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THE RESOLVE MISSION: NASA'S ROBOTIC LUNAR LANDER DEVELOPMENT

Abstract

Abstract NASA's RESOLVE Mission to the Moon brings together the lander development efforts under the Science Mission and Human Exploration Mission Directorates. The RESOLVE Mission will be the first In-Situ Resource Utilization (ISRU) demonstration on the lunar surface. RESOLVE is a miniature drilling and chemistry plant packaged onto a medium-sized rover to collect and analyze soil for volatile components such as water or hydrogen that could be used in human exploration efforts. Over the last seven years, NASA has invested in development and risk-reduction for a new generation of small-medium planetary landers capable of carrying instruments and technology projects to the lunar surface. NASA Marshall Space Flight Center (MSFC) and the Johns Hopkins University Applied Physics Laboratory (APL) have jointly implemented the robotic lander development. The project has made significant investments in technology risk reduction in focused subsystems. In addition, many lander technologies and algorithms have been tested and demonstrated in an integrated systems environment using the Mighty Eagle free-flying test article. These design and testing investments have significantly reduced development risk for landers, thereby reducing overall risk and associated costs for future missions. Since 2010, the NASA Johnson Space Center (JSC) has been developing a vertical test bed to demonstrate new green propellant propulsion systems and autonomous landing and hazard detection technology. Work on several systems began in 2006, when NASA's focus was to plan a human return to the Moon (known as the Constellation Program). Morpheus is a large lander, and is designed to deliver 500kg of cargo to the lunar surface. Morpheus utilizes a quad configuration liquid oxygen and liquid methane propulsion system. This propellant combination is of great interest and extensible, to human exploration. It is possible that the Moon's resources could be utilized to someday produce this propellant from the lunar surface. Since the first hot-fire test in 2011, the Morpheus test vehicle has progressed to free-flight testing at Kennedy Space Center. This paper presents the current lander configuration for RESOLVE, now jointly designed and implemented by the newly merged lander teams. The lander pallet configuration as conceived by APL, is unique, and brings together many technologies from both lander developments. This transport system is specially designed and optimized to land the maximum payload mass to the surface, and has no legs nor ramps. The RESOLVE Mission is scheduled for their Mission Concept Review (MCR) in early Fall of 2013, with a launch in 2017.