NASA'S Space Launch System: A Cornerstone Capability for Exploration

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Abstract

Under construction today, the National Aeronautics and Space Administration's (NASA) Space Launch System (SLS), managed at the Marshall Space Flight Center, will provide a robust new capability for human and robotic exploration beyond Earth orbit. The vehicle's initial configuration, scheduled for first launch in 2017, will enable human missions into lunar space and beyond, as well as provide game-changing benefits for space science missions, including offering substantially reduced transit times for conventionally designed spacecraft. From there, the vehicle will undergo a series of block upgrades via an evolutionary development process designed to expedite mission capture as capability increases. The Space Launch System offers multiple benefits for a variety of utilization areas. From a mass-lift perspective, the initial configuration of the vehicle, capable of delivering 70 metric tons (t) to low Earth orbit (LEO), will be the world's most powerful launch vehicle. Optimized for missions beyond Earth orbit, it will also be the world's only exploration-class launch vehicle capable of delivering 25 t to lunar orbit. The evolved configuration, with a capability of 130 t to LEO, will be the most powerful launch vehicle ever flown. From a volume perspective, SLS will be compatible with the payload envelopes of contemporary launch vehicles, but will also offer options for larger fairings with unprecedented volume-lift capability. The vehicle's mass-lift capability also means that it offers extremely high characteristic energy for missions into deep space. This paper will discuss the impacts that these factors – mass-lift, volume, and characteristic energy – have on a variety of mission classes, particularly human exploration and space science. It will address the vehicle's capability to enable existing architectures for deep-space exploration, such as those documented in the Global Exploration Roadmap, a capabilities-driven outline for future deep-space voyages created by the International Space Exploration Coordination Group, which represents 12 of the world's space agencies. In addition, this paper will detail this new rocket's capability to support missions beyond the human exploration roadmap, including robotic precursor missions to other worlds or uniquely high-mass space operation facilities in Earth orbit. As this paper will explain, the SLS Program is currently building a global infrastructure asset that will provide robust space launch capability to deliver sustainable solutions for exploration.