Space scientists set for final spacecraft flyby of Mercury

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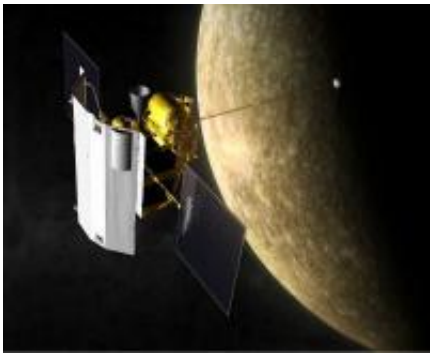

An $8.7 million CU-Boulder instrument en route to Mercury should help scientist better understand the hot, rocky inner planet and the early evolution of the solar system. Credit: NASA/Johns Hopkins University Applied Physics Laboratory/Carnegie Institution of Washington

NASA's MESSENGER spacecraft, which is toting an $8.7 million University of Colorado at Boulder instrument, will make its third and final flyby of Mercury on Sept. 29 -- a clever gravity-assist maneuver that will steer it into orbit around the rocky planet beginning in March 2011.

The spacecraft will zip within 142 miles of the planet's surface at more than 100,000 miles per hour on Sept. 29, taking high-resolution color images of the surface terrain. MESSENGER also will be making ultraviolet and visible light measurements of the harsh planet's surface,

its tenuous atmosphere and a comet-tailed gas cloud 25,000 thousand miles long that trails behind the planet.

MESSENGER is carrying seven instruments -- a camera, a magnetometer, an altimeter and four spectrometers -- and includes CU-Boulder's Mercury Atmospheric and Surface Composition Spectrometer, or MASCS. Despite the spacecraft's eye-popping speed, rapid rotation maneuvers during the flyby will allow the MASCS instrument to "stare" at a handful of selected targets such as surface craters as the spacecraft passes overhead, said CU-Boulder Senior Research Associate William McClintock.

"We will be pointing at each individual target from several different angles during the flyby, which will allow us to collect more data," said McClintock of CU-Boulder's Laboratory for Atmospheric and Space Physics and a MESSENGER mission co-investigator who led the development of the MASCS instrument. The MASCS team is particularly interested in unusual surface deposits spotted by the camera during Messenger's previous flybys, McClintock said.

"One of the big questions planetary scientist have is how much iron there is on Mercury's surface," said McClintock. "We hope to pinpoint the iron, determine what chemical form it is in and how it is bound up on the planet's surface." Iron, which dominates Mercury's core, is responsible for maintaining the planet's magnetic field.

The dynamic magnetic field of Mercury absorbs and stores energy from the powerful solar wind, periodically "snapping like a rubber band" and driving charged particles into the planet's surface, said McClintock. The collisions cause atoms of sodium, potassium and calcium -- and likely iron, silicon and aluminum -- to be ejected into the planet's wispy atmosphere, he said.

Some of the atoms are then accelerated by solar radiation pressure into the gigantic gas cloud tail, while other drift back down to the planet's surface, only to be lofted once again into the exosphere, where they make their way into gaseous tail, he said.

McClintock said that after the third and final flyby, the researchers will have collected about the same amount of data as they will gather during a single orbit around Mercury. Once MESSENGER settles into a yearlong pattern of twice-a-day orbits around Mercury in 2011, analyzing the massive streams of images and data "will be like drinking from a fire hose," said McClintock.

Dozens of CU-Boulder undergraduate students at LASP will become more and more involved in data analysis during the next several years as information and images pour back to Earth from MESSENGER said Mark Lankton, the LASP program manager for the MASCS instrument. The information will be streamed to LASP's Space Technology Building in the CU-Research Park.

"The hands-on space education and training opportunities offered to students at LASP in science, engineering and mission operations is available at few other places in the world," said LASP Director Daniel Baker, a co-investigator on the MESSENGER mission. "CU-Boulder undergraduates and graduate students are involved in virtually all of our space efforts, from designing and building flight instruments to controlling satellites from campus, which makes for a profound educational experience."

The 4.9 billion-mile-journey to Mercury requires MESSENGER to make more than 15 loops around the sun to guide it closer to Mercury's orbit. The craft is equipped with a large sunshade made from a heat-resistant ceramic fabric to protect it from the sun.

"During this third encounter, the MESSENGER camera will again image areas never before seen at close range, and we will obtain color images of other regions at resolutions superior to those of previous observations," said MESSENGER Principal Investigator Sean Solomon of the Carnegie Institution of Washington.

LASP also has a spectrometer riding on NASA's Cassini spacecraft that is now touring the Saturn system, a dust detector aboard the New Horizons spacecraft making its way to Pluto, and is leading a $485 million orbiting space mission slated for launch by NASA in 2013 to probe the past climate of Mars. CU-Boulder is the only research institution in the world to have designed and built space instruments for NASA that have been launched to every planet in the solar system.

More information: For more information on the MESSENGER mission visit the Web at messenger.jhuapl.edu/

Source: University of Colorado at Boulder (news : web)