China's Next Step in Lunar Exploration

by Marsha Freeman

Nov. 5—The Nov. 1 landing of the Chang'e-5T Return Module back on Earth, has brought China closer to its ultimate goal—to land astronauts on the Moon.

The first phase of the program was the unmanned orbiting of the Moon with Chang'e 1 and 2, in 2007 and 2010, which produced high-resolution imagery, and a basic lunar survey. The second phase landed a spacecraft on the lunar surface last December, and deployed a rover. The third phase, scheduled for 2017, will be to return lunar samples to Earth.

China's lunar program is aimed at the development of lunar resources, particularly helium-3, an ideal fuel for nuclear fusion power. Scientists need samples to carry out a detailed examination of the chemical composition of lunar soil, and quantify lunar resources.

Returning a spacecraft from the Moon, which has not been done since the 1970s, by Soviet unmanned missions and the American Apollo program, poses new challenges. A spacecraft must make a precision landing, and the soil samples must be placed in a sealed capsule. The sample capsule must blast off from the lunar surface, and link up with an orbiting return vehicle to head back to Earth. The purpose of this recent test, was to make sure the capsule can safely return.

The Test Mission

Chang'e-5T (T for "test"), was launched on Oct. 23, for an eight-day mission to swing around the Moon, and return to Earth. The objective was to test the descent of the Return Module through the Earth's atmosphere, at a higher speed and higher temperature than the return of China's astronauts from Earth orbit.

Chang'e-5T, nicknamed "Xiaofei," or "Little Flyer," consisted of a Service Module for communication, propulsion, on-board power, and navigation, and an attached Return Module, resembling a scaled-down version of the Shenzhou manned capsule. The Return Module also carried samples of seeds and plants, an instrument to measure the radiation dose on a trans-lunar trip, and the LUX Space 4M Radio Experiment, which transmitted signals to the amateur radio community worldwide, from deep space. This was the first foreign experiment ever carried on a Chinese lunar mission.

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An artist's rendition of the Chang'e-5T spacecraft, with the Return Module on top of the Service Module. The Service Module, with its solar arrays, provides the power, communications, and navigation for the spacecraft.

The Service Module, designed only for travel in space, separated from the Return Module shortly before reentry. According to space scientist Emily Lakdawalla, the Service Module is now on its way to the Earth-Moon L-2 (libration) point, 37,000 miles past the Moon, where gravitational balance allows it to hover. But, she reported, according to *China Military Online*, it will go back to lunar orbit, and can be used during the sample return mission.

On Nov. 2, the recovery team turned over the Return Module to scientists. Yang Mengfei, at the China Aerospace Science and Technology Corporation, explained: "We will run some tests on the capsule" to examine "the degree of burns on its surface. Then we will conduct an analysis based on the data [obtained from] telemetry. From what we have seen, the capsule is in good condition.... The orbiter's trip has been very productive. It will lay a solid foundation for our future space program."

Asked about the Chang'e-5T mission by space.com's Leonard David, lunar scientist Paul Spudis, who has been lobbying to return the U.S. to the Moon, observed: "China now has positive practical experience with all of the elements of a human mission to the Moon.... And to the brainless twits who might comment that they are only doing something that we have already done, I will simply note that no one at the current incarnation of NASA has done it."