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NASA'S SPACE LAUNCH SYSTEM: TRANSFORMATIVE LAUNCH CAPABILITY FOR HUMAN AND ROBOTIC DEEP SPACE MISSIONS

Abstract

With elements of the Block 1 vehicle beginning integration at Kennedy Space Center and the core stage undergoing a "green run" test, NASA's new super heavy-lift vehicle, the Space Launch System (SLS), presents mission planners with an unrivalled new launch option. The past year has seen substantial progress as the vehicle nears first launch, including additional analysis and definition of the vehicle's capabilities. Maturation of plans for landing the first woman and next man on the moon has driven detailed study of SLS's performance for lunar architectures, and support for a proposed probe to the interstellar medium has resulted in new approaches for edge-of-the-envelope performance to the outer solar system and beyond. An evolvable system that will become progressively more capable through block upgrades, each SLS variant will be available in crew and cargo configurations. The flexible SLS architecture will enable a variety of configurations to launch to the Moon and beyond, with the cargo variant providing significant volume in large-diameter payload fairings to benefit exploration missions to the Moon and science missions to the outer solar system. The Block 1 vehicle lifts at least 27 metric tons (t) to trans-lunar injection (TLI) and can be outfitted with a 5 m-diameter payload fairing. The second configuration to come online, Block 1B, will replace Block 1's single-engine upper stage with a more powerful four-engine stage, increasing payload mass to TLI to 38-42 t, depending on crew or cargo configuration. In addition, the Block 1B crew vehicle has 286 m3 of volume available for a 10 t co-manifested payload. The Block 1B cargo vehicle can be outfitted with an 8.4 m-diameter fairing in 19.1 m or 27.4 m lengths, providing unprecedented volume. The ultimate variant, Block 2, will increase payload to at least 43-46 t to TLI. The large fairing volume can be used to package an additional upper stage and/or a solid rocket motor kick stage to enable missions with a C3 as high as 300 km2/sec2. In addition, SLS offers CubeSats rideshare opportunities to deep space when mission parameters allow. With these powerful launch options, SLS provides unique benefits to a number of missions. SLS is the backbone of Artemis, NASA's program for a sustainable return to the Moon with international and commercial partners. At IAC, the SLS Program will present information on the capabilities of SLS and its utilization for transformative human and science deep space missions.