

**Development of a Modular End-Effector System and Mapping for Autonomous Robotic
Maintenance and Repair of Resilient Extraterrestrial Habitats**

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Abstract

As the future of mankind lies in space exploration, a system to support exploratory astronauts while on extraterrestrial surfaces is an important aspect of space exploration that should be considered. The NASA funded research project to establish the resilient extraterrestrial habitats institute (RETHi) has three main goals: developing resilient habitats that can adapt to threats, developing intelligent awareness networks that can detect and diagnose issues, and constructing autonomous robots that can inspect, maintain, and repair issues in the habitats independently or in collaboration with humans. Due to the variety of anticipated tasks that the robots must carry out, specific end-effectors for the robot to use for specific types of tasks are being developed. Therefore, a modular end-effector system, that will be compatible with the space robots, is being designed. Various end-effectors, such as grippers, along with a modular camera system, can be affixed to the system. Using resources offered at the Purdue Bechtel Innovation Design Center, such as 3D printers and CNC machines, prototypes of the designs are being developed. A Fetch mobile manipulation robot is being used to simulate the robots in space for testing purposes of the end-effector system and the autonomous localization, mapping, and navigation software. A successful robot will be able to autonomously navigate to a repair site, choose the appropriate end-effectors and tools needed, and complete the repair or maintenance task.

Keywords: RETHi, space, extraterrestrial habitats, NASA, repair, robots, autonomous