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# News release

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# Information technology to boost efficiency of traditional oil sands mining with new $4.9 million Industry Chair

EDMONTON — A new research program to make oil sands mining methods safer and more efficient, is being launched today at an event with Minister of Innovation and Science Victor Doerksen.

"When the energy sector and the information technology sector come together to increase productivity, reduce impact on the environment, and improve safety, you know it is a winning combination for Alberta and Canada," says Anne McLellan, Deputy Prime Minister, Minister of Public Safety and Emergency Preparedness, and Member of Parliament for Edmonton West.

"This is an exciting example of how Alberta's culture of innovation is helping improve our ability to tap a core resource in the most optimal way – for the workers involved, for the environment we cherish, and for the stakeholders in the company," Minister Doerksen said. "Information technology research can foster innovation in many sectors, and the use of technology with the oil industry assists in meeting the Alberta government's commitment to environmental protection, and work place safety."

The research team will be led by Dr Hong Zhang, a professor at the University of Alberta in the department of computing science. He has been awarded an NSERC/iCORE Syncrude/Matrikon Industrial Research Chair in Intelligent Sensing Systems, valued at $4.9 million over five years.

Several challenges in oil sands mining will be tackled by using information and communications technologies to remotely monitor and improve the performance of oils sands operations. A five megabits-per-second optical network will stream live video footage from the Syncrude mine in Fort McMurray into a lab on the third floor of Athabasca Hall at the University of Alberta. There, researchers will analyze oil sands fragments to develop accurate measurement of their sizes so that equipment can be improved to produce less waste. Modelling of other mining activities to improve efficiency are also planned. The remote monitoring of equipment will also identify problems before they occur. Jams in the equipment, caused by large fragments, can put someone's life at risk if they have to climb onto the massive machines.

The research project is funded by the Alberta Government, through the Alberta Informatics Circle of Research Excellence (iCORE) for $150,000 per year for 5 years, for a total of $750,000. This represents roughly 15 percent of the total budget. NSERC, which now operates under the new name of Science and Engineering Research Canada, also is contributing $800,000. The University of Alberta is contributing $100,000 in cash and $800,000 in kind. There are two private companies involved in the creation of this initiative. Syncrude is contributing $500,000 in cash and $1.35 million in kind. Matrikon is contributing $250,000 in cash and $350,000 in kind.

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**NOTE to EDITORS: Backgrounder attached. For more information, contact:**

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# Dr Hong Zhang

## Background: New role of technology in oil sands mining methods

The oil sands industry is a pillar of the resource sector of Alberta's economy. With more than 300 billion barrels of recoverable bitumen in northern Alberta, the oil sands industry plays an increasingly important role in Alberta's economy as well as Canada's future energy supply.

Oil sands mining is completely different from, and substantially more difficult than, drilling for conventional oil. This has given rise to extensive research aimed at increasing production, reducing unit cost, and minimizing environmental impact. Syncrude has been a leader in oil sands research. A cornerstone of its technological innovations is the use of trucks and shovels, in place of draglines and bucketwheels, to transport oil sands ore to crushers. This truck and shovel system, coupled with hydrotransport technology (in which oil sand is mixed with hot water into a slurry and pumped via pipelines to the extraction plant kilometers away), significantly improves the energy efficiency in oil sands mining by conditioning oil sand during its transportation before the extraction process. Because of its advantages, trucks and shovels have become the industry standard, adopted by not only Syncrude but also other major oil sands producers such as Suncor and Shell Canada.

The change in mining methods from dragline and bucketwheel of the 1970s to today's shovel and truck operation has resulted in a tighter coupling between the mining and extraction processes. With dragline mining, a four-day buffer existed between the mining and extraction of oil from the sands. With the current shovel and truck mining methods a 20-minute buffer exists. Decisions on mining operations now have a more immediate impact on downstream extraction operations. Critical to this decision process is the timely delivery of key performance indicators, many of which are currently missing. For example, ore size could not be optimized without a direct means of measuring the size distributions of oil sand fragments. The new crushing equipment is also sensitive to tramp metal entering the system, and its detection and control has become a major issue. Winter operation in an oil sand mine is difficult because of the increasing number of large frozen oil sand lumps that plug the crushing equipment. A common need stemming from all these issues is new sensing technologies to measure the additional performance indicators (ore size, tramp metal, large lumps and others) required for optimization.

Oil sand mining has a huge environmental footprint in terms of the energy used and land disturbed to mine the oil-rich ore. With the increased activity there is a desire by the industry to reduce the energy (and therefore $CO^2$ emissions) used per unit of production, and to increase efficiency thereby minimizing annual land disturbance to match reclamation rates. An optimized mining process will help reduce not only per unit cost of oil production but also its environmental impact.

Although traditionally viewed as a low-tech sunset industry, surface mining in Alberta has begun to embrace the potential benefits that information and communications technology has to offer. GPS and wireless communications are currently being used to gather data from mobile mining equipment. Wireless desktops for haul truck drivers have been examined in trial pilot studies. Fiber optic and ATM communication networks bring data and live video information from the pit floors in Fort McMurray mines to support research in laboratories in Edmonton, allowing researchers to measure the ore size of conveyed oil sands 500 kilometres away. It is with such communications technologies that ICT researchers in Edmonton can remotely investigate potential applications of machine vision and integrated

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sensing techniques to the problems of monitoring the health and performance of oil sand mining equipment. Advanced communication technologies have narrowed the gap between mine sites and the operation's decision makers as well as allowing researchers access to operational data with near real-time performance.

## Research Program Overview

This research, supported directly by Syncrude Canada, and Matrikon (an Edmonton-based information technology company) addresses several major challenges in oil sands mining, namely, accurate measurement of the sizes of oil sand fragments, real-time monitoring of mining equipment, and analytical modeling of mining activities. Effective solutions to these issues will allow the oil sands industry to characterize the performance of material sizing equipment, and optimize production by reducing rejects, increasing throughput, and lessening the environment impact of oil sand mining.

To address the issue of size analysis of oil sand ore, research will be conducted in three directions: image analysis using mathematical morphology (both intensity and range), ore size analysis algorithms using mathematical transformations, and sensor data fusion. For equipment monitoring, the focus will be on the applications of monitoring shovel toothline, oil sand screens, and major metal structures, and solutions that make use of computer vision and range sensing techniques. On activity modeling, the team will attempt to establish characteristics of mining equipment (crushers and screens) in relation to their operating conditions.

Most of the research activities will be performed in the newly created Centre for Intelligent Mining Systems (CIMS) at the University of Alberta, a 100 square meter facility with the necessary sensing, video, and computing equipment. Notable among the facilities is Dirt TV, which is a live video feed that can stream images from any one of 12 in-field cameras, carried on a dedicated fiber-optic link from Syncrude's North Mine to the CIMS Laboratory.

## Biographical Information

Dr. Hong Zhang is a tenured full professor in the Department of Computing Science at the University of Alberta, and the Director of the Centre for Intelligent Mining Systems (CIMS). His research include significant work in robotics and its applications, as well the development of intelligent sensing systems. He has published extensively on robotics and machine sensing, and served as the program chair of major international conferences in the area. He currently chairs the technical committee on Robotics and Manufacturing Automation of the IEEE Systems, Man, and Cybernetics (SMC) Society, and is an associate editor of the IEEE Transactions on SMC. He is a winner of the IEEE Millennium Medal, a winner of the Faculty of Science Award for Excellent Teaching in 2002, and a co-winner of the Best Student Paper Award of the 16th International Conference on Vision Interface in 2003. He is serving as the Program Chair of the 2005 IEEE/RSJ International Conference on Robotics and Intelligent Systems, to be held in Edmonton, in August 2005.

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## Research Team

A team of 10 researchers will be involved in this research. Dr Zhang, as chair, will continue to serve as the Director of CIMS, and assume the leadership role of the overall research program with close and continuous consultation with the industrial partners. A junior chair will share workload with the chair by supervising or co-supervising post-doctoral fellows, international visitors, and students. Assisting the chairs will be a laboratory manager, two research associates with PhD research experience. Full-time CIMS research staff members will also include two research programmers. To adapt the software developed in CIMS to industrial settings at Syncrude and Matrikon, one of the research programmers will have experience with Matrikon's software platforms. Three graduate students, at either the MSc or PhD level, will be involved in specific research projects. In addition, two undergraduate students will be hired part-time in the fall and winter terms and full-time during the summer. Finally, visiting researchers, usually from China and Japan will be placed in various projects.

For more information, contact Dr Hong Zhang at zhang@cs.ualberta.ca.

## Collaborators

*University researchers*
Within the department of computing science, expertise and interest exist among several faculty members who will be important collaborators, including Martin Jagersand, Vadim Bulitko, Russ Greiner, and Dale Schuurmans. Outside computing science, several other faculty members at University of Alberta work closely with Syncrude, in particular, Fraser Forbes in chemical engineering, Dwayne Tannant in mining and petroleum engineering, and Mingjian Zuo of mechanical engineering. Finally, contact with international experts in mining automation, such as CSIRO in Australia, will be established to share ideas and results and catalyze the research progress.

*Syncrude*
Dr Ron Kube at Syncrude research in Edmonton will serve as the liaison between CIMS activities and Syncrude and provide all the necessary field support and context in order for the research to be grounded and practical. His continuous feedback will be critical to the success of all CIMS projects. In addition, he will work with Matrikon to transfer the technologies developed at the University of Alberta's CIMS laboratory to Syncrude as well as other oil sands companies in general.

*Matrikon*
Dr Mark Polak will represent Matrikon in this partnership. Mark will manage technical resource and functional application requirements to ensure the product meets the need of potential clients. Matrikon will contribute application deployment platforms – ProcessMonitor and ProcessNet software – to enable the embedding of the image analysis and ore-size analysis algorithms, and to provide seamless integration with industrial databases, historians and control systems. Matrikon staff will continually enhance, support and evolve the features of these products, working closely with the University of Alberta and Syncrude to ensure a robust software development path for transitioning core technology research results into efficient industrial software.

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## Funding partners

*About Syncrude*
Syncrude Canada Ltd. is the world's largest producer of crude oil from oil sands and the largest single source producer in Canada. It currently supplies 13 percent of the nation's petroleum requirements. It operates a large oil sand mine, utilities plant, bitumen extraction plant and upgrading facility that processes bitumen and produces light, sweet crude oil for domestic consumption and export. Corporate headquarters are located in Fort McMurray. Its Mildred Lake facility is 40 kilometres north of the city, and Aurora project located an additional 35 kilometres north of Mildred Lake. All operations are found on the Athabasca Oil Sands Deposit. It provides jobs for 14,000 people directly and indirectly across Canada. It is one of the largest private sector employers in Alberta, employing approximately 4,000 people directly and an average of 1,000-1,500 maintenance contractor employees. It is the largest industrial employer of Aboriginal people in Canada. Syncrude spends more than $30 million annually on research and development. It also operates one of the largest private-sector research programs in western Canada and is one of the top 50 R & D spenders in Canada. For more information, visit www.syncrude.com.

*About Matrikon*
Founded in 1988, Matrikon’s core business is industrial information technology solutions. It is a leading provider of industrial information technology solutions to a broad industrial client base, which includes industry leaders in oil and gas, chemicals, energy and utilities, forestry, mining and numerous other manufacturing sectors. The company has a tradition of growth and profitability, a growing international presence and expanding market share with potential for sustained growth. It has a blue chip client base, acquisition and integration ability, no debt and a diverse and growing line of products and services. Its shares trade on the Toronto Stock Exchange (MTK). For more information, visit www.matrikon.com.

*About iCORE*
The mission of the Alberta Informatics Circle of Research Excellence (iCORE) is to attract and grow a critical mass of exceptional researchers in the field of informatics, that is, areas of computer science, electrical and computer engineering, physics, mathematics and other disciplines related to information and communications technology (ICT). iCORE was established in October 1999 by the Government of Alberta to foster world-class university-based research that supports the ICT sector. This investment stems from a belief that strong fundamental research is at the core of a healthy economic sector, and that ICT research warrants special attention as an engine for innovation. This in turn creates social, cultural and economic advantages for Albertans. For more information, visit www.icore.ca.

*About NSERC*
NSERC's role is to make investments in people, discovery and innovation for the benefit of all Canadians. It supports more than 17,700 university students and postdoctoral fellows in their advanced studies, funds more than 9,600 university professors every year and stimulates innovation by encouraging more than 500 Canadian companies to invest in university research. This year, NSERC will invest $850 million in university-based research and training in all the natural sciences and engineering.
For more information, visit www.nserc.ca.