TIM MUENSCH WITH THE SASK POLYTECH 3D PRINTER

SPECIAL REPORT: AT THE INTERSECTION OF INNOVATION, LEARNING AND COMMERCE

SASKATCHEWAN POLYTECHNIC ADVANCES APPLIED RESEARCH AND DEVELOPMENT ACROSS INDUSTRIES

Saskatchewan Polytechnic (Sask Polytech) has a storied history since its humble beginnings as a vocational school. It has had a few names over the years, and became Sask Polytech on September 24, 2014, to better reflect the education, training and applied research the institution provides across its four Saskatchewan campuses.

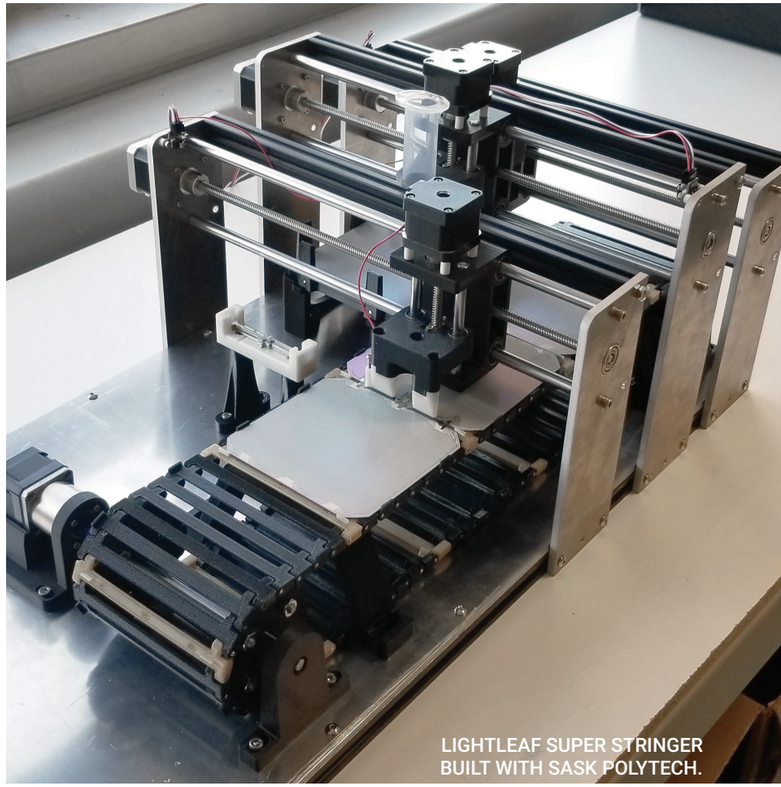
Putting Expertise and Skills to Work

Beyond its mandate to provide quality, applied education to the province's learners, Sask Polytech also proves itself as an integral part of Saskatchewan's innovation ecosystem every day. At the heart of it is the Office of Applied Research and Innovation, led by Dr. Susan Blum, associate vice-president, Applied Research and Innovation and her team.

"The office is the touchpoint for industry to engage with us on the various services we can offer," says Blum. It's here where the journey into innovation begins. The process is a simple one. If you're a business with an idea that needs to be tested or a problem that needs to be solved, they can work with you to see what Sask Polytech can do to help. "It starts with a meeting to determine what the partner needs and what our faculty members, students and research centres can offer," says Blum. "We work with businesses of all sizes, from startup to multinational."

As the province's primary institution for post-secondary applied education and research, Saskatchewan Polytechnic plays an important role in the health of Saskatchewan's economy.

Once the project is defined, the team looks for funding to support the work and manages applications. There are several places to source project dollars such as the National Research Council (NRC) and Natural Sciences and Engineering Research Council of Canada



LIGHTLEAF SUPER STRINGER BUILT WITH SASK POLYTECH.

LIGHTLEAF SOLAR PANEL. PHOTO PROVIDED BY LIGHTLEAF SOLAR

(NSERC). Lastly, and likely the best part of a project collaboration with Sask Polytech, is that the industry partner retains all intellectual property (IP) generated, even if co-developed. "The retention of IP is a huge benefit for our partners," says Blum. "Partners get the end results, and our faculty and students get to build their knowledge and expertise through practical, applied research. It's win-win."

Making Manufacturing Better

Saskatoon's LightLeaf Solar manufactures solar panels "for things that move" such as boats, trailers and vehicles, says company principal Rick Retzlaff. The company is growing, with its largest market south of the border, selling to U.S. manufacturers. LightLeaf needed a more efficient, safer way to assemble its solar panels. Retzlaff has known Tim Muench, Sask Polytech's program head for Design and Manufacturing Engineering Technology and research chair in Additive and Advanced Manufacturing at the Saskatoon campus for years, and they got to talking about how Sask Polytech could help address LightLeaf's manufacturing problem. The Office of Applied Research and Innovation was engaged to see how the Sask Polytech Innovative Manufacturing Centre (IMC) could help.

"We had a meeting to discuss the issues we needed addressed—assembling solar cells more efficiently and automating the processes to place cells and trim panel edges," says Retzlaff. "All three processes were labour-intensive, and the trimming process needed to be safer."

A team at Sask Polytech was assembled and an application for an NSERC Engage Grant was accepted and funded. "We worked to create solutions that would automate the solar cell process and trim the final product, eliminating the tedious way it was done previously," says Muench. "We turned to our 3D printing and mechatronics as technologies that could help develop what LightLeaf needed."

Work commenced on how to better manufacture LightLeaf's solar panels and today, the company has usable solutions that have improved their processes greatly.

Both Retzlaff and Muench have nothing but good things to say about the project. "There is no way

RESEARCH ASSOCIATE LEILA BENMERROUCHE, SASK POLYTECH SCHOOL OF NATURAL RESOURCES AND BUILT ENVIRONMENT

we, as a startup, could have conducted this type of research and development on our own," says Retzlaff. "Gaining access to the R&D capacity at Sask Polytech has allowed our business to grow and become more profitable." For Muench, his team of researchers were able to prove a concept and solve a problem. LightLeaf's existing Sask Polytech graduate employee also collaborated on the project, and there will likely be more hiring from Sask Polytech in the future. "For us, we benefited from the process knowledge and expertise development. It was a great collaboration where we all gained something valuable," says Retzlaff.

Digging Into a Problem

The International Minerals Innovation Institute (IMII), based in Saskatoon, came together with the Digital Integration Centre of Excellence (DICE) to work on how existing technology could be improved to help the mining industry enhance safety underground. On surface the solution is simple—use GPS technology to pinpoint where people and equipment are. However, current GPS technology doesn't work underground—and mining companies want a better way to locate people and equipment more easily. Al Shpyth, IMII's executive director, Dr. Terry Peckham, DICE director and research chair at Sask Polytech, and industry partners BHP and Nutrien came together to see what could be done to address the issue.

"Our idea was to see how we could take existing GPS technology and have it work in the underground mine environment so that people and equipment locations can be pinpointed," says Peckham. The project saw $314,000 invested from IMII, BHP and Nutrien in cash and in-kind resources, and another $324,000 from NSERC's Applied Research and Development program.

Peckham, Sask Polytech students and DICE created a prototype for the first phase of the project and are now in discussions for phase two where the prototype will be engaged with mining partners on separate projects. "We're at the stage where mining companies want to work with us individually to tailor the solution to their unique mining environments," says Peckham.

The project has been worthwhile for all involved. For IMII, the organization gets the benefits of developing technology that will advance the industry they support, plus the training of people who know how to use the technology. "It's one thing to develop new technology," says Shpyth. "However, you also need qualified people to use it. Projects like this do both."

For Peckham, learning is the valuable part of the equation. "I am not a miner. I am a computer scientist. Working on a project like this, we get to learn about an industry, how it works and what we can bring to the table," he says. "Applying expertise and experience to solve problems, and see it applied in the real world is the reward for our faculty and our students."

Bird's-eye View

Forsite Consultants Ltd., a Canadian forest management company with an office in Prince Albert, uses light detection and ranging (LiDAR) scanners on manned aircraft to measure trees in mature forest stands. Conducting regeneration assessments takes a significant amount of time and money and provides data that could have its accuracy greatly improved through a revised process. "We wanted to explore the possibility of using LiDAR to determine how well trees are regenerating by flying over stands with the scanner," says Darryl Sande, Forsite's operations manager for Saskatchewan. "We started to wonder what drones could do for the process." Sande reached out to David Halstead the research chair for the School of Natural Resources and Built Environment at Sask Polytech in Prince Albert to see how the idea could be tested.

A project was born to conduct multiple trials with drone-mounted LiDAR. The objective of the project was to maximize drone-mounted LiDAR data resolution by varying the flight parameters of the drone in combination with different data processing procedures. Funding was acquired from an NSERC Engage research grant. Forsite personnel were given the opportunity to work with the data to maximize optimal point spacing for reliable forest inventory while facilitating recalibration of existing models and more efficient forest management. "The project worked well," says Halstead. "We demonstrated that drone-mounted LiDAR possesses the necessary capabilities to provide an accurate picture of regenerating stands. There is, however, more work to be done."

Sande says the first project has been a success for Forsite. "We're pushing the envelope of technology to see what it can do. Our trial showed us that while it worked, the data richness needs to be improved. Eighty per cent of science comes from what doesn't work," he says. "We're going to make improvements with the next phase, re-fly, and see if the data intensity and richness improves. It also affirmed that while drones are great technology, they are not perfect for all applications. That's how projects like this work."

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>
> -Darryl Sande, Forsite operations manager for Saskatchewan

Waste Not, Want Not

In 2018, Craik, Sask.-based Titan Carbon Smart Technologies (Titan) came to Sask Polytech's Innovative Manufacturing Centre (IMC) for help to develop a biocarbon masterbatch that could replace traditional carbon black. Carbon black is formed by the incomplete combustion or thermal decomposition of hydrocarbon fuel or natural gas. It's used in everything from tires to paint and plastic, and because it's fossil fuel-based the production of carbon black has some of highest carbon emissions of any chemical.

Titan was already producing biocarbon from waste biomass such as construction wood waste, sawdust, and agricultural residues for four carbon products used in animal feed, odour elimination, fertilizer and health and beauty care. Titan saw the opportunity that a biocarbon could replace carbon black because of its similar properties.

The company engaged with Dr. Satya Panigrahi, Sask Polytech research chair, IMC. The project sought and was granted NSERC and ReMAP funding to explore how a carbon black alternative could be produced with biocarbon from waste such as plastics and straw. "The project will end in 2022, and so far, the results have been really good," says Dr. Panigrahi. "Titan will be able to produce a biocarbon product that can compete in the carbon black market."

A patent for the product is coming, and the future is bright for an idea developed between industry and Sask Polytech. "The biocarbon product should see commercialization for moulding and grain containers first, and then onto other applications," says Panigrahi.

"The depth of Dr. Panigrahi's knowledge and the substantial materials engineering resources at Sask Polytech has allowed Titan to enter into an extremely important market for our biocarbon. The product uses only waste materials and generates enormous carbon sequestration benefits. We are very pleased with the research and this new business opportunity," says Jamie Bakos, president and CEO of Titan.

Learn By Doing

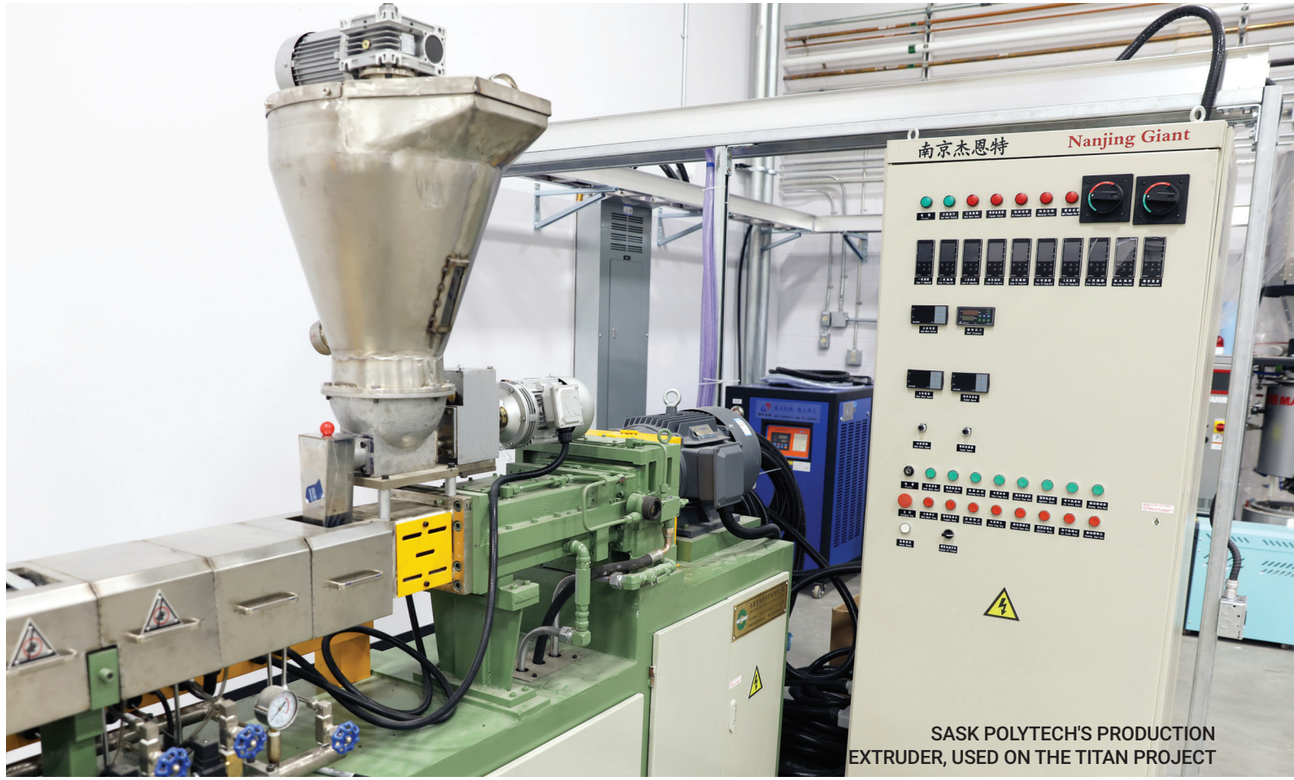
Sask Polytech knows well the role it plays in the innovation ecosystem, providing industry the opportunity to test, research and grow ideas. "The work we do through our research centres provides valuable insights for our industry partners and strengthens our connections to the business community," says Dr. Larry Rosia, Sask Polytech president and CEO. "It also develops and demonstrates another aspect of our students' knowledge and skills which they take into the workforce." Rosia says that Sask Polytech has always wholly supported the industry partner's ownership of the patents or IP that come from the work, as Sask Polytech's only requirement is the knowledge students gain directly from the work itself.

"Having our students experience innovation journeys that produce real world outcomes is invaluable. Our role is developing the talent pool to do the work in the innovation economy, and our Office of Applied Research and Innovation is an important tool we use to make that happen."

Find Your Solution

The first step to learning what Sask Polytech's Office of Applied Research and Innovation and its team of expert faculty can do for your business is reach out. "All it takes is a phone call or an email to get started," says Blum. "We'll work with you—whether you're just starting out or in a large organization—to determine what you need to accomplish and how we can help you get there."

Learn more at saskpolytech.ca/research.



SASK POLYTECH'S PRODUCTION EXTRUDER, USED ON THE TITAN PROJECT