

SYMPOSIUM ON BUILDING BLOCKS FOR FUTURE SPACE EXPLORATION AND
DEVELOPMENT (D3)Systems and Infrastructures to Implement Future Building Blocks in Space Exploration and Development
(2)

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EVOLVED HUMAN SPACE EXPLORATION ARCHITECTURE USING COMMERCIAL LAUNCH
AND PROPELLANT DEPOTS**Abstract**

Using current and future commercial launch services, human space exploration destinations can be evolved for the foreseen mission needs including cis-lunar space, lunar surface, asteroids and ultimately to Mars. Because 80 percent of the required mass to low-Earth orbit is propellant, large space transportation inert mass systems can be delivered with current launch systems for all of these destinations; however they require larger payload shrouds. An orbiting propellant depot is defined in an optimal orbit location for boilloff, station keeping, maintenance, and MMOD that can store cryogenic propellant from incremental launches later to be transferred to the in-space transportation system. Results include complete mission cost, reliability, technology requirements, and risk analysis to determine the “best” system architecture. Current results with a mixed fleet of commercial launch systems compared to a new heavy lift launch system reveal program costs approximately half cost, 70 billion dollars saved over 20 years, and comparable mission reliability with the redundant mixed commercial fleet, and no new technology requirements except in-orbit cryogenic propellant transfer for cis-lunar missions, and advanced multilayer insulation and cryocoolers for long duration missions to asteroids and Mars.