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The Human Space Exploration Value Proposition (07)
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ASTROBIOLOGICAL BENEFITS OF HUMAN SPACE EXPLORATION: FUNDAMENTAL SCIENCE ENABLED BY THE GLOBAL EXPLORATION ROADMAP

Abstract

The Apollo missions demonstrated that humans bring a flexibility and versatility to space exploration that robots alone cannot. Specific scientific benefits include: (i) on-the-spot decision making, with increased chances for serendipitous discoveries; (ii) efficient sample identification and collection; (iii) enhanced sample return capacity; (iv) support for large-scale exploratory activities (e.g. sub-surface drilling) and the deployment and maintenance of complex equipment on planetary surfaces; and (v) studies in human physiology and medicine which require people in space as experimental test subjects. Moreover, human space exploration will require the development of a heavy-lift launch capability, and associated infrastructure, which will have wider scientific applications. For these reasons, an ambitious programme of human space exploration, such as that envisaged by the recent ISECG Global Exploration Roadmap, may be expected to result in scientific advances across multiple fields.

A particular field likely to benefit especially from human space exploration is the new science of astrobiology. Human space exploration will help advance the core aims of astrobiology in the following areas: (i) the exploitation of the International Space Station to conduct biological studies of the adaptability and survivability of organisms in space (with relevance to both planetary protection and to constraining theories of panspermia); (ii) the exploration of the lunar geological record to elucidate conditions on the early Earth; (iii) the detailed study of Near Earth Objects for clues relating to the formation of the Solar System; (iv) the search for evidence of past and/or present life on Mars (and especially deep sub-surface life); (v) the provision of a heavy-lift launch capability which will facilitate the robotic exploration of the outer Solar System (e.g. possible sample return missions to Titan and Europa); and (vi) the construction and maintenance of sophisticated space-based astronomical tools for the study of extrasolar planetary systems. In all these areas a human presence in space, and especially on planetary surfaces, will yield a net scientific benefit over what can plausibly be achieved by autonomous robotic systems.