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NASA'S Space Launch System: An Evolving Capability for Exploration

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Abstract

Designed to enable human space exploration missions, including eventually landings on Mars, NASA's Space Launch System (SLS) represents a unique launch capability with a wide range of utilization opportunities, from delivering habitation systems into the "proving ground" of lunar-vicinity space to enabling high-energy transits through the outer solar system. Substantial progress has been made toward the first launch of the initial configuration of SLS, which will be able to deliver more than 70 metric tons of payload into low Earth orbit (LEO). Preparations are also underway to evolve the vehicle into more powerful configurations, culminating with the capability to deliver more than 130 metric tons to LEO. Even the initial configuration of SLS will be able to deliver greater mass to orbit than any contemporary launch vehicle, and the evolved configuration will have greater performance than the Saturn V rocket that enabled human landings on the moon. SLS will also be able to carry larger payload fairings than any contemporary launch vehicle, and will offer opportunities for co-manifested and secondary payloads. Because of its substantial mass-lift capability, SLS will also offer unrivaled departure energy, enabling mission profiles currently not possible. The basic capabilities of SLS have been driven by studies on the requirements of human deep-space exploration missions, and continue to be validated by maturing analysis of Mars mission options, including the Global Exploration Roadmap. Early collaboration with science teams planning future decadal-class missions have contributed to a greater understanding of the vehicle's potential range of utilization. As SLS draws closer to its first launch, the Program is maturing concepts for future capability upgrades, which could begin being available within a decade. These upgrades, from multiple unique payload accommodations to an upper stage providing more power for in-space propulsion, have ramifications for a variety of missions, from human exploration to robotic science.