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SYMPOSIUM ON TECHNOLOGICAL REQUIREMENTS FOR FUTURE SPACE ASTRONOMY AND SOLAR-SYSTEM SCIENCE MISSIONS (A7)
Technology Needs for Future Missions, Platforms (3)

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AUTONOMOUS SYSTEMS ADVANCES FOR FUTURE SOLAR SYSTEM SCIENCE MISSION REQUIREMENTS

Abstract

As global space agencies continue to make progress on planetary science decadal survey goals or similar strategies, future science missions will only become more ambitious in their choice of destination and objective. As a result, there's an upcoming need for more sophisticated autonomous systems in spacecraft. For instance, future planetary missions to asteroids, comets, the Moon, and Mars will likely seek to land or rendezvous with destinations that have challenging topography, in environments with severely limited communications. Moreover, such missions are likely to approach unmapped asteroids, surfaces with difficult features such as polar peaks, crater rims, and skylights on the Moon and Mars. This paper will highlight recent technical advancements taking place at Astrobotic that take these challenges head on with techniques born from the robotics field.

For example, the Astrobotic Autolanding System (AAS) is a sophisticated navigation system that is advancing the state of the art in autonomous landing and rendezvous systems. The AAS uses terrain registration to provide accurate navigation for planetary landing. It tracks vehicle location and altitude using a combination of cameras and an IMU. LIDAR is used to identify landing hazards and determine a safe landing point. Astrobotic tested the AAS in a series of tests on a vertical testbed in Mojave, California. The tests were carried out completely autonomously without the aid of an outside operator or GPS.

This paper will also highlight recent progress in passive visual approaches for tracking unmapped rotating objects like asteroids and satellites. These techniques observe features on objects like asteroids to determine the object shape and rotation. It simultaneously tracks the spacecraft state in a dual-state filter. These techniques could serve as the basis for spacecraft to approach and model unmapped asteroids, moons, and planets where clouds occlude the landing surface.