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Medicine in Space and Extreme Environments (4)

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U.S. AND AUSTRALIAN RESEARCHERS TEAM TO TEST NEW PHYSICAL AND MENTAL
HEALTH TECHNOLOGIES FOR SAFEGUARDING THE HEALTH OF ANTARCTIC
EXPEDITIONERS AND ASTRONAUTS**Abstract**

Explorers working in inhospitable environments, on Earth or in space, are subject to many physical and mental challenges. Both in space and on the ice, access to traditional healthcare capabilities is non-existent, and careful monitoring, prevention, and timely intervention are highly impactful. Uniquely isolated, working with small teams and a medical approach that relies on training non-medical personnel to assist, with long winter nights and the monotonous environment, the Australian Antarctic Division (AAD) expeditionary program challenges expeditioners in ways that are like the stressors of astronauts on a Mars mission.

The NASA-funded Translational Research Institute for Space Health (TRISH), based in Houston, Texas, using private funds, has partnered with the AAD to introduce novel medical and mental health technologies for Australian expeditioners to test. AAD researchers assessed overall physical health status through body composition analysis utilizing a 3-dimensional optical body scanning combined with bioimpedance analysis. The methodology was invented at the University of Hawaii and was validated against the gold standard, Dual X-ray Absorptiometry (DXA). The technique could substitute for DXA in places such as Antarctica, space, and in people's homes and deliver an estimation of metabolic state and possibly early signs of diabetes and heart disease.

Ultrasound is a powerful diagnostic tool that is the leading imaging modality in spaceflight. Its clinical use requires many hours of training. TRISH funded researchers at KBR in Houston, Texas in a collaboration with AAD to implement a just-in-time training program developed for astronauts. The study used the Butterfly iQ+ (Guilford, CT) single-probe system. The research team enrolled 89 operators at 4 AAD stations and evaluated the effectiveness of the new training protocols in obtaining medical-grade images. This training protocol would increase access to health screening in places where trained ultrasonographers are not available.

Expeditioners, whether in Antarctica or in space must overcome challenges to their mental health due to long periods of isolation and confinement and disruptions to circadian rhythms. Fitness for duty assessments can predict decrements in mental readiness for hazardous work. AAD researchers implemented a neurocognitive test developed by a team at the University of Pennsylvania in Philadelphia, PA, and collected data along with sleep and other physiological measurements. The goal is to learn how to improve the performance and safety of all explorers under extreme conditions. This collaboration benefits both the Antarctic program and the US and Australian space programs by enabling research with direct applications to improving operations.