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Lander Technologies

Project Manager(s)/Lead(s)

Greg Chavers, Ph.D./FP30
(256) 544–0494

Sponsoring Program(s)

Human Exploration and Operations Mission Directorate
Advanced Exploration Systems
Science Mission Directorate

Project Description

Since 2006 NASA has been formulating robotic missions to the lunar surface through programs and projects like the Robotic Lunar Exploration Program, Lunar Precursor Robotic Program, and International Lunar Network. All of these were led by NASA Marshall Space Flight Center (MSFC). Due to funding shortfalls, the lunar missions associated with these efforts, the designs, were not completed. From 2010 to 2013, the Robotic Lunar Lander Development Activity was funded by the Science Mission Directorate (SMD) to develop technologies that would enable and enhance robotic lunar surface missions at lower costs. In 2013, a requirements-driven, low-cost robotic lunar lander concept was developed for the Resource Prospector Mission. Beginning in 2014, The Advanced Exploration Systems funded the lander team and established the MSFC, Johnson Space Center, Applied Physics Laboratory, and the Jet Propulsion Laboratory team with MSFC leading the project. The lander concept to place a 300-kg rover on the lunar surface has been described in the New Technology Report Case Number MFS-33238-1. A low-cost lander concept for placing a robotic payload on the lunar surface is shown in figures 1 and 2. The NASA lander team has developed several lander concepts using common hardware and software to allow the lander to be configured for a specific mission need.

In addition, the team began to transition lander expertise to United States (U.S.) industry to encourage the commercialization of space, specifically the lunar surface. The Lunar Cargo Transportation and Landing by Soft Touchdown (CATALYST) initiative was started and the NASA lander team listed above is partnering with three competitively selected U.S. companies (Astrobotic, Masten Space Systems, and Moon Express) to develop, test, and operate their lunar landers.

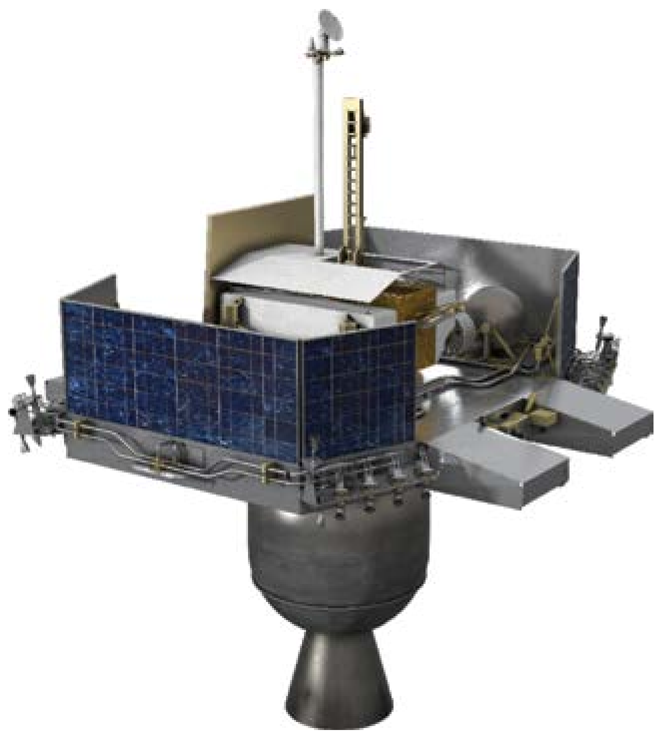

Figure 1: Lunar lander with solid rocket braking motor and rover.

Figure 2: Lunar pallet lander only.

The inspace engine (ISE100) is a 100-lbf thruster that operates using MMH and MON25 (fig.3). The SMD has funded this technology development for use on interplanetary missions (including landers) to reduce the heater requirements for propellants and to allow a high thrust to weight engine that requires low volume for packaging. The engine can operate with propellant temperatures as low as –40 ºF.

Figure 3: ISE100 fabricated in 2014.

Anticipated Benefits

Anticipated benefits of this project include low-cost lunar surface access for multiple missions which feeds forward to large Mars landers.

Potential Applications

Lunar landers specifically targeted at exploration and in situ resource utilization demonstrations, Mars landers, and interplanetary missions are potential applications.

Notable Accomplishments

Some of the notable accomplishments include the design of the low-cost robotic lunar lander with the prototype/engineering unit at the system level with flight software and simulation including a flight hardware-in-the-loop simulation. Development of subsystems and components for lunar landers with an application for science and exploration missions is also an accomplishment.