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NASA's Space Launch System: An Enabling Capability for International Exploration

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Abstract

As the program moves out of the formulation phase and into implementation, work is well underway on NASA's new Space Launch System, the world's most powerful launch vehicle, which will enable a new era of human exploration of deep space. As assembly and testing of the rocket is taking place at numerous sites around the United States, mission planners within NASA and at the agency's international partners continue to evaluate utilization opportunities for this ground-breaking capability. Developed with the goals of safety, affordability, and sustainability in mind, the SLS rocket will launch the Orion Multi-Purpose Crew Vehicle (MPCV), equipment, supplies, and major science missions for exploration and discovery. NASA is developing this new capability in an austere economic climate, a fact which has inspired the SLS team to find innovative solutions to the challenges of designing, developing, fielding, and operating the largest rocket in history, via a path that will deliver an initial 70 metric ton (t) capability in December 2017 and then continuing through an incremental evolutionary strategy to reach a full capability greater than 130 t. This paper will summarize the planned capabilities of the vehicle, the progress the SLS Program has made in the years since the Agency formally announced its architecture in September 2011, and the path the program is following to reach the launch pad. The paper will outline the milestones the program has already reached, from developmental milestones such as the manufacture of the first flight hardware and record-breaking engine testing, to life-cycle milestones such as the vehicle's Preliminary Design Review in the summer of 2013. In its initial and evolved configurations, SLS will be enabling for the first missions of human exploration beyond low Earth in almost half a century, and from its crewed flight will be able to carry humans farther into space than they have ever voyaged before. In planning for the future of exploration, 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 these destinations. This paper will explore the capability of SLS to meet those requirements and enable such missions. The SLS will offer a robust way to transport international crews and the air, water, food, and equipment they would need for extended trips to explore new frontiers. While the initial 70 t configuration of SLS is being produced by US-based prime contractors, international involvement has been brought into the critical path for the first exploration mission via the Orion service module, being developed by the European Space Agency, and opportunities exist for international partnerships in the launch vehicle itself in future evolutionary developments. In addition to outlining SLS utilization opportunities for international human exploration, this paper will detail the SLS rocket's capability to support science and robotic precursor missions to other worlds, or uniquely high-mass space operation 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.