



Photo: Quentin Mackie

## ANCIENT TECHNOLOGY... MEET THE FUTURE OF UNDERWATER ARCHAEOLOGY

—By Suzanne Ahearne

Using some of the leading technologies in underwater archaeology, Quentin Mackie (anthropology) and Alison Proctor (engineering) may have discovered one of the oldest archaeological finds in Canada: a stone fish weir, a simple and ancient technology used by peoples all over the world to catch migrating fish in rivers. If it were, it would also be the oldest known fish weir in the world.

Right now all they know for sure is that they've discovered a line of basketball-sized rocks on the seafloor but those rocks may well add to the mounting evidence about the ingenuity of an ice age people who lived and thrived on the west coast of Canada while much of Europe was still under ice. It's a tantalizing possibility.

Proctor was the project's technical lead on the research trip to Gwaii Haanas National Park Reserve, at the southern end of the Haida Gwaii archipelago. The marine and terrestrial protected area managed cooperatively by the Government of Canada and the Haida Nation is also the site of most of Mackie's life's work. Supported by Parks Canada, and funds from the Ronald Ramsay Trust, the researchers used the Ocean Technology Lab's autonomous underwater vehicle (AUV) equipped with side-scan sonar to "fly" along the ocean bottom, searching for evidence of ancient habitation, drowned when sea levels rose by as much as 150 metres due to glacial melt at the end of the last ice age.

"Without the AUV, this discovery would have been much more difficult," said Proctor. These locations are too deep for divers and surveying the underwater canyons would have been challenging using a towed side scan system. AUV-mounted sonar collects crystal-clear imagery, which is especially important when looking for small features in the sonar record, she said.

The 3.5-metre long Bluefin Robotics vehicle was purchased in 2010 with grants from Western Economic Diversification and the Canadian Foundation for Innovation and was operated by Colin Bradley, Proctor and a team of UVic engineers during the 2012 search for the Franklin shipwrecks.

If further investigation by a seafloor geologist rules out a natural explanation for this line of boulders 122 metres underwater, the find will also provide further evidence of the human occupation of Haida Gwaii—at a time of extreme environmental change that also coincides with the Time of Transformation from Haida oral history.

That it might be a fish weir is not such a huge inferential leap, Mackie said. As he describes it, "the table was already set." Previous research by himself, Daryl Fedje (assistant professor of anthropology, whose work is funded by the Tula Foundation) and others had already turned up evidence of 12,800 year-old human habitation close by from a time when sea levels were 100 metres lower than today. They had DNA evidence of up to 14,000-year-old salmon and detailed bathymetry (underwater maps) showing a drowned landscape of river systems and areas that could have supported small village sites.

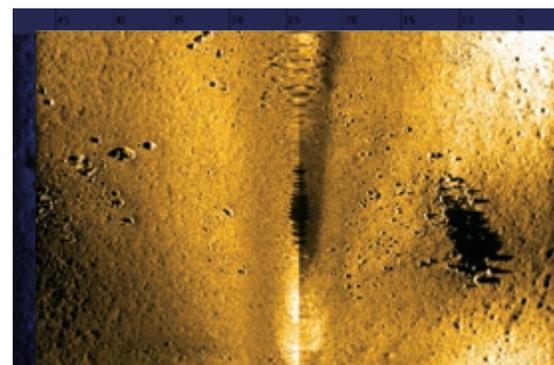
Along with Fedje and Jacqueline LeMaistre (AUV support technician), Mackie and Proctor spent eight days surveying seven square kilometres of the seafloor with side-scan sonar mounted on the AUV. Very similar technology discovered and provided images of the Franklin shipwreck this summer.

They've been poring over all the sonar imagery in the 150 gigabytes of data, looking for rectangles, straight lines—anything that looks out of place or unnatural. Their short list of promising finds includes a row of rocks in what

would have been a stream bed feeding into a river system. At least, that's what it would have been before hundreds of square kilometres of coastal plain were flooded by the sea, forcing the inhabitants higher into the islands of Haida Gwaii.

"It is a very emotional experience," Mackie said, "to look at these images and think that what we might be looking at is evidence that people were living on this land and catching salmon before there was even a forest here, when it was still a grassland almost 14,000 years ago."

Mackie will spend this winter poring over scans with experts. Next summer, he and Proctor plan to return to a few pinpointed locations, dropping a remotely operated vehicle to the same depth, with high hopes they might find stone tools and collect video of the locations.



Boulder wall, possibly made by people as a fish weir, extending into stream channel now at 122 meters below sea level. The boulder wall in lower right is casting a dark acoustic shadow. It is about 15 meters long by 3 meters wide.

## MESSAGE FROM THE DEAN



Welcome to the fall 2014 edition of EngineerRing.

It's fun to brag about our students and faculty, but I'll let the numbers speak for themselves.

The international rankings for UVic are consistently strong. Most recently, four UVic faculty members including Yang Shi and Ned Djilali, both mechanical engineers, and Pauline van den Driessche, an emeritus faculty member in Mathematics and Statistics and adjunct professor in Computer Science, have been recognized in the 2014 list of Highly Cited Researchers compiled by Thomson Reuters. These researchers published work of exceptional value in their field, and are the top one per cent of most-cited researchers. Among Canadian universities, UVic is fifth on the Thomson Reuters list. While most universities have one or two researchers on this list, the fact that UVic has four speaks to the calibre of talent that we attract. This dovetails nicely with the 2014 Leiden Rankings, which placed UVic second in Canada in citation impact in Math, Computer Science and Engineering.

Margaret-Anne (Peggy) Storey, a faculty member in computer science, has been elected as a member of the Royal Society of Canada's newly formed College of New Scholars, Artists and Scientists for her research into better understanding the interaction of technology, human behaviour, cognitive ability and social structure.

I'm also pleased to announce the Faculty's first Schulich Leader Scholarship winner, Mohammed Abousaleh. Two of these scholarships are given out each year at UVic as part of one of the largest scholarship programs in Canada. You can read more about Mohammed and the Schulich Scholarship program on page 3.

Our first-year admission numbers were at an all-time high last year, and we had a modest further increase this year after raising admission cut-offs.

Our students, faculty and staff are grateful for your continued and sustained support. Your contributions are important to the success of the faculty, and much appreciated. I encourage you to keep in touch with the Faculty of Engineering and the university. I hope to see you on campus soon.

Tom Tiedje Ph.D., FCAE, FRSC, P.Eng.



Photo: UVic Photo Services

## Engineering grad casts new light on nanoscale interactions

—By Julie Sloan

Researchers all over the world dream of making new discoveries in well-established fields, but engineering grad Ana Zehtabi-Oskuie's path has gone straight to the edge of an emerging field. While studying Electrical Engineering at the University of Tehran, Zehtabi-Oskuie became intrigued by optical trapping, a method under investigation by electrical engineering professor Reuven Gordon and a team of UVic grad students.

Zehtabi-Oskuie describes optical trapping as the use of light and nanomaterials "to trap very small particles, on a nano scale, to move, manipulate and study them." She knew that it was the field for her, combining her desire to work in electrical engineering and her love of chemistry. And UVic's Nanoplasmonics and Optronics Lab was where Zehtabi-Oskuie knew she was headed.

When Zehtabi-Oskuie started research for her thesis in Gordon's lab, optical trapping was done with molecules in one medium—water. She has since developed a new technique to better isolate and study individual protein molecules and their interactions. This groundbreaking work means that by using optical trapping, researchers can now look at and manipulate, for example, how a protein binds with a virus. Her research has far-reaching implications, extending well beyond health care research. Zehtabi-Oskuie's work has attracted the interest of industry partners in optics and pharmaceuticals. Thorlabs, the

world's largest optics supplier, sponsored a web-based video about her work.

Zehtabi-Oskuie credits Gordon for a great deal of this success. "Dr. Gordon has tons of new ideas every day. I was just the person to implement them." The admiration goes both ways. As Gordon explains, "I have had many excellent researchers in my group. While these students are all highly intelligent and dedicated, what sets Zehtabi-Oskuie apart is her exceptional professionalism in accomplishing her research goals. I think this will play a big role in her future success."

And Zehtabi-Oskuie seems to be successful wherever she goes. She completed an eight-month co-op work term with Blackberry in 2013, during which time she was the primary inventor for a near field communication (NFC) patent.

Zehtabi-Oskuie will receive the Lieutenant Governor's Silver Medal during June convocation for her thesis: *Microfluidic Integration of a Double-Nanohole Optical Trap with Applications*. Her work has been published in four international peer-reviewed journals and she has given talks at two international conferences.

So what's next for Zehtabi-Oskuie? She has her eye on post-doctoral research, hopefully at the Argonne National Laboratory. Given what she's accomplished so far, it's likely we'll be hearing more about Ana Zehtabi-Oskuie in the future.

## Leadership Through Diversity

—By Anna Stukas

Leadership Through Diversity in Engineering (LTD) is a group that strives to promote equality and inclusivity throughout the engineering faculty. LTD began two years ago and has been thriving since. In the past, LTD has run a variety of events including LAN parties, Multicultural Potlucks, and Women in Engineering Mixers. In the last year LTD has expanded its scope, starting UVic Engineering's first tri-mentoring program, connecting triads of first year students with senior students and industry mentors. This program ran from September 2013 – April 2014 and had great success. Another initiative started last semester is the ENGR Summit, a hike up Mount Finlayson to promote community within engineering as well as an active lifestyle.

Throughout the coming term, LTD looks forward to once again running the tri-mentoring program including a leadership and communications workshop facilitated by Anna Stukas (Oct 9th). LTD also plans on organizing other events, such as the ENGR Summit (Sep 27th), Thanksgiving Multicultural Potluck,

Women in Engineering event, and much more. LTD's goals for this term are to (A) run a variety of events that appeal to all engineering students, (B) celebrate the difference that minority groups (including first years, bridging students, international students, students with disabilities, LGBTQ students, and women) bring to engineering, and (C) provide resources to help with all aspects of being a student. This includes physical and mental well-being, academic support, and positive interactions with peers. For more information, to volunteer as an industry mentor, or to help support LTD, check out <http://ltd.uvic.ca>.

Anna Stukas (B. Eng '04) was one of the first mentors in the program. She graduated with a degree in Mechanical Engineering and is now the Manager of Intellectual Property and Regulations at BIC.



Photo: Eamon Murphy

# UVic ECOSat team's winning satellite design could be the next big thing in space travel

— By Suzanne Aheame

It looks like a tiny black office tower with an antenna, but when this unassuming shoebox-sized nano-satellite is launched 800 kilometres into space, the UVic engineering students who built and designed it will be experimenting with what might just be the next big thing in space travel: diamagnetic propulsion.

Project manager Devin Pelletier, electrical lead Cass Hussman and chief engineer Justin Curran, together with a team of 20 students comprising the UVic ECOSat-2 entry in the Canadian Satellite Design Challenge (CSDC), won the top prize in the final round of the three-year-long Canada-wide competition.

Ten university teams participated in the challenge to design and build a small operational science research satellite with a maximum mass of four kilograms. The prize was announced in June.

"It's so exciting to be working on the foundations of a technology that could one day change space travel as we know it," says Pelletier, a third-year mechanical engineering student.

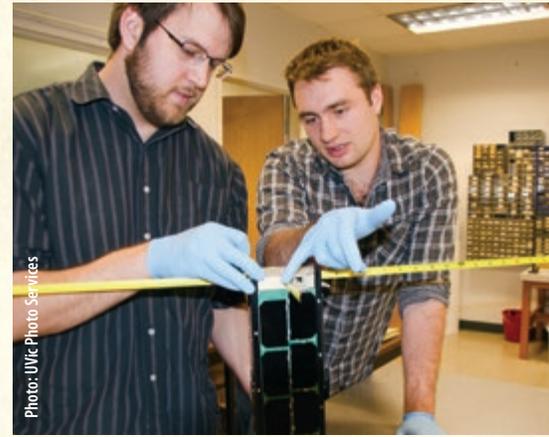
Inside the satellite is a solar-powered laser and a block of pyrolytic graphite, a naturally occurring mineral that is diamagnetic—it repels a magnetic field regardless of polarity.

The project goal is very basic: to measure the motion (if any) created by the diamagnetic force between the on-board solar-powered laser and a piece of graphite (which naturally repels a magnetic field regardless of polarity) as they interact with the Earth's magnetic field.

Pelletier says the concept isn't so much a long shot as a long haul. He acknowledges that it may take another 50 years to develop the technology for space travel, but the purpose of the experiments is to stimulate research and create awareness of its potential for locomotion in space.

"None of this would be possible," he says, "without people like Afzal Suleman, Jim Harrington, and CSDC founder Larry Reeves giving us the guidance and support we need to pursue our passion."

Along with the prize comes a launch deal that Reeves is working to secure, most likely with a space agency in Russia, India or China. In the meantime, the team of undergraduate and graduate students will receive up to \$10,000 to build a ground control centre to monitor the satellite and receive data when it passes within communication range of UVic four or five times a day.



Cass Hussman and Devin Pelletier make refinements to their satellite

The team's same design was chosen as a runner-up for the Canadian Dyson Award. If selected for the short list, which will be announced in October, teams will get the chance to send a video pitch to British inventor and multimillionaire James Dyson, founder of the Dyson company and the James Dyson Foundation, which describes itself as "dedicated to helping young people think differently, make mistakes, invent and realize their engineering potential."

Dyson will choose the winner of the \$50,000 grand prize on Nov. 6.

# 499 Design Project Winners

— By Chrystal Phan

Failing to take medications is one of Canada's most problematic healthcare issues, costing taxpayers over \$1.6 billion a year. The problem has grown into a national concern as our population ages and more individuals are placed on complex health regimes.

Companies in the U.S. are working on assistive devices to address the issue, devices such as smart pill bottles that send you text messages along with other visual and audio reminders. None of these devices have hit the market yet, but in the meantime, four UVic undergrads have developed their own prototype, one that adds an ePaper screen to display your prescription information on a smart pill bottle.

The creators, all fourth-year students in electrical or software engineering designed *Smart Med*, a set of smart pill bottles capable of communicating wirelessly with a base station to

receive and transmit prescription information. The bottles use this information to notify users with audio, tactile, and visual cues to indicate a dosage is needed. The students created this project for their fourth-year design project course and received First Prize in the IEEE Student Technical Design Competition Award.

The idea evolved from a software engineering course project that focused on a software application, but because the team consisted of students with electrical and mechanical experience as well, they set to work on creating an integrated device.

All four team members continue to work with their supervisors on the project and are open to commercialization — but for now they're focused on coursework and graduation.

L-R - Kelsey Blair, Simon Diemert, Paul Hunter, Kirk Richardson



Photo: Ashwin Sira

## SCHULICH SCHOLARSHIP WINNER — A FIRST FOR ENGINEERING

Mohammed Abousaleh is one of two recent high school graduates selected to receive this year's prestigious Schulich Leader Scholarship, one of Canada's largest scholarship programs.

Created in 2011 by entrepreneur and philanthropist Seymour Schulich, the scholarships are awarded annually to 40 students in Canada pursuing undergraduate studies in STEM subjects: Science, Technology, Engineering and Mathematics. The scholarship for engineering studies is \$80,000 over four years and \$60,000 for the other areas of study.

Nominees must demonstrate two of the following attributes: academic excellence, outstanding community, business or entrepreneurial leadership, and financial need. The scholarships are payable over four years.

Mohammed Abousaleh's work ethic not only resulted in an outstanding GPA of 100% at Oak Bay High School, but also compelled him to volunteer and help others. At Oak Bay High, he had a lead role helping raise money for the Cops for Cancer campaign. He also spent hundreds of hours with various math clubs as founder, leader, and tutor, and was a member of student council. His high school classmates voted him to be their 2014 grad class valedictorian.

A member of the selection committee remarked that Abousaleh "has shown his peers and teachers what it is to be humble, yet driving, while also compassionate and helpful. It is Mohammed's dedication, leadership, and hard work that distinguish his efforts from among his peers."

UVic has welcomed six Schulich Leaders since becoming part of the program, and this is the first time it has been awarded to an Engineering student.

## Limbic Media ALUMNUS JUSTIN LOVE

Photo: Hugh Patterson

### HUGH PATTERSON: Adventurer, Conservationist and now, Inventor

In 2007, Mechanical Engineering alumnus Hugh Patterson and brothers Bryson and Ryan Robertson embarked on a 3-year voyage to circumnavigate the globe, and in the process became passionate conservationists due to the amount of plastic garbage they encountered at sea and on beaches all over the world. They made a film of what became known as the OceanGybe Expedition called *Tide Lines*, which played last summer at the Victoria Film Festival.

Not the kind to sit idle, Hugh Patterson is busy again, this time using his engineering background to solve a backcountry skiing issue that has bothered him for years. Frustrated by how difficult it was to adjust his alpine touring

bindings while out on the mountain, he decided to create a ski pole that would allow him to raise and lower the heel lifters on the fly.

The invention has so much potential that Patterson left his full-time job to work on bringing his invention to market. He has a patent pending on the pole basket design, which features two different ways to change the angle of heel lifters on popular touring bindings.

Patterson's branded Lift Baskets will sell for \$25 a pair, and he hopes to have them in retail stores this winter. He's also examining the possibility of partnering with major pole manufacturers. For more information, go to [liftbaskets.com](http://liftbaskets.com).

### LEANER, GREENER AND SAFER Afzal Suleman awarded Canada Research Chair

Afzal Suleman is one of University of Victoria's three newest Canada Research Chairs after being awarded a Tier 1 Canada Research Chair in Computational and Experimental Mechanics. Suleman is using advanced computational tools to develop state-of-the-art sustainable designs for the next generation of aerospace transportation systems. He is an international leader in the fields of smart structures and aeronautical design, and director of UVic's Centre for Aerospace Research, which works closely with industry and academic partners on the design of unmanned air vehicles for uses such as precision agriculture, wildlife conservation and oceans monitoring. Tier 1 chairs go to researchers considered world leaders in their fields. As



Photo: UVic Photo Services

part of the appointment, the university receives \$200,000 annually for the seven-year term.

"Air traffic in Canada is expected to double every 16 years, which means environmental factors—such as noise and emissions—will play a dominant role in future aircraft design," says Suleman. "The challenge is to design more environmentally and economically efficient aircraft, while improving public safety."

*"The walls between art and engineering are only in our mind." – Dutch kinetic artist Theo Jansen*

Justin Love (BSc'06, MSc'12) has a combined degree in both computer science and visual art and has presented his work in galleries and international events in Canada, USA, Mexico, Portugal, Switzerland, Turkey, and China.

Love founded Limbic Media in 2006, to create interfaces and devices that allow people to interact with and control audio, visuals, lights, and machines using natural user interfaces (e.g. body movements, facial expressions, eye movements), alternative interfaces (e.g. smart phones, wearable sensors, modified paintbrush) and biometrics (e.g. brainwave activity, heart rate, breathing).

"There is definitely a lot of potential for deeper applications of these types of technologies, although I think that the most important questions in life won't be answered by science and technology," Love says, "I think they can be useful tools to enhance the exploration and experience of the human condition."

A combination of hard work, luck and being in the right place at the right time brought Limbic Media into being. During the last summer of his undergrad, he was hired to work with Will Bauer – an artist-engineer with 20 years of experience creating interactive art and its underlying enabling technologies. Recently, Limbic has won contracts in the industrial sensing industry.

"At the end of the day we all just want to keep working on projects we love – is there anything better than that?"

[Limbic Media was awarded "Member of the Year" at the 2014 VIATeC Technology Awards Gala. They were chosen as a leading community supporter and collaborator, celebrating innovation and excellence in Greater Victoria's advanced technology sector.]

### Giving Back

Our alumni make a difference by volunteering at events, speaking to classes, hiring co-op students or supporting scholarships. To help change the lives of our current students, you can make a donation today at [www.uvic.ca/givingtovic](http://www.uvic.ca/givingtovic) or by contacting the Development Coordinator, at 250-472-4210 or [devtcoor@uvic.ca](mailto:devtcoor@uvic.ca).

### Planning a reunion?

The UVic Alumni Association can help by promoting your event to classmates, arranging speakers or providing door prizes. Network and keep involved by exploring the list of groups and upcoming events to find something that's right for you. [www.alumni.uvic.ca/events/reunions.php](http://www.alumni.uvic.ca/events/reunions.php)

### Alumni Newsletter

EngineeRing 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. Send your story ideas and feedback to Julie Sloan at [jsloan@uvic.ca](mailto:jsloan@uvic.ca).



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