# Annual Report

2023 🍁 2024



# Highlights from 2023-24



More than 360 semiconductor prototypes submitted to fabrication from researchers and entrepreneurs in Atlantic Canada, Quebec, Ontario, and Western Canada.



Hosted the first annual Canadian Semiconductor Symposium – the signature annual event for the Canadian Semiconductor Ecosystem



Diversified our training with a new offering : TnT -Semiconductor Technology for Non-Techies, for professionals in non-technical roles who are involved in the semiconductor business or want to learn more about it.

Welcome to our newest members





ROATI Technologies Inc





Awarded \$171,292 to fund a training initiative that is unique in the world: Build Your Own Superconducting Quantum Device workshop. This financial support is from the NovaScience program, an initiative of the Government of Quebec's Ministère de l'Économie, de l'Innovation et de l'Énergie (MEIE), which develops the next generation of scientists in Québec.

Welcome to over 2,700 clients across Canada who are first time users of services.

25 start-ups in Canada supported through CMC's Virtual Incubator Environment (VIE) program, now in its fourth year.



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# **Thanks to Our Funders!**

## **Major Partners**



Canada Foundation for Innovation (CFI) Major Science Initiatives (MSI) program

Major Research Facility: Canada's National Design Network





# Joint letter from the Chair of the Board & CEO

In 2023-2024, CMC helped maintain Canada's leadership in semiconductor innovation. In 2023-24, CMC helped maintain Canada's leadership in semiconductor innovation. A major proposal was submitted to Innovation, Science and Economic Development Canada (ISED). The FABrIC project is designed to lower the barriers faced by Canadian companies to develop semiconductor manufacturing processes and to create semiconductor Internet-connected products and services (IoT). Exciting news for the ecosystems will be announced in the summer of 2024.. Looking to the future of the Canadian semiconductor ecosystem, continued to make the training of highly qualified personnel (HQP) a priority. It has become clear across the ecosystem that providing our graduates with essential industry skills is key to building on our competitive advantage. In this report, you will learn more about our strategic core technologies, and how we can leverage Canadian expertise to succeed in the global marketplace – developing products and solutions in:

- Microelectronics
- Photonics
- Micro-Electro-Mechanical Systems (MEMS)
- IoT & Edge AI
- Quantum

CMC also celebrated its 40th anniversary this year, which gave us a chance to look back on some our accomplishments and milestones over the past four decades. More importantly, it gave us a chance to reflect on where the Canadian semiconductor ecosystem stands today, and where we want to be tomorrow.

This was the basic question we posed to the broader Canadian semiconductor ecosystem for the first annual Canadian Semiconductor Symposium, held November 23-24 in Ottawa. Leaders from across the spectrum from leaders of established large firms to emerging startups shared their views on where Canada can excel in an increasingly competitive and rapidly evolving global semiconductor space. Technology and product development was an important part of the conversation, however we also discussed how venture capital, public policy, and other factors are key to a vibrant Canadian semiconductor ecosystem.

With the semiconductor industry in flux, CMC is plotting a way forward for Canada to succeed. Lowering barriers and making chip design and fabrication more accessible to our traditional research partners and increasingly to industry, and training and developing HQP to thrive in the technologies where Canada already has an edge are how we are concrete ways that CMC is helping strengthen the Canadian semiconductor ecosystem for future success.

CMC is dedicated to preparing the next generation of chip designers and tech leaders in Canada, reflecting our mission and core values. As the Canadian semiconductor ecosystem reaches a pivotal moment, CMC is proud to guide Canadian innovators, researchers, and entrepreneurs on the path to success.

Thanks for taking the time to learn more about CMC.



Steve Bonham Chair of the Board of Directors CMC Microsystems



Gordon Harling President and Chief Executive Officer CMC Microsystems

## **Board of Directors**

**Mr. Steve Bonham, Chair** Plant Manager, Teledyne Micralyne, Inc.

**Dr. May Siksik, Vice-Chair** Chief Executive Officer, Canadian Innovation Network

#### **Dr. Vincent Aimez**

Vice-President Partnerships and Knowledge Transfer, Université de Sherbrooke

#### Dr. Douglas Barlage

Professor, Department of Electrical & Computer Engineering Department, University of Alberta Served until July 2023 Dr. Eric Flaim

Director, University of Alberta nanoFAB

Mr. Gordon Harling President and Chief Executive Officer, CMC Microsystems

Ms. Vanessa Little Global CTO – CloudConverge Technology Solutions

**Dr. Michel Pioro-Ladrière** Director of Partnerships and Strategy, Nord Quantique

**Dr. Madison Rilling** General Manager, Optonique

#### Ms. Chunfang Xie

Associate Director, Process Engineering, Microchip Technology Inc. Served until July 2023

#### Dr. Jeff Young

Department of Physics and Astronomy, Stewart Blusson Quantum Matter Institute Advanced Materials and Process Engineering Laboratory University of British Columbia

#### Mr. Marco Blouin

Board Observer Économie et Innovation Québec

#### **Officers of the Corporation**

David Lynch Vice-President, Technology Peter A. Stokes Secretary Marie Thiele Treasurer

## **Technology and Strategic Direction**

## Foundational Technologies

Microchips - chips, integrated circuits, semiconductors - are at the heart of electronic devices essential in virtually all industries.

CMC's strategies focus on the technologies driving semiconductor innovation.





#### SELECTED MICROELECTRONICS R&D PROJECTS

- 🧭 Edgewater RF design
- 🗹 ThinkRF RF design

#### **Microelectronics**

Cutting-edge microelectronics technology is essential for researchers working on a wide range of applications, from data centers to mobile edge solutions, with AI integrated into every aspect, from product development to service delivery.

CMC provides affordable access to these technologies through our proven Multi-Project Wafer (MPW) model and strong partnerships with world-class suppliers and foundries.

## Our Guiding Principle

### **Benefits to Canada**

Microchip technologies are vital to Canada's technology ecosystem. Semiconductors drive digital economies and are key enablers of economic growth and productivity improvements. Canadian innovators excel in fast-growing niche technologies where we have significant expertise and can achieve global leadership, such as compound semiconductors, silicon photonics, microelectromechanical systems, and quantum devices. CMC is dedicated to supporting Canadian innovators in strategic sectors with high growth potential to drive our national ecosystem forward.

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#### **Photonics**

Photonics is a systems-enabling technology widely used in modern applications, providing functionalities that range from data transmission for data centers and the telecom industry to environmental and life science sensing.

CMC enhances technology integration by incorporating more photonic functionality onto each chip and integrating photonics with other technologies, such as microelectromechanical systems (MEMS) and microelectronics. Photonic integration is also a crucial step toward sustainability, as it plays a vital role in reducing the Size, Weight, and Power (SWaP) requirements of components.



## MEMS

Microelectromechanical systems (MEMS) and sensors are becoming increasingly popular throughout the advanced technology ecosystem. Enhanced accuracy, reliability, and miniaturization have led to MEMS devices being integrated into a wide range of applications, from wearables and IoT-connected devices to Industry 4.0 applications in the automotive sector.

#### SELECTED PHOTONICS R&D PROJECTS

- Fiber-to-chip interconnect using laser splicing (Photonect)
- High speed modulator packaging demonstrator
- Oevelopment of silicon photonics library cells
- ✓ Optical Logic Gate



- 🛇 Quantum Sensing
- Diamond substrate
  (photonics as an example)
- MEMS hearing aid device

#### Quantum

Quantum computing is exploding, powered by significant increases in investment and technological breakthroughs. Industrial applications are almost limitless, with the pharmaceutical and financial services industries being early adopters. CMC's strategy is to democratize access to stateof- the-art quantum hardware and software technologies.

Our quantum programming experts have access to state-of-the-art quantum platforms from IBM, Xanadu, PasQal, Anyon, D-Wave, and IonQ to serve Canadian researchers and entrepreneurs.

On the hardware side, CMC offers Multi-Project Wafer (MPW) fabrication services, including PDK development, for superconducting and photonic quantum devices, a crucial step to accelerate innovation in this emerging space.



## IoT & Edge AI

The rise of the Internet of Things (IoT), artificial intelligence (AI) and machine learning (ML), and 5G network capability have driven demand for power-efficient, secure computing at the network edge.

Applications such as wearables, biomedical monitoring, autonomous driving, and precision agriculture are producing an unprecedented amount of data from sensors.

#### SELECTED QUANTUM R&D PROJECTS

- Unsupervised quantum machine learning for applications in health sciences
- Implementing division operation in a quantum computer
- Solving black-box optimization problems with quantum computers
- Process design kit for Canada-Made superconducting quantum devices



- Swiftmote open source IoT sensor platform
- Untether AI tsunAImi Accelerator deployment
- Tenstorrent-Grayskull-e150
  Accelerator deployment

# By the Numbers

## A Growing Research Community

A national network of over 10,000 academic participants and 1,200 companies developing innovations in micro-nanotechnologies.

#### **Collaborative Initiatives**



415 academic collaborations with industry valued at \$23M

590 university collaborations in Canada and abroad

155 academic collaborations

with government and not-for profit organizations

#### **Research Excellence**

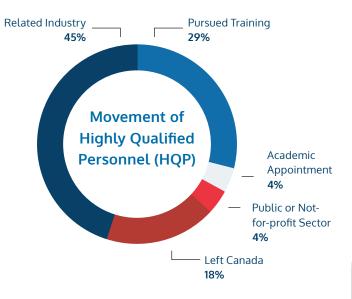


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# Developing Semiconductor Skills Needed in Canada

Finding, keeping, and developing talent is critical to keep Canada's semiconductor sector globally competitive.

CMC is playing a key role in helping to build Canada's semiconductor sector, and CMC-trained alumni are developing into the leading chip designers of tomorrow.



CMC-trained personnel work for and collaborate with over 1,200 Canadian firms from start-ups and scale-ups to industry giants in sectors where Canadian innovation is most needed.



82% of HQP Stayed in Canada

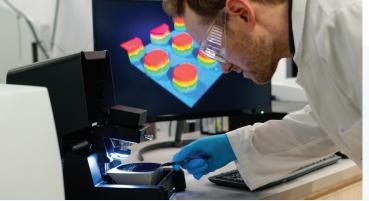


**Success Stories** 

## Making atomic force microscopes fast, easyto-use, powerful – and accessible

Atomic Force Microscopy (AFM) is a powerful tool used in nanotechnology and material science to examine surfaces at the atomic and molecular levels.

Traditional AFM instruments were difficult and time-consuming to operate, and largely



unchanged since their invention in the 1980s. Their cost and complexity hindered widespread adoption, especially for emerging firms in the booming field of nanoscience. The solution: AFM-on-a-chip technology that was developed over the course of ten years at the University of Waterloo by Neil Sarkar of ICSPI Corp. with a helping hand from CMC in the form of CAD tools and fabrication services.

#### In 2023-2024 CMC Delivered:

 ✓ 7 training courses including four highly-specialized, intensive CMC Basecamp<sup>™</sup> training courses delivered to over 200 participants.



We offered training on the entire Design-Fabricate-Test cycle of superconducting devices used in quantum computer hardware – a unique learning opportunity for students in this emerging area.

#### ${}^{\scriptsize ext{O}}$ We also offered training in Quantum Machine Learning

In partnership with the NSERC CREATE programs of Quantum BC, QSciTech, and the Quantum AlgoLab of Institut quantique 60 trainees gained practical skills on quantum computers Participants were given access to IBM Quantum platforms - running calculations on some of the world's most powerful quantum machines to solve real-world problems in finance, drug development, and cybersecurity.

- Ø Active Silicon Photonics Fabrication Course
- Ø Passive Silicon Photonics Fabrication Course
- Analog/Mixed-Signal Design Methodology and FinFET Layout Training

These courses provide a unique combination of theory and lab work and a trainee experiences the entire design/fabrication/test cycle of their very own microchip.

# 95% Satisfaction rate from course attendees

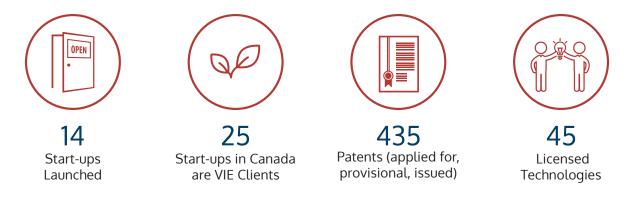


We also launched the TnT series – semiconductor training for non-techies.

Targeted at individuals who work inside technology firms or supplier companies but don't have experience or education in hardware technology, TnT equips non-technical professionals with the knowledge and skills to progress in the dynamic world of semiconductors.

# **Industrial Impact**

# Geared for Growth: Path to Commercialization for Academic Research



In the past 25 years researchers have reported 256 spinoff companies of which more than half are still Canadian controlled and active. The 10-year survival rate for CMC enabled start-ups is 80 percent, far better than the typical rate of about 45 percent.

## Serving Industrial and International Customers



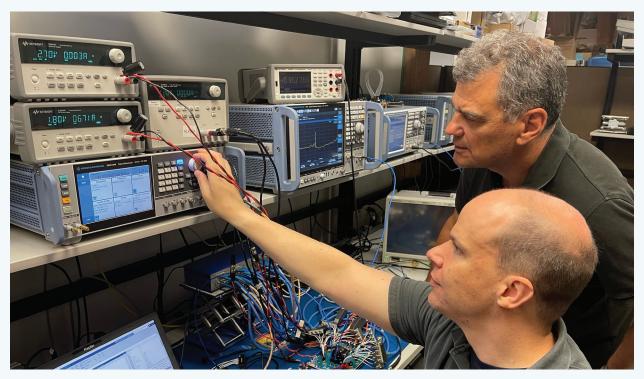
# Peraso Inc. offers solutions that are ahead of the curve

Peraso Inc. was founded in 2009 based on research by the University of Toronto's Professor Sorin Voinigescu. In the mid-2000s their work in the thennew high-frequency 60 gigahertz (GHz) band was well ahead of its time, at a time when cellphones didn't have the capacity to process the vast amounts of data we all take for granted today.

It would be another 10 years before the wireless industry caught up with the solution offered by Peraso – mmWave technology, a range of electromagnetic frequencies between microwaves and infrared. In 2019 the company's fortunes accelerated when it attracted \$42M U.S. to develop its chips for the 60 GHz band. More recently, the company's technology has found traction in the emergence of the fixed-wireless access (FWA) market, where mmWave technology is replacing the need for digging optic fibers. It's also finding market niches in the growth of virtual reality and any other wireless applications that requires high data rate and low latency.

In 2022 Peraso Inc. went public with a listing on the Nasdaq stock exchange (ticker: PRSO). It is currently one of a handful of pure-play 5G companies publicly trading on that exchange.

## 'They're shining examples of the success you can have with semiconductor-based devices. It shows we have good expertise here in Canada, and CMC is at the heart of that ecosystem.'



Dr. Ian McWalter, Member of the Board of Directors, Peraso

# Capability to Keep Researchers at the Leading-Edge

#### CAD

High-performance Computer Aided Design (CAD) tools and environments for successful design from over 20 vendors

- 🛇 85 CAD tool suites available via desktop or through CMC Cloud
- 🕢 8,693 users
- $\oslash$  254 user guides, design flows, and training materials
- ✓ 3 webinars

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#### FAB

Multi-project wafer services, value-added packaging and assembly services and in-house expertise for first-time-right prototypes

Over 360 designs prototyped for researchers and entrepreneurs in Atlantic Canada, Quebec, Ontario, and Western Canada.

Over 40% of these are photonic designs – an internationally recognized Canadian strength. Designs fabricated in a diverse range of technologies and applications:

- Photonics
- Quantum technologies
- MEMS
- Microelectronics
- Nanoelectronics

- Microfluidics
- Advanced Packaging
- Characterization
- IoT & Edge AI devices

Over the past five years, almost 1,800 designs have been fabricated, while over 3,500 have been fabricated over the last decade.

#### LAB

#### Device validation to system demonstration

- Oevice validation to system demonstration
  - 680 programmable development systems
  - 80 pieces of test equipment for rent
- 🔗 Online support system with more than 2,200 cases closed annually
- RISC-V processor design & prototyping
- 🧭 Electronic Sensor Platform (ESP)
- SwiftMote Sensor Platform (wireless sensor)
- ✓ 8 PetaFLOP Atlas 800 AI training server installed at the University of Waterloo to accelerate research projects

# A Supply Chain for Key Economic Sectors

## **Global partners'**

CMC's international technology alliances enable access to accelerate innovative research in Canada.



\*Collaborative organizations have similar mandates to accelerate advanced technology research and innovation.

# A Thriving Advanced Technology Supply Chain in Canada

## CMC is Building Capability in Canada and is Proud to Play a Vital Role in the Thriving Canadian Ecosystem

A National Supply Chain >50 Organizations, for example:



# Working with International Peers to Advance the Global Potential of Micro-Nanotechnology



## Facilitating Ecosystem Development Through Membership in Strategically Aligned Organizations



## Revealing the secrets of dark matter

Researchers at the Université de Sherbrooke, supported by CMC Microsystems, are helping build sensors to detect 'dark matter' – the unknown substance that scientists think makes up about 25% of the universe.

They developed Single-Photon Avalanche Diode (SPAD) array photodetectors that can detect lowintensity signals down to single light particles (photons). By digitally counting individual photon particles, SPAD sensors can achieve exceptional low-light performance, even in conditions approaching near total darkness. CMC provided the Sherbrooke team with technical support, and subsidized, cost-effective access for a photodetector fabrication run.

Understanding dark matter can unlock fundamental mysteries of the universe itself which have puzzled humanity since the beginning of time. Many physicists are hopeful that dark matter may turn out to be just like radio waves, infrared light, X-rays and gamma rays – impossible to see, but used every day for new innovations once understood and harnessed.



"CMC provided us with tools that would otherwise be out of reach"

Nicolas Roy, 3IT

## **Celebrating Innovation**

In 2024, CMC celebrated our 40th anniversary. As we reach this milestone, we are proud of our history and role in the Canadian semiconductor, advanced manufacturing, and innovation ecosystem. Here are a few important steps from the past four decades



#### 2021

CMC introduces quantum computing services, providing access to world-leading quantum platforms, coding services, and superconducting hardware fabrication to the Canadian quantum ecosystem.



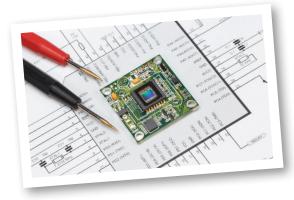
#### 2020

CMC launches the Virtual Incubator Environment (VIE), a suite of tools and services designed specifically for startups.



#### 2015

CMC partners with Queen's University and Innovation Park to establish the Kingston Nano-Fabrication Lab, giving academics and commercial customers access to leading-edge services for creating and testing advanced micro-nano technologies.



#### 2014

CMC completes 400 design projects in photonics, including more than 300 projects in silicon photonics.



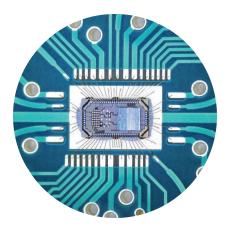
#### 2010

CMC introduces a low-cost subscription model to optimize the selection and use of design tools and equipment by researchers. This approach enables CMC to better track research results, build relationships with users and continuously monitor/update its offerings and service model.



#### 2005

CMC gives academics access to highly specialized integration processes for multiple technologies via industrial partners Dalsa Semiconductor and CMP (France)



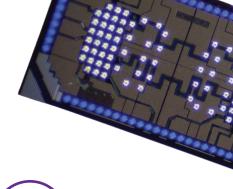
#### 2001

CMC deploys national Systemon-Chip Research Network (SOCRN), the world's first research program focused on platforms for creating complex, integrated microsystems; and a national Microelectronics and Photonics Testing Collaboratory.



#### 1996

CMC launches a low-cost test equipment pool, providing academics with the loan of specialized testing equipment otherwise unavailable/ unaffordable to them.





#### **1988**

CMC now offers \$2M/year worth of commercial design tools at cost-effective academic rates, ensuring that researchers' and students' work is leading-edge and compatible with commercial development environments.



#### **1985**

CMC begins to distribute design tools to universities; participation in this network grows from four universities (1984) to 24 universities in nine provinces.

## Working Together to Complete the Circuit

#### 1984

Pre-internet, CMC establishes its own electronic network for data transfer, with "electronic messaging" system provided by Telecom Canada.



#### 1983

First fabrication runs in collaboration with Northern Telecom, from 5-micron to 1.2-micron CMOS

## **Canadian Semiconductor Symposium**

CMC launched the first ever Canadian Semiconductor Symposium, held November 23 and 24 in Ottawa.



# Creating a vibrant and sustainable semiconductor ecosystem to benefit Canada

This signature event featured prominent voices from across Canada's semiconductor ecosystem, including industry leaders, researchers, entrepreneurs and venture capitalists.

We asked leaders where the Canadian semiconductor ecosystem stands today, identifying strengths and opportunities for semiconductor innovation in Canada. The event drew over 100 people from across Canada in many areas of expertise including photonics, compound semiconductors, quantum, advanced packaging, venture capital, and public policy.

The Symposium will be an annual event, with the 2024 edition taking place in October in Markham, Ontario.



## Greater Bandwidth for Next-Generation Mobile Communications



Dr. Thomas Jones, founder, director, and CEO of Jones Microwave Inc., Adjunct Professor at the University of Alberta and Senior Research Associate at Purdue University, won the 2023 CMC Microsystems Douglas R. Colton Medal for Research Excellence for his work on light-activated switches that controls microwaves at high frequencies, high powers, and high speeds to increase the bandwidth of mobile devices and other communications equipment.

During his joint post-doctoral fellowship at the University of Alberta and Purdue University, Jones developed a light-activated switch that controls microwaves at high frequencies, high powers, and high speeds and could increase the bandwidth of mobile devices and other communications equipment.

High-frequency bands, such as millimeter and sub-THz waves in the 30 to 300 GHz spectrum, are challenging to control. But as lower frequency, standard communication bands become more congested, millimeter-wave to sub-THz bands are expected to be essential for future fifth- and sixthgeneration, or 5G/6G technology, and Internet of Things (IoT) applications.

The fabrication lab nanoFAB located at the University of Alberta is producing the switch, which has been patented. The next step for Jones Microwave Inc. is to work with clients to build the component into their systems and field test it.

The company has a contract with the Canadian Department of National Defence. Jones says "In a war zone, you are in a battle for electromagnetic



#### 'This has been a 10-year journey. CMC supported me throughout my PhD and post-doc and now as I build my own company.'

- Thomas Jones

space: You must be able to adapt to the constant attempts to spy on and jam communication lines, so you need higher security communications. These higher frequencies enable the military to have a superior level of control over the flow of information."

#### **TEXPO 2023**

#### **Graduate student competition recognizing novel research with industrial relevance.** Congratulations to our award winners!



#### Award for Excellence in Microsystems Fabrication

Sponsored by Teledyne Micralyne



Ali Maghzian

York University

Supervisor: Pouya Rezai

Fabrication Of Biomimetic and Flat Collagen Scaffolds Containing Embedded Microchannels Inside 3D Extracellular Matrices With 2D Basement Membrane Linings

#### Brian L. Barge Microsystems Integration Award

Sponsored by CMC Microsystems



**Emerich Kovacs** 

University of Manitoba Supervisor: Douglas Thomson

Lensless Optical Dielectrophoresis Cytometer for Single Cell Analysis

#### Award for Microsystems Innovation by Women Sponsored by GlobalFoundries



Alisa Ugodnikov

University of Toronto Supervisor: Craig Simmons

Development and validation of platforms with integrated electrical sensing for application to in vitro biological barrier modeling Award for Excellence in Microsystems CAD Tools and Design Methodology

Sponsored by COMSOL



#### Vishal Balasurbramanian

University of British Columbia Supervisor: Mohammad H. Zarif IoT-Ready Microwave-based Smart Coatings for Real-Time Coating Damage Detection

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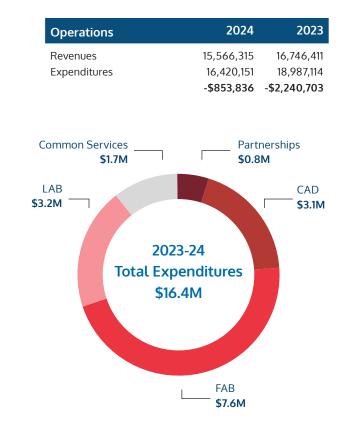
# Financial Summary

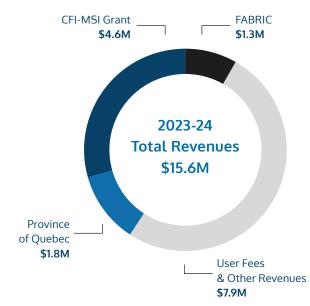
CMC delivers on its mission through the support of serveral financial stakeholders. In 2023-24, total revenues of \$15.6M came from CFI's Major Sciences Initiatives (MSI) program, the Province of Quebec, Innovation, Science and Economic Development Canada's SIF program, and a variety of other sources. The drop in revenues corresponds to the reduced MSI contribution in this final year of funding. Total expenditures were reduced to match the phased out MSI funding.

# Statement of Financial Position as of March 31, 2024

| Assets                             | 2024                                      | 2023                                       |
|------------------------------------|---|--|
| Current Assets<br>Long-term Assets | 7408,562<br>121,991<br><b>\$7,530,553</b> | 6,169,796<br>180,354<br><b>\$6,350,150</b> |
|                                    |   |  |
| Liabilities & Net Assets           | 2024                                      | 2023                                       |

# Statement of Revenue and Expenditure for the Year Ended March 31, 2024





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www.CMC.ca/Corporate-Reports

for our complete audited financial statements



Kingston | Montreal | Ottawa | Sherbrooke



#### Join the Conversation!



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