LADEE instruments healthy and ready for science

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This is an artist's concept of NASA's Lunar Atmosphere and Dust Environment Explorer in orbit above the moon as dust scatters light during the lunar sunset. Credit: NASA Ames/Dana Berry

Now in orbit around the moon, NASA's newest lunar mission has completed the commissioning phase, and its science instruments have passed their preliminary checks.

The Lunar Atmosphere and Dust Environment Explorer (LADEE), launched Sept. 6, 2013, carries three science instruments designed to gather detailed information about the structure and composition of the

thin lunar atmosphere and determine whether dust is being lofted into the lunar sky. A thorough understanding of these characteristics of our nearest celestial neighbor will help researchers understand other bodies in the solar system, such as large asteroids, Mercury, and the moons of outer planets.

"This is very promising for LADEE's science phase – we are already seeing the shape of things to come," said Rick Elphic, LADEE project scientist at NASA's Ames Research Center in Moffett Field, Calif., the center that is managing the mission.

The mission's commissioning phase lasted roughly one month, a period in which the spacecraft remained in a high-altitude preliminary orbit and the instruments were turned on, checked and calibrated.

All three science instruments are in good health, according to the mission's payloads manager, Robert Caffrey at NASA's Goddard Space Flight Center in Greenbelt, Md. "The sensitivity of the instruments is very high, and we are looking forward to an exciting science phase!"

The Lunar Dust Experiment (LDEX), built to collect and analyze lunar dust particles in the moon's thin atmosphere, is fully operational. The instrument recorded its first dust hit within minutes after its cover was deployed on Oct. 16. In subsequent orbits, LDEX observed dozens of dust particles, indicating an impact rate on the order of one hit per minute. Preliminary analysis suggests the particle sizes are much smaller than one micrometer in radius.

The Ultraviolet and Visible Light Spectrometer (UVS), designed to probe the composition of the lunar atmosphere, made its first measurements shortly after the telescope door opened on Oct. 16. The instrument has been performing as expected and has conducted a series of pointing and instrument-performance calibrations, including looking

at the limb of the moon and performing solar crossings by aiming the solar viewer at the sun and panning back and forth.

The Neutral Mass Spectrometer (NMS), which will measure variations in the lunar atmosphere over multiple lunar orbits, is operating normally. One of the first steps in getting the NMS ready for science measurements was to remove the cover of the instrument and expose the mass spectrometer to the lunar atmosphere. To do this, a pyrotechnic device was commanded to fire, breaking a ceramic to metal to ceramic seal, and the cover flew away from the spacecraft. Sensors on the spacecraft detected a small amount of motion caused by this event, and measurements made before and after the cover deployment showed that trapped calibration gases had indeed been released to space.

In addition to the three science instruments, LADEE includes a Lunar Laser Communication Demonstration (LLCD) payload. LLCD has made history using a pulsed laser beam to transmit data over the 239,000 miles between the moon and Earth at a record-breaking download rate of 622 megabits per second (Mbps). LLCD is NASA's first system for two-way communication using a laser instead of radio waves. It also has demonstrated an error-free data upload rate of 20 Mbps transmitted from the primary ground station in New Mexico to the spacecraft currently orbiting the moon.

"LLCD's goal is to validate and build confidence in the technology, so that future missions will consider using it," said Don Cornwell, LLCD manager at NASA's Goddard Space Flight Center in Greenbelt, Md. "The unique ability developed by the Massachusetts Institute of Technology's Lincoln Laboratory has incredible possibilities."

In addition to LLCD, LADEE marks several other firsts. The mission is the first flight of a spacecraft developed at Ames, the first spacecraft launched on a U.S. Air Force Minotaur V rocket integrated by Orbital

Sciences Corp., and the first deep-space mission to launch from NASA's Wallops Flight Facility in Virginia.

Now that the commissioning phase has ended, LADEE has lowered its orbit to get closer to the lunar surface and begin its 100-day science mission.

NASA's Science Mission Directorate in Washington funds the LADEE mission; a cooperative effort led by Ames, which manages the mission, built the spacecraft and performs mission operations. Goddard manages the science instruments and technology demonstration payload, and the science operations center. Wallops was responsible for launch vehicle integration, launch services, and launch range operations. NASA's Marshall Space Flight Center in Huntsville, Ala., manages LADEE within the Lunar Quest Program Office.

Provided by NASA's Goddard Space Flight Center