

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

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## SINGLE SLS LAUNCHED DUAL OUTER PLANET MISSION TO URANUS AND TO NEPTUNE

**Abstract**

The Space Launch System (SLS) is NASA's new heavy lift launch vehicle which successfully flew for the first time in November 2022. In addition to providing significant increases in payload mass, the SLS also excels at providing very high injection velocities; allowing scientific spacecraft to arrive at distant destinations much sooner compared to spacecraft launching on less capable launch vehicles. In the concept described in this paper both advantages provided by the SLS are applied to a specific mission. The SLS can inject two deep-space outer-planet spacecraft, together totaling 21.3 metric tons (mt), on a trajectory that swings reaches Jupiter in 4.7 years, and Saturn, 3.3 years later. The first spacecraft is released for a Jupiter encounter, and captures into orbit around Callisto, an outer moon of Jupiter. The second spacecraft arriving at Saturn 3.3 years later, captures into orbit around Titan, the only moon in the Solar system with a substantial atmosphere and with liquid oceans. The trajectory includes a flyby of Earth, and, for the second (Saturn/ Titan) spacecraft, a gravity-turn flyby of Jupiter. For the mission presented here, launch date is 10/07/2034 and launch injection energy (C3) is 26.4 km<sup>2</sup>/s<sup>2</sup>. The first DSM occurs on 8/21/2035, the second on 10/6/2035. Jupiter arrival dates are 6/9 and 6/28 of 2039, and Saturn arrival date is 10/7/2042. In this paper a brief description is given of the SLS and its evolution into the higher performing Block 2 configuration (utilizing the new NASA Exploration Upper Stage (EUS) now in development). Also included is a discussion of the SLS' capability for injecting spacecraft to very high velocities, and information describing the spacecraft and their heliocentric trajectory. Trajectory events are presented, including separate Deep Space Maneuvers (DSM) to target Jupiter and Saturn. This work is being done by the Boeing Exploration Launch Systems division in Huntsville Alabama, USA and the Boeing Advanced Systems group in Houston, Texas, USA. This presentation will highlight the SLS abilities, over the next 20 years, to inject heavy payloads to far distant destinations, so as to provide more high value science in much less time, with fewer launches than could be provided by launch vehicles with lesser capabilities.