, D. Petr

**Investigation of FPGA Rapid Prototyping of Military Software Radio Systems**
Rome Laboratory
Glenn E. Prescott, J. Evans, K.S. Shanmugan

**Investigations of Electromagnetic Techniques for Deep Subsurface Probing**
Sandia Laboratories
Christopher T. Allen

**Kansas Participation in Sea Winds Instrument Activities**
Oregon State University
Richard K. Moore

**KEURP-Link: Phase III**
Kansas Electric Utilities Research Program
Susan E. Gauch

**Licensing Agreements with ISS and AC+—Student Support**
Accelerated Care Plus
Timouthy W. Johnson

**Logistic and Instrumentation Development Cost Support for Collaborative Research Radar Measurements Over the Greenland Ice Sheet**
University of Copenhagen
Sivaprasad Gogineni

**MAGIC II**
Defense Advanced Research Project Agency
Victor S. Frost, with J. Evans, R.D. Niehaus

**Measurement of the Thickness of the Greenland Ice Sheet and High Resolution Mapping of Internal Layers**
National Aeronautics & Space Administration
Sivaprasad Gogineni, with J. Stiles, D. Braaten

**Measurement of Thickness of the Greenland Ice Sheet and Investigation of Scattering Properties of Glacial Ice**
National Aeronautics & Space Administration
Sivaprasad Gogineni, with J. Stiles

**Miniature Ground Penetrating Radar Probe for Planetary Stratigraphy and Subsurface Water-Ice Detection**
California Institute of Technology
Sivaprasad Gogineni, with R. Plumb

**Minimization of Building Energy Use Through an Internet Based Building Shape Planning Tool**
AT&T Foundation
Martin Moeck, with K. Roddis

**Modeling Ultra-Dense, Ultra-High Speed WDM Fiber Networks**
Sprint Corp. (United Management Co.)
Kenneth R. Demarest, with A. Agah, R. Hui

**Monopulse and Super-Resolution Array Processing for Arbitrary Polarization States**
Texas Instruments
James Stiles

**Moving Target Indication Using Sparse-Aperture Multi-Channel SAR**
Research and Development Labs
James Stiles

**Multi-Dimensional Companding Based Sonoelasticity and Scatterer Size Imaging with the TMS320-Based System**
University of Kansas Medical Center
Glenn E. Prescott

**Multi-Dimensional Signal Processing Algorithms for Sparse Radar Arrays**
Air Force Office of Scientific Research
James Stiles, with J. Gauch

**Multidisciplinary Research in Mine Detection and Neutralization Systems**
University of Missouri, Rolla
James Stiles, with S. Gogineni

**Network Capacity Trade-offs for the Traffic Aggregation in Future Networks**
Sprint Corp. (United Management Co.)
Victor S. Frost

**Network Monitoring for Performance Analysis and for Enabling Network-Aware Applications**
US Dept. of Energy
Joseph B. Evans, with V. Frost

**Open Control Architectures**
Sprint Corp. (United Management Co.)
Joseph B. Evans

**PMD Characterization on an Active Fiber Link**
Sprint Corp. (United Management Co.)
Christopher T. Allen, with K. Demarest, R. Hui

**Pricing of Services in ATM Networks, The**
Sprint Corp.
David W. Petr

**Quality of Service Translations**
Sprint Corp. (United Management Co.)
Joseph B. Evans, with G. Minden

**Radar Interferometry for Improved Cross-Track Resolution Measurements of the Tickness of the Greenland Ice Sheet**
National Aeronautics & Space Administration
Sivaprasad Gogineni

**Rapidly Deployable Radio Network (RDRN)—Phase II**
Defense Advanced Research Project Agency
K. Sam Shanmugan, with J. Evans, V. Frost, G. Minden, D. Petr, G. Prescott, J. Roberts

**Reporting System to Improve Safety of the Blood Supply**
Columbia University
Constantinos P. Tsatsoulis

**RF Channel Simulator for Wireless Communications, An**
Medtronic, Inc.
Glenn E. Prescott, with J. Roberts

**SGER: Enhanced Scalability of Chemical Processes through Narrow-Gap Architectures**
NSF Engineering (ENG)
Galen J. Suppes, with K. Nordheden

**SOCCER Phase II**
EDAptive Computing, Inc.
W. Perry Alexander

**Stochastic Adaptive Control and Related Topics**
NSF Mathematical & Physical Sciences (MPS)
Tyrone E. Duncan, B. Pasik-Duncan

**System Level Description Language (SLDL) Mechanical Demonstration**
Anteon Corp.
W. Perry Alexander

**System Support and Performance Evaluation of Conventional and Real-Time ORBs**
Sprint Corp. (United Management Co.)
R. Douglas Niehaus

**Systems Level Design Languages and Notations**
AverStar, Inc.
W. Perry Alexander

**Teaching Aid: Steel Building Design Case Study**
American Institute of Steel Construction, Inc.
Kim Roddis

**Technology Transfer**
ProFusion L.L.C.
Timouthy W. Johnson

**Torsion of Exterior Girders: Improved Design Aid**
Kansas Dept. of Transportation
Kim Roddis

**Tracking Internal Layers of the Greenland Ice Sheet Using Airborne Radio Echo Sounder Images**
National Aeronautics & Space Administration
John M. Gauch

**Traffic Management and Controls for ATM Networks**
Sprint Corp.
David W. Petr, with V. Frost, R. D. Niehaus

**Voice Transport Over ATM**
Sprint Corp. (United Management Co.)
David W. Petr

**Wireless Network Systems Research**
Adaptive Broadband Ltd.
Joseph B. Evans

**Wireless Networking Laboratory with High Frequency (3-20 GHz) Capabilities**
Sprint Corp. (United Management Co.)
Joseph B. Evans, with G. Prescott

# ITTC-Affiliated Publications, FY2000

## Books and Book Chapters

**2000 (January-June)**

**Data Mining Experiments for a Melanoma Data Set,**
J.W. Grzymala-Busse, Z. Hippe; *Advances in Soft Computing*, (eds.) M. Klopotek, M. Michalewicz, S. T. Wierzchon; Physica-Verlag, 2000, pp. 27-34.

**Duncan-Mortensen-Zakai Equation,**
T. Duncan; *Encyclopaedia of Mathematics*; Kluwer Academic Publishing Co., 2000, pp. 174-175.

**Personal Robotics,**
A. Agah; *Encyclopedia of Computers and Computer History*, ed. Raul Rojas; Fitzroy Dearborn Publishers, Chicago, Ill. (2000).

**Some Applications of Fractional Brownian Motion to Linear Systems System Theory: Modeling, Analysis and Control,**
T. Duncan; eds. T.E. Djaferis, I. C. Schick; Kluwer, 2000, pp. 97-105.

**The VISION Digital Video Library Project,**
S. Gauch, J.M. Gauch, K.M. Pua; *The Encyclopedia of Library and Information Science*, Vol. 68, Supplement 31, 2000.

**1999 (July-December)**

**Identification for Linear Stochastic Distributed Parameter Systems with Boundary/Point Control,**
B. Pasik-Duncan; *Stochastic Analysis, Control, Optimization and Applications*, eds. W. McEneaney, G. G. Yin, Q. Zhang; Birkhauser, 1999, pp. 497-505.

**To Appear**

**Multi-facetted Modeling: The Key to Systems Engineering,**
P. Alexander, D. Barton; accepted for *Best of FDL*.

## Journal Articles

**2000 (January-June)**

**An Adaptive First-Order Polarization-Mode Dispersion Compensation System: Theory and Demonstration,**
H.Y. Pua, K. Peddanarappagari, B. Zhu, C. Allen, K. Demarest, R. Hui; *IEEE/OSA Journal of Lightwave Technology*, Vol. 18 (6), June 2000, pp. 832-841.

**Composing Protocol Frameworks for Active Wireless Networks,**
A.B. Kulkarni, G.J. Minden; *IEEE Communications Magazine*, 2000).

**Currency Exchange Rate Forecasting with Neural Networks,**
B.P. Nasution, A. Agah; *Journal of Intelligent Systems*, Vol. 10 (3), 2000, pp. 219-252.

**Data Mining and Rough Set Theory,**
J.W. Grzymala-Busse, W. Ziarko; *Communications of the ACM 43*, 2000, pp. 108-109.

**Electromagnetic Scattering from Grassland, Part I: A Fully Phase-Coherent Scattering Model,**
J.M. Stiles, K. Sarabandi, F.T. Ulaby; *IEEE Transactions on Geoscience and Remote Sensing*, Vol. 38 (1), 2000, pp. 339-348.

**Electromagnetic Scattering from Grassland, Part II: Measurement and Modeling Results,**
J.M. Stiles, K. Sarabandi; *IEEE Transactions on Geoscience and Remote Sensing*, Vol. 38 (1), 2000, pp. 3349-3356.

**Emergent Cooperative Strategies for Robot Team Sports,**
A. Agah, B. Doyle, K. Kuok, K. Tanie; *Intelligent Automation and Soft Computing Journal*, Vol. 6 (1), 2000, pp. 45-56.

**Intelligent Graphical User Interface Design Utilizing Multiple Fuzzy Agents,**
A. Agah, K. Tanie; Interacting with Computers, Vol. 12 (5), 2000, pp. 529-542.

**Modeling Correlated Traffic with a Generalized IPP,**
Y.D. Lee, A. Van de Liefvoort, V.L. Wallace; *Performance Evaluation*, Vol. 40, February 2000, pp. 99-114.

**Preface to Special Issue on the 7th International Conference on Ground Penetrating Radar,**
C. Allen, R. Plumb; *Journal of Applied Geophysics*, Vol. 43, 2000, pp. 117-118.

**The Radar Systems and Remote Sensing Laboratory (RSL) at the University of Kansas,**
S.P. Lohmeier, J.M. Stiles, C.T. Allen, P. Gogineni, R.K. Moore; *IEEE Geoscience and Remote Sensing Society Newsletter*; Cum. Issue #113, March 2000, pp. 11-16.

**Rosetta Rolls Out System-Level Language for Designers,**
P. Alexander, D. Barton; *Electronic Engineering Times*, June 5, 2000.

**Tunable Millimeter-Wave Generation with Sub-Harmonic Injection Locking in Two-Section Strongly Gain-Coupled DFB Lasers,**
J. Hong, R. Hui; *IEEE Photonics Technology Letters*, Vol. 12 (5), May 2000.

**Separating Touching Objects in Remote Sensing Imagery,**
L-K Soh,. C. Tsatsoulis; *IEEE Transactions on Image Processing*, Vol. 9 (2), 2000, pp. 312-315.

**Stochastic Calculus for Fractional Brownian Motion I. Theory,**
T. Duncan, Y. Z. Hu, B. Pasik-Duncan; *SIAM Journal of Control Optimization*, Vol. 38, 2000, pp. 582-612.

**Tunable Millimeter-Wave Generation with Sub-Harmonic Injection Locking in Two-Section Strongly Gain-Coupled DFB Lasers,**
J. Hong, R. Hui; *IEEE Photonics Technology Letters*; Vol. 12 (5), May 2000.

**1999 (July-December)**

**Abstract Architecture Specification Using VSPEC**,
P. Alexander, P. Baraona; *VLSI Design*, Vol. 9 (2), 1999, pp. 181-201.

**Adaptive Continuous Time Linear Quadratic Gaussian Control,**
T. Duncan, L. Guo, B. Pasik-Duncan; *IEEE Transactions on Automatic Control*, Vol. 44, 1999, pp. 1653-1662.

**A Corpus Analysis Approach for Automatic Query Expansion and Its Extension to Multiple Databases,**
S. Gauch, J. Wang, S. M. Rachakonda; *ACM Transactions on Information Systems*, Vol. 17 (3), July 1999, pp. 250-269.

**An FDTD/MoM Hybrid Technique for Modeling Complex Antennas in the Presence of Heterogeneous Grounds,**
Z. Huang, K. Demarest, R. Plumb; *IEEE Transactions on Geoscience and Remote Sensing*, Vol. 37 (6), November 1999, pp. 2692-2698.

**Ice Flow of Humboldt, Petermann, and Ryder Glaciers, North Greenland,**
I. Joughin, M. Fahnestock, R. Kwok, P. Gogineni, C. Allen; *Journal of Glaciology*, Vol. 45 (150), 1999, pp. 231-241.

**Identification and Adaptive Control of Some Stochastic Distributed Parameter Systems,**
B. Pasik-Duncan; *International Journal on Adaptive Control and Signal Processing, Special Issue,* 1999.

**Intensity-Dependent Phase-Matching Effects on Four-Wave Mixing in Optical Fiber,**
S. Song, C. Allen, K. Demarest, R. Hui; *Journal of Lightwave Technology*, Vol. 17 (11), 1999, pp. 2285-2290.

**A Novel Method for Measuring Polarization-Mode Dispersion Using Four-Wave Mixing,**
S. Song, C. Allen, K. Demarest, R. Hui; *Journal of Lightwave Technology*, Vol. 17 (12), 1999, pp. 2530-2533.

**A Note on Sampling and Parameter Estimation in Linear Stochastic Systems,**
T. Duncan, P. Mandl, B. Pasik-Duncan; *IEEE Transactions on Automatic Control*, Vol. 44, 1999, pp. 2120-2125.

**The Rapidly Deployable Radio Network,**
J.B. Evans, G.J. Minden, G. Prescott, K.S. Shanmugan, V.S. Frost, D.W. Petr, R. Plumb; *IEEE Journal of Selected Areas of Communications*; Vol. 17 (4), 1999, pp. 689-703.

**Relationships Between Radar Backscatter and Accumulation Rates on the Greenland Ice Sheet,**
R.R. Forster, K.C. Jezek, J. Bolzan, F. Baumgartner, S.P. Gogineni; *International Journal of Remote Sensing*, Vol. 20 (15,16), 1999, pp. 3131-3147.

**Undergraduate Research and Intellectual Property Rights,**
K.J. Nordheden, M.H. Hoeflich; *IEEE Transactions on Education*, Vol. 42 (4), 1999, p. 233.

**Unsupervised Segmentation of ERS and RADARSAT Sea Ice Images Using Multi-Resolution Peak Detection and Aggregated Population Equalization,**
L.K. Soh, C. Tsatsoulis; *International Journal of Remote Sensing, Special Issue on Remote Sensing of the Polar Regions*, Vol. 20 (15,16), 1999, pp. 3087-3190.

<u>To Appear</u>

**Adaptive Control for Semilinear Stochastic Systems,**
T. Duncan, B. Maslowski, B. Pasik-Duncan; accepted for *SIAM Journal of Control Optimization.*

**On Adaptive Control of Discrete Time Markov Processes by the Method of Large Deviations,**
T. Duncan, B. Pasik-Duncan, L. Stettner; accepted for *Applicationes Mathematicae*.

**Detectability Models for Multiple Access Low Probability of Intercept Networks,**
R. Mills, G. Prescott; accepted for *IEEE Transactions on Aerospace and Electronic Systems*.

**GaAs Etch Rate Enhancement with SF6 Addition to BCl3 Plasmas,**
K.J. Nordheden, K. Upadhyaya, Y.S. Lee, S.P. Gogineni, M.Y. Kao; accepted for *Journal of Electrochemical Society*, Vol. 147, 2000.

**Human Interactions with Intelligent Systems: Research Taxonomy and Survey,**
A. Agah; accepted for *Journal of Computers & Electrical Engineering,* 2000.

**Mass Balance of the Greenland Ice Sheet,**
R. Thomas, T. Akins, B. Scatho, M. Fahnestock, P. Gogineni, C. Kim, J. Sonntag; accepted for *Science,* 2000.

**Psychological Effects of Behavior Patterns of a Mobile Personal Robot,**
J.T. Butler, A. Agah; accepted for *Autonomous Robots Journal, Special Issue on Personal Robotics,* 2000.

**A Scalable Agent-Based Network Measurement Infrastructure,**
Y.I. Wijata, D. Niehaus, V.S. Frost; accepted for *IEEE Communications Magazine*.

**Selective RIE of GaAs/AlAs in BCl3/SF6 for Gate Recess,**
Y.-S. Lee, K. Upadhyaya, K.J. Nordheden, M.-Y. Kao; accepted for *Journal of Vacuum Science Technology*, Vol. B (18), 2000.

**The VSPEC Systems Level Analysis Environment,**
M. Rangarajan, K. Jambhekar, A. Rajkhowa, P. Alexander; accepted for *Journal of Systems Architecture,* June, 2000.

## *Conference Papers and Presentations*

<u>2000 (January-June)</u>

**Burst Error Correction Capabilities of Turbo Codes in Mobile Environments,**
S. Shanmugan, M. Sanchez, et.al; 3G Wireless Communication Systems Conference, San Francisco, June 14-16, 2000.

**Data Mining Experiments for a Melanoma Data Set,**
J.W. Grzymala-Busse, Zdzislaw Hippe; *Proceedings of the Ninth International Symposium on Intelligent Information Systems*, Bystrak/Bielska Biala, Poland, June 12-16, 2000.

**On the Design of Orbit,**
R. Murali, P. Alexander, et al.; IEEE Engineering of Computer Based Systems Workshop, Edinburgh, U.K., April 2000.

**Digital Network Performance under Autocorrelated Traffic Loads,**
V.L.Wallace; EECS Colloquium, University of Kansas Department of EECS, May 1, 2000.

**Fatigue Crack Investigation for the Arkansas River Bridge in Hutchinson, Kansas,**
Y. Zhao, W.M.K. Roddis; TRB 79th Annual Meeting, Washington, D.C., Transportation Research Board, CD ROM, Jan. 9-13, 2000.

**A First Step Towards Systems Level Design,**
P. Alexander; Iowa State University, Department of Computer Science, Jan. 27, 2000.

**Knowledge Discovery Using System LERS,**
J.W. Grzymala-Busse; Rzeszow University of Technology, Rzeszow, Poland, June 16, 2000.

**Performance Simulation Studies for a Class of Smart, Conformal Array Antenna Architectures,**
D. Chaterjee, S. Chakrabarti, K. Shanmugan, G. Prescott; *Proceedings of the IEEE International Conference on Phased Array Systems and Technology*, Dana Point, Calif., May 21-25, 2000.

**The Rosetta Functional Requirements Specification Domains,**
P. Alexander, C. Kong, D. Barton; Hardware Description Language Conference (HDLCON'00), Los Angeles, March 2000.

**On Stochastic Adaptive Control,**
B. Pasik-Duncan; Optimization Days, Montreal, May 2000.

**Static Pricing and Quality of Service in Multiple Service Networks,**
L.A. DaSilva, D.W. Petr, N. Akar; 5th International Conference on Computer Science and Informatics, March 2000.

**Synchronous Fine-Grain Distributed Computations,**
S.B. House, D. Niehaus; *Proceedings of the Real-Time Technology and Applications Symposium*, Washington D.C., June 2000.

**On System Performance Issues and Channel Estimation in Highly Variant Mobile Environments,**
S. Shanmugan, M. Sanchez et al.; 3rd Generation Mobile Technologies, London, 2000.

**System Specification in Rosetta,**
P. Alexander, R. Kamath, D. Barton; IEEE Engineering of Computer Based Systems Workshop and Symposium, Edinburgh, U.K., April 2000.

**Using LERS for Knowledge Discovery from Real-Life Data,**
J.W. Grzymala-Busse; Norwegian University of Science and Technology, Trondheim, Norway, Jan. 26, 2000.

**1999 (July-December)**

**An Agent-Based Approach to Anticipatory Information Dissemination,**
H. Sevay, C. Tsatsoulis; IASTED International Conference on Artificial Intelligence and Soft Computing, Honolulu, 1999, pp. 146-150.

**Algorithm for Correcting Spaceborne Wind-Vector Scatterometers for Rain Attenuation,**
R.K. Moore, D. Chatterjee, S. Taherion; *Proceedings of the 26th General Assembly of URSI*, Toronto, Aug. 13-21,1999, p. 393.

**Application of Proof Obligations in the Design Process,**
M. Rangarajan, P. Alexander; International Conference on Software Engineering and Knowledge Engineering, SEKE-99, 1999.

**A Brief Summary of VSPEC,**
P. Alexander, M. Rangarajan, P. Baraona; World Congress on Formal Methods (FM 99), Tolouse, France, September 1999.

**A Closest Fit Approach to Missing Attribute Values in Preterm Birth Data,**
J.W. Grzymala-Busse, W.J. Grzymala-Busse, L.K. Goodwin; *Proceedings of the Seventh International Workshop on Rough Sets, Fuzzy Sets, Data Mining and Granular-Soft Computing (RSFDGrC'99)*, Ube, Yamaguchi, Japan, Nov. 8-10, 1999. Also, *Lecture Notes in Artificial Intelligence*, No. 1711, Springer Verlag, 1999, pp. 405-413.

**A Cognitive Robot with Reconfigurable Mind for Studying Theories of Ambiguity Resolution,**
F.M. Brown, A. Agah, J.M. Gauch, T. Schreiber, S.R. Speer; *Proceedings of The IEEE International Conference on Systems, Man, and Cybernetics (SMC'99)*, Tokyo, Vol. VI, October 1999, pp. 994-999.

**Connection Admission Control for Differentiating Priority Traffic on Public Networks,**
C.C. Beard, V.S. Frost; IEEE MILCOM '99.

**Convergence Of Networking Technologies**,
V. Frost; Navy Marine Corps Intranet (NMCI) Panel, Norfolk, Va., Dec. 17, 1999.

**Design and FPGA Implementation of a Reconfigurable Demodulator,**
S. Mukthavaram, J.B. Evans; Third Annual Workshop on High Performance Embedded Computing, Lexington, Mass., September 1999.

**Electromagnetic Scattering from Closed, Convex Lossy Dielectric Scatterers with Applications to Spaceborne Scatterometry,**
D. Chatterjee, S. Taherion, R.K. Moore; 1999 AP-S/URSI meeting, Orlando, Fla., July 11-16, 99.

**The Emerging Systems Level Design Language,**
P. Alexander; Sunflower Lecture Series, Wichita State University, Department of Electrical and Computer Engineering, Nov. 12, 1999.

**Enabling Collaboration Through Specification Based Search and Retrieval,**
P. Chawla, P. Alexander; Collaborative Engineering Workshop, Detroit, Mich., Nov. 9, 1999.

**Evolving Control for Distributed Micro Air Vehicles,**
A.S. Wu, A.C. Schultz, A. Agah; *Proceedings of the 1999 IEEE International Symposium on Computational Intelligence in Robotics and Automation (CIRA'99)*, Monterey, Calif., November 1999.

**Facets and Domains in SLDL,**
P. Alexander, R. Kamath, D. Barton; Forum on Design Languages, Lyon, France, September 1999.

**On Fractional Brownian Motion,**
B. Pasik-Duncan; International Conference on Probability Theory, Naleczow, Poland, September1999.

**A Functional Programming Environment for Design and Implementation of High Performance Radio and Synthetic Aperture Radar Processing Functions,**
G. Minden; DARPA Adaptive Computational Systems Principal Investigators Meeting, San Juan, Puerto Rico, Oct. 6, 1999.

**High-Resolution Monitoring of Internal Layers at NGRIP,**
P. Kanagaratnam, P. Gogineni, J. Legarsky, T. Akins; IGARSS'99, Hamburg, Germany, June 28 to July 2, 1999, pp. 95-97.

**High Speed Computation of Mathematical Functions Using Interpolating and Computing Artificial Neural Network (ICANN),**
E. Setiawan, S. Chakrabarti; *Proceedings of the Artificial Neural Networks in Engineering*, Vol. 9, ASME Press, St. Louis, Mo., Nov. 7-10, 1999, pp.1093-1098.

**Ice Thickness Measurements of the Southwest Greenland 2000-m Contour Line,**
J. Legarsky, P. Gogineni, P. Kanagaratnam, T. Akins, A. Wong; IGARSS'99, Hamburg, Germany, June 28 to July 2, 1999, pp. 89-91.

**Identification of Linear Systems Driven by Fractional Brownian Motion,**
B. Pasik-Duncan; International Conference on Applied Mathematics, Zakopane, Poland, September 1999.

**Implementation of an Active Congestion Control Scheme in Narrowband ATM Networks,**
S. Sheth, J. Evans, A. Kulkarni, G. Minden; 37th Conference on Communications, Control, and Computing, Monticello, Ill., September 1999.

**Intelligent Fusion of Multisource Data for Sea Ice Classification,**
C. Tsatsoulis, L.K. Soh, C. Bertoia, K. Partington; Workshop on Intelligent Techniques for Spatio-Temporal Data Analysis in Environmental Applications, Chania, Greece, 1999.

**Kansas Information Technology Enterprise,**
G. Minden; U.S. Senator Roberts' Task Force, University of Kansas, Dec. 13, 1999.

**Measuring Rainfall Rates Using a Spaceborne Synthetic-Aperture Radar,**
R.K. Moore, B. Murtha, D. Chatterjee; *Proceedings of the 26th General Assembly of URSI*, Toronto, Aug. 13-21, 1999, p. 393.

**Networking on the Battlefield: Challenges in Highly Dynamic Multi-Hop Wireless Networks,**
R. Sanchez, J.B. Evans, G.J. Minden; *Proceedings of IEEE MILCOM '99*, Atlantic City, N.J., October 1999.

**Numerically Reversing the Nonlinear Wave Propagation Single-Mode Optical Fiber,**
S. Song, K. Demarest, C. Allen; IEEE Lasers and Electro-Optics Society 1999 Annual Meeting (LEOS'99), San Francisco, November 1999, pp. 611-612.

**Ontology-Based Personalized Search,**
A. Pretschner, S. Gauch; *Proceedings of the Eleventh IEEE International Conference on Tools with Artificial Intelligence (ICTAI '99)*, Chicago, November 1999, pp. 391-398.

**Ontology-Based Web Site Mapping for Information Exploration,**
X. Zhu, S. Gauch, L. Gerhard, N. Kral, A. Pretschner; *Proceedings of the Eighth International Conference on Information and Knowledge Management, CIKM '99*, Kansas City, Mo., November 1999, pp. 188-194.

**Proportional Time Simulation of ATM Networks,**
S.B. House, S. Murthy, D. Niehaus; *Proceedings of the IEEE Real-Time System Symposium*, Phoenix, 1999.

**Rapidly Deployable Radio Network,**
G. Minden; DARPA Global Mobile Principal Investigators Meeting, Augusta, Ga., July 29, 1999.

**Real Time Information Technology Challenges in NASA's Earth Science Enterprise,**
G. Prescott, S. Smith, K. Moe; 1999 Workshop on Real Time Mission Critical Systems, Phoenix, Nov. 30, 1999.

**Rosetta: Objectives and Semantics,**
P. Alexander; VHDL International Users Forum (VIUF-99), Orlando, Fla., October 1999.

**SLDL: A Systems Level Design Language,**
R. Kamath, P. Alexander, D. Barton; ASIC/SOC 99, Washington D.C., September 1999.

**Some Methods of Stochastic Calculus for Fractional Brownian Motion,**
T. Duncan, Y.Z. Hu, B. Pasik-Duncan; *Proceedings of the 38th Conference on Decision and Control*, Phoenix, 1999, pp. 2390-2393.

**Spectral and Angular Ground-Based Radar Backscatter Measurements of Greenland Snow Facies,**
F. Baumgartner, K. Jezek, R.R. Forster, S.P. Gogineni, I. Zabel; IGARSS'99, Hamburg, Germany, June 28 to July 2, 1999, pp. 1053-1055.

**A Strategy for Moving from a Silicon Prairie to National Relevance,**
G Minden; U.S. Army Fort Leavenworth Center for Army Lessons Learned Quarterly Review, Lawrence, Kan., Sept. 1, 1999.

**Study of a Class of ''Smart'' Conformal Array Architectures,**
D. Chatterjee, S. Chakrabarti, K. Shanmugan, G. Prescott; *Proceedings of the 2000 IEEE International Conference on Phased Array Systems & Technology*, Dana Point, Calif., May 21-25, 2000, pp. 251-254.

**Tactical Battlefield Communications,**
M. Frankel, G. Minden, et al.; Defense Science Board Task Force on Tactical Battlefield Communications, Defense Science Board, December 1999.

**Two Approaches to Numerical Attribute Discretization for Rule Induction**,
J.W. Grzymala-Busse, J. Stefanowski; *Proceedings of the 5th International Conference of the Decision Sciences Institute*, Athens, Greece, July 4-7, 1999, pp. 1377-1379.

**UPC Parameter Estimation Using Virtual Buffer Measurement With Application to AAL2 Traffic,**
D.W. Petr, G. Vaddi, Y.-Q. Lu; *Proceedings of IEEE Globecom'99 Conference,* December 1999.

**VIDSEEK: Dynamic Multi-dimensional Browsing of Video Archives,**
K.M. Pua, S. Gauch, J. Gauch; ACM SIGIR '99 Workshop on Multimedia Indexing and Retrieval, Berkeley, Calif., August 1999, pp. 1-17.

**Wide Swath, High Resolution SAR Using Multiple Receive Apertures,**
N. Goodman, D. Rajakrishna, J. Stiles; IGARSS'99, Hamburg, Germany, June 28 to July 2, 1999, pp. 1767-1769.

**Wideband Radar for Determination of Snow Accumulation over the Greenland Ice Sheet,**
S. Gogineni, P. Kanagaratnam; *Proceedings of XXVIth General Assembly of URSI*, Toronto, August 13-21, 1999, p. 722.

**To Appear**

**Applying DSP Technology to Real-time Ultrasound Strain Imaging,**
A. Leung, G. Prescott, T. Hall, Y. Zhu; accepted for *Proceedings of the 2000 International Conference on Signal Processing and Applied Technology*, Dallas, September 2000.

**Development of a 1310-nm, Coherent Laser Radar with RF Pulse Compression,**
C. Allen, Y. Cobanoglu, S.K. Chong, S. Gogineni; accepted for IGARSS'2000, Honolulu, July 24-28, 2000.

**Discrimination of Six Grassland Management Practices Using Merged Landsat TM and ERS-2 SAR Data,**
K.P. Price, X. Guo, J. Stiles; accepted for 84th Annual Meetings of Ecological Society of America, Spokane, Wash., Aug. 8-12, 1999.

**Distributed Processing of Genetic Algorithms for Robot Soccer,**
M.W. Turvey, I.C. Ellis, A. Agah; accepted for *Proceedings of The Eighth International Symposium on Robotics with Applications (ISORA'00)*, World Automation Congress (WAC'00), Maui, Hawaii, June 2000.

**Effectiveness of Incorporating Force Feedback into Multimedia Interfaces,**
H. Fei, A. Agah; accepted for *Proceedings of The Second International Forum on Multimedia & Image Processing (IFMIP'00)*, World Automation Congress (WAC'00), Maui, Hawaii, June 2000.

**The Effects of Team Size on the Evolution of Distributed Micro Air Vehicles,**
D.J. Collins, A. Agah, A.S. Wu, A.C. Schultz; accepted for *Proceedings of the Genetic and Evolutionary Computation Conference (GECCO-2000)*, Las Vegas, July 2000.

**Estimating a Volumetric Backscatter Coefficient from In-situ Measurements in the Greenland Ice Sheet,**
J. Munk, F. Baumgartner, K. Jezek, P. Gogineni, R. Forster, et al.; accepted for IGARSS'2000, Honolulu, July 24-28, 2000.

**High-Resolution Monitoring of Internal Layers Over the Greenland Ice Sheet,**
S. Gogineni, P. Kanagaratnam, C. Leuschen, L. Larson, N. Gundestrup; accepted for IGARSS'2000, Honolulu, July 24-28, 2000.

**Incorporating Quality Metrics in Centralize/Distributed Information Retrieval on the World Wide Web,**
X. Zhu, S. Gauch; accepted for *Proceedings of the 23rd International ACM SIGIR Conference*, Athens, Greece, July. 2000.

**A MMSE Filter for Range Sidelobe Reduction**,
N. Goodman, J. Stiles; accepted for IGARSS'2000, Honolulu, July 24-28, 2000).

**Neural Networks for Foreign Currency Exchange Rate Prediction,**
B.P. Nasution, A. Agah; accepted for *Proceedings of The Third International Symposium on Soft Computing for Industry (ISSCI'00)*, World Automation Congress (WAC'00), Maui, Hawaii, June 2000.

**Performance and Processing of SAR Satellite,**
J. Stiles, N. Goodman, S. Lin; accepted for IGARSS'2000, Honolulu, July 24-28, 2000.

**Repair of Fatigue Cracking Due to Out-of-Plane Distortion,**
Y. Zhao, W.M.K. Roddis; accepted for Retrofit of Existing Bridges Session, 2001 Structures Congress, American Society of Civil Engineers, Washington D.C. (May 21-23, 2001).

**Some Aspects of a Robust Maximum Principle,**
T. Duncan, A. Poznyak, V. Boltyansky, B. Pasik-Duncan; accepted for *Proceedings of the Fourteenth International Symposium of Mathematical Theory of Networks and Systems*, Perpignan, France, June 19-23, 2000.

**Wideband Radar for Determination of Snow Accumulation over the Greenland Ice Sheet,**
S. Gogineni, P. Kanagaratnam; accepted for Eighth International Conference on Ground Penetrating Radar (GPR'2000), Gold Coast, Australia, May 23-26, 2000.

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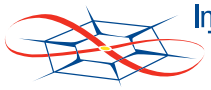


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