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# MICRO-SATELLITES FOR INTERPLANETARY AND DEEP SPACE EXPLORATION – POTENTIAL, LIMITATIONS, AND CAPABILITIES

**Abstract**

Micro-satellites have become ubiquitous in low Earth orbit applications. In 2017 alone, there were close to 300 micro-satellite (1 to 500 kg) launches for a variety of applications ranging from science missions to technology demonstration missions. The ever-expanding application potential of micro-satellites now venture further into space. While extremely promising, the use of micro-satellites for deep space exploration, particularly of Moon, Mars and Near-Earth Asteroids, will require new capabilities and technologies. The focus of this study is to identify key technology enablers for micro-satellite exploration missions.

This paper will present a comprehensive survey of currently planned and prospective exploration missions with micro-satellites. A systematic selection process is carried out to reduce this set to the most promising microsatellite exploration missions. The driving requirements for these missions are then identified and analyzed. Examining the requirements of these missions, using parallels to larger exploration spacecraft, where necessary, highlights the challenges unique (or not) to deep space application.

Current and planned spacecraft technology developments such as propulsion, navigation, autonomy and more, is then synthesized and categorized on expected performance and technology readiness levels (TRL). Comparison of the requirements with the current and emerging capabilities of microsatellites exposes gaps and synergies that, once addressed, will open deep space to exploration with microsatellites. The paper concludes with projected time-lines for micro-satellite deep space missions.