McMaster engineer working with NASA to improve deep space medicine

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Dr. Tom Doyle at the Eureka, NU outpost during fieldwork where he is being telementored in realtime by a McMaster medical expert communicating from Scotland, UK, on how to conduct his first intubation. Credit: McMaster

Imagine a doctor trying to perform a life saving medical procedure in the middle of the wilderness. That's what it's like tackling medical emergencies in deep space.

It's an issue that's become the focus of Tom Doyle's research. The McMaster Electrical and Computer Engineering professor and Director of the McMaster eHealth Program is among a team of experts working with NASA to determine what medial training and technology astronauts need to save a life in space.

As missions to space become longer, the need for diagnosis and treatment of trauma and major illness in astronauts is becoming more acute.

"With longer class missions like Mars within reach, we have to come up with better methods and measures to keep our astronauts safe for longer periods of time," said Doyle, who is working with experts from Harvard University and the Northern Ontario School of Medicine on the project.

Doyle's research will focus on developing new supports for astronaut health during deep space exploration missions, both remotely and at the International Space Station (ISS). "We have medical kits," Doyle said, "but right now space is a lot like camping. You have the basic tools but you're too remote to easily access help if something serious goes wrong."

Currently, if an astronaut has a major medical event in space, it takes about 12 hours to get back to Earth. As well, gravity wreaks havoc on everything from containing blood, to finding organs that shift in the body.

Doyle's team will be looking to create new protocols and intelligent systems for telemedicine, which is remote medical monitoring and decision support via telecommunications technology. Similar to the Ontario Telehealth Network (OTN), a medical expert on Earth connects with an astronaut crew member in Space and walks them through a situation. However, unlike OTN, the communication link may have time delays, limited bandwidth, or there may be no link at all. This creates a much more challenging medical scenario than most terrestrial telemedicine.

Doyle's research team will create an ISS simulator and work to come up with a better set of guidelines for conducting telemedicine and better tools to do it. Tools like handheld devices that can assist with crew peak performance monitoring and informing medical diagnoses. As they develop newer procedures, they will test them by simulating emergencies that have to be addressed with the equipment on the ISS. The end goal is to develop a simulator to develop and test better guidelines and tools to support astronauts so that they can respond to events like a heart attack, even when they've lost contact with Earth.

Doyle's field experience in Eureka, Nunavut with McMaster's Centre for Simulation Based Learning and the Canadian Space Agency for the study of tele-medical support and education provides rare insight into overcoming the challenges of real-time remote medical care, simulation, and education in austere environments and under bandwidth limitations.

More broadly, Doyle's research investigates 'cybranetics', which he defines as the communication channel between human and machine. His work centers on the enhancement of human attributes through assistive and rehabilitative computing technology, most recently relating to machine learning for the monitoring of cardiovascular disease.

"What excites me the most [about the NASA project] is that the research

and development of a space crew health application fully integrates my expertise in Computer and Biomedical Engineering," he said. "Looking at the ramifications of this work, the outcomes will have direct applicability to remote terrestrial medical care and communication [and] will have tremendous importance for our aging population."

The work is being administered through NASA's Human Research Program and the National Space Biomedical Research Institute. The investigations will span one to three years and will take place on the team's ISS Simulator, ground-analog settings that mimic the spaceflight environment, and the International Space Station.

Provided by McMaster University