

Using the ISS to Prepare for Exploration (01)
Exploration Technology Demonstrations Using ISS (2)

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ISS CREW CONTROL OF SURFACE TELEROBOTS

Abstract

ISS Crew Control of Surface Telerobots (ICCST) is a planned test to examine how astronauts in the International Space Station can remotely operate a surface robot across short time delay. This test will obtain baseline engineering data and will improve our understanding of how to: (1) deploy a crew-controlled telerobotics system for performing surface activities and (2) conduct joint human-robot exploration operations. This test will also help reduce risks for future human missions, identify technical gaps, and refine key system requirements.

In planning for future exploration missions, architecture and study teams have made numerous assumptions about how crew can remotely operate surface robots from a flight vehicle. These assumptions include estimates of technology maturity, existing technology gaps, and likely operational and functional risks. These assumptions, however, are not grounded by actual experimental data. Moreover, no crew-controlled surface telerobotics system has yet been fully tested, or rigorously validated, through flight testing.

The primary objective of ICCST, therefore, is to obtain baseline engineering data for a crew-controlled surface telerobotics system through ISS testing. The test is the culmination of hundreds of hours of ground-based simulations of surface telerobots. ISS testing is needed to validate the key functional issues, refine the draft system requirements, and confirm the conclusions drawn from these prior tests. ISS testing is also required to verify that prior ground tests included all significant factors and that these factors were simulated at sufficiently high levels of fidelity.

ICCST will collect and analyze data from robot on-board software modules, crew user interfaces, and operations protocols. The results and lessons learned from this test will be used to further mature technologies required for future deep-space human missions, including robot planning and commanding interfaces, automated summarization and notification systems for situation awareness, on-board robot autonomy software, data messaging, and short time-delay mitigation tools. Additional ground tests will be designed and conducted following the test.

ICCST is directly relevant to several future human missions currently under consideration, including L2 Lunar Farside, Near-Earth Asteroid, and Mars Orbit. The test follows ground-based simulation

and testing of surface telerobots during the 2007 Haughton-Mars, 2008 Human-Robotic Systems, 2009 Desert RATS, and 2010 Haughton-Mars field experiments. ICCST is part of NASA's Human Exploration Telerobotics (HET) project.