

## **Analysis of potential glove-induced hand injury metrics during typical neutral buoyancy training operations**

Injuries to the hands are common among astronauts who train for extravehicular activity. When the gloves are pressurized, they restrict movement and create pressure points during tasks, sometimes resulting in pain, muscle fatigue, abrasions, and occasionally more severe injuries such as onycholysis. A brief review of NASA's Lifetime Surveillance of Astronaut Health's injury database reveals that 76% of astronaut hand and arm injuries from training between 1993 and 2010 occurred either to the fingernail, finger crotch, metacarpophalangeal joint, or fingertip. The purpose of this study was to assess the potential of using small sensors to measure forces acting on the fingers and hand within pressurized gloves and other variables such as skin temperature, humidity, and fingernail strain of a NASA crewmember during typical NBL training activity. During the 5-hour exercise, the crewmember seemed to exhibit very large forces on some fingers, resulting in higher strain than seen in previous glovebox testing. In addition, vital information was collected on the glove cavity environment with respect to temperature and humidity. All of this information gathered during testing will be carried forward into future testing, potentially in glovebox or 1G or NBL suited environments, to better characterize and understand the possible causes of hand injury amongst NASA crew.