



Researchers take unmanned aircraft to new heights



Suleman (left) and Richards with an UAV.

The University of Victoria is helping Vancouver Island position itself at the leading edge of an emerging aerospace industry here in British Columbia. UVic's new Centre for Aerospace Research, near Victoria International Airport, will be producing from the ground up—including conceptualization, design, manufacture, testing, operation and monitoring—an airframe fleet or "family" of UAVs (Unmanned Air Vehicles).

The new centre near Sidney, BC will be led by aerospace engineer and centre director Prof. Afzal Suleman of the Department of Mechanical Engineering and, in addition to two colleagues, also includes 10 undergraduate students and five graduate students, including PhD candidate and centre manager Jenner Richards. The undergraduate student Aero Club on campus will also play a role in the development of these airframes.

The UVic UAVs will have a broad range of purposes primarily focused on commercial and industrial applications, including port security, civil disaster response, search and rescue, forest firefighting, coastal patrol, agricultural crop monitoring and aerial mapping. These autonomous aircraft can be remotely flown and monitored from a mobile ground control station located up to two kilometres from the flying plane. Civilian UAV commercial use is currently in the embryonic stage in North America, and there is a

substantial gap between hobby-grade aircraft used for recreational purposes and prohibitively expensive systems geared specifically for government and military purposes.

The UAVs have exciting potential for use in agriculture. "They allow us to check whether, for example, it's the right time to pick a particular crop," says Suleman. He uses the example of aerial mapping of a vineyard, "Usually this type of work is done manually at a high cost. We can do it in a day or two." The UAV would follow a pre-determined route approximately 500 metres above the ground. A high-definition camera is housed in the belly or undercarriage.

He also points out another goal is "to increase safety. Hydro workers won't have to conduct dangerous flights around powerlines, taking pictures from helicopters." The UAVs can stay up in the air for 30 hours or more, can be back up in the air quickly between operations and have significantly smaller environmental impacts.

The UVic research will be focusing on green technology, such as potentially using electric engines and hydrogen fuel cells. The new inventions and industrial patents, filed with assistance from UVic Industry Partnerships, will be made available for licensing to industry.

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MESSAGE FROM THE DEAN



The 2012–2013 academic year marks the University of Victoria's 50th Anniversary and the Faculty of Engineering's 30th Anniversary. As you will see from the stories highlighted in this newsletter, we have a great deal to celebrate! UVic placed first in Canada (and 11th in the world)

among universities under 50 years of age in the *Times Higher Education's* 100-under-50 rankings. As alumni, I encourage you to join in our celebrations by following our news at www.uvic.ca/engineering and by participating in 50th Anniversary events taking place all year long.

Our EngineRing newsletter features outstanding members of our alumni community who are active in industry, academia, and beyond. One such alumnus, Geoff Kabush (BEng Mechanical 2003), competed in the Olympics this summer, placing 8th in Men's Cross-country Mountain Biking. Our inaugural Homecoming Weekend was held September 28-29, bringing together past students, staff, and faculty to commemorate UVic's 50 years of excellence.

As a Faculty, we are looking forward to January 2013, when Victoria will welcome over 200 students from 12 schools across Canada to compete in the Western Engineering Conference. This event offers a wonderful opportunity for our students to exhibit their skills and network with industry, alumni and peers from other universities.

The Minister of Advanced Education has given approval for a Civil Engineering program that will begin accepting students into 2nd year program-specific courses next September. The worldwide effort to achieve carbon neutrality, solve critical water quality issues, improve environmental stewardship and rebuild aging infrastructure is driving labor-market demand for civil engineers. This new degree will integrate principles of sustainability to meet the challenges of a low-carbon society.

Our new Biomedical Engineering program has exceeded our target enrollment and students are currently on campus pursuing their degrees. The QS World University Rankings placed our Electrical and Computer Engineering department 5th in Canada (up from 8th in 2011) and in the top 100-150 globally out of the top 700 universities selected (out of a pool of more than 7,000 worldwide.) We are pleased to have another big increase in first year admissions in 2012, to the point where we are pushing the limits of our capacity.

Tom Tiedje
Ph.D., FRSC, PEng.



Homecoming Weekend!

On September 28–29, UVic celebrated its 50th Anniversary with a community festival and the inaugural Alumni Homecoming. The jam-packed schedule of events included "Ideas that will change the world" presentations from Engineering alumni and faculty, Vikes athletic games, a KidZone, live music, open house tours, alumni presentations, a reunion dinner, retro dance party and more!

Established in 1963, UVic has grown to become a leading research-intensive institution with alumni making a difference around the world. Join UVic's 50th Anniversary celebrations! Events, activities and projects are running year long from September 2012 to June 2013—www.uvic.ca/anniversary.



Alumni Andrew Cripps (MAsc 1987) proudly displays his old student ID during the Engineering & Computer Science pancake breakfast at Homecoming.

Subatomic views:

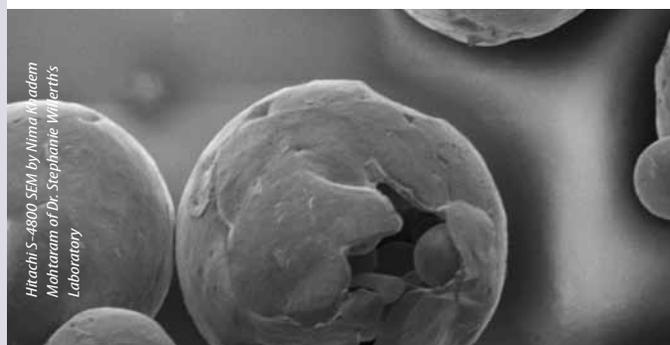
World's most advanced microscope arrives at UVic

The University of Victoria is now home to the most powerful microscope ever built. On May 22, the 7-tonne, 4.5-metre tall Scanning Transmission Electron Holography Microscope (STEM) arrived on campus in 22 pieces. The STEM is a one-of-a-kind machine built for UVic in Japan by Hitachi High Technologies Canada and is the highest-resolution microscope in the world.

Unlike conventional microscopes, which use light to peer at specimens, the STEM uses an electron beam and holography techniques to observe the inside of materials and their surfaces to an expected resolution smaller than the size of an atom. The STEM will see materials beyond the nanoscale to the picoscale. A nanometer is one-billionth of a metre, while a picometre is one-trillionth of a metre. Atoms are typically between 62 and 520 picometres in diameter.

"This machine will be used for thousands of different types of research by scientists from around the world, who are already lining up to use it," says Rodney Herring, a professor of mechanical engineering and director of UVic's Advanced Microscopy Facility. "This microscope will open up a hidden world and gives UVic a research capability that no other institution has."

Engineers, physicists, chemists, biologists and medical researchers will use the STEM to better understand subatomic structures relevant to areas such as medical and environmental diagnostics, communications, computers, alternative energy and manufacturing. The STEM is expected to be operational by this fall.



Hitachi S-4800 SEM by Nimra K. Adem Maharam or Dr. Stephanie Willett's Laboratory

UVic researchers isolate an individual protein-loaded polymer microsphere designed for encapsulated release of proteins as a novel device of drug delivery. The image shown is 200 nanometers, while the STEM will give access to the atomic scale of picometers.

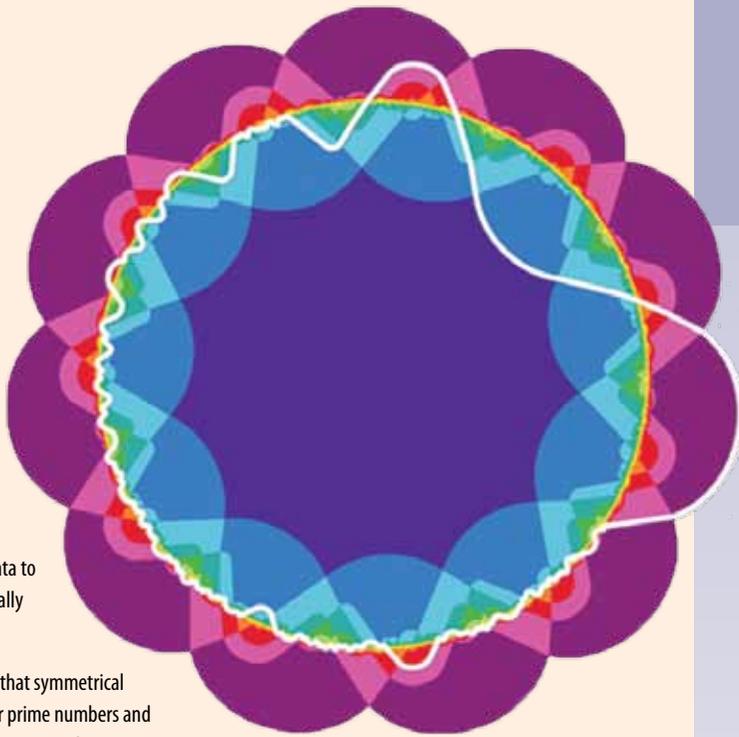
Blooming discovery

It may look like a flower, but hidden within these colours and swirls hides layers of complicated data. While most of us are familiar with Venn diagrams that show relationships between two-to-three sets of data using overlapping circles, a breakthrough by two UVic researchers provides the first Venn that allows 11 sets of data to be combined – in an esthetically pleasing layout.

Mathematicians have proven that symmetrical diagrams are possible only for prime numbers and for simplicity's sake, the diagrams must have no more than two curves crossing at any point. It sounds straightforward, but it was problem that had eluded researchers since the 1960s. Previous attempts to produce complicated diagrams resulted in images so distorted that they were too elaborate to be useful.

Dr. Frank Ruskey and grad student Khalegh Mamakani of the Department of Computer Science uncovered the new design by using a computer simulation to generate a host of diagrams. By using mathematical results to limit the search to a space of potential solutions, they were able to concentrate on a smaller pool than what previous researchers had employed. Of course, there were no guarantees that what they were looking for even existed. "After searching for them for so long, the big surprise was to find one at all," says Ruskey.

"I think that it is fair to say that a certain amount of luck was involved, as is often the case in scientific research," says Ruskey. The team's discovery will allow for more visually simplistic, logical comparisons between complicated data groups. Let's hope luck is on their side again as the search for a 13-set Venn begins.



Different colours represent the different overlapping areas of data.

Online tool soothes rental woes

Are you in a mad scramble to find rental accommodation in Victoria's tight real estate market? Help is at hand. A new online map tool, created through UVic's Computer Human Interaction Software Engineering Lab (CHISEL) group by Computer Science PhD students Jamie Starke and Lars Grammel, is aimed at helping people looking for rentals in Victoria find the right place to live.

The pair, who work on creating online tools that gather data in a visual and user-friendly format, have produced a mapping application that allows users to compare property locations and accessibility to transit routes, while allowing them to conveniently get rental details with just the click of a mouse.

"When I was looking to rent a place here, I was frustrated by the amount of time I had to spend talking to property management companies to make sure I was aware of everything on the market," says Starke. "Then I had to look at a map and sort out whether the location works for me. That's when I decided to take matters in my own hands and create something that would allow users to do both easily and in one online location."



Victoria online rental map: www.bit.ly/vicrentalmap

Researchers patent behavioural biometrics software

UVic researchers have earned US patent approval for a new security technology that can tell who is using a computer by creating a biometric profile based on monitored user behaviors. Tracking keyboard strokes and mouse movements, the system locks out any users who don't meet the behavioural criteria at any point during the session. With ongoing testing of nearly 200 users, the system is now performing with a 98-per cent success rate.

UVic associate professor Dr. Issa Traore explains that "instead of a more traditional biometric system, like retinal or fingerprint recognition, that requires expensive hardware and is limited by users only being able to access the network from a specific computer, our system can be used by anyone from any location."

Traore, who along with his former PhD student Dr. Ahmed Ahmed, spent the last decade bringing their technology solution to market with the support of UVic Industry Partnerships. For Traore this prudent approach helped spur the launch of a company, Plurilock Security Solutions, and an approved US patent. The duo's forward-thinking technology is raising the interest of government and the defense industry.

"If a user is called away from the computer and another user tries to access the system, it will immediately recognize that this is someone else and lock them out." An associate professor in Electrical and Computer Engineering as well as the Coordinator of the Information Security and Object Technology Research Group, Traore led the research that resulted in the innovative security protocol.

"Since my background has been in avionics and defense, I created something that is robust and can be used in very high security environments. Working under such a high standard has helped create a very secure and reliable system," says Traore. "With the number and level of security breaches happening on the Internet these days, there is no such thing, in my opinion, as too much security."



UVic team helping solve arctic mystery

Will this be the year that the great Canadian mystery of the lost ships of Sir John Franklin is solved? Researchers from the University of Victoria were in the Arctic this summer with their autonomous underwater vehicle (AUV) to assist Parks Canada as it continues its search.

Underwater archeologists from Parks Canada have recently spent three field seasons searching for *HMS Erebus* and *HMS Terror*, which disappeared during the British explorer's 1845 mission to chart the Northwest Passage. None of the 129 men on board survived and despite traces of the expedition being found, the ships' final resting place remain unknown. Parks Canada has expanded the scope of its investigation with new partners, vessels and instrumentation to cover a larger area over an approximate four weeks rather than the six days of surveying done in past years.

"This collaboration with Parks Canada offers incredible learning opportunities for graduate students in our lab and also showcases the type of work we're able to do," says Dr. Colin Bradley (PhD Mechanical Engineering 1992), director of the Ocean Technology Lab. UVic's AUV is equipped with a bathymetric side-scan sonar



Colin Bradley and the AUV.

system to gather three-dimensional data about the ocean floor that can be used for charting and to identify items of archeological interest.

Team members spent 12 to 14 hours a day on the water operating the AUV from a 16-foot boat launched daily from a Canadian Coast Guard vessel and a research vessel provided by the Arctic Research Foundation. Other collaborators include the Canadian Hydrographic Service, Canadian Space Agency, Canadian Ice Service, the Government of Nunavut and Environment Canada.

Faculty honours former professor

Decades before climate change and modern energy needs came to wider attention, Dr. David Sanborn Scott laid out a framework for the analysis of energy and sustainability. His vision represented a paradigm shift that has influenced two generations of students, academics, policymakers and entrepreneurs. Recognizing his extraordinary work and the ability to inspire, UVic granted Dr. Scott an honorary degree in Engineering during spring convocation ceremonies in June.

Dr. Scott joined UVic in 1989 and founded the Institute for Integrated Energy Systems, focusing on fuel cell systems, cryofuel liquefaction and energy systems analysis. Today, IESVic includes more than 60 UVic faculty, graduate students and staff. Dr. Scott is currently vice-president (for the Americas) of the International Association for Hydrogen Energy. In 2006, he received the Jules Verne Award for "outstanding contributions to hydrogen physics, hydrogen energy, sociology and philosophy." He is also the author of *Smelling Land: The Hydrogen Defense Against Climate Catastrophe* (2007).

Giving to UVic Engineering

The generous support of donors helps fund student scholarships, equipment, and research. To explore how your gift can make a difference, contact Ms. Jody Kitts, Development Officer at 250-853-3245 or kittsj@uvic.ca.

Alumni Profile

Rob Bennett Bachelor of Computer Science 1983



Like all Computer Science grads, Rob Bennett understands technology. But what sets him apart—and what has helped propel his thriving career in the technology industry—is his ability to understand people.

"To have a successful career most people have to learn to get a long with other people. That's certainly a theme to a lot of the discussions I have—exactly how to do that." In running his own companies, Bennett had to learn how to motivate his team to keep everyone getting along across disciplines.

In his current role as Program Director of VIATeC (Victoria Advanced Technology Council), Bennett has seen Victoria's tech sector double in size in the past decade. Employing more than 13,000 people and generating in excess of \$1.95 billion in annual revenues, advanced technology is Greater Victoria's number one industry. For entrepreneurs looking for success, his first-hand experience is invaluable in various strategic and tactical issues.

Bennett holds one of his core values as the growth and development of other people and is an active participant in various mentorship groups. He frequently lectures and participates in guest panels on campus to provide students with advice, knowing how important it would have been during the early stages of his own career.

"When I went to university there wasn't very much industry collaboration, but I was lucky to have a couple of professors in Computer Science that were actually quite active in the private sector." It was this interaction that excited Bennett in the classroom; how theories and tools could be applied practically to real life situations. Bennett encourages professors to partner with industry leaders to facilitate student engagement and cites the tremendous resource Victoria has within its thriving tech community.

"What I hear most often from business students is that they are looking for a CTO to run the technology side of their business. But over on the engineering side, they say, we need someone to run the business – we need a CEO." Recognizing this gap, several interdisciplinary groups on campus are aimed at bringing people together to collaborate on projects. Engineering Entrepreneurship@UVic has already helped launch two student-run companies, the Innovation Centre for Entrepreneurs (ICE) provides business resources to students in faculties across campus, while the Technology Entrepreneurship Club @UVic invites industry speakers to campus to address students.



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EngineRing is published twice yearly by the Faculty of Engineering to communicate the faculty's goals, strategic direction and activities in order to connect alumni with each other and the university.

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