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

Author: Dr. Ralph L. McNutt, Jr.
Johns Hopkins University Applied Physics Laboratory, United States

Mr. Steven Vernon
The Johns Hopkins University Applied Physics Laboratory, United States

ENABLING SOLAR SYSTEM SCIENCE WITH THE SPACE LAUNCH SYSTEM (SLS)

Abstract

The approach of NASA's Planetary Science Division to interplanetary exploration in our solar system has been an incremental, tiered one of "Flyby, Orbit, Land, Rove, and Return Samples." With the flyby of the Pluto system in July 2015, the initial reconnaissance of all the major bodies of the inner solar system has been completed. With the completion of the MESSENGER mission, the second stage of "orbit" has now been accomplished for all of the planets though Saturn. Landers have been deployed on Venus, Mars, Saturn's large moon Titan and the comet 67P/Churyumov–Gerasimenko, while samples have now been returned from an asteroid 25143 Itokawa, as well as a comet Wild 2. Those bodies yet to be orbited (Uranus, Neptune, and Pluto) and others of interest for landers (notably Mercury, Europa, Enceladus, and distant Triton) all have correspondingly more difficult propulsive requirements due to proximity to the Sun (Mercury), distance (Neptune), and a significant gravity well with no significant atmosphere to help brake a lander's descent. Dealing with the latter case is well known and understood from experiences at the Moon for Surveyor and Apollo (U.S.), Luna and Lunokhod (Russia) and Chang'e 3 (China). For the other bodies in question, the issue is entirely one of propulsion. The need for large propulsive capability for human missions to deep-space suggests the solution: use of large-class launch vehicles, e.g. the Space Launch System (SLS) for enabling science missions. The idea is not new, e.g. the Voyager Program for using the Saturn V in robotic exploration in the 1960's, but it may now be timely, and more crucial for these next steps. As an example by using the SLS large lift capacity to carry multiple solid rocket stages, a short, Hohmann trajectory transfer of less than half a year to Mercury, combined with a direct landing, should be possible. Such a mission, building upon MESSENGER and BepiColombo orbital findings, would provide for the next step of exploration of this enigmatic planet in our inner solar system. The use of such human-space capability for robotic probes would add a new, paradigm-shifting possibility for the next steps in solar system exploration.