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NASA's Space Launch Transitions From Design to Production

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Abstract

NASA's Space Launch System (SLS) successfully completed its Critical Design Review (CDR) in 2015, a major milestone on the journey to an unprecedented era of exploration for humanity. CDR formally marked the program's transition from design to production phase just four years after the program's inception and the first such milestone for a human launch vehicle in 40 years. While challenges typical of a complex development program lie ahead, CDR evaluators concluded that the design is technically and programmatically sound and ready to press forward to Design Certification Review (DCR) and readiness for launch of Exploration Mission 1 (EM-1) in the 2018 timeframe. SLS is prudently based on existing propulsion systems, infrastructure and knowledge with a clear, evolutionary path as required by mission needs. In its initial configuration, designated Block I, SLS will a minimum of 70 metric tons (t) of payload to low Earth orbit (LEO). It can evolve to a 130 t payload capacity by upgrading its engines, boosters, and upper stage, dramatically increasing the mass and volume of human and robotic exploration while decreasing mission risk, increasing safety, and simplifying ground and mission operations. CDR was the central programmatic accomplishment among many technical accomplishments that will be described in this paper. The government/industry SLS team successfully test fired a flight-like five-segment solid rocket motor, as well as seven hotfire development tests of the RS-25 core stage engine. The majority of the major test article and flight barrels, rings, and domes for the core stage liquid oxygen, liquid hydrogen, engine section, intertank, and forward skirt were manufactured at NASA's Michoud Assembly Facility. Renovations to the B-2 test stand for stage green run testing were completed at NASA Stennis Space Center. Core stage test stands are rising at NASA Marshall Space Flight Center. The modified Pegasus barge for core stage transportation from manufacturing to testing and launch sites was delivered. The Interim Cryogenic Propulsion System test article was also completed. This paper will discuss these and other technical and programmatic successes and challenges over the past year and provide a preview of work ahead before the first flight of this new capability.