



RESEARCH & DEVELOPMENT

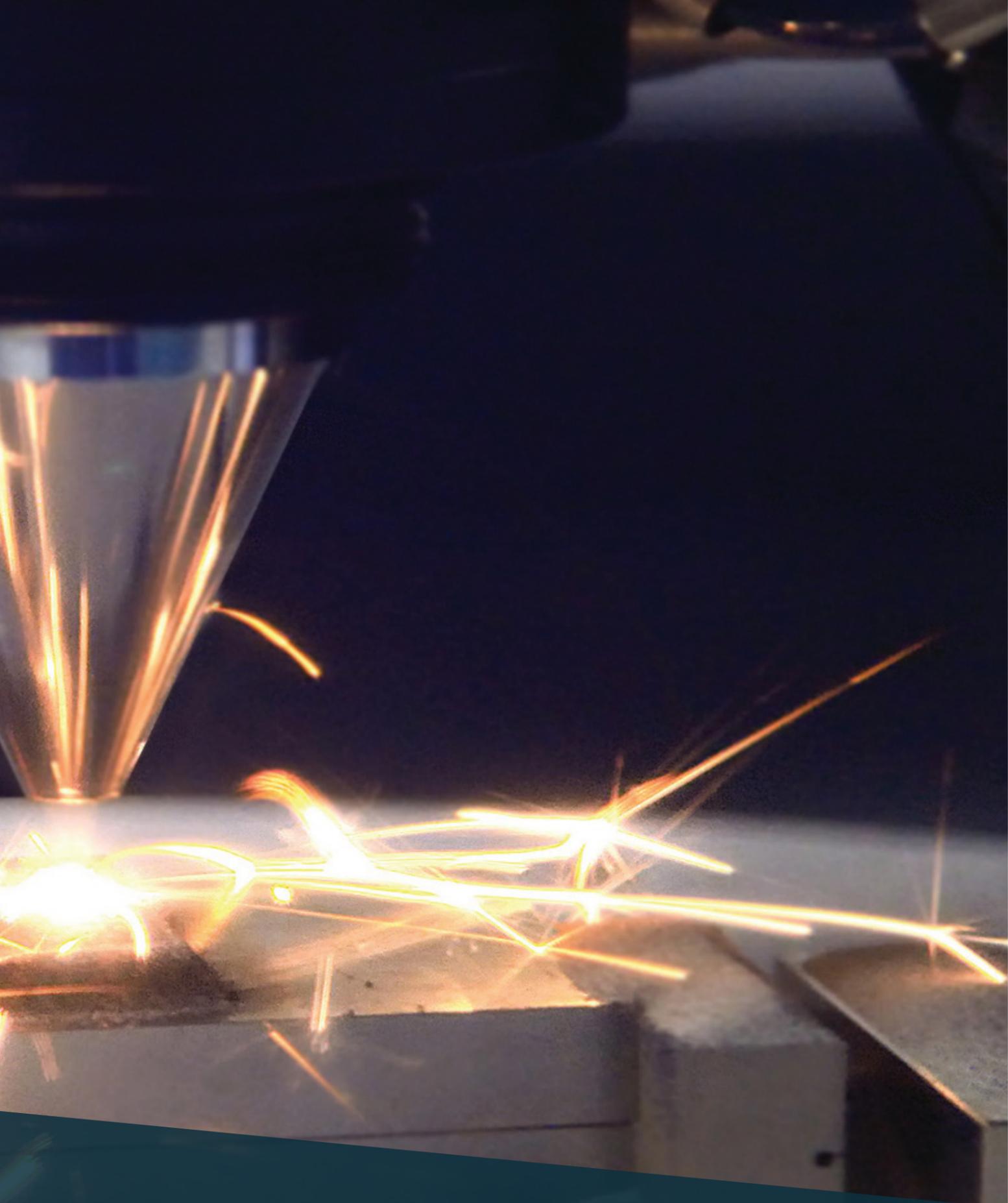
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COMMERCIALIZATION

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PARTNER ATTRIBUTES

Partners will be organizations that have interests in the greater marine industry, naval technology, marine manufacturing and 3D metal printing. They will have a desire to contribute to research projects that will advance the adoption of additive manufacturing in Canada in the marine sector.

Partners will have an interest in the success of the Centre, and the success of the manufacturing sector in Canada. This interest will come in the form of funding and long-term commitment to participate in the direction and technology discussions of the Centre.

COMMERCIALIZATION OPPORTUNITIES

Industrial partners are invited to submit project proposals to the Director of Commercialization. The Centre will provide the full spectrum of services to ensure the success of the projects

Services Offered:

- Part design assistance for optimal printer use
- Design for additive manufacturing design enhancements
- Review of research by academic faculty at university
- Part printing (electron beam or laser methods)
- Post-printing, part finishing (e.g. polishing, cutting, assembly, threading, etc.)
- Rapid prototyping
- Light weight design
- Assembly consolidation
- Stress analysis for part design
- 3D imaging for broken part replacement

WHY BE A PARTNER?

There are numerous benefits to being a partner:

- Priority access to a vast collection of relevant research
- Access to experts in the associated fields relating to additive manufacturing
- Review of research at a university grade facility
- The opportunity to leverage funding through IRB / ITB credits
- Potential for contract research projects, and for those projects to be eligible for scientific research and experimental development investment tax credits
- Recognition as an industry funding member in all publications and media materials
- Access to rapid prototyping for testing and validation



INTELLECTUAL PROPERTY

MAMCE leadership team, L-R: Garry Warren, VP Industrial Development - Construction and Equipment Division, J.D. Irving, Ltd.; Dr. Mohsen Mohammadi, MAMCE Director of Research & Development & Assistant Professor, Faculty of Engineering, University of New Brunswick; Dr. Craig Murphy, MAMCE Director of Commercialization & Director of Technology Commercialization - Construction & Equipment Division, J.D. Irving, Ltd.



BACKGROUND

NECESSITY MEETS OPPORTUNITY

UNB DIRECTED RESEARCH

- Fundamental/applied research directed by UNB
- Background and foreground IP remain with UNB (UNB may seek protection of foreground IP)
- IP licensed to industry on non-exclusive basis
- Industry partners have first right to negotiate exclusive license to IP
- UNB retains rights for purpose of research, educational use, and scholarly publication

INDUSTRY DIRECTED RESEARCH

- UNB as a partner in industry-directed R&D to address specific technological challenges for commercial purposes
- Background IP remains with UNB and licensed to industry (if required)
- Foreground IP assigned to industry
- UNB retains rights for purpose of research, educational use, and scholarly publication

The challenge for Canada's manufacturing industry is to stay current to ever changing fabrication equipment and methods. Much like the telecommunications industry which has been transformed by advances in wireless technology, traditional fabricators and engineers now face the disruption of Additive Manufacturing (AM). The profitability and competitiveness of once popular and proven methods of fabrication will decrease to the point of being unsustainable. To survive and prosper, industry must partner with those advancing this technology as well as with the educational institutions that will train the next generation of workers.

The Marine Additive Manufacturing Centre of Excellence will be the first in Canada to use 3D metal printing as a method for manufacturing certified

parts for the marine industry. This application of Additive Manufacturing (AM) will simplify supply chains, provide complicated parts on demand, and enable the fabrication of new components by Canadian fabricators.

The Centre is an excellent investment for suppliers looking to offset Canada's Industrial and Technological Benefits (ITB) requirements. This program is run by the University of New Brunswick (UNB) and will be eligible for the IRB/ITB multiplier. Partnership in the Centre will also give access to cutting edge research on metals important to marine applications. Supporting the Centre will ensure that the workforce is in place for the future of marine manufacturing in Canada. 🇨🇦

ADDITIVE MANUFACTURING

Additive Manufacturing or “3D printing” refers to processes used to synthesize a three-dimensional object in which successive layers of material are formed under computer control to create a part. Of particular interest is a family of additive processes where digital 3D design data is used to build up a component in layers through material deposition. 3D printing provides the freedom to design more complex shapes with fewer independent parts and the ability to combine assemblies into a single part.

METAL 3D PRINTING

To date, most AM applications have focused on the aerospace and medical industries which are capital cost insensitive. However, focus has been modest in the marine sector which has unique concerns such as corrosion, isolated systems (ships), and time sensitive access to complex and critical spare parts. In the marine industry, these concerns can remove an asset from service.

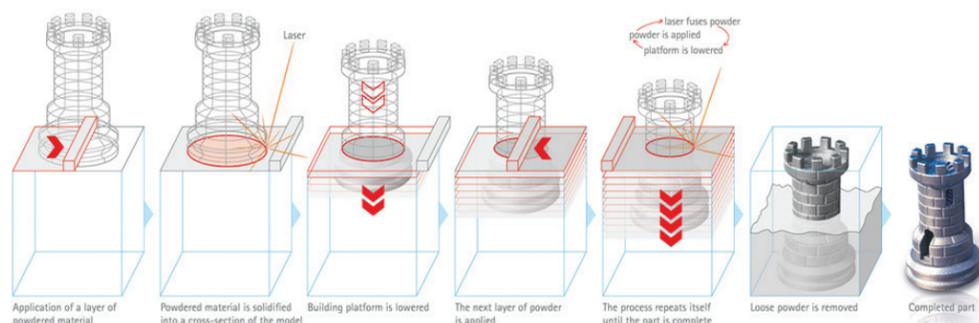
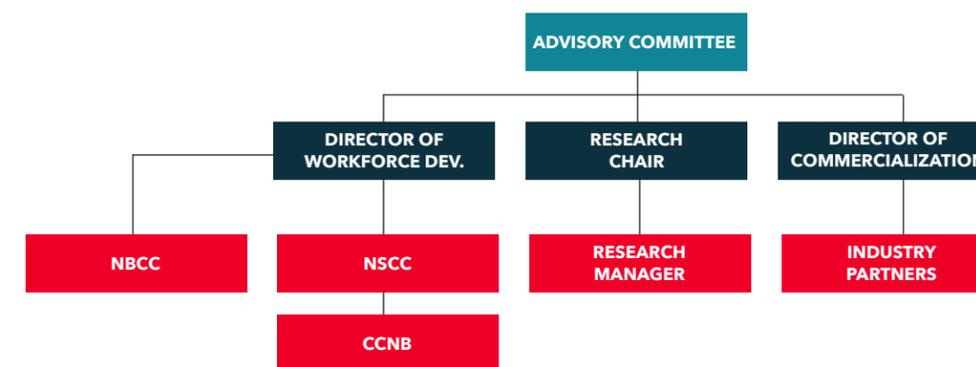


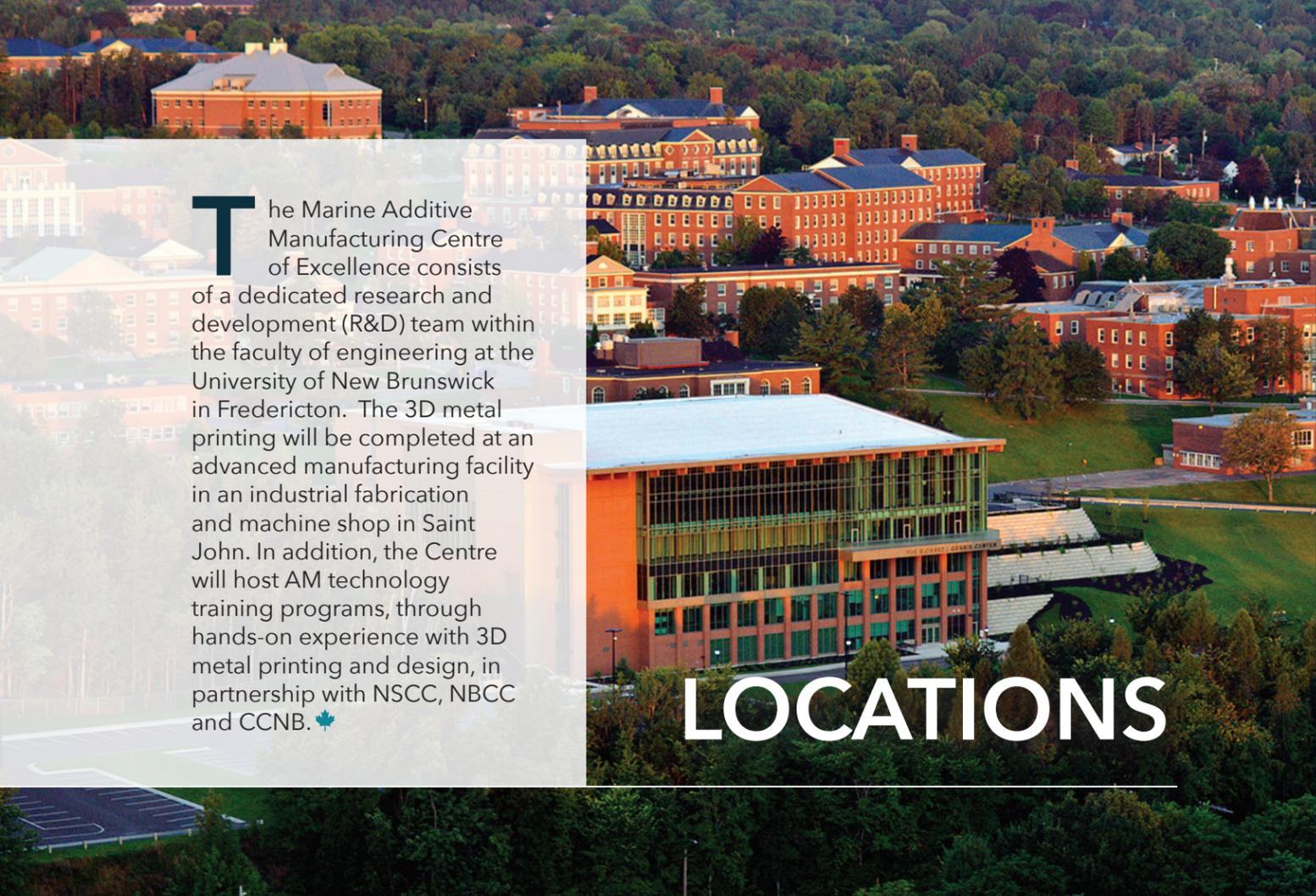
Figure 1: 3D printing using powder bed technology; explained with images, courtesy of EOS.

GOVERNANCE & ORGANIZATION CHART

The Marine Additive Manufacturing Centre of Excellence will be located at the University of New Brunswick. The Centre will be governed by an Advisory Committee, including the industrial and technical partners.

Industrial partners will have the ability to work with R&D and commercialization sections of the Centre, to guide and influence research topics and projects. The Advisory Committee will approve of research topics and specific programs.





The Marine Additive Manufacturing Centre of Excellence consists of a dedicated research and development (R&D) team within the faculty of engineering at the University of New Brunswick in Fredericton. The 3D metal printing will be completed at an advanced manufacturing facility in an industrial fabrication and machine shop in Saint John. In addition, the Centre will host AM technology training programs, through hands-on experience with 3D metal printing and design, in partnership with NSCC, NBCC and CCNB. 🍁

LOCATIONS

MISSION

OUR MISSION is to ensure the adoption of additive manufacturing in the industrial marine sector of Canada by developing methods, procedures, and effective workforce training systems. The Marine Additive Manufacturing Centre of Excellence will work with certification organizations to ensure that designs and parts developed will be certified for commercial use. 🍁

UNB SNAPSHOT

First English-language university in Canada, established in 1785



75% OF PUBLICLY FUNDED RESEARCH
in New Brunswick happens at UNB



STARTUP CANADA
UNB named Canada's most entrepreneurial university by Startup Canada

TWO CAMPUSES
Fredericton and Saint John

6:1

to graduate students

835 FULL-TIME FACULTY AND 1,245 SUPPORT STAFF



\$45 MILLION
in annual research funding (2015) through grants and contracts



20+
research institutes and centres



25+
research chairs



75+
startup and spinoff companies

INDUSTRY FUNDING MEMBERS

The Marine Additive Manufacturing Centre of Excellence is seeking industry participants who have an active interest in marine and defense manufacturing, and related industries. Partners capable of bringing experience in AM in other sectors are also valued. Further, partners willing to participate in field trials and commercialization projects are welcome.

The Centre is a non-profit organization focusing on the successful adoption of additive manufacturing in Canada. 🍁

THE 3 PILLARS FOR ADOPTION

The University of New Brunswick with industrial partners Custom Fabricators & Machinists (CFM), Irving Shipbuilding Inc. (ISI), Lockheed Martin and Lloyd's Register, and training partners New Brunswick Community College (NBCC), Collège communautaire du Nouveau-Brunswick (CCNB), and Nova Scotia Community College (NSCC), is developing an additive manufacturing adoption program using commercialization, research in metal 3D printing, and workforce development. The Centre is primarily focused on additive manufacturing in marine environments.

The research portion of the Centre will be led by Dr. Mohsen Mohammadi at UNB.

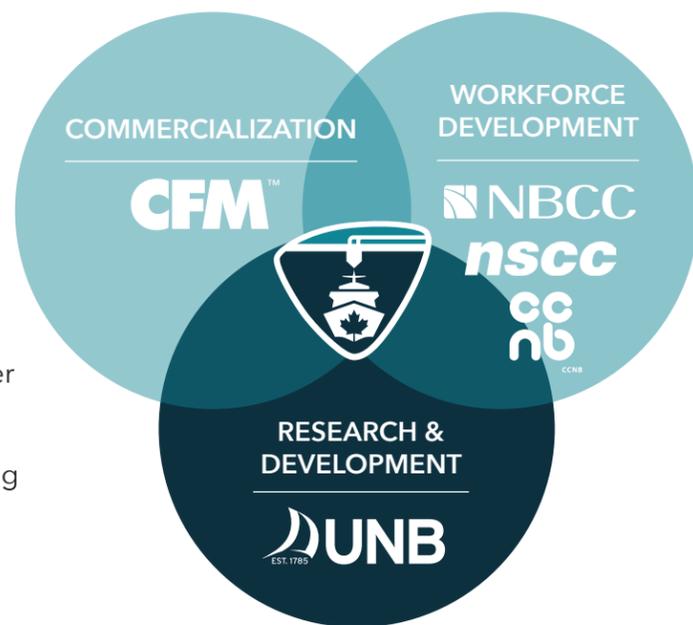
THE RESEARCH AND DEVELOPMENT TOPICS WILL INCLUDE:

- Enhanced Corrosion Protection
- Hybrid Printing
- Smart Parts
- Blast Resistance

Workforce development and training will be led by both NBCC, CCNB and NSCC. Additive manufacturing courses will be enhanced by the opportunity to work hands-on with the Centre's powder bed 3D metal printers. Certificate programs are being developed to provide workforce exposure and training to this disruptive technology.

The third and final pillar for the successful adoption of AM in Atlantic Canada is the commercialization of the technology through integration with the fabrication and manufacturing sector. The Centre has enlisted a Director of Commercialization, whose focus is on business development. Industry will have access to experts in the field of 3D metal printing with no financial barrier to entry in the development of their product or part. The centre will act as an incubator for new commercial product development.

With effective partnerships, proven research techniques, and workforce development; the Centre will ensure the successful adoption of additive manufacturing in Canada. 🍁



Dr. Mohsen Mohammadi is Director of Research and Development for the Marine Additive Manufacturing Centre of Excellence. He is also an Assistant Professor of Mechanical Engineering, and Director of the Cognitive Performance Optimization Lab at the University of New Brunswick.

Dr. Mohammadi is developing advanced materials using additive manufacturing techniques. His current research focuses on enhancing the mechanical, corrosion, impact, and fatigue properties of additively manufactured metals (aluminum, titanium, steels). It also involves: 3D printed long fibre composites, metal matrix coatings, and ultra-light high strength metamaterials.

Prior to beginning his academic career at UNB in 2015, he was a Research Associate and Postdoctoral Fellow at the University of Waterloo in Ontario, NSERC Visiting Research Fellow at Canmet MATERIALS (Natural Resources Canada), and PhD candidate at the University of Western Ontario.

Dr. Mohammadi is a leader of several significant projects on metal additive manufacturing in marine, defense, automotive and aerospace sectors. 🍁

DR. MOHSEN MOHAMMADI

