

McMASTER ENGINEERING:

BUILDING A DEFENSE AND AEROSPACE LANDSCAPE

The defense and aerospace sectors in Canada are evolving and McMaster Engineering is providing the knowledge and resources that position Canada with a greater competitive advantage in local and international markets. Our researchers work with industry to support the modernization of both the civilian and military sectors, by delivering reliable and efficient solutions for key aerospace and defense challenges, such as:

- Energy generation and utilization (battery technology, smart & micro grids for remote or critical asset protection)
- Industry 4.0 & the IoT: digitization of information and systems integration
- New materials design and testing (lightweight alloys, composite materials)
- Smart sensors and bio sensors for learning machines and human machine interfaces
- Protective technologies and nanoscale coatings for corrosion and/or wear resistance
- Additive manufacturing for efficient production of parts with complex shapes
- Big data and predictive analytics for decision making
- Security and cyber security
- Wearable technologies



OUR EXPERTISE

Access our expertise and equipment at:

- Centre for Automotive Materials and Corrosion
- Initiative for Automotive Manufacturing Innovation
- Centre for Mechatronics and Hybrid Technologies
- McMaster Manufacturing Research Institute
- Brockhouse Institute for Materials Research
- McMaster Institute for Transportation and Logistics
- Canadian Centre for Electron Microscopy
- W Booth School of Engineering Practice and Technology



Dr. Nabil Bassim
Associate Professor,
Materials Science and
Engineering; Former
Research Engineer, U.S.
Naval Research
Laboratory

Research interests: Advancing electron and ion microscopy of materials microstructures, ranging from thin films for optoelectronic application, 2-D materials, nanobiomaterials, and structural materials such as steel, Al alloys and concrete.



Dr. Florent Lefevre-Schlick
Senior Advisor for
Defense, Security and
Aerospace; Research
Associate in Materials
Engineering

Research interests: The development and manufacturing of complex materials with a particular interest in man/machine interface, wearables, manufacturing processes and efficiency.



Dr. Mo Elbestawi
Director, W Booth
School of Engineering
Practice and
Technology;
Professor, Mechanical
Engineering

Research interests: Manufacturing engineering, specifically additive manufacturing, machine tools, metal cutting, and computer-aided manufacturing.



Dr. John Preston
Associate Dean,
Research and
External Relations;
Professor,
Engineering Physics

Research interests: The application of lasers in the creation, fabrication and analysis of novel materials that are of interest for future devices. A major focus is the need for better materials and processes for solar cells.



Dr. Stephen Veldhuis
Director, McMaster
Manufacturing Research
Institute (MMRI);
Professor, Mechanical
Engineering

Research interests: Selecting and developing surface engineering solutions for high performance machining and tuning of machining parameters to improve productivity and quality while reducing cost. Strong focus on developing efficient manufacturing processes for machining operations.



Dr. Hatem Zurob
Chair,
Department of
Materials Science and
Engineering

Research interests: Microstructural evolution in engineering materials and the effect of microstructure on mechanical properties. Development of novel solutions for aerospace applications including 3-D printed materials, functionally-graded materials and architecture materials.

Let McMaster University be your partner of choice for innovation.

Dr. John Preston, Associate Dean
Research & External Relations

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ENGINEERING SOLUTIONS THROUGH COLLABORATION

Our researchers collaborate with government, the private sector, and other institutions to discover, design, and commercialize today's most innovative technologies and materials. For advanced aerospace engineering and defense applications, innovations include: material design and characterization; process design for additive manufacturing of Ti based alloys for aerospace engineering; new aluminium alloys for space applications; steels and Inconel for turbine applications; invar for electronic and aerospace applications; and final part machining and finishing.

Microwave Radar Technology for Concealed Weapon Detection

The radar imaging and detection team led by Dr. Natalia Nikolova at McMaster University is at the forefront of innovation in radio-frequency, microwave and millimeter-wave systems for imaging and detection. Nikolova's exciting new technology, a cognitive radar for the stand-off detection of on-body concealed weapons, can detect a variety of small weapons, such as handguns, knives, grenades and explosive vests hidden under clothing.



Canadian Centre for Electron Microscopy (CCEM)

(CCEM) provides world-class electron microscopy capabilities and expertise. Operated by the renowned Brockhouse Institute for Materials Research, the CCEM offers access to state-of-the-art instrumentation that industry needs to push the boundaries of discovery. Researchers are pioneering game-changing advancements for applications in aerospace, defense, energy, nanomaterials, electronics, biomaterials and metallurgy.

Major Equipment

- **Atom Probe Tomography: CAMECA LEAP4000X HR:** Unparalleled spatial and compositional accuracy for 3D analysis
- **JEOL 2010F and Philips CM12:** In-situ liquid electrochemistry experiments
- **FEI Titan 80-300 HB & LB:** For atomic imaging and analysis tomography, with cryogenic capability
- **Focused Ion Beam — Zeiss NVision40:** 3D FIB tomography, energy dispersive X-ray spectrometry, precise and controlled removal of material at the micro or nano scale

McMaster Manufacturing Research Institute (MMRI)

\$18M in equipment investments provide researchers with an industrial-scale platform that spans nearly all of Ontario's established and emerging manufacturing sectors. For aerospace engineering, research focuses on manufacturing processes such as tooling selection, material development and characterization, process development, and optimization with extensive support for difficult-to-process materials, which are critical to the industry. Activity also centers on the development of cyber-physical systems for on-line process monitoring, closed-loop machining feedback, process optimization and custom machine design.



Major Equipment

- **Advanced Experimental PVD Coater** for tooling, parts and functional coatings
- **11 CNC production machines** including 5-axis and high speed machines, highly instrumented with a range of data-collection sensors
- **Micro Materials NanoTest** for nano-mechanical and nano-tribological tests
- **Alicona G5 Infinitefocus 3D** for Metrology & Tooling Wear Characterization Equipment



Additive Manufacturing Group (AMG) supports academic research and educational programs in design for multi-scale modelling and simulation for AM processes, development of tailored materials for AM, in-process monitoring and control for AM processes and metal hybrid manufacturing.

Invest in excellence with Scientific Research & Experimental Development Tax Incentive Program

Funds spent on Canadian university research are eligible for tax credits through programs such as the Scientific Research & Experimental Development (SRED) Tax Incentive Program, the largest single source of federal government support for Industrial Research and Development in Canada. Any business involved in basic or applied research, or in developing new and improved materials, devices, products or processes may be eligible. Visit www.cra.gc.ca/srec-assessment for more details.

