National Aeronautics and Space Administration

NASAfacts

Space Technology
Game Changing Development
Human Robotic Systems: Rover Technologies

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Overview

The Rover Technologies element of the Human Robotic Systems (HRS) project primarily focuses on development and advancement of rover technologies for infusion into future NASA surface missions.

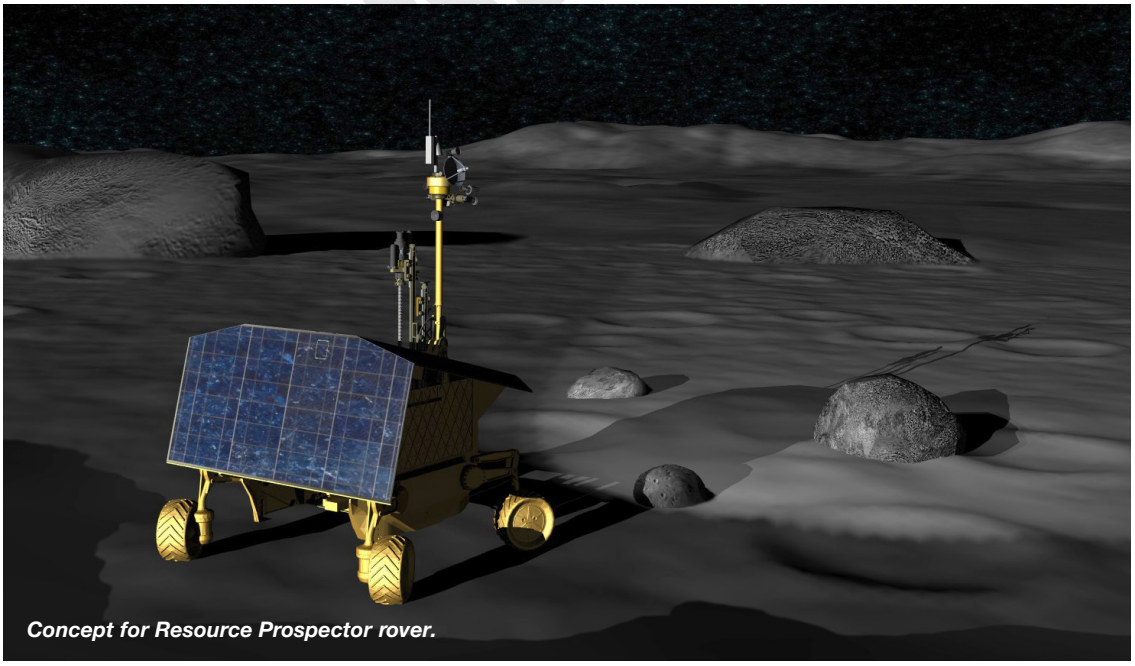
Resource Prospector

The primary mission infusion target in FY15 and beyond is the Human Exploration and Operations Mission Directorate (HEOMD) Advance Exploration Systems (AES) Resource Prospector (RP). Resource Prospector is a mission, currently planned to fly in 2020, that will demonstrate prospecting and processing volatiles from lunar regolith. The mission is the next step in using volatiles for in situ resource utilization (ISRU) after prior lunar probes have indicated water-ice may be trapped in permanently shadowed craters near the lunar poles.

The choice of destination in dark craters near the Moon's poles poses several technological challenges, including (1) a need for improved navigation capability for a rover to operate in and sense soft soils and other hazards in low-light or dark conditions and (2) improved avionics and motor control to enable communication with and control of a remote rover and its tools over significant time delays up to 30 seconds.

Rover Technology Development

In response to the mission goals and technology requirements of the RP mission, HRS will leverage existing HRS and Space Technology Mission Directorate robotics investments, adapting them for the RP mission requirements and increasing their technology readiness levels (TRL) to 6 with respect to the mission requirements.



Concept for Resource Prospector rover.

As part of this activity, HRS will develop a prototype rover in 2015, which will be used as a platform to develop and test the key rover technologies. Following on preliminary concepts developed in FY14 by HRS for AES, the prototype rover will have four wheel modules, each with independent propulsion, steering and active suspension. These features will assist in operation on soft soil, aid in getting individual wheels unstuck if they lose traction, and will allow the rover to drive in any direction (called crabbing) while keeping its solar array pointed at the sun (when available). Other technologies that will be developed/improved include:

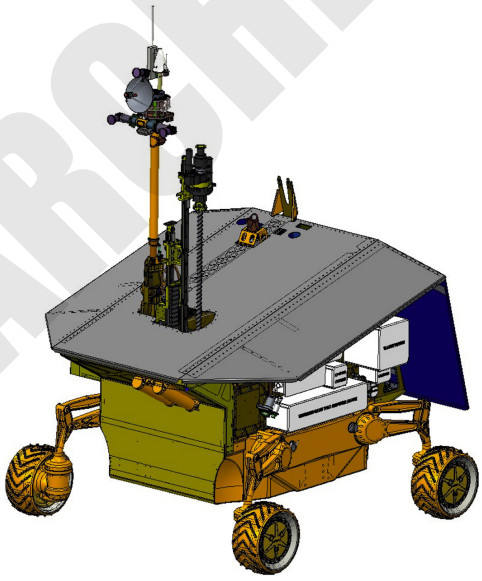
- Motor control and avionics capable of driving rovers and controlling rover tools over the Earth-Moon time delay.
- Advanced navigation software for rover's operation in the dark, with low on-rover computation resources.
- Advanced ground software systems that support rover exploration at a high pace under moderate time delays (1 week mission duration, with <30 second time delay).

Resource Prospector Prototype

The prototype rover must operate under Earth's 1G gravity, but will be designed as closely as practical to the actual flight vehicle.

At the end of FY15, the Rover Technologies task will have generated a functional prototype rover designed for operations under a 1G environment, with designs focused on a path towards a lunar environment. This prototype will be available for functional testing with integrated ISRU payloads and for testing in rockyards, gravity offloaded conditions and environmental test chambers.

In FY16, the primary focus will be TRL advancement through environmental and field testing. During FY16, HRS will conduct quarterly integrated field tests with the rover at NASA's Johnson Space Center while being commanded from NASA's Ames Research Center. This action will serve as a forcing function for software integration onto the rover, will engage the RP mission operations team early in the development cycle, and will serve as a baseline evaluation of progress.



Resource Prospector rover 2015 CAD design.

Resource Prospector prototype assembly.

Partnerships

Human Robotic Systems is led by NASA's Johnson Space Center, with support across multiple centers. HRS resides within the Game Changing Development (GCD) Program. HRS is partnered with the AES Resource Prospector mission.

Projects under GCD investigate ideas and approaches that could solve significant technological problems and revolutionize future space endeavors. GCD projects develop technologies through component and subsystem testing on Earth to prepare them for future use in space. GCD is part of NASA's Space Technology Mission Directorate.

For more information about HRS please visit http://www.nasa.gov/directorates/spacetech/game_changing_development/human-robotic-systems.html (public)

For more information about GCD, please visit http://gameon.nasa.gov/

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