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Joint Session on Going To and Beyond the Earth-Moon System: Human Missions to Mars, Libration Points and NEO's (4-D2.8)

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PROGRESS ON DEMONSTRATION OF AN AFFORDABLE, ADVANCED LIQUID BOOSTER FOR THE SPACE LAUNCH SYSTEM

Abstract

In October 2012, NASA awarded Dynetics and Pratt Whitney Rocketdyne (PWR) a Space Launch System (SLS) Advanced Booster Engineering Demonstration and/or Risk Reduction (ABEDRR) contract to reduce risk and demonstrate the team's concept for an affordable booster approach that meets the evolved capabilities of the SLS. The Pyrios booster will provide an affordable, high performance, flexible capability to enable NASA to travel beyond the earth-moon system. The Pyrios booster concept takes advantage of the flight-proven Apollo-Saturn F-1, still the most powerful U.S. liquid rocket engine ever flown. The modernized F-1B is well suited to the Advanced Booster, providing a combination of high thrust-to-weight and reliability in a low-cost package. PWR brings unique cost and performance lessons from having recently worked on modernize another Saturn-era engine, the J-2X. The F-1B engine allows the Dynetics Pyrios liquid booster to deliver significant performance margin well beyond NASA's 130 mT Low Earth Orbit (LEO) payload requirement, permitting a low cost, robust approach to structural design. Dynetics has completed design of their 18-ft diameter tank, developed weld schedules and is about to begin friction stir welding using NASA Marshall Space Flight Center manufacturing tools and facilities. The F-1B offers safety and reliability features demonstrated on thirteen Saturn V flights of 65 engines with no failures. The new PWR F1-B will incorporate improved design features as well as modern manufacturing techniques to reduce the cost of the engine. Dynetics and PWR completed a series of F-1 Gas Generator hot fire tests at MSFC and are beginning manufacturing of new, more affordable components for demonstration in an F-1B turbopump. The Dynetics Team is making excellent progress in applying state-of-the-art manufacturing and processing techniques to the heritage F-1, demonstrating the ability to produce a low recurring cost engine while retaining the benefits of Apollo-era experience. The culmination of the ABEDRR effort will be a full-scale F-1 powerpack hotfire and a full size tank assembly test to verify the structural design.