

Ruggedizing a Commercial Depth Camera for Novel Lunar Exploration

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The novel contribution of this instrument is to take the first depth images on the moon. A commercial Kinect camera from Microsoft has been ruggedized for a CLPS mission to the Lunar South Pole. The 12-megapixel color camera is combined with a 1-megapixel color time-of-flight (ToF) depth sensor. The solid-state depth sensor/LIDAR provides greater resolution, a wider field of view, pixel binning, and reduced power consumption. The high-resolution data collected from the mission can be used to construct a near-field virtual environment of the lunar surface for scientific applications. The depth camera can provide a 360-degree view of the target area by combining ToF data with RGB imagery and rover turning.

The unit was evaluated for space flight compliant materials and parts at NASA Ames. The microphone array, RF shield, front face, and outer body parts were removed to reduce mass. Plastic parts were replaced with vacuum-compatible materials; manufactured cables were added to properly interface with the host rover, built by Lunar Outpost. The environmental testing was performed on the Kinect with Random Vibration/Sine Testing (Fig 1a), per GEVS (NASA's General Environmental Verification Standard for spaceflight launch survival). Thermal Vacuum testing cycled the instrument between expected hot (+ 85 C) and cold survival temperatures, as well as +50 C and -25 C operational temps (Fig 1b). The instrument functioned nominally at the conclusion of vibration and thermal cycling tests.

The Azure Kinect is manifested on the Nova-C lander which flies on the Intuitive Machines mission IM-2, landing at the lunar south pole for a mission duration of 14 days (one lunar daylight cycle). The unit will be integrated to the MAPP (Mobile Autonomous Prospecting Platform) rover at Lunar Outpost. The Azure Kinect with ToF feature will improve the resolution of lunar geology data near the south pole and enable ground-based VR experience of details of the lunar surface (Fig 1c).

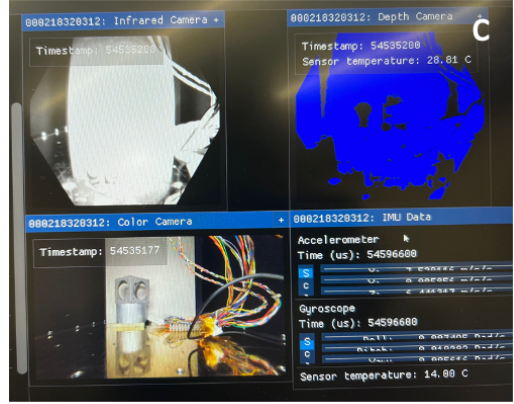
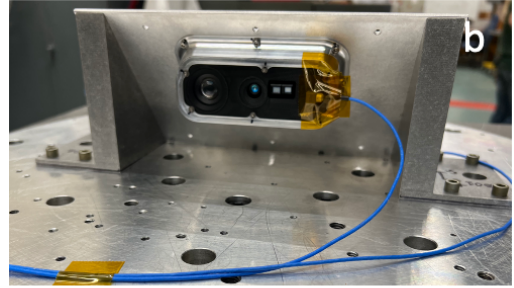
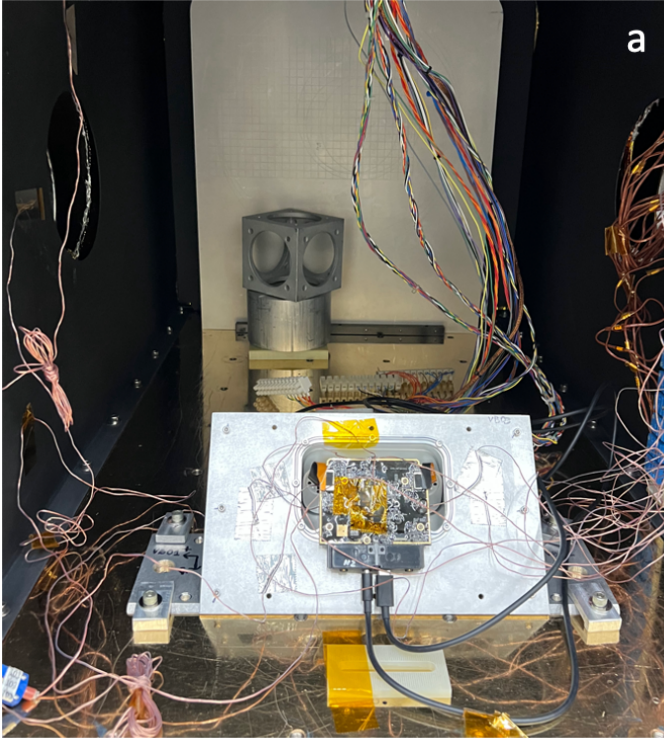


Fig 1(a): Kinect inside the Thermal Vacuum chamber (TVAC) during Environmental test, (b) Kinect on the Vibration Table and (c) Kinect image during thermal vacuum test