

EVOLUTION OF ORION MISSION DESIGN FOR EXPLORATION MISSION 1 AND 2

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The evolving mission design and concepts of NASA's next steps have shaped Orion into the spacecraft that it is today. Since the initial inception of Orion, through the Constellation Program, and now in the Exploration Mission framework with the Space Launch System (SLS), each mission design concept and program goal have left Orion with a set of capabilities that can be utilized in many different mission types. Exploration Missions 1 and 2 (EM-1 and EM-2) have now been at the forefront of the mission design focus for the last several years. During that time, different Design Reference Missions (DRMs) were built, analyzed, and modified to solve or mitigate enterprise level design trades to ensure a viable mission from launch to landing. The resulting DRMs for EM-1 and EM-2 were then expanded into multi-year trajectory scans to characterize vehicle performance and Earth-Moon geometry trends. This provides Orion's subsystems with stressing reference trajectories to help design their system. Now that Orion has progressed through the Preliminary and Critical Design Reviews (PDR and CDR) there is a general shift in the focus of mission design from aiding the vehicle design to providing mission specific products needed for pre-flight and real time operations. Some of the mission specific products needed include analysis of steering law performance, inputs into navigational accuracy assessments, abort options at any point in the mission for each valid trajectory in the launch window, recontact avoidance between the upper stage and Orion post nominal separation, etc.

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