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NASA's Space Launch System: One Vehicle, Many Destinations

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Abstract

The National Aeronautics and Space Administration's (NASA's) Space Launch System (SLS) Program, managed at the Marshall Space Flight Center, is making progress toward delivering a new capability for exploration beyond Earth orbit. Developed with the goals of safety, affordability, and sustainability in mind, the SLS rocket will start its missions in 2017 with 10 percent more thrust than the Saturn V rocket that launched astronauts to the Moon 40 years ago. From there it will evolve into the most powerful launch vehicle ever flown, via an upgrade approach that will provide building blocks for future space exploration and development. The International Space Exploration Coordination Group, representing 12 of the world's space agencies, has created the Global Exploration Roadmap, which outlines paths toward a human landing on Mars, beginning with capability-demonstrating missions to the Moon or an asteroid. The Roadmap and corresponding NASA research outline the requirements for reference missions for all three destinations. This paper will explore the capability of SLS to meet those requirements and enable those missions. It will explain how the SLS Program is executing this development within flat budgetary guidelines by using existing engines assets and developing advanced technology based on heritage systems, from the initial 70 metric ton (t) lift capability through a block upgrade approach to an evolved 130-t capability. It will also detail the significant progress that has already been made toward its first launch in 2017. The SLS will offer a robust way to transport international crews and the air, water, food, and equipment they will need for extended trips to explore new frontiers. In addition, this paper will summarize the SLS rocket's capability to support science and robotic precursor missions to other worlds, or uniquely high-mass space facilities in Earth orbit. As this paper will explain, the SLS is making measurable progress toward becoming a global infrastructure asset for robotic and human scouts of all nations by providing the robust launch capability to deliver sustainable solutions for space exploration.