SPACE TRANSPORTATION SOLUTIONS AND INNOVATIONS (D2)
New missions enabled by Extra-large launchers (8)

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NEW MISSION CAPABILITY USING HEAVY LIFT LAUNCH VEHICLES WITH IN SPACE PROPELLANT DEPOTS

Abstract

The potential benefits of propellant depots have been studied as far back as Werner Von Braun's Project Horizon study in 1959. During the 2009 national review of human space flight plans, the advantages of propellant depots were again deliberated. Findings resulted in a new emphasis in technology development and demonstration that will enable much greater capability and mission flexibility for science and exploration beyond earth orbit. This paper examines the synergism between various heavy lift launch vehicle (HLV) concepts and a variety of propellant depot capabilities and characteristics including their orbital placements and concept of operations. Propellant depots can reduce HLV size for a given mission and can enable increased mission capability for a given HLV configuration. More important is the mission flexibility enabled by well coordinated HLV and propellant depot concepts. Key considerations include; HLV production and operations fixed costs versus vehicle size and launch capacity, propellant depot services provided, earth departure stage configuration and propellant depot orbital locations. Enabling technologies include large very mass efficient and affordable structures, in-space propellant storage, micro gravity propellant transfer, autonomous rendezvous and docking, autonomous propellant transfer and micrometeorite and orbital debris (MMOD) protection. Potential concepts illustrating the available design space are presented along with a development roadmap for further discussion.