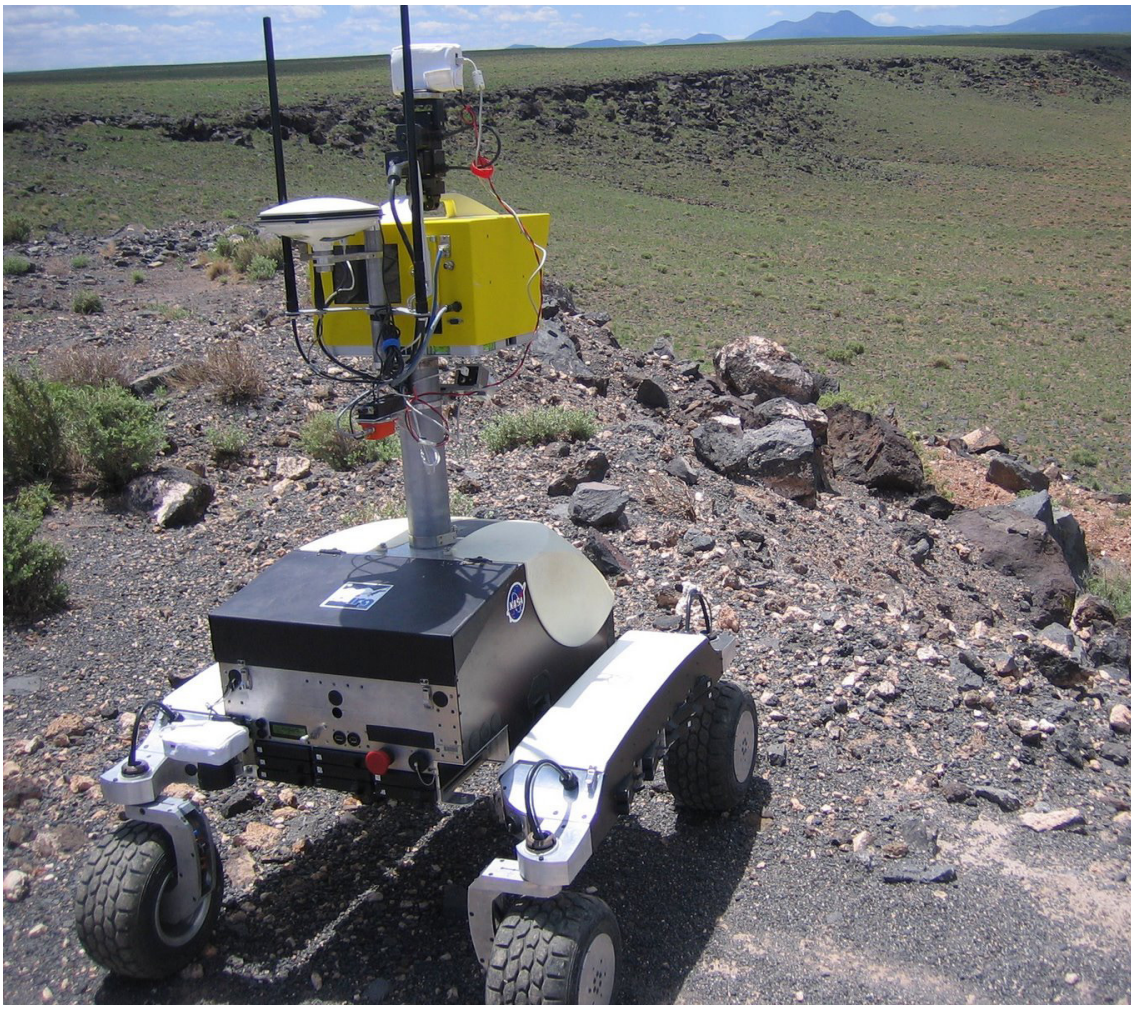
National Aeronautics and Space Administration

NASAfacts

K10 Robots:
Scouts for Human Explorers

Human missions to the moon will provide numerous opportunities to advance the scientific exploration of the lunar surface. Initially, human exploration of the moon will be for short periods of time – no more than a few weeks per year. To make use of the time between human missions, robots can be used to perform highly repetitive and long-duration tasks, such as site-mapping and science reconnaissance.

NASA's "K10" robots are designed to be remotely operated on planetary surfaces and act as scouts for human explorers. Scouting is an essential phase of fieldwork, particularly for geology, to help establish priorities and scientific objectives. Robotic scouting can improve human exploration of the moon by providing mission planners with detailed ground-level information to supplement and complement data collected by orbiting satellites.



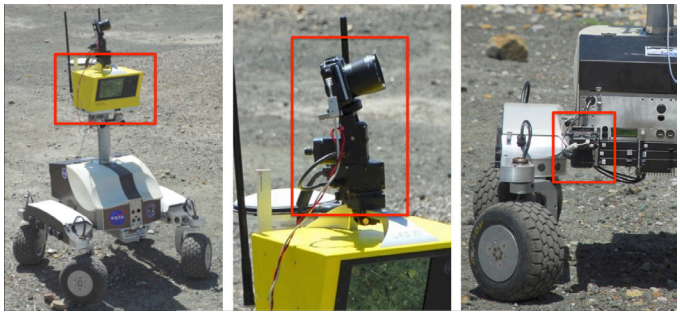
Overview

The Intelligent Robotics Group (IRG) at NASA's Ames Research Center, Moffett Field, Calif., developed the K10 robots using specially designed parts and off-the-shelf components. IRG's research supports the Human-Robotic Systems project, which is funded by NASA's Exploration Technology Development Program (ETDP). ETDP develops and matures technologies to meet the demands of NASA's lunar exploration mission objectives.

The K10 robots drive autonomously and can traverse long distances and over a wide variety of terrain. The K10 runs on custom, embedded software on a dual-core Linux laptop. Scientists and robot operators remotely operate K10 using wireless communications, the Ames-developed 'Viz' 3-D user interface, Google Earth, and a Web-based photo gallery.

The K10 uses 20 laptop computer lithium-ion batteries to power its four-wheel-drive, all-wheel steering equipment and sensors. It stands a little more than four feet tall, weighs 175 pounds and can carry 30-pounds of science instruments. The K10 can scale hills as steep as 45 degrees, climb over rocks while moving at approximately two feet per second, a human's average walking speed. The K10 uses the Global Positioning System, stereo cameras, a laser scanner, a digital compass, a sun tracker and an inertial measurement unit, or motion sensor, for navigation.

For scouting, K10 carries a 3-D scanning laser system, also known as a lidar, which is used to build topographic and panoramic 3-D terrain models. The K10 is equipped with a GigaPan robotic camera that can take panoramic pictures containing more than a billion pixels. It also uses a microscopic imaging camera to take high-resolution photographs of the ground to help scientists analyze surface features.



Left to right: scanning lidar, GigaPan, microscopic imager

In addition to scouting, the K10 robots are used to perform site surveys. These surveys are needed to plan for landing zones, prospect for resources, and conduct science on the lunar surface. During a survey, the K10 carries a variety of instruments, including a ground penetrating radar to map underground layers and structures; a penetrometer, to measure a surface's weight-bearing strength; wireless network monitors to map coverage area and bandwidth; and a neutron spectrometer to search for buried water ice.

For additional information about the K10 robot and scouting experiments, visit:

http://lunarscience.nasa.gov/roboticrecon

For information about NASA's plans to return to the moon, visit:

http://www.nasa.gov/exploration

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FS Number FS-2009-09-04-ARC