CENTRE FOR INTEGRATED COMPUTER SYSTEMS RESEARCH • C • I • C • S • R •

THE UNIVERSITY OF BRITISH COLUMBIA

FOCUS

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FUNDING SOURCES

A look at the trend towards increased funding for research with an industrial focus.

For those university researchers interested in collaborating with industry — and most CICSR members are — there has been a noticeable increase in funding sources over the past few years. That's in part due to the creation of new programs that require industry collaboration, and in part due to an increased emphasis on industrial collaboration from some of the traditional funding sources.

Martha Salcudean, Associate Vice President Research (Physical and Applied Sciences)

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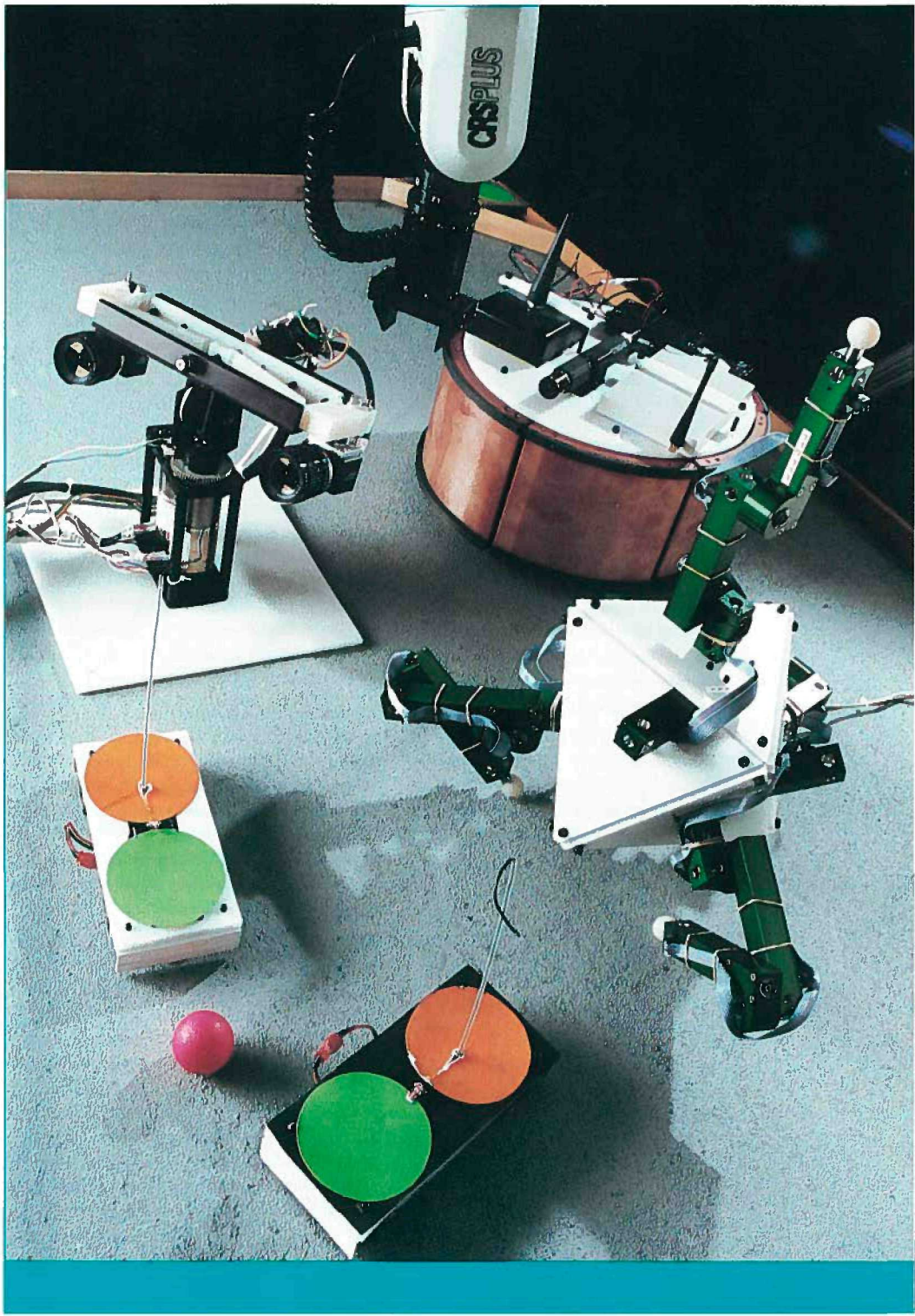


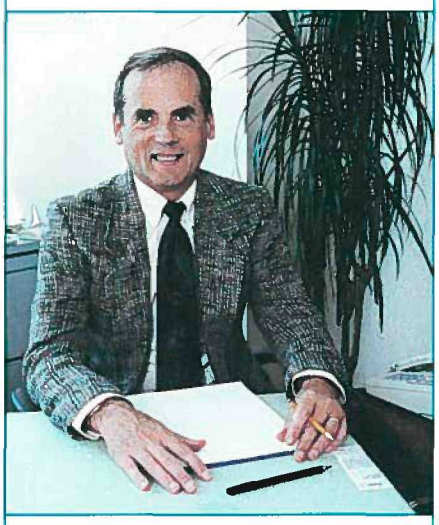
IRIS is one of several Networks of Centres of Excellence which had its funding renewed. Shown in the photo are robots developed as part of the IRIS network.

IN THIS ISSUE

- *CITR helps Canadian Telecom compete* — *page 3*
- *A better way to handle fish* — *page 4*
- *Co-op program* — *page 5*
- *Report on IRIS* — *page 6*
- *A look at ASI* — *page 7*
- *Calendar* — *page 8*

DIRECTOR'S STATEMENT

■ This issue of our CICSR Newsletter focuses on the increasing importance of industrial relevance and participation in research for Information Technology. This trend has been apparent over the past several years, and is now firmly established in federally funded programs (like NSERC and the NCEs) and provincially-funded programs (like ASI and the Science Council of B.C.). Several examples of successful industry-related programs involving CICSR members are given here, along with interviews with representatives of granting agencies.



In addition to the encouragement of industrially-relevant research by the granting agencies, more and more faculty members are finding interesting research problems in industry — not only in Engineering, but also in Computer Science. At the same time, industry is discovering that academic researchers can and will help solve their problems.

This trend is bound to continue, and hopefully will result in the production of more and better products and processes, and in making Canada more competitive in the global marketplace. ■

Dr. James Varah, CICSR Director

FUNDING ... continued from cover

feels the trend is a good thing for the Canadian economy. "Canadian science and engineering research is recognized worldwide, but in the commercialization of our research, we could do far better," said Salcudean. "There is a general desire that universities play a larger role in the economy of the country. It is felt that university-based research can contribute to the competitiveness of our industries."

At UBC, university-industry collaboration has increased dramatically in recent years. According to Salcudean, the industrial component of research funding has increased several-fold. "There are many new programs addressing the needs of industry. Researchers should be aware that there are opportunities out there for them, if they have an interest in working with industry."

In her own research, Salcudean has a strong industrial component. She has been working with industry for many years. For example, she did some work on the safety of nuclear reactors. The results of her research have been incorporated into the Atomic Energy of Canada Ltd. safety codes.

Salcudean is also working with Ian Gartshore of the Department of Mechanical Engineering on investigation into film cooling of turbine blades to protect them from the hot gas in the environment they're used in. She and Gartshore have been working on this problem for more than five years, and have received funding from both Pratt and Whitney Co. (Canada) and the NSERC collaborative research funding program. P&W are now incorporating Salcudean and Gartshore's work in their new engine design.

Salcudean and Gartshore are also involved in an international research project on black liquor recovery boilers used in the process of making pulp and paper. The boilers cost about $100 million each, and every pulp and paper mill has one, so there is a strong interest in the work, which is aimed at increasing productivity, reducing pollution and making more efficient use of energy.

The project, as well as Salcudean's other industrial projects, receives a combined total of more than $500,000 in funding annually from a mix of industry and government sources. Funding sources for the recovery boiler research include Weyerhaeuser, the U.S. Department of Energy, Industry Canada, and Energy Mines and Resources Canada. The research project has already spun off a company, Process Simulators, which focuses on calculation for black liquor recovery boilers.

Martha Salcudean, Associate Vice President Research (Physical and Applied Sciences).

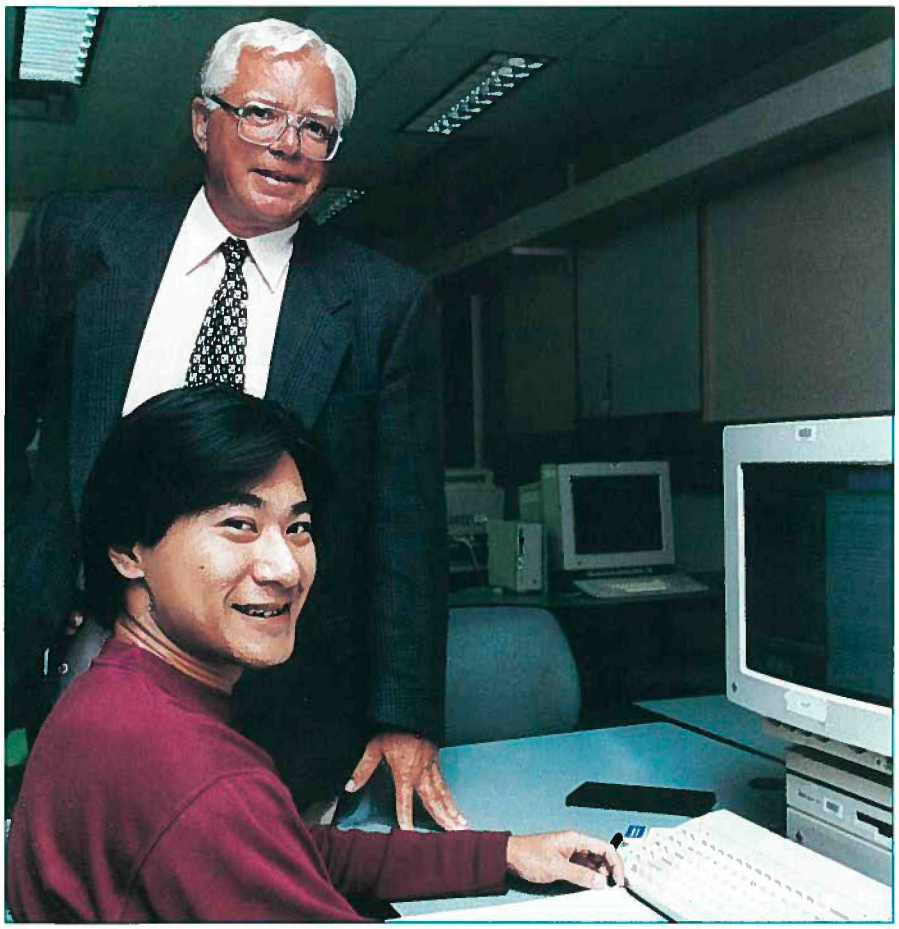
UBC was awarded several research contracts as part of the project to investigate flow fields in recovery boilers. "We are in the process of transferring technology to boiler manufacturers and pulp and paper companies," said Salcudean. But their work is far from finished. They will spend the next year and a half working on a global recovery model which includes combustion and chemistry.

For Salcudean, and many other UBC researchers, industrial collaboration is not only rewarding, but gives them access to a wider range of funding sources. According to CICSR director James Varah, "If you look at funding levels over the past several years, this is where all the new money is going. I believe it's part of a federal government strategy to force the marriage between university researchers and industry. I've seen it working."

Both Varah and Salcudean have noted that both companies and university researchers are becoming more and more amenable to working together. "It's amazing the acceptance level in the universities now," said Varah. "There is no stigma attached to working with industry. In fact, it's the opposite. Industrial collaboration is now seen as a good thing to do." ■

CITR Helping Canadian Telecom Compete

The work of the Canadian Institute for Telecom Research will help maintain Canada's competitiveness in telecom.



Dr. Donaldson, with one of the many researchers in the CITR network, Electrical Engineering Masters student William Wong.

■ The telecom industry is one of the strongest industry sectors in Canada, and the Canadian Institute for Telecom Research (CITR) was created to make it even stronger, according Dr. Robert Donaldson, Department of Electrical Engineering Head, and leader of a CITR project area.

CITR is a nationwide project, with participants from 15 universities and two research institutes. CITR recently had its funding renewed for the second phase of the program to the tune of about $4 million per year. To qualify for the funding, a network must have excellent research and personnel, must make use of networking and partnerships, and there must be strong potential for knowledge exchange and technology exploitation. This is yet another research funding program that requires research that will lead to commercial exploitation and contribution to economic growth.

Part of CITR's strength is its strong representation from industry. About half of the members of the board of directors are from industry. CITR projects are not approved by the board unless they have high academic quality, plus industrial relevance.

CITR is divided into five major project areas that, combined, will boost the Canadian telecom industry into the next generation of technology. The project areas include: broadband networks, broadband services, photonic systems, mobile and personal communications, and broadband indoor wireless communications. Within each major project area are a number of individual projects.

Donaldson's own research falls in the mobile and personal communications project area. Entitled "Internetworking of wireless communication networks," the project's objective is to find ways to interconnect wireless networks with each other, with broadband networks and services and with people-on-the-move. The project is relevant to at least three other major project areas, demonstrating the interaction among major projects.

"When CITR was reviewed by a panel of experts prior to phase two, this project was seen as an important and essential component of the whole program," said Donaldson. The review took place last summer, and phase two started April 1 of this year. Of the 15 original networks of excellence, ten were renewed, five in engineering, five in medical research. Of the five engineering centres, the UBC department of electrical engineering is participating in four, a claim no other department in the country can make.

As part of his CITR research, Donaldson is studying new and different approaches to interconnecting wireless networks. Currently wireless networks are connected via radio-based site controllers to broadband networks in a highly centralized fashion. The problem with this architecture is that the network traffic associated with the coming microcellular communication devices is expected to be so heavy that a centralized architecture will not be effective.

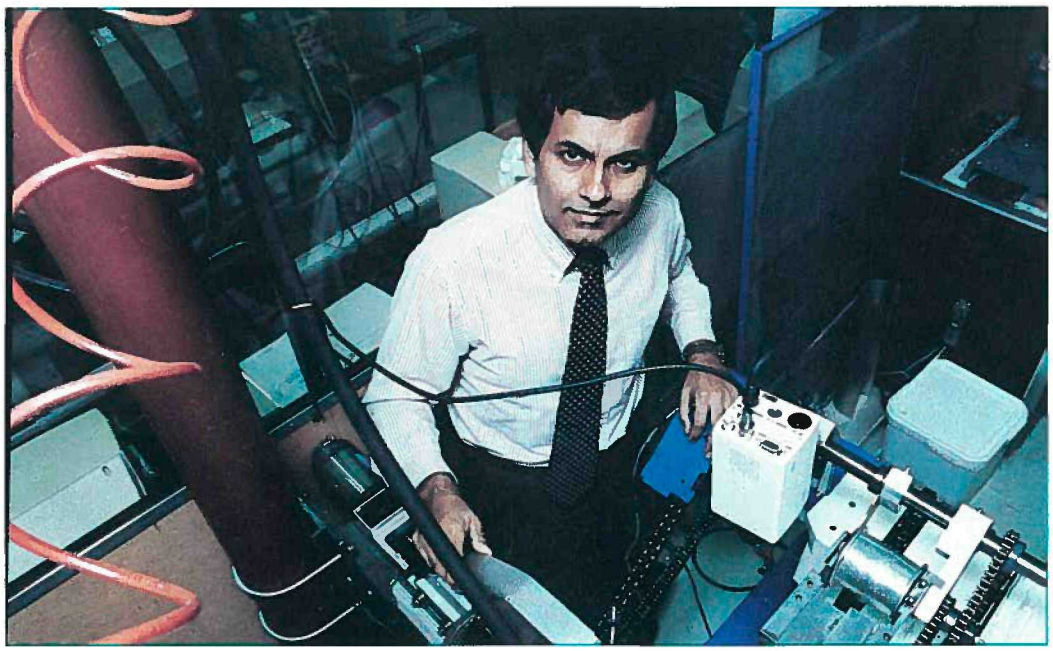
Donaldson and his research team have analyzed a distributed switching architecture, and are comparing the cost and performance of it against a centralized system. However, the question about which system is preferred will not be answered just by looking at technical issues. There are economic considerations, and strong competition for control of the communication networks of the future. Telephone companies may prefer to stay with existing centralized architectures, while others in the communications arena, including cable companies, may prefer new, distributed schemes.

Donaldson and his colleagues prepared a report and journal paper about a distributed switching architecture which interconnects radio-based site controllers via metropolitan area network (MAN) rings, which are bridged to each other, and to broadband networks. This scheme was compared to an ATM-based centralized switching system. "There is a lot more interest in a distributed scheme now, in part because of the work we've done and published," said Donaldson.

The analysis that was done looked at voice communications only. Over the next four years, Donaldson and his research team will study the implications for video, fax and data communications traffic as well. "I cannot overemphasize the complexity of the project," he said. ■

A Better Way to Handle Fish

CICSR researcher Clarence de Silva looks at ways of making Canadian fish processing more competitive.



Clarence de Silva is working with the fish processing industry to develop better processing machines.

■ The research of Clarence de Silva is a perfect example of how research funding sources are putting more weight on projects that are not just academically interesting, but beneficial to industry as well. According to de Silva, who holds the NSERC and B.C. Packers chair, his research program was established for the sole purpose of making the Canadian fish processing industry more competitive.

"They started by asking B.C. Packers for their priorities," said de Silva, who is a member of the UBC Department of Mechanical Engineering. B.C. Packers, and the industry in general, wanted better recovery in salmon processing. When the heads are cut off salmon prior to further processing, a lot of meat is thrown out with the head. De Silva and his research team have since developed a complex cutting machine that reduces waste to less than one percent. With previous methods, five percent waste was typical, and each percentage of waste costs the industry $5 million per year. The economic benefits of de Silva's new machines are obvious.

To date, de Silva and his team have built one research prototype and one industrial prototype. The machines use a vision system to analyze the fish, robotics to position, hold and cut them, and a sophisticated computer system to perform complex calculations on the fly. De Silva said that at first he was concerned about the speed of the vision system. It has to be very fast, since to be competitive, the machines must process two fish per second. Faster image processing hardware and improved algorithms have enabled the research team to speed the process.

De Silva is now working on adding intelligence to the machines by adding an intelligent control system that is "like a supervisor watching over each machine." The system takes sensory information such as speed of the conveyor, force exerted on the blades, cutting position, and blade speed. Another part of the system looks at the end product to analyze the smoothness of the cut, depth and other factors needed to evaluate the process. All of this information is compiled and sent to the electronic "brain" of the system, which uses the information, and its knowledge base, to make decisions, such as: Should the conveyor be slowed down, or sped up? Should the blades have more power? Or is something drastically wrong that would require a complete shut-down?

"The knowledge base decides on the adjustments," said de Silva. "They could involve simple parameter adjustments in the software, or physical changes, such as adjustment of the conveyor speed." The information is also useful after the fact, to determine the quality of the batch processed, and help determine its price. The intelligent control system is now installed on the research prototype at UBC.

"There is no end to the uses for that type of system," said de Silva. "The same ideas, with a new knowledge base, could apply to many different applications."

For example, de Silva and his team are now working on an expert system for grading herring roe. The resident expert at B.C. Packers currently has to train people each year — the job requires a high degree of skill, and is not a pleasant task. The automated grading system could not only be used for the grading itself, but also to train new graders using the knowledge base provided by an expert. So far, de Silva and his team have developed the shape and colour analysis part of the system. Next in line is ultrasound to gauge the texture of the roe, and the decision-making system.

Both the herring roe grading system and the salmon cutting machine have considerable commercial potential . A five percent improvement in grading accuracy could save the B.C. herring roe industry about $3 million per year.

According to de Silva, B.C. Packers is now negotiating with a company to build commercial prototypes. However, the actual commercialization of the research does not concern him. The fact that his work has such strong commercial potential is due to the industrial focus that was there from the outset. In fact, in the past year, B.C. Packers has doubled its funding in de Silva's work to $120,000 per year, while NSERC has reduced its contribution.

De Silva also receives funding from other sources as well. He holds a B.C. Advanced Systems Institute Fellowship, and his herring roe project has been funded by the Science Council of B.C. Both organizations require a strong industry connection as a prerequisite to funding. The Institute for Robotics and Intelligent Systems (IRIS) has also provided a four-year grant to finance a project on sensor-based robotics.

The IRIS project will involve research into the use of fuzzy logic to provide a higher level of "feeling" and control in the fish processing and roe grading equipment. Other researchers in universities across Canada are working on other sensory aspects of robots as part of IRIS.

"I'm not working in isolation," said de Silva. "Networking is one of the goals." And, increasingly, another of the goals of research funding bodies is to encourage research that will have some industrial benefits down the road. ■

Co-op Provides Hands-On Education

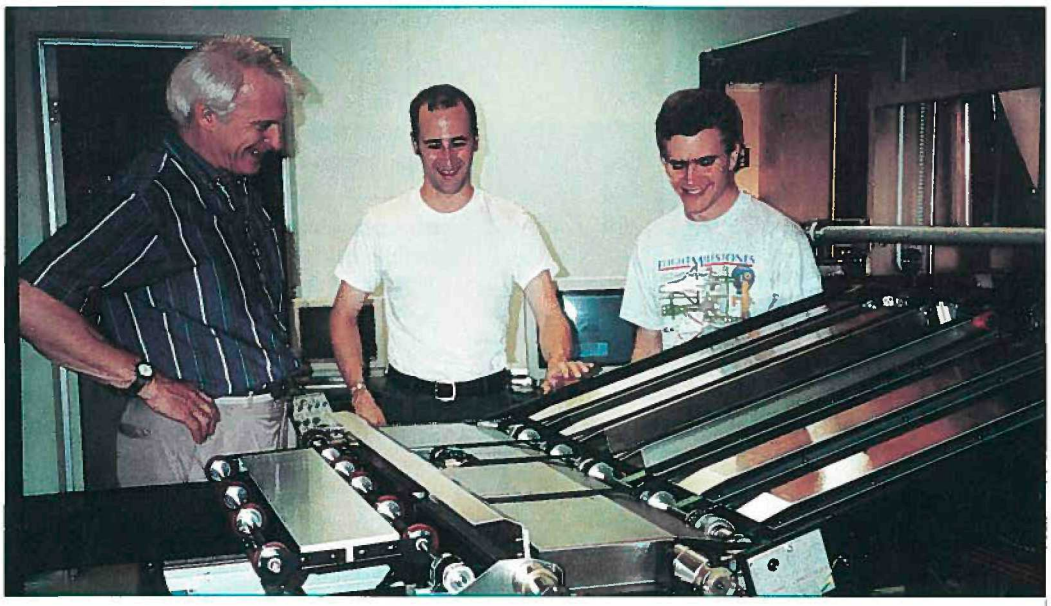
UBC science and engineering co-op students receive training in job skills, course material... and life.

■ One of the earliest forms of university-industry collaboration in a researcher's life may well be experience in a co-operative education program. UBC has strong co-operative education programs in many of the engineering and science disciplines, and these programs benefit participating students, companies and faculty alike.

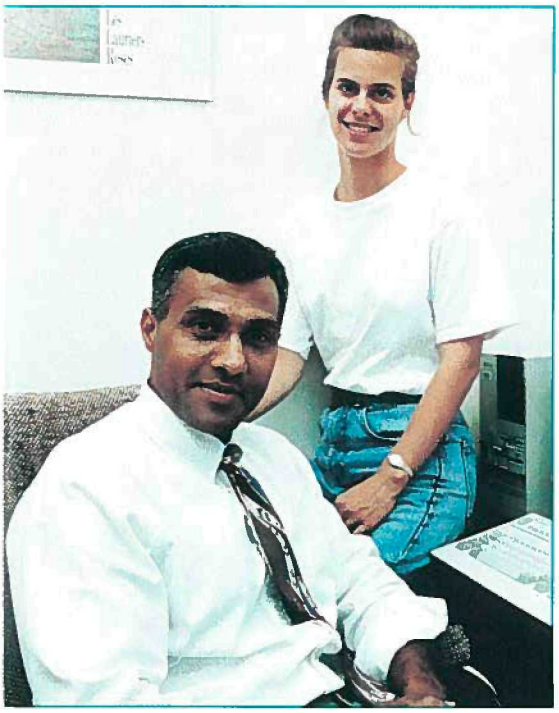
According to Doug Chivers, the Mechanical and Civil Engineering Programs Coordinator, there are more than 1,600 companies from around the world participating in the co-op program. The companies cover the complete spectrum, from large multinational firms to small start-ups.

Chivers tries to encourage his co-op students to work for as many different types of companies as possible, so they have a clear idea what they want before they graduate and move into the work force. Stephanie Moroz is an engineering physics co-op student now working at TRIUMF. She said, "I definitely wanted to experience working at different places before graduating." In a sense, she says, co-op is more than simply an academic education — it's also an education in life: in getting a job, living on your own, and learning to function in a work environment.

For the companies, the co-op program provides access to skilled employees for projects of short duration, and provides an excellent, risk-free means for them to try out and recruit new staff. According to Chivers, it's not uncommon for co-op students to be hired after graduation by companies they worked for while in the co-op program.



From left: Doug Chivers, Co-op Coordinator with co-op students Michael Procter and Chris Waterman.



Javed Iqbal with Engineering Physics co-op student Stephanie Moroz.

Co-op at UBC has almost 200 engineering students, and about 130 science students. The co-op disciplines include chemical, civil, electrical, and mechanical engineering as well as engineering physics, computer science, and physics. New co-op programs are being established in statistics, microbiology/biotechnology and metals and materials engineering.

According to Javed Iqbal, Science and Engineering Physics Programs Co-ordinator, "We don't have co-op programs in all the sciences, but we're slowly bringing them on board." He'd like to see students in all scientific disciplines have access to a co-op education.

Mike Procter and Chris Waterman are two of five UBC co-op students currently working at CREO Products in Burnaby, which is the first company in the world to develop a direct-to-plate imagesetter for the printing industry. Waterman, an electrical engineering student, said he felt lucky to be at CREO at a time when he could become involved in such world-leading research. He is doing two work terms at CREO, spending eight consecutive months at the company.

Procter, a mechanical engineering student, says there's a huge amount of knowledge he's picking up at CREO that he simply couldn't learn in the classroom — things like machining skills, knowing where to find components, and interpersonal skills. "Experience is half the battle," he said. "And it sure beats waiting on tables." Co-op students all say they find it very gratifying to be working in jobs that are directly related to their studies, rather than doing work during the summer that requires little skill or training.

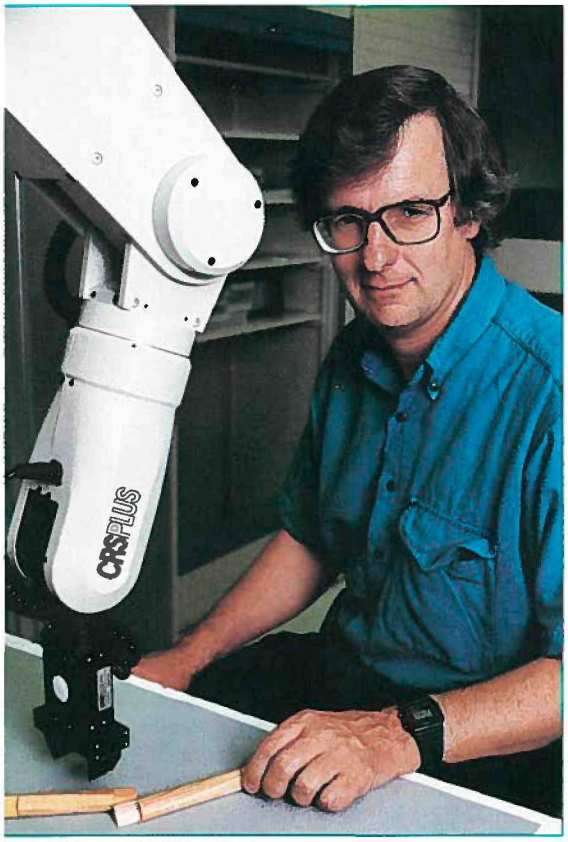
The co-op program provides students with real-world experience, so that by the time they graduate, they have a clear idea what kind of work they can do, given their education. "They are able to make an informed choice about what they want to do," said Iqbal. "Co-op can also make students more motivated."

As the students in the co-op program discover, there is more than one way to learn science and engineering concepts. "You can gain valuable knowledge working in industry, which complements classroom education," Iqbal points out. "Traditionally, in North America, the education system has focused on classroom-based learning, with less emphasis on work-based learning, but things are changing." There is now increasing emphasis on practical, hands-on education as well.

The UBC co-op co-ordinators, participating companies and students would all agree that this is a good thing. ■

IRIS Network Builds Better Robots

The Institute for Robotics and Intelligent Systems (IRIS) is developing the next generation of intelligent systems — robots that will work in unpredictable environments.



Dr. Alan Mackworth, with one of the many robots developed as part of the IRIS network.

■ The world of robotics is changing. Early robots were designed to work in very specific, and very controlled environments. But the real world isn't predictable, and the design of robotic devices to work in the real world requires a whole new approach.

CICSR member Dr. Alan Mackworth of the Department of Computer Science leads a research project that will help to solve some of the complex problems associated with developing robots that can react to their environment, even when it's changing in unpredictable ways. The project, called Constraint-Based Visual Robotic Systems, is part of the larger project within the Institute for Robotics and Intelligent Systems (IRIS).

IRIS is one of the ten Networks of Centres of Excellence (NCE) that has made it to the second phase. UBC researchers involved in the network will receive a total of $3.3 million over the next four years to develop the robotic systems of the future. IRIS is divided into five main project themes: intelligent computation, machine sensing, human-machine interfaces, advanced medical devices, and integrated systems in dynamic environments (ISDE).

ISDE, the theme which Mackworth's project falls into, is a key area within IRIS because its role is to find ways to integrate the various technologies and find ways to make them work well together in complex robotic systems. According to Mackworth, IRIS is a very diverse research network, which includes researchers with very different views about robotic systems. Mackworth views this diversity as a very good thing. "The integration of the various technologies — including artificial intelligence and engineering-based control systems — is causing us to change our scientific views," said Mackworth.

One of the basic things that's changed within IRIS as a result of the past few years of research is the approach taken to developing robotic systems. The widely-accepted definition of a robot is a system with a front end that perceives its world, a reasoning part that plans its actions, and an active, mechanical part that carries out a task. "In the first phase of IRIS, we carried out research into those three categories, but there were not projects to integrate the systems. Phase two of IRIS will take an integrated systems approach."

The objective of Mackworth's specific project is to develop new techniques for responsive vision on mobile platforms in dynamic environments. The researchers, Jim Little, David Lowe, Dinesh Pai, Robert Woodham and Mackworth plan to deliver practical tools for building constraint-based visual robotic systems. Vision systems for monitoring and controlling the robot plant and the environment will be built for various testbed platforms, including visual telerobotic control on machines currently used in the resource and construction industries. Other areas of research will include 3-D vision, real-time systems integration software, new techniques for deformable surface visual interpretation, a symmetrical vision platform, and the development of complete, integrated constraint-based visual robotic systems in several realistic dynamic environments.

As part of the project proposal, Mackworth provided considerable detail on the potential economic impact of the research, a key factor NCE considered in its renewal of funding. In terms of industrial collaboration, the project team plans to work with several companies that have an interest in various aspects of robotic systems. For example, the team will work with Kinetic Sciences of Vancouver to develop real-time vision systems for application to space and terrestrial robots. They will also interact with MacMillan Bloedel Research, Spar Aerospace and RSI Research through their collaboration with CICSR member Peter Lawrence's project on Partial Autonomy on Mobile Machines. Mackworth and his team also work with CRS Plus of Hamilton, Ontario, Xerox PARC, Traquair Data Systems, Cognitiative Systems, and International Submarine Engineering of Port Coquitlam, B.C.

"As part of our proposal, we were required to get industrial support," said Mackworth. This support will become more important to the project as it progresses, because NCE funding levels drop in the final two years, and the team is expected to make up the shortfall through contributions from industry. In the first two years, NCE will provide UBC IRIS researchers with more than $900,000 per year; in the last two years, funding is about $750,000 per year.

Mackworth is one of several UBC researchers involved in the IRIS network. Other participants include: Peter Lawrence of Electrical Engineering, who heads the project within ISDE on partial autonomy in mobile machines; Tim Salcudean of Electrical Engineering, who is working on medical and micro robots in the Advanced Medical Devices area; Max Cynader, who is developing an effective display system for teleoperator control of remote environments; and Robert Woodham of Computer Science, who is heading a project to develop content-based analysis and abstraction for visual information management.

All of these projects, along with those being tackled by researchers in other universities and within research institutions and companies across Canada as part of IRIS, combine to advance the capabilities of robotic systems, and to enable these systems to work more autonomously, and in dynamic environments. This research will help bring robots into the real world, and will vastly increase the ways they can be put to work within industry. ■

ASI: Institute Without Walls

A closer look at the B.C. Advanced Systems Institute

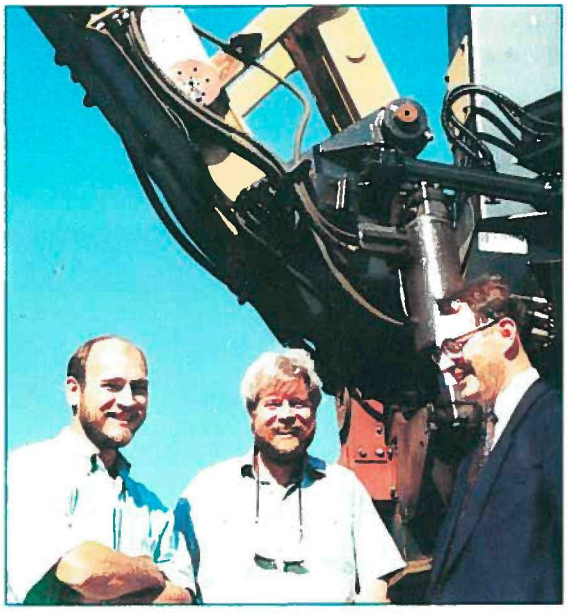
■ One of the major catalysts for university-industry research within B.C. is the B.C. Advanced Systems Institute (ASI). ASI has a number of programs, all of which are aimed, directly or indirectly, at fostering increased collaboration between university researchers and industry.

The program CICSR has the greatest involvement in is the Fellowship Program. Currently UBC has 15 ASI fellows. All fellows are CICSR members working with industry. ASI has spent some $2.7 million to support the research of UBC Fellows, but ASI executive director Brent Sauder strongly states that ASI should not be viewed as a funding body.

"We should be viewed as facilitators in bringing researchers and industry together," said Sauder. "We take requirements stated by industry and we put the right teams together to solve their problems."

ASI support often leads to other funding, noted Sauder. A recent study showed that for every ASI dollar spent at UBC, an additional $2.70 was raised from other sources. UBC was found to excel in the use of graduate students and in collaboration with industry.

UBC's 15 current Fellows, include Kellogg Booth, Ian Cumming, Clarence de Silva, Guy Dumont, Alain Fournier, David Forsey, Mark Greenstreet, Andre Ivanov, Nicholas Jaeger, Jeff Joyce, Takis Mathiopoulos, Dinesh Pai, Septimiu Salcudean, Carl Seger and Jack Snoeyink.



ASI executive director Brent Sauder (centre) with Peter Lawrence (r) and Tim Salcudean (l).

To qualify for a Fellowship researchers must be doing excellent research in advanced systems: information systems, telecommunications, microelectronics or robotics. The work must also point towards a current or future solution to an industrial problem.

ASI's mission is "to ensure that advanced systems technologies are developed, commercialized and used to aid in the growth of B.C.'s economy. The mission is achieved by providing solutions to industry's current and future technical needs by facilitating interactions between industry and post-secondary institutions. ASI is an institute without walls in that its research programs are conducted at the most appropriate site, be that in industry or at a campus."

In addition to the Fellowship program, ASI has a number of other programs to help it realize its mission. One that CICSR members are taking advantage of the Industrial Partnership Program. This program is for companies that need university research assistance on a problem that can be solved in less than a year. ASI provides the contacts and 50 percent of the required funding.

Another program, the Industrial Fellowship Program, has enabled CICSR's Jeff Joyce to work at Hughes Aircraft investigating possible applications of formal specification techniques. Farrokh Sassani is a recent addition to the Industrial Fellowship roster.

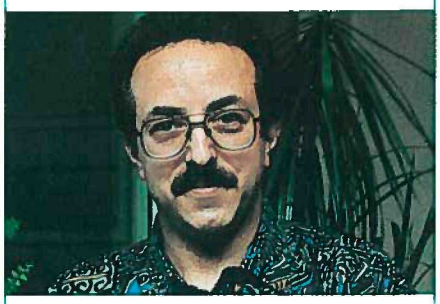
ASI also has programs in place for longer-term projects with advanced systems. Focusing on multi-year projects, these programs share the attributes common to other ASI programs: they are industry-driven and promote personal contact between industry and academic staff.

Other programs, not directly tied to university researchers, but often linked, include the ASI Affiliate Program, aimed at companies that want to benefit from the work of ASI, and the Product Development Fund, which provides development funds for advanced systems projects in the final commercialization stage. As well, ASI's industry-driven Focus Fellowship Program has provided $105,000 in support to the E-GEMS project involving UBC researchers.

ASI is funded by the B.C. Ministry of Employment and Investment, and by its industry partners. Its lean organizational structure consists of an executive director and a staff of two. But this small group has been able to accomplish big things in terms of university-industry collaboration. ■

PASSING NOTES

■ The National Research Council and UBC have established a new institute at UBC. The Institute of Machinery Research (IMR) develops technical solutions to machinery design, operation and maintenance problems faced by Canadian Industry, and will support collaboration in machinery research by NRC, UBC and industry. ■



■ Mechanical Engineering professor Farrokh Sassani has been awarded a Visiting Industrial Fellowship from the B.C. Advanced Systems Institute. His fellowship is in collaboration with DynaMotive Canada Corporation of Vancouver. Sassani is working on the design of a computer integrated steel rod handling system and controls for an innovative continuous electrolytic de-scaling process. ■

■ Science Council of B.C. has announced that funding for its Technology B.C. program has been increased to $6.5 million from $4.3 million.

Tech B.C. provides funding to both university and company-based research, but an industrial component is required for funding. The program has funded the research of several CICSR members, including, most recently, the work of Ian Yellowley, Tim Salcudean and Cyril Leung. ■

■ Faculty of Commerce and Business Administration, MIS Division faculty members Izak Benbasat and Robert Goldstein will chair the 15th Annual International Conference on Information Systems to be held December 14-17, 1994 in Vancouver.

The theme for ICIS '94 is *Improving Productivity and Adding Value Through Information Systems*. Over 900 faculty members from around the world are expected to attend. ■

C•A•L•E•N•D•A•R

CICSR Faculty Forum 1994/95

In this second annual Faculty Forum, six CICSR members present and discuss their ground-breaking research in integrated computer systems.

September 29, 1994
Teleoperation with Force Feedback: Design and Applications
Tim Salcudean
Department of Electrical Engineering

October 20, 1994
Intelligent Machines in Real and Virtual Worlds
Dinesh Pai
Department of Computer Science

November 17, 1994
Automation Intelligence
Clarence de Silva
Department of Mechanical Engineering

January 19, 1995
Empirical Investigations of the Determinants and Consequences of the Use of Explanations in Knowledge-Based Systems
Izak Benbasat
Faculty of Commerce and Business Administration

February 16, 1995
Monitoring and Improving Television Picture Quality
Rabab Ward
Department of Electrical Engineering

March 16, 1995
High-Speed Networks: Multimedia File Servers and Protocols
Gerald Neufeld
Department of Computer Science

CICSR Faculty Forum For 1994-1995
The CICSR Faculty Forum was created to provide local researchers and industry with an opportunity to find out more about the world-class research in integrated computer systems being performed at the University of B.C. by CICSR Faculty.

Join Us For a Closer Look at the Integrated Systems Research Being Performed by UBC's World-Class Researchers

Talks will be held from 4:00 to 5:30 pm in the new CICSR/CS Building, Room 208, 2366 Main Mall, UBC. Lectures are complimentary.

This sculpture, by Dr. Jack Snoeyink, with help from graduate students, will be hung in the CICSR/CS atrium. The design comes from a mathematical theorem about the difficulty of three-dimensional geometric assembly problems.

Distinguished Lecture Series 1994-95 Window to the Future

Six academic and industrial leaders address the changing face of human-computer interaction.

September 22, 1994
User Interfaces for information visualization dashboards and roadmaps for the Information Superhighway
Dr. Ben Shneiderman
University of Maryland

October 13, 1994
Groupwork and Groupware: How the process and product of real-time group work changes with shared workspaces and long-distance connectivity.
Dr. Judith Olson
University of Michigan

November 10, 1994
Collaborative Multimedia and Multimedia for Collaboration
Dr. Ronald Baecker
University of Toronto

January 12, 1995
Continual Improvement Software: A Case for Progressive Problem Solving
Dr. Marlene Scardamalia
Ontario Institute for Studies in Education

February 9, 1995
Work-Oriented System Design
Dr. Lucy Suchman
Xerox Palo Alto Research Center

March 9, 1995
"Being There" in Virtual Space
Dr. Thomas Furness
University of Washington

CICSR is hosting its sixth annual Distinguished Lecture Series, bringing in academic and industrial leaders in the forefront of their respective fields.

This year, DLS speakers will be discussing the changing human-computer interface, and looking at new ways individuals and groups interact with computers to access information, solve problems and more.

Join us for a Glimpse of the Future of Human-Computer Interaction

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CICSR:

The UBC Centre for Integrated Computer Systems Research (CICSR) is an interdepartmental research organization made up of computer-related research faculty members in the Departments of Computer Science, Electrical Engineering and Mechanical Engineering. Currently there are more than 60 CICSR researchers which direct over 200 graduate students and collaborate with dozens of industrial firms in areas such as robotics, artificial intelligence, communications, VLSI design and industrial automation.

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EDITOR: Leslie Ellis
Office: 289-2366 Main Mall,
Vancouver, B.C. V6T 1Z4
Tel: (604) 822-6894, fax: (604) 822-9013
Contact: Margy de Vries

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