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SPACE EXPLORATION SYMPOSIUM (A3)
Space Exploration Overview (1)

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SCIENTIFIC OPPORTUNITIES ENABLED BY HUMAN EXPLORATION BEYOND LOW-EARTH ORBIT

Abstract

Future space exploration goals call for sending humans and robots beyond low Earth orbit and establishing sustained access to destinations such as the Moon, asteroids and Mars. Space agencies participating in the International Space Exploration Coordination Group (ISECG) are discussing an international approach for achieving these goals, documented in ISECG's Global Exploration Roadmap (GER). The GER reference scenario reflects a step-wise evolution of critical capabilities from activities in Low Earth Orbit to missions on and around the Moon in preparation for the journey of humans to Mars. As an element of this road mapping effort, the ISECG agencies have coordinated discussions with the scientific community to better articulate and promote the scientific opportunities that result from this exploration. A goal is the improved understanding of the scientific drivers and the requirements to address priority science questions that can be addressed by near-term human exploration in to the solar system (i.e. a deep space habitat in the lunar vicinity, lunar surface, or an asteroid). The output of this interaction has been the development of a Science White Paper that 1) Identifies and highlights the scientific opportunities in early human exploration missions as the GER reference architecture matures, 2) Communicates overarching science themes and their relevance in the GER destinations, 3) Ensures international science communities' perspectives inform the future evolution of mission concepts considered in the GER. The paper aims to capture the opportunities offered by the missions in the GER for a broad range of scientific disciplines. These include planetary and space sciences, astrobiology, life sciences, physical sciences, astronomy and Earth science. The paper is structured around grand science themes that draw together and connect research in the various disciplines, and focuses on opportunities created by the near-term mission themes in the GER centered around 1) extended duration crew missions to an exploration habitat in cislunar space, 2), crewed missions to the lunar surface and 3) crewed missions to an asteroid.