Paper ID: 40185
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SYMPOSIUM ON FUTURE SPACE ASTRONOMY AND SOLAR-SYSTEM SCIENCE MISSIONS (A7)
Space Agency Strategies and Plans (1)

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PROGRAM OPTIONS TO EXPLORE OCEAN WORLDS

Abstract

The next US planetary Decadal Survey's mission priorities will emerge in 2022-23. US law already requires NASA to implement a "virtual" Ocean Worlds Exploration Program (OWEP) using a mix of mission classes. NASA and ESA are currently developing large missions to explore Europa and Ganymede, respectively; NASA is also formulating concepts for a potential large mission to search for biosignatures on the Europa surface. Small-class mission concepts for Titan and Enceladus were proposed in 2010 and 2014, but not selected; NASA awarded $25 Min16 technology-development projects pertinent to Europa and other ocean worlds; and pres$
$class OWEP mission concepts proposed to the New Frontiers program. The Mars Exploration Program (MEP) offers a succe$
$1) almost a dozen diverse ocean worlds of varying priority, with key pieces of the ocean-world scientific puzzle are distributed a$
$space propulsion impose half-decade (to Jupiter) or decade-long (to Saturn) transfers; and 4) the oceans are beneath kilomete$
allocated in FY17 is but a small down-payment, and enhanced investment would compete against many other solar system objectives. Second, medium-class OWEP missions would compete against unrelated science objectives in a fine-grained, non-strategic evaluation. Presently NASA has no mission-opportunity class comparable to the MEP backbone (MGS, Odyssey, and MRO, all directed, medium-class missions) that supports surface missions. Progress would be fastest if NASA could adapt three MEP program characteristics: 1) major technology investments separate from mission projects; 2) directed medium-class missions that conduct pivotal investigations on a sustained roadmap; and 3) multi-mission technical infrastructure that "lowers the bar" for individual missions. Th most important OWEP example is space transportation, e.g., the Space Launch System and high-power solar-electric propulsion, to minimize trip times into Saturn and Jupiter orbit. This analysis treats the governing programmatic constraints, technical uncertainties, and policy gaps for an OWEP, then lays out multiple options for maximizing progress on the highest priority science objectives.