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NASA's Space Launch System: A Flagship for Exploration Beyond Earth's Orbit

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Abstract

The National Aeronautics and Space Administration's (NASA) 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 in an austere economic climate. This fact drives the SLS team to find innovative solutions to the challenges of designing, developing, fielding, and operating the largest rocket in history. To arrive at the current SLS plan, government and industry experts carefully analyzed hundreds of architecture options and arrived at the one clear solution to stringent requirements for safety, affordability, and sustainability over the decades that the rocket will be in operation. This paper will explore ways to fit this major development within the funding guidelines by using existing engine assets and hardware now in testing to meet a first launch by 2017. It will explain the SLS Program's long-range plan to keep the budget within bounds, yet evolve the 70 metric ton (t) initial lift capability to 130-t lift capability after the first two flights. To achieve the evolved configuration, advanced technologies must offer appropriate return on investment to be selected through a competitive process. For context, the SLS will be larger than the Saturn V that took 12 men on 6 trips for a total of 11 days on the lunar surface over 4 decades ago. Astronauts train for long-duration voyages on the International Space Station, but have not had transportation to go beyond Earth orbit in modern times, until now. NASA is refining its mission manifest, guided by U.S. Space Policy and the Global Exploration Roadmap. Launching the Orion Multi-Purpose Cargo Vehicle's first autonomous certification flight in 2017, followed by a crewed flight in 2021, the SLS will offer a robust way to transport international crews and the air, water, food, and equipment they need for extended trips to asteroids, Lagrange Points, and Mars. In addition, the SLS will accommodate high-priority science experiments. SLS affordability initiatives include streamlining interfaces, applying risk-based insight into contracted work, centralizing systems engineering and integration, and nurturing a learning culture that continually benchmarks its performance against successful ventures. 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 harnessing business and technological innovations to deliver sustainable solutions for space exploration.