Desktop Metal

CASE STUDY

# AM 2.0 Technologies as Catalyst for Industry Growth

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## Red Deer Polytechnic invests in next-generation manufacturing solutions that benefit students and industry

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Tonya Wolfe, Associate Vice President of Applied Research at Red Deer Polytechnic, left, provides a tour of the Centre for Innovation in Manufacturing to Rachel Notley, former premier of Alberta, center. Here they look at a project printed on the ETEC Xtreme 8K.

**Customer**
Red Deer Polytechnic
The Centre for Innovation in Manufacturing – Technology Access Centre (CIM-TAC)

**Location**
Alberta, Canada

**Industry**
Education, Research, Business Development

**Machines**
Binder Jetting on the
Desktop Metal InventX™

Digital Light Processing on the
ETEC Xtreme 8K

**Materials**
A variety of metal alloys and technical ceramics in development projects

DuraChain™ Elastic ToughRubber™ 90

**Website**
www.rdpolytech.ca/cimtac

**Regional sales partner**
Proto3000
www.proto3000.com

## Engineering and manufacturing excellence on campus

Red Deer Polytechnic in Alberta, Canada offers programming for students that prioritizes applied learning, industry relevance, and multi-disciplinary opportunities. Additionally, the Polytechnic is focused on serving the needs of regional businesses to integrate applied research into the local industrial community.

Integrated within campus is a 15,000 square foot center with a team of engineers, technicians, technologists, and business developers that work on industry projects, often in collaboration with students and faculty. The Centre for Innovation in Manufacturing (CIM) is home to over $7.6M of advanced prototyping and manufacturing equipment – a collection curated to help businesses turn innovative designs into products. The facility also serves as a Technology Access Centre (TAC) – a trusted applied R&D center that provides Canadian industries with access to state-of-the-art technology and equipment, as well as a multi-disciplinary team to help companies deliver market-ready products.

“CIM-TAC delivers high value-added solutions in the areas of engineering and manufacturing excellence,” said Tonya Wolfe, PhD, P.Eng, Associate Vice President of Applied Research who spearheaded the growth and development of the center. In 2022, CIM-TAC staff engaged with over a thousand industry

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CIM-TAC at Red Deer Polytechnic is home to over $7.6M of advanced prototyping and manufacturing equipment, including the InnoventX, top, for binder jet 3D printing of metals and technical ceramics and the Xtreme 8K for DLP 3D printing elastomeric resins.

inquiries and initiated 73 projects, supporting innovation and economic prosperity across Alberta for over 50 companies.

As part of a network of over 60 TACs across Canada, Red Deer Polytechnic offers specialized knowledge in design for manufacturing. And to bring these advanced designs to life, CIM-TAC focuses on offering next-generation production solutions that are unique within the network and that support regional business interests.

So CIM-TAC targets its equipment investments to be relevant the needs of the industrial community. Wolfe describes projects with the oil and gas industry to redesign legacy parts or safety components, as well as projects supporting growing sectors like solar, wind, and hydrogen energy equipment, agriculture, consumer goods, and expanding interest in healthcare devices.

"The equipment that we have, it meets an industry need," Wolfe emphasized. "Whether the goal of a project is to be more cost effective, sustainable, or target reshoring, we let companies de-risk technologies that lead to innovative solutions," she explained. "Us acquiring a new piece of equipment means that we have seen or heard enough of a need in the community to be able to put together a business case to do that type of work."

Complementing an extensive portfolio that includes technologies like laser cutting, vacuum forming, and 5-axis milling, CIM-TAC has invested in both binder jet technology (BJT) with a Desktop Metal InnoventX and digital light process (DLP) with an ETEC Xtreme 8K.

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## Binder jetting material development on the InnoventX

As a leading research polytechnic in Canada, Red Deer Polytechnic applied research specialists collaborate with businesses and entrepreneurs to innovate solutions to real-world problems. With a background in metallurgical engineering and metal matrix composites, Wolfe explained guiding CIM-TAC toward a flexible 3D printing powder bed process. "We were interested in a

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The compact footprint of the InnoventX and material flexibility of binder jetting technology allows the CIM-TAC team to efficiently research 3D printing powders that are challenging with laser-based systems.

technology that we could utilize with different metallurgy systems and also wanted to grow ceramic additive manufacturing capabilities in the province." The material flexibility of the binder jetting process allows the team to investigate materials found to be challenging to print using a laser powder bed fusion system.

Installed in 2021, the InnoventX is an open control system that utilizes Triple ACT binder jetting technology to process a variety of powders. Because of its reliable results, more binder jet 3D printing research has been done on the InnoventX than any other platform[1]. Its compact footprint and easy-to-manage powder volume made it the right fit for the center's work in material and process research, helping the team investigate projects in materials ranging from cast iron to tungsten carbide.

## Sized for commercialization with the Xtreme 8K

Looking to expand the size of the industrial polymer solutions it could offer, the CIM-TAC installed an ETEC Xtreme 8K in 2022. As the largest production-grade DLP 3D printer on the market, the top-down DLP system met the production needs of industrial projects. "It's critical to have commercial-sized equipment," Wolfe emphasized, explaining how easily-accessible technologies like desktop Fused Deposition Modelling (FDM) and Stereolithography (SLA) were limited to small builds.

CIM-TAC is interested in expanding DLP for printing complex components that would otherwise be produced with a more laborious and time-consuming urethane casting process. Using patented top-down DLP technology, the Xtreme 8K 3D prints complex designs and iterations in DuraChain Elastic ToughRubber 90, a high-hardness elastomer, without hard tooling investments or long lead times.

"Access to higher productivity, different materials, and especially the size was the interesting part of DLP technology on the Xtreme 8K," Wolfe said. "A lot of our clients needed a larger bed size and we want commercial equipment here to set them up for success beyond testing on small pieces; we are moving them right out into commercialization."

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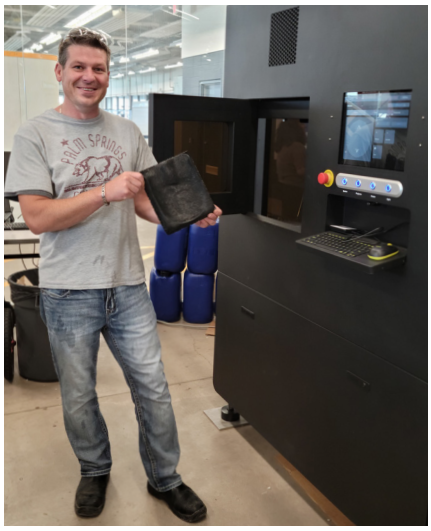
[1] https://www.sciencedirect.com/search?qs=exone%20and%20innovent

## Learning environments benefit students and industry



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Experienced manufacturing staff members operate machinery with learning opportunities for students. Above, the Xtreme 8K is used for testing at the Red Deer Polytechnic CIM-TAC.

While every project has an industry that benefits from the outcome of the work, the CIM-TAC is about more than just access to advanced equipment. As part of a polytechnic institution, it creates a learning environment for students and allows industries to benefit from a multidisciplinary project team.

An experienced group of innovative designers and advanced machinists work alongside students in an active environment of real-world scenarios. Faculty are also brought in to offer subject matter expertise and perspectives that help projects succeed with a holistic approach.

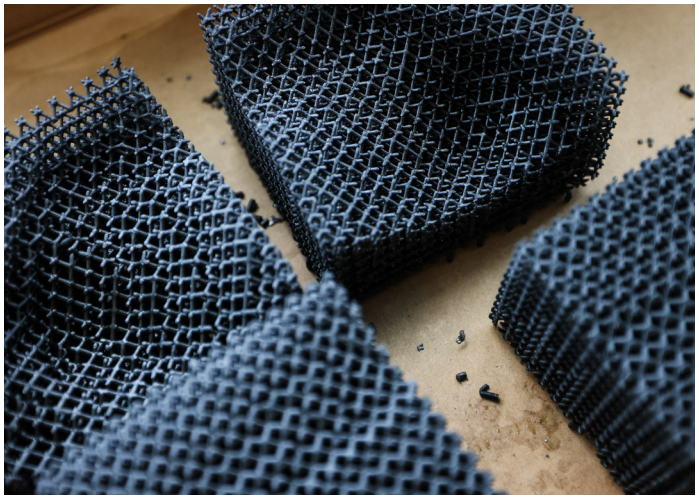
"Students see how skills are applied in industry," Wolfe said. "And not just engineers! Students come from science, computing, health, nursing, psychology, sociology, or arts and animation," she emphasized. "We pull from across the entire Polytechnic to learn how diverse skills are applied in a manufacturing setting with the full application, economics, and business need for industry projects."

Exposure to these scenarios helps create a highly-skilled workforce for the province with the exposure to processes and skills that advance next-generation manufacturing technologies. Today, Wolfe sees an increasing demand in the region for the design skills that can unleash the true capabilities of advanced manufacturing technologies like 3D printing.

## Student research data to support industrial adoption

Highlighting the unique collaboration atmosphere of Red Deer Polytechnic, Wolfe explained how students have the opportunity to not only learn the technical application and business economics of a process, but also work on advancing the understanding of these concepts.

"Tools like lattice optimization with organic structures and generative AI are helping students stretch these advanced processes, it's a really exciting time for them," Wolfe said.



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Elastomeric lattice structures 3D printed with DLP technology on the Xtreme 8K. Elastic ToughRubber material unlocks the benefits of additive manufacturing for the rubber, polyurethane, and foam industries for applications like vibration dampening components, seals, and baffles. Red Deer Polytechnic researches cell structures to optimize compression responses - collecting data for generative designs on future industrial projects.

One current project highlights work in lattice optimization to engineer different stiffnesses of elastomeric materials. A variety of cell structures were evaluated for compression responses and it was decided to focus on testing bending-dominated unit cells due to their energy-absorption, elasticity, and deformation capabilities. The octet lattice structure, which is stretching-dominated, was also tested to provide a comparison.

Based on ASTM D575-91 test methods, compressive forces are applied to sample cell structures, as seen below, to reach 10%, 20%, 30%, 40%, and 50% of the average specimen height in three successive cycles. This research is confirming the effect of relative density on the strength and elastic modulus of stretching and bending-dominated structures.

For stretching-dominated structures, this is a linear relationship, whereas it is an exponential relationship for bending-dominated structures. “This concept is only definitive when comparing lattice structures with the same type of unit cell,” Wolff explained. “It can be hypothesized that testing multiple lattice structures containing the same unit cell type at different relative densities will have a greater correlation.”

The full paper of this study will be published in a journal later this year. “Through that work we can use data for our generative designs on future industrial projects,” Wolfe concluded.

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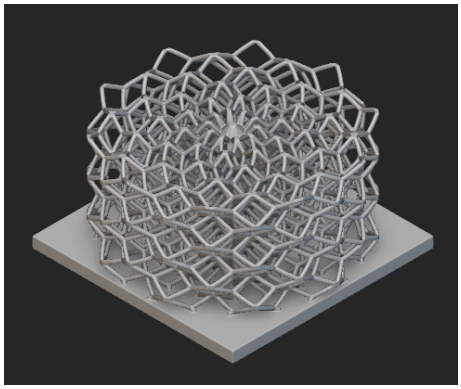
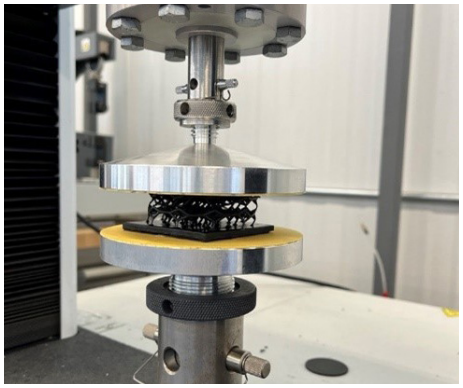
Right, an example of a cell structure sample to be printed on the ETEC Xtreme 8K.

Far right, the testing apparatus of the cell structures based on ASTM D575-91 test methods.





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Various cell structures are 3D printed on the Xtreme 8K in a student research project to study compression responses and optimize lattice designs that can be used in industry applications.

Red Deer Polytechnic

**About Red Deer Polytechnic**

Red Deer Polytechnic is proudly rooted in central Alberta, while making an impact across our province and around the world.  RDP has delivered quality, hands-on education that prepares graduates for success within Alberta's diverse economy for nearly 60 years. The Polytechnic currently serves about 6,300 credit and apprenticeship students and more than 3,400 extended education students with more than 80,000 alumni making an impact across all sectors.

The Centre for Innovation in Manufacturing (CIM-TAC) turns leading edge ideas into reality by collaborating with clients on innovative manufacturing solutions. As a Technology Access Centre located on the Red Deer Polytechnic campus, the CIM-TAC is a key hub of the central Alberta innovation community with a focus on product and process development, improvement through innovative technical services, and applied research projects.

Desktop Metal

**About Desktop Metal Inc.**

Desktop Metal (NYSE:DM) is driving Additive Manufacturing 2.0, a new era of on-demand, digital mass production of industrial, medical, and consumer products. Our innovative 3D printers, materials, and software deliver the speed, cost, and part quality required for this transformation. We're the original inventors and world leaders of the 3D printing methods we believe will empower this shift, binder jetting and digital light processing. Today, our systems print metal, polymer, sand and other ceramics, as well as foam and recycled wood. Manufacturers use our technology worldwide to save time and money, reduce waste, increase flexibility, and produce designs that solve the world's toughest problems and enable once-impossible innovations. Learn more about Desktop Metal and our #TeamDM brands at www.desktopmetal.com