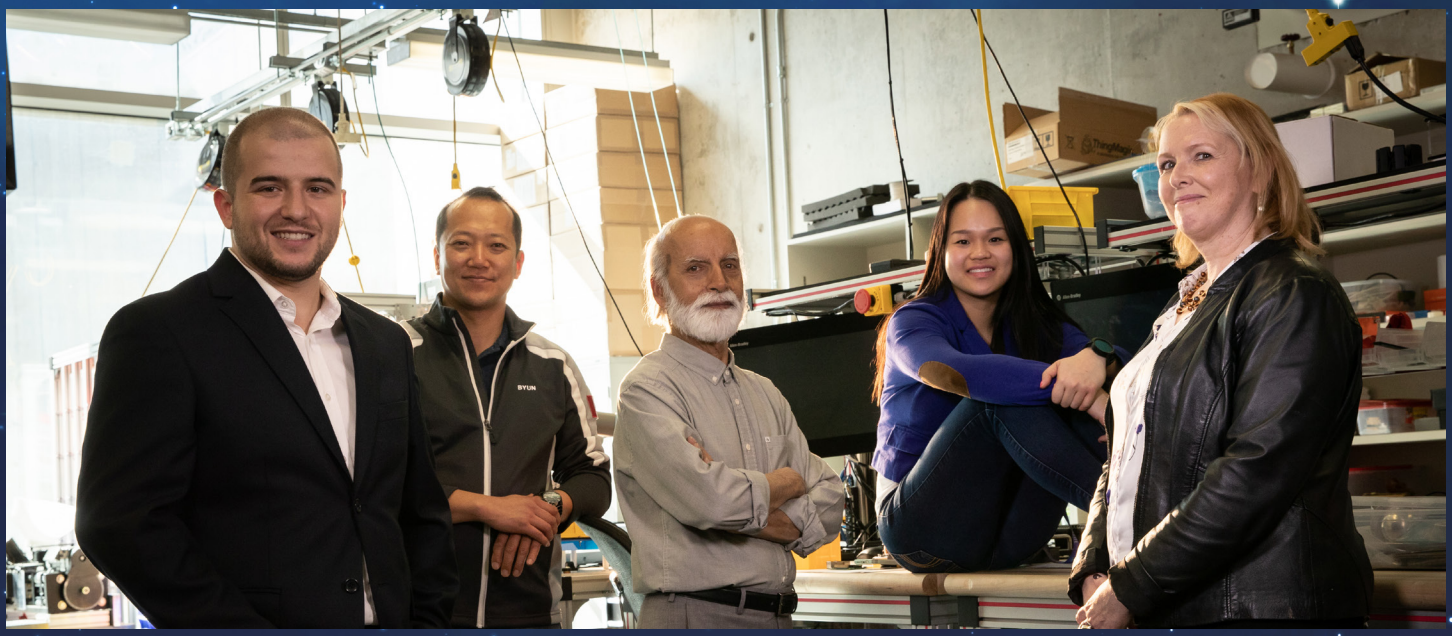

TO GO WHERE NO NUCLEAR DOSIMETRY PROGRAM HAS GONE BEFORE

A Bruce Power scientist helps McMaster University launch a project with the Canadian Space Agency

A new Canadian Space Agency (CSA) tool to ensure safe levels of radiation for astronauts during space exploration got its start in technology used in nuclear power plants.

Space explorers can face a number of unknown risks, including one familiar to us here on earth where it is just as difficult to quantify without the proper tools: radiation exposure.

With humans starting to extend their space exploration beyond a low earth orbit – where the International Space Station is located – radiation detection systems that can classify and characterize radiation hazards are more necessary than ever.

A satellite the size of a loaf of bread, conceived by Bruce Power senior scientist, and CANDU Owners Group (COG) Health, Safety and Environment (HS&E) committee member, Andrei Hanu is one of 15 projects chosen by the CSA to be launched into space as part of the Canadian CubeSat Project. The project was developed by Hanu working with a team of McMaster faculty and students.

The satellite, named NEUDOSE — "NEU" for neutrons, "DOS" for dosimetry (the measurement of radiation dose) and "E" for exploration – is the first device to measure the amount of neutron and charged particle radiation an astronaut receives during a spacewalk. Neutrons, which are produced when galactic cosmic rays interact with the earth's upper atmosphere, make up about 50 per cent of the radiation dose that humans receive in space. It's important to track an astronaut's exposure to neutrons, because they can have serious effects on a body's DNA – but that hasn't always been possible.

"Conventionally, the instruments that were required to measure neutrons in space were very heavy – up to 50 kilograms, and using 600 watts of power," explains Hanu, a graduate of McMaster's Radiation Sciences program. "You can't use those instruments for personal dosimetry. So we wanted to develop something that would solve that problem."

NEUDOSE, which is expected to be deployed from the International Space Station in 2021, will beam data from the International Space Station back to McMaster, where it will be collected and analyzed, helping researchers on the ground understand how long-term exposure to

charged and neutral particles affects the human body.

The project that has been years in the making – one that started with Hanu, during a fellowship at NASA's Goddard Space Flight Centre from 2013-2017, where a fifth of his time was dedicated to creating "game-changing" technology.

Hanu was working on developing an instrument to measure radiation exposure in astronauts and reached out to two people he knew could help him: Fiona McNeill, the director of McMaster's Radiation Sciences graduate program, and Soo Hyun Byun, a professor of physics and astronomy.

The project's information meeting attracted almost 100 students across a range of disciplines, from engineering to life sciences to science. Since then, roughly 40 undergraduate and graduate students have worked on the project designing, fabricating and testing the satellite structure as well as its supporting structure.

A group of students tested the satellite through NASA's High Altitude Student Platform (HASP) program in 2017, flying the satellite's radiation detector 100,000 feet above the earth in a high-altitude balloon above the Columbia Scientific Balloon Facility in Palestine, Texas. Another group will return this year to perform further tests.

Collaboration, whether with academia or with industry colleagues, such as through COG, provides an important opportunity to advance ideas and to train Highly Qualified Persons (HQP), says Hanu. That is true for radiation dosimetry and in other fields where innovation is helping us improve safety and advance the quality of life we experience right here on earth.

— Files and photos by McMaster University

At the top of the page and above, members of the McMaster team that launched a Canadian Space Agency project. Top of page, left to right: Bruce Power's Andrei Hanu with McMaster's Soo-Hyun Byun, Ishwar Singh, Erica Dao (student project manager) and Fiona McNeill. Photo above, Hanu and Singh discuss the Neudose project.

CANDU Owners Group shares message of collaboration and innovation at industry licence renewal hearings

COG President and CEO Fred Dermarkar recently spoke at the Ontario Power Generation Pickering Nuclear and Bruce Power licence renewal hearings. In doing so, he highlighted both companies' commitment and achievements in furthering nuclear safety and advancing knowledge of CANDU plant and equipment management as well as human performance.

In his remarks to the Canadian Nuclear Safety Commission on the Pickering station, June 27, Dermarkar highlighted OPG's high safety standards and their leadership role in COG programming.

"OPG is a leader in continuous improvement, innovation through R&D, nuclear safety and emergency preparedness," Dermarkar said. "These efforts have a direct correlation on OPG's ability to safely and predictably manage the Pickering station until end of operation. The quality of the work and the resulting performance is transparent and measurable."

In support of the 10-year licence renewal for Bruce Power's Nuclear Generating Stations A and B in Kincardine, Ont., on May 30, Dermarkar highlighted the important contributions Bruce Power has made to the industry through its R&D activities at the site and through its membership in COG over several decades.

"Through its contributions to the nuclear industry, Bruce Power is advancing health care, is helping Canada achieve its goals for climate change and is helping us provide safe, reliable, affordable electricity with nuclear technology," Dermarkar said.

Dermarkar also appeared at the Canadian Nuclear Laboratories Ltd. hearing earlier in the year and at the New Brunswick Power hearing in 2017.

Read more on COG's CNSC submissions on the Pickering Nuclear and Bruce Power licences:
OPG Pickering Nuclear
Bruce Power