

THE ISECG SCIENCE WHITE PAPER: SCIENCE ENABLED BY HUMAN EXPLORATION

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Introduction: Space agencies participating in the International Space Exploration Coordination Group (ISECG) are discussing an international approach for human and robotic space exploration to achieve the social, intellectual and economic benefits the status of this work is documented in ISECG's Global Exploration Roadmap. The Global Exploration Roadmap (GER) reflects a coordinated international effort to prepare for collaborative space exploration missions beginning with the International Space Station and continuing to the lunar vicinity, the Moon, asteroids and Mars.

Science White Paper: As an element of this road mapping effort, the ISECG agencies have been soliciting input and coordinating discussion with the scientific community to better articulate and promote the scientific opportunities of the proposed mission themes. The aim is for an 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. lunar surface, a deep space habitat in the lunar vicinity, or an asteroid). The output of this interaction is the development of a Science White Paper to

- Identify and highlight the scientific opportunities in early exploration missions beyond low Earth orbit
- Communicate overarching science themes and their relevance in the GER destinations,
- Ensure 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 Global Exploration Roadmap 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 the science themes "*Understanding Our Place in the Universe*" and "*Living and Working in Space*", that draw together and connect research in the various disciplines, and it will focus on opportunities created by the near-term mission themes in the GER centred around 1) extended duration crew missions to an exploration habitat in the lunar vicinity, 2) crewed missions to an asteroid, and 3) crewed missions to the lunar surface.

The preparation of that Science White Paper has been coordinated and lead by an external Science Advisory Group composed of scientists from a variety of nations. The first draft of this White Paper was discussed at a COSPAR-ISECG-ESF workshop in Paris on February 2016. The recommendations developed at the workshop provided further input that will be incorporated in to the final version of the ISECG Science White Paper, expected to be published in the fall of 2016.

At METSOC we will present the content of the science white paper, with particular focus on the science enabled by human missions to an asteroid. We will discuss both the science that can be achieved by visiting an asteroid in its native orbit, as well as the science enabled by the GER reference mission which is based on NASA's ARM scenario where a crew of two will visit a boulder that has been brought from the surface of an asteroid and placed in to lunar orbit.