INSTITUTE FOR COMPUTING, INFORMATION AND COGNITIVE SYSTEMS •I•C•I•C•S•

ICICS FOCUS

THE UNIVERSITY OF BRITISH COLUMBIA

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Spearheading Expansion—Expanding the Vision

ICICS Director Rabab Ward has realized a grand collaborative vision that has expanded research and infrastructure and created one of the foremost technology research institutes in the world.

- **Facilitating Interdisciplinary Research**
- **Increasing International Collaborations**
- **Investing in Future Innovation**

Over the course of her ten-year tenure as director of the Institute for Computing, Information and Cognitive Systems (ICICS), including its transformation from the Centre for Integrated Computer Systems Research, Rabab Ward has overseen the colossal growth of both faculty and facilities—and spearheaded a process that expanded the Institute's research vision to encompass human experience, perception and needs. When Ward took the helm in 1996, there were fewer than 60 faculty members from the three core disciplines of computer science (CS), mechanical engineering (ME) and electrical and computer engineering (ECE). Since then, ICICS has evolved into an institute of 161 faculty from across campus, including commerce, music, mathematics, education, ethics, forestry, linguistics, mining engineering, physics, psychology, and statistics.

One hundred and twenty people were involved in drafting the proposal for the ICICS expansion, which took eighteen months and procured over $22 million in funding: $8.85 million from the Canada Foundation for Innovation (the largest CFI academic infrastructure grant awarded to UBC), $8.45 million from the BC Knowledge Development Fund, $2.6 million from UBC's Blusson Research Fund, and the balance from industry partners.

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"We are the only institute in the world that has such an extensive combination of equipment, facilities and expertise related to human-centred technology,"
– Dr. Rabab Ward, Director, ICICS.

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ICICS Director's Corner

In this issue of FOCUS, my final as ICICS director, I reflect upon the challenges and rewards of guiding ICICS over the last ten years. I have promoted a collaborative, interdisciplinary approach to human-centered research during my time as director. In this spirit, I wish to thank my colleagues, whose enthusiasm and creative ideas over the years have made my job much easier. They are a fun, infinitely resourceful group, and I will miss working with them on a daily basis.

ICICS has grown from 60 to over 160 members in the last decade. We profile in this issue some of the innovative work emerging from the new lab space we have built to accommodate them.

ICICS researchers in the Microsystems and Nanotechnology (MiNa) research group are investigating and developing novel micro- and nano-scale devices and systems for applications such as nano-computing, printing of circuitry, neural implants for prosthetic control, and cellular-level imaging.

Civil Engineering professor Sheryl Staub-French is looking at collaborative computer systems that will make it easier for construction professionals to share information across distance and time.

Please join me in welcoming Nimal Rajapakse as ICICS director effective July 1, 2007. As head of Mechanical Engineering at UBC since 2000 and a deeply committed ICICS member and advisor, Nimal is well acquainted with the inner workings of ICICS, and has a clear vision for its future. I know that ICICS will flourish under his direction.

Rabab Ward, ICICS Director

Ward: ***Continued from page 1***

Today, these partners include BC Hydro, Boeing, General Motors, Hewlett-Packard, IBM, Motorola, Nortel Networks, Nissan, Powertech Labs, Shaw Communications, Sierra Wireless, Sony, Weyerhaeuser Inc., and Xerox.

"I had a lot of help and expertise to rely upon," emphasizes Ward, acknowledging KD Srivastava and Jim Varah, who were involved in the early stages, as well as Kellogg Booth, Sid Fels and a host of others integral to the ICICS vision.

Crafting Consensus

"One of the biggest challenges was to build a consensus among the group, particularly with respect to office space, labs and equipment," admits Ward. "We involved the researchers themselves and I tried to ensure that everyone was well-represented on various committees." With the number of faculty snowballing, meeting the needs of all stakeholders was a formidable task, requiring considerable interpersonal skills—and the ability to counsel, coax and craft consensus among such a large and disparate group. "I believe in personal contact," she says. "Discussing issues over the phone or in meetings is very important." Under her warm, soft-spoken exterior, Ward clearly has the power of persuasion.

The new ICICS building—one of several facilities now used by ICICS researchers across campus—opened in 2005 and houses 30,000 sq. ft. of cutting-edge equipment and 25 dedicated research labs. In addition, common labs are available to all researchers. These include an observation studio, interactive workrooms, physical simulation and measurement lab, sound studio, digital media studio, and human measurement lab. "The common labs were designed to facilitate collaborative research, which is one of the major aspirations of ICICS," states Ward.

Infrastructure Inspires Innovation and Collaboration

The scope of study now undertaken at ICICS is staggering, and collaborations involve leading researchers from across UBC, Canada and around the world. Nationally, ICICS members are key players in the Joint Infrastructure Interdependencies Research Program (JIIRP), funded by the Natural Sciences and Engineering Research Council and Public Safety and Emergency Preparedness Canada. JIIRP involves six partner projects at universities across Canada. ICICS researchers lead the largest project—a $1.1 million initiative that involves BC Hydro, BC Transportation Commission, TELUS, and the Greater Vancouver Regional District. ICICS members from ECE, CS, ME, Commerce, Psychology, and Geography are working to develop real-time simulation tools for the continent-spanning infrastructure systems that would be called into play—or compromised—by catastrophic events (*FOCUS* Fall 2005).

International collaborations under Ward's directorship include eight research projects in the applied sciences funded by the National University of Singapore, with ICICS providing the lab space and much of the equipment. In another international collaboration, ICICS members worked with Shanghai Jiaotong University, Shanghai Post & Telecom, BCT, TELUS, and Nortel China to investigate ways of improving China's telecommunications sector.

More specific projects include the computer vision software for AIBO, the Robotic Dog, developed by ICICS researchers in the Lab for Computational Intelligence, and licensed by Sony. The technology can also be used in robotic vacuum cleaners, lawn mowers, etc., and to help elderly people with security-type applications, cooking, and cleaning. Other projects include image analysis for biomedical applications; data mining to improve lung cancer treatment; a technique for finding the mechanical parameters of tissue that can be used in the diagnosis, prognosis, and treatment of prostate cancer; and a daily planner program for people with aphasia (who have lost the ability to recognize words) that will allow them to record meetings and appointments using images and sounds.

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Toward Digital Environments for Design and Construction Coordination

Civil Engineering professor Sheryl Staub-French is working on digital environments that will allow construction professionals to coordinate designs in 3D, and collaborate across distance and time.

- **Design Coordination**
- **3D Modelling**
- **Digital Collaboration**

Collaboration is bred in the bone for a civil engineer. While working on her PhD at Stanford, ICICS member Sheryl Staub-French collaborated with a company on 3D modelling to support design coordination, cost estimating and scheduling in building construction. When UBC Properties Trust learned of her experience in this area, they approached her to model some of the building systems in the Chemical and Biological Engineering building then being constructed. The 3D computer-aided design (CAD) model her student created from schematic drawings identified over 50 potential conflicts before construction, saving many thousands of dollars.

Impressed, UBC Properties Trust bid out the Centre for Interactive Research on Sustainability (CIRS) building as a 3D project, and brought Staub-French in to facilitate the 3D modelling process. "It's a different way of working for everyone when you move to 3D," she says. "It requires a coordinated effort around how you develop your designs, because now you're collaborating electronically and trying to leverage the integrated models for a variety of purposes." The "what-if" scenarios this approach permits will likely save considerable money and time.

Staub-French's consulting work on the CIRS building dovetails nicely with her research. In one strand, she is collecting domain-specific knowledge through the different phases of construction. "What are the constraints governing the design and construction process, what is the construction knowledge being considered, how do different design decisions impact construction cost?" Staub-French aims to build this reasoning into her models.

In the other strand of her research, Staub-French is looking at the nature of collaboration during the design and construction process. Fellow ICICS members and computer scientists Kellogg Booth and Rachel Pottinger are contributing their respective expertise in collaborative technology and information integration, through a 3-year NSERC Strategic Projects grant with Staub-French as Principal Investigator. Melanie Tory of the University of Victoria is working on information visualization aspects of the project.

The researchers are observing the interactions that take place during design and construction meetings—annotations made to drawings, group and side conversations, note-passing, etc.—with a view to understanding how digital environments might better support the process. For example, annotations to a 3D model made on a tablet computer during a meeting could be reviewed at a later date, or in real time at a different location.

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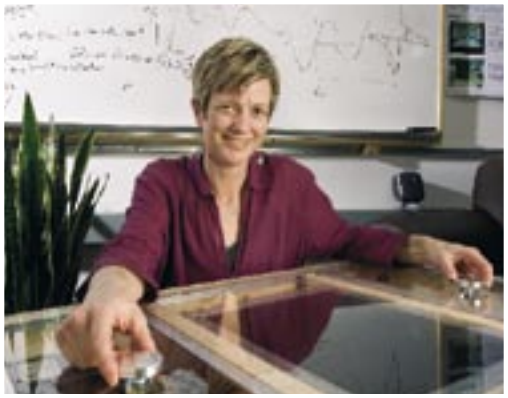
Ingenuity + Infrastructure = Innovation

Aided by a new suite of laboratories opened in the summer of 2005, ICICS researchers are making more breakthroughs than ever before.

Engaging the Technology of Touch

Most current technological devices make only rudimentary use of our sense of touch—or haptics. The Sensory Perception and Interaction (SPIN) research group, led by Karon MacLean, uses a host of ICICS facilities to explore how haptic feedback can enhance and improve our interaction with—and use of—technology. MacLean and her group are interested in learning how haptics can facilitate the communication of both abstract information and emotion, and how this can be incorporated into information applications.



The smaller devices such as cell phones, PDAs and portable media players become, the more difficult they are to control and navigate. In addition, user notification, such as a phone ringing during a meeting or movie, can be intrusive and annoying. In collaboration with colleagues at McGill, SPIN researchers have developed haptic technology to improve navigation and notification in handheld mobile devices. They have developed a prototype that uses piezoelectric actuators (crystals that generate an electric charge in response to mechanical stress) to produce a series of different skin-stretching sensations. "The McGill team led the hardware evolution and our ICICS team handled the perceptually-driven application and design," says MacLean. "We conducted a series of studies to learn how people can use these novel sensations to get detailed information from a handheld display." **Contact: maclean@cs.ubc.ca or visit www.cs.ubc.ca/labs/spin**

Playing in Sync

ICICS member Keith Hamel from UBC's School of Music is developing a software environment that facilitates interactive music and video performance. Live performances by instrumentalists trigger various electronic sounds, real-time processing effects and video images. Hamel's software allows musicians to synchronize their performances with the computer-generated sound and video. "Once the ICICS Open Media Environment (OME) is fully functioning, it will be an ideal space for presenting multimedia works like these," says Hamel. The OME is designed to be a focal point for interactive multimedia performances involving ICICS faculty and students, and artists from all over the world. **Contact: hamel@interchange.ubc.ca**

Understanding Unwanted Effects of Parkinson's Disease Medication

Parkinson's disease (PD), the second most common neurological disease after Alzheimer's, is characterized by slowness of movement, stiffness and tremor. Dr. Martin McKeown, member of the Pacific Parkinson's Research Centre and of ICICS, is studying the effects of medication on Parkinson's disease patients. Some brain chemicals such as dopamine—the one deficient in PD—are released from brain cells that have two modes of activity. "Steady-state" or "tonic" activity refers to activity that is sustained at the same level over long periods of time. "Transient" or "phasic" modes refer to abrupt bursts of activity.

Dopamine normally has complex, incompletely understood effects in the brain, but the steady-state activity appears more related to motor performance and the transient activity more related to reward-seeking behaviour. The drugs used to replace the deficient levels of dopamine in PD attempt to increase the steady-state activity to within normal levels, but this may result in unintended consequences on transient activity. For example, PD patients taking dopamine-replacement therapy to improve their motor performance occasionally develop problems with impulsive behaviour, such as pathological gambling or hypersexuality.

Medical researchers measure transient brain activity with electroencephalography (EEG) and muscle activity with electromyography (EMG). Dr. McKeown's lab is using ICICS' high-resolution projection screens to observe the effects of visual stimuli on EEG and EMG activity and to study various aspects of movement in PD patients, including frequency, force production, visual guidance, and task ordering and timing. ICICS members Jane Wang and Victor Leung are assisting with the wireless and sensor hardware used in the acquisition of the data and in the analysis of the acquired data. **Contact: mmckeown@interchange.ubc.ca**

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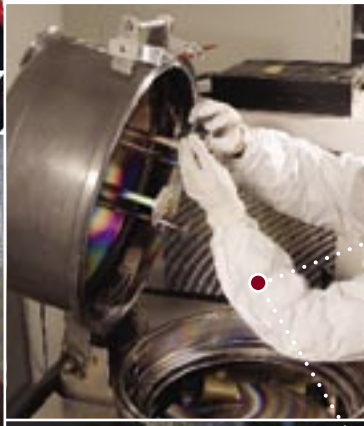
Pioneering Tiny, Powerful Technology

The fifteen researchers in ICICS' young, dynamic Microsystems and Nanotechnology Group are making quantum leaps in the development and fabrication of these emerging technologies.



The prefixes micro and nano have become buzzwords for powerful technology so small that it seems to belong to the realm of science fiction, not science (one nanometre is one-billionth, or 10^{-9} of a metre). Yet, the devices under development by ICICS' Microsystems and Nanotechnology (MiNa) group promise a host of real-world applications. "In the next five to fifteen years this will be the dominant technology, so our goal is to be leaders in the design and fabrication of future systems," says ECE's Lukas Chrostowski. The group currently has six main research foci: biomedical devices, nano-devices and computing, energy, optical communications, sensors and actuators, and micro- and nano-fabrication technology development.

Nanotubes, Nanowires and Nano-electronics

Carbon nanotubes are single molecules of carbon rolled up to form tubes, which have unique electronic and mechanical properties. Alireza Nojeh and MiNa colleagues are working on both single-walled and multiple-walled nanotubes (layers of cylinders inside each other) to better understand their intriguing properties in order to apply them to an array of potential industrial uses.

One potential application for single-walled nanotubes is electron emitters for flat-panel displays, which combine high quality visuals with long product lifetime and low cost. "It's the best of both worlds," says Nojeh. "This technology provides the high brightness and wide viewing angle of old cathode ray tubes with the thinner and lighter structure of the flat-panel technology." Other applications include high-resolution electron microscopes, electron beam lithography, high frequency transistors, and chemical and biological sensors.

Nanowires are similar to carbon nanotubes, in that they are very long only in one dimension. However, nanowires can be fabricated from both organic materials, such as carbon and DNA, and inorganic materials, such as metal oxides. One of the main attractions of nanowires, and nanotechnology in general, is that their electrons are confined in two dimensions, and the tighter the confinement, the more marked the quantum-mechanical properties. Nanowires of silicon and other inorganic composites have applications in integrated circuits, photonics, solar cells, and displays. ECE professor Peyman Servati has fabricated photo detectors from silicon composite nanowires that exhibit extremely promising light sensitivity, and which could be used for developing future solar cells.

Advances in Nano-computing

In current computer hardware, logic gates and wires a fraction of a micron wide are fabricated onto a silicon chip. However, as these components become smaller—the size of a few atoms—the laws of classical physics break down and the rules of quantum mechanics take over. Group members are working on several aspects of nano-computing, including device simulation (ECE/ICICS' Nojeh, Konrad Walus, David Pulfrey), device fabrication (Nojeh, Servati) and nano-device circuit and systems simulation (Walus). In another complementary and essential area, Walus and ECE/ICICS colleague André Ivanov are researching the design and testability of nanoelectronic circuits. "Many of these nanoscale devices have relatively poor reliability and exact fabrication and connection of the 100 million or more components that are in current computers may not be possible," notes Walus. "It is imperative that we develop new methodologies to design and test these future circuits."

Inkjet Technology "Prints" Bio-materials

One exciting research direction in the MiNa group is the application of inkjet

technology for printing organic electronic circuits and biological materials. "The advantage of this method is the very low cost of circuit/sample fabrication and the fast turnaround time," says Walus. Inkjet printing allows researchers to print and pattern organic polymer-based devices, or even living cells, in specific orientations and on multiple layers—the same way that a paper document is printed. "We think we will be able to use this not only for printing circuitry, or flat structures, but for tissue scaffolds as well," says colleague Karen Cheung (ECE/ICICS). "This is the first step in growing tissues such as artificial retinas or skin to replace scar tissue in burn patients."

Biomedical Devices Improve Diagnosis and Treatment

Cheung's research in biological microelectromechanical systems (bioMEMS) focuses on implantable microelectrodes for recording and stimulation, such as neural implants for prosthetics. Implantable devices record signals directly from the motor cortex at the cellular level. These signals have the potential to enable real-time control of prosthetic limbs. Cheung is also researching the use of neuro-implants to administer drugs such as antibiotics or agents that promote neuronal growth. ICICS colleagues Mu Chiao (ME) and Boris Stoeber (ECE) also investigate MEMS and microfluidics, the behaviour of fluids at the microscale, which is important in the development of cell- and molecule-based systems for drug delivery, genetic assays and high-throughput screening.

Kenichi Takahata (ECE/ICICS) is designing implantable stents to prevent arteries from collapsing after bypass surgery. The stents have wireless interfaces that can also monitor blood pressure, blood flow and body chemistry to communicate regular updates on the status of the patient. In related research, fellow ECE professor and ICICS member Vikram Krishnamurthy is modelling carbon nanotube interactions with cells for potential drug transport.

Breakthroughs in Biophotonics

In the area of biophotonics, ECE professor Shuo Tang is working on medical imaging at the cellular and tissue level. The technology focuses optical waves to submicron resolutions to provide extremely detailed images and determine chemical specificity. These measurements can establish cell function, structure and chemical composition essentially in vitro, by taking an optical sample—without the need for biopsies or invasive surgery.

Lukas Chrostowski is making very small lasers, detectors and sources for spectroscopy, DNA sequencing and optical lab-on-a-chip applications. Along with his ECE/ICICS colleague Nick Jaeger, he is also working on developing next-generation devices for high-speed networks, ranging in distances from centimetres for on-chip applications, to kilometres for long-distance communication (*FOCUS* Spring 2006).

Nanoscale "Sensor Perception"

Several MiNa researchers are developing nanoscale sensors and actuators for a wide array of applications, from environmental monitoring to robotic surgery. ECE professor and ICICS member Edmond Cretu is working on micro- and nanosensors to detect movement and vibration, and to help in precise navigation and positioning of micro-surgery tools. Current solutions lack the resolution to do accurate 3D imaging, so it is difficult for a surgeon to pinpoint a specific area. Combined with the optical core sampling technology mentioned above, such micro/nano sensor clusters will enable further steps in minimally-invasive surgery.

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Technological innovation requires creativity, research excellence and state-of-the-art technological tools. Under ICICS' collaborative umbrella, researchers from a diverse array of disciplines collaborate—along with industry partners—to develop scientific and technological tools focused on human needs and activities.

Pioneering Projection and Display Technology

High-definition TV doesn't hold a candle to the high dynamic range (HDR) display technology developed by ICICS member Wolfgang Heidrich (CS) and UBC physicist Lorne Whitehead. Working in conjunction with UBC spin-off company Brightside Technologies Inc., they have developed a visual display with contrast 50 times brighter than conventional display technology, providing superlative colour intensity and very dark blacks. Current displays use LCD panels with a constant backlight source. HDR uses an array of low-resolution LEDs, in effect adding a grey-scale underneath the image.

While Whitehead's lab developed the hardware, Heidrich and CS student Alan Rempel (pictured) developed the software algorithms to transform old video footage for viewing on an HDR display. The effect is stunning. The armour that Russell Crowe wears in *The Gladiator* actually glints in the sunlight. "This is definitely a more faithful representation of the Italian sun," remarks Heidrich. Video game companies already have game engines that support HDR displays. However, when it comes to image and video recording, digital is still playing catch-up to film. "We are working with Brightside on developing video recording technology as well," says Heidrich. He and his students have also developed a number of software components related to HDR.
Contact: heidrich@cs.ubc.ca

"Cubee" is another display innovation, developed by ICICS member Sid Fels. The cubic display has projections on five sides, which produces a 3D image inside the cube that moves in relation to the viewer. The projection allows engineers to preview a digital design prototype and make changes before beginning costly fabrication. **Contact: ssfels@ece.ubc.ca**

ICICS' video conferencing capability—complete with a wall-sized screen and stereo surround-sound—can connect with over 200 countries and have as many as 40 sites connected at one time. The UBC facility is part of WestGrid, a $50 million project to operate high performance computing (HPC), collaboration and visualization infrastructure across western Canada. As one of 14 partner institutions, UBC is a leader in this HPC collaboration and visualization community, which is unique in Canada and involves disciplines in the sciences, engineering, arts and the humanities. **Contact: ksbooth@cs.ubc.ca or see www.westgrid.ca**

Biomechanics in Motion

Farrokh Sassani in Mechanical Engineering and PhD candidate Mohammadreza Mallakzadeh are conducting research into the biomechanics of manual wheelchair propulsion to determine the degree of influence of factors that relate to repetitive stress injury. They have been working with wheelchair users to measure kinetic, kinematic and biomedical data including forces and movements in upper limb joints, speed, heart rate, blood pressure, body mass index, and percentage of body fat. Their goal is to formalize the relationship between wheelchair parameters, body forces and movements, and propulsion habits in order to develop a protocol for optimum wheelchair seat and backrest positions to reduce injury and improve efficiency. ICICS' state-of-the-art VICON motion analysis system in the Human Measurement Laboratory is used to analyze propulsion patterns in conjunction with these measurements. **Contact: sassani@mech.ubc.ca**

"Getting" Attention

Anyone who has seen the recent movie *The Prestige* will have a better idea of just how much visual perception depends upon attention. What happens when we add technology to the magician's bag of tricks? As PI of ICICS' Visual Cognition Lab, computer scientist and psychologist Ron Rensink is working to answer those questions. One project—featured in a National Geographic program—investigates how observers can fail to see a large change when their attention is diverted. For example, how does a magician use attentional misdirection to trick us into believing—or at least being astounded by—a feat that we know logically is impossible? Rensink has received major funding from industry partner Nissan for his basic research (*FOCUS* Spring 2002), and his work has been featured on the Knowledge Network. **Contact: rensink@cs.ubc.ca**

Vibrotactile Alert

The modern operating room is a hectic place, where the theatre of surgery is performed using a host of technological assistance. Anaesthesiologists in particular are bombarded with aural and visual stimulation. Guy Dumont and ICICS members from Electrical and Computing Engineering, along with researchers from BC Children's Hospital, have used haptic technology to develop a vibrotactile display. The device acts as a tap on the shoulder or squeeze on the arm of the anaesthesiologist when the patient's vital signs have changed. It helps filter visual overload, and alerts doctors only when a patient needs attention. **Contact: guyd@ece.ubc.ca**

Ward: ***Continued from page 2***

"All of these collaborations are a result of the calibre of our people and the excellence of our infrastructure," emphasizes Ward. "Individually, the facilities exist in other places, but it is their combination that makes ICICS one of the best-equipped research labs in the world and a major draw for top faculty and students."

Master of Software Systems

During her tenure as director, Ward established a Master of Software Systems (MSS) degree program. "We saw many brilliant people with degrees in physics, chemistry, engineering, and math, who were unable to find suitable jobs," she states. Ward envisioned a degree program that would re-skill these individuals for careers in the software industry. Since its inception in 2000, the MSS has been an extremely successful venture—for graduates and for ICICS. The average annual enrolment has been 25 students, and 160 have already graduated. "Our graduates are finding high-level jobs in companies across Canada and the US, including such places as Microsoft, IBM, Adobe, Alcatel, HSBC, Aligent Technologies, and Kodak," Ward notes.

Future Aspirations

After a hectic and rewarding ten years at the helm of ICICS, Rabab Ward is looking forward to having some free time for friends, travel and catching up on her research in interactive television, water-marking to prevent video piracy, and brain–computer interface technology with ICICS colleagues Gary Birch and Peter Lawrence (*FOCUS* Fall 2006).

"We have such a talented and diverse group of faculty and such a wealth of resources at ICICS that the research possibilities seem limitless."

Expanding the awareness of ICICS to the broader research and industry communities was an important mandate of her directorship, and it remains a focus of Ward's aspirations. "There are limitless possibilities as ICICS director, and I feel very fortunate," she says. "I loved my job and even though I'm stepping down, my ideas for ICICS haven't stopped."

Rabab Ward can be contacted at 604.822.6894 rababw@icics.ubc.ca

Staub-French: ***Continued from page 3***

The ability to manage and share information across distance and time will allow the architects, engineers, and construction experts involved in a building project to be more productive in meetings and make better-informed decisions. Designs that are more constructable, cost-effective, and easier to maintain should be the result.

Digital prototypes will be developed and tested in Staub-French's visualization lab, a mock-up meeting room with two large SMART boards to display the 3D model and related information. Various ports around the table allow meeting participants to interact with the model through tablet PCs, laptops, PDAs, etc. A mobile version of the lab will be used to conduct field studies, both in the architect's offices and on-site in a construction trailer.

Kellogg Booth will be looking at ways to digitally share the knowledge brought to meetings by various parties. Rachel Pottinger will focus on data integration, so that data from all stakeholders can be shared. Melanie Tory will develop data visualization tools that will make the integrated data useful for collaboration purposes.

"What makes this team so great," says Staub-French, "is that we've got the right people working together to tackle this problem—people with expertise in construction management, collaboration, data integration, and visualization."

Sheryl Staub-French can be contacted at 604.827.5118 or ssf@civil.ubc.ca

Pioneering Tiny, Powerful Technology: ***Continued from page 6***

Once a tumour is located, a tiny accelerometer on the head of the scalpel would guide the surgeon to the exact site," explains Chrostowski. "On screen you could see where the tool is relative to the arterial wall, tumour site, etc."

Silicon nanowires and carbon nanotubes can also be used in biosensors to detect toxic substances, such as anthrax. The use of embedded nanosensors to measure load, temperature, pressure, moisture, and chemical emissions has broad application for forestry, mining and other industries. Environmental monitoring is an important area of interest for MiNa research. Carbon nanotube sensors can have several advantages over conventional sensors: they are compact, safe to operate, have low power consumption, and can potentially be very stable in a wide range of temperatures, humidity and gas flow variations.

Nanotubes can also be used for actuation. ICICS member John Madden (ECE) is making molecular actuators by spinning yarn from thousands of single-walled nanotubes (*FOCUS* Fall 2003). These "artificial muscles" are leading to breakthroughs in artificial organs, robotics and nanosystem fabrication. Madden's work also has applications for energy storage devices, such as batteries and automotive fuel cells. "Once you learn how to handle these nano materials, you can make all sorts of devices," notes Chrostowski.

With funding from NSERC, CFI and CIHR, MiNa researchers are using state-of-the-art facilities in AMPEL and ECE to develop novel methods to fabricate these emerging devices and to control fabrication at the nanoscale. "We are developing new methods of 3D fabrication and new ways of making nanodevices," Chrostowski states. Sounds simple. However, creating tiny powerful technology based on quantum properties of matter is anything but.

Lukas Chrostowski can be reached at 604.822.8507 or lukasc@ece.ubc.ca

Passing Notes: ***Continued from back page***

ECE Head Appointed Editor-in-Chief

Vijay Bhargava (ECE) has been appointed editor-in-chief of the *IEEE Transactions on Wireless Communications*, for a two-year term that started January 1, 2007. *The Transactions* is considered the premier journal in advancing state-of-the-art wireless communications applications.

ICICS Member Wins Young Innovator Award

The BC Innovation Council's 2006 Young Innovator Award goes to **Mu Chiao** (ME) for his breakthroughs in the design and fabrication of microelectro-mechanical systems (MEMS). Chiao's work on biomedical applications of MEMS, such as drug delivery and micro needles, was recently featured on the Knowledge Network program, *The Leading Edge: Innovation in BC.*

Demystifying Magic

The work of **Ron Rensink** (CS/Psychology) has also recently caught the attention of *The Leading Edge: Innovation in BC*. In a segment on research into the psychology of magic, Rensink discussed the role of visual attention in magic, and how to control it so that observers will or will not see a given object.

Intelligent User Interfaces Conference Best Paper Award

"Supporting Interface Customization Using a Mixed-Initiative Approach," by Andrea Bunt, **Cristina Conati** and **Joanna McGrenere**, won the Best Paper Award at the 2007 International Conference on Intelligent User Interfaces, held in Honolulu this past January. Bunt is a PhD candidate in Computer Science, co-supervised by McGrenere and Conati.

CS Researcher Quoted in The Economist

Haptics is the science of simulating touch sensations, and will soon see widespread use in applications such as touch screen mobile phones. In a recent article in *The Economist*, **Karon MacLean** of Computer Science pointed out the potential of haptics to relay information by touch when people's other senses are occupied, e.g., while walking or driving.

Canadian Society of Cinematographers Award

Cinematographer Cathryn Robertson (UBC Film Program) and ICICS' **Bob Pritchard** (Music) have been recognized by the Canadian Society of Cinematographers with a Unique Award of Merit for *Strength*. The piece is an interactive work for alto saxophone, video, sound clips, and Max/MSP/Jitter, a graphical object-based language for realtime processing of MIDI, audio, and video data.

Second UBC–IEEE Workshop on Future Communications Systems

ICICS sponsored the Second UBC–IEEE Workshop on Future Communications Systems, held March 9, 2007 as part of UBC's Celebrate Research Week. The workshop featured speakers from industry, ICICS and elsewhere in UBC, and other institutions. Topics covered included cognitive radio, mobile broadband wireless systems, heterogenous wireless networks, and wireless sensor networks.

IEEE Ultra-Wideband Conference Best Paper Award

ECE doctoral candidate Amir Nasir and professors Lutz Lampe and Robert Schober received the Best Paper Award from the 2006 IEEE International Conference on Ultra-Wideband (ICUWB) for their paper "Interference from MB-OFDM UWB Systems: Exact, Approximate, and Symptotic Analysis." The conference, held in Boston from September 24–27, 2006, is the leading conference in ultra-wideband technology.

NSERC: ***Continued from back page***

NSERC Strategic Project Grant Funding for ICICS Researchers

Vijay Bhargava (ECE) has been awarded a 3-year, $473,500 grant, along with co-investigators from the Université du Québec, to develop adaptive access technologies for cognitive radio networks. In these networks, either the network or a wireless node can change its transmission or reception parameters to communicate efficiently without interruption.

John Madden (ECE), with co-investigators Mike Wolf and Mark MacLachlan from Chemistry and Carl Michael from Physics, have been awarded a 3-year, $361,400 grant for their study, "Supercapacitors for Power Quality and Energy Storage." The team will assess the feasibility of new high energy, high power density electrochemical capacitors.

A 3-year grant totaling $349,000 will enable **Tim Salcudean** and **Peter Lawrence** of ECE and **Robert Rohling** (ECE/ME) to investigate an "Ultrasound Vibro-elastography System for Real-time Identification of Tissue Mechanical Properties." The participating industrial organization is Ultrasonix Medical Corporation.

Researchers from Sunnybrook Hospital in Toronto, with co-investigator **John Madden** (ECE), are working on a catheter that will enable imaging within arteries, so that diseased areas can be identified and removed. The project is funded by a 3-year, $254,200 grant, supported by Ultrasonix Medical Corporation.

Chemical and Biological Engineering professor **Chad Bennington**, along with ECE professors **John Madden**, **Shahriar Mirabbasi**, and **Mu Chiao**, are developing a "SmartChip" sensor to record pressure, temperature, and position during processing in chemical reactors, such as pulp and paper digesters. The work is funded by a 3-year, $386,100 grant, with the support of Howe Sound Pulp & Paper, Paprican, and SST Wireless.

A team headed by **Brian Fisher** (SFU/MAGIC/CS) that includes **Ron Rensink** (CS/Psychology) has been awarded $462,000 over 3 years to look at integrating Canadian and international efforts in the field of visual analytics. Visual analytics uses visualization tools to analyze mass amounts of different types of data for use in areas such as emergency planning and response, intelligence analysis, and healthcare management. Industrial partners include Greenley & Associates, IDELIX Software, MacDonald Dettwiler, and Oculus Information.

Passing Notes:

APEGBC Awards

ICICS members have won three out of eleven 2006 President's Awards from the Association of Professional Engineers and Geoscientists of BC. ECE professor and ICICS Director **Rabab Ward** received the R.A. McLachlan Memorial Award, APEGBC's highest honour. The award recognizes Rabab's extraordinary and continuing professional career, and her exemplary service to the community, particularly in mentoring women in the profession.

Sheldon Green (ECE) received the Award for Teaching Excellence in Engineering and Geoscience Education, for his innovative and dedicated contributions to undergraduate engineering education.

Carlos Ventura of Mechanical Engineering was given the Meritorious Achievement Award for his notable achievements in the field of earthquake engineering.

ASME Outstanding Investigator Award

Clarence de Silva has received the prestigious Henry M. Paynter Outstanding Investigator Award from the Dynamic Systems and Control Division of the American Society of Mechanical Engineers (ASME). The award was presented in November 2006 at the ASME Annual Congress in Chicago. Professor de Silva has also recently been elected a Fellow of the Canadian Academy of Engineering.

Peter Wall Institute Distinguished Scholar

Alan Mackworth of Computer Science has been named a Peter Wall Institute for Advanced Studies Distinguished Scholar in Residence for 2007. Mackworth focuses on developing practical theories of real-time constraint-based computational intelligence. The PWIAS, like ICICS, bridges departmental and faculty boundaries within UBC, and promotes contact between UBC researchers and others from around the world.

Killam Research Prize for ECE Professor

Congratulations to **Robert Schober** (ECE) on winning a prestigious Killam Research Prize for 2006. Established in 1986, the prizes are awarded annually to top campus researchers in recognition of their outstanding research and scholarly contributions. Schober's current research interests include high-rate networks, ultra-wideband (UWB) communications, sensor networks, and free-space optical communications.

Continued on Page 9

ICICS Researchers Awarded NSERC Collaborative Research and Development Grants

ICICS researchers from ECE are recipients of a $219,000, 3-year grant supported by TELUS. **Victor Leung** and co-investigators **Panos Nasiopoulos** and **Konstantin Beznesov** will develop technologies to deliver "always best connected" IP-based multimedia services to wireless subscribers.

Principal investigator **Sheryl Staub-French** (CIVIL), **Kellogg Booth** (CS), **Rachel Pottinger** (CS), and UVic professor Melanie Tory are looking at how future collaborative computer systems can be designed to make it easier for construction professionals to share information across distance and time. The team is funded by a $442,500, 3-year grant.

Elizabeth Croft (ME) and **Jim Little** (CS) have won a grant totalling $254,860, with the support of ICICS and Braintech Inc. The researchers will work on developing advanced vision guided robotic systems that can search for, locate, and retrieve objects jumbled in a bin.

An interdisciplinary team at UBC headed by **James Olson** (ME) has been awarded a 3-year, $1.3M grant to investigate non-mechanical pulp-refining processes. The team, which includes ICICS members **Guy Dumont** (ECE), **Sheldon Green** (ME), and **Chad Bennnington** (ChemBio Engineering), are investigating chemical and biological technologies to drastically reduce the pulp industry's energy consumption while improving paper production and quality. Support from BC Hydro and other industrial partners brings the funding to over $2M.

More NSERC on Page 9

•I•C•I•C•S• Institute for Computing, Information and Cognitive Systems www.icics.ubc.ca

UBC's Institute for Computing, Information and Cognitive Systems (ICICS) is an umbrella organization that promotes collaboration between researchers from the faculties of Applied Science, Arts, Commerce, Education, Forestry, Medicine, and Science. ICICS supports the collaborative computer-oriented research of more than 160 faculty members and over 800 graduate students in these faculties. ICICS researchers attract approximately $15 million in annual grants and contracts. Their work will have a positive impact on us all in the future.

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ICICS, University of British Columbia
289-2366 Main Mall,
Vancouver, BC, V6T 1Z4
info@icics.ubc.ca

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Writing: Mari-Louise Rowley, Pro-Textual Communications; Craig Wilson, ICICS Editorial Assistant

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Office: University of British Columbia
289-2366 Main Mall
Vancouver, BC, Canada, V6T 1Z4

Tel: 604.822.6894
Fax: 604.822.9013
E-mail: info@icics.ubc.ca