IAF SPACE EXPLORATION SYMPOSIUM (A3)
Solar System Exploration including Ocean Worlds (5)

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AN SLS LAUNCHED TITAN BALLOON-SPACECRAFT MISSION

Abstract

The SLS' ability to launch heavy payloads to distant destinations will enable science rich outer planet missions. One such mission is presented in this paper; the delivery of an inflatable Zeppelin type spacecraft and science package to ride the currents of the thick, nitrogen rich atmosphere of Titan. Having the ability to vary its altitude, the Balloon and spacecraft would flyover and view large segments of the surface. The Zeppelin-spacecraft combination serves as a scientific platform for the investigation of Titan and will also serve as an observatory to find a scientifically rich landing site location for a later Titan lander mission. There is also the potential for the balloon system to deploy robotic surface probes that collect information, and, as an option, obtain surface samples; these might be returned to the primary balloon system for analysis. Another option involves a drone-based instrument suite, which would utilize a multi-propeller arrangement along with a novel wing design. It would fly sorties to collect data and return to the Balloon. The wing will facilitate low-power flight, and the copter would enable vertical flight for docking with the Balloon. The drone would provide further imaging of the surface and visual inspection of the balloon. Titan exploration would include terrain mapping the surface, study of its atmosphere, magnetic field, volcanic activity, and conditions at the poles. With the new SLS Exploration Upper Stage (EUS), the largest upper stage ever produced (in development now), the enhanced SLS Block 2 configuration will deliver more payload to Titan than other launch vehicle, allowing for significantly increased science return from this unique moon.

Other objectives of this mission include: • Determine the composition, density, structure, source, spatial and temporal variability, and dynamics of Titans atmosphere • Determine Titans atmospheric heat balance • Measure Titans tropospheric zonal, meridional, vertical flows, their lifecycles, and deep convective activity • Characterize the temporal changes in the atmosphere. • Obtain a complete inventory of surface features including lakes, shorelines, valleys and mountains • Investigate solar wind-magnetosphere

a brief description is given of the new SLS Block 2, with a description of the trajectory to Saturn, the Balloon-spacecraft system and its technology, operations and challenges. This work is done by the Boeing Exploration Launch Systems division and the Boeing Advanced Systems group.