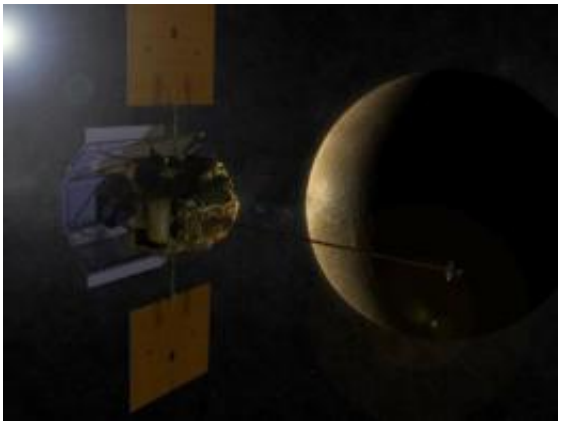
# Space scientists ready for orbital insertion of Mercury spacecraft

March 15 2011



Launched in 2004, an $8.7 million CU-Boulder instrument riding on NASA's MESSENGER mission to Mercury will begin orbiting the hot, rocky planet on March 17. Credit: Image courtesy NASA/Johns Hopkins University Applied Physics Laboratory/Carnegie Institution of Washington

NASA's MESSENGER mission, launched in 2004, is slated to slide into Mercury's orbit March 17 after a harrowing 4.7 billion mile journey that involved 15 loops around the sun and will bring relief and renewed excitement to the University of Colorado Boulder team that designed and a built an $8.7 million instrument onboard.

"In 2004, this milestone seemed like it was a long, long way away," said Senior Research Associate William McClintock, a mission co-investigator from CU-Boulder's Laboratory for Atmospheric and Space

Physics. "But here we are at last, poised to help solve some of the many tantalizing mysteries about Mercury."

The smallest of the solar system's four rocky planets, Mercury is about two-thirds of the way nearer to the sun than Earth and has been visited by only one other spacecraft, NASA's Mariner 10, in 1974 and 1975. CU-Boulder scientists say learning what makes the hot, rocky planet tick will help them better understand the formation and evolution of planetary systems.

The refrigerator-sized spacecraft is carrying seven instruments -- a camera, a magnetometer, an altimeter and four spectrometers. Designed and built by CU-Boulder's LASP, the Mercury Atmospheric and Surface Composition Spectrometer, or MASCS, is a power-packed, 7-pound instrument that will make measurements of Mercury's surface and its tenuous atmosphere, called the exosphere.

MASCS breaks up light like a prism, and since each element and compound has a unique spectral signature, scientists can determine the distribution and abundance of various minerals and gases on the planet's surface and exosphere, said McClintock. "We now know Mercury's exosphere is constantly changing," he said.

During a 2009 MESSENGER flyby of Mercury, MASCS detected magnesium, an element created inside exploding stars, clumped in the exosphere. The team determined magnesium, sodium and potassium and several other kinds of atoms flying off Mercury's surface were being accelerated by solar radiation pressure to form a gigantic tail of material flowing away from the sun, said McClintock.

"All of the instruments on MESSENGER had to be extremely light, which stretched our imaginations and creativity," said LASP's Mark Lankton, program manager for MASCS. "We have learned a lot, and

wound up getting a lot of bang for our buck."

LASP Director Daniel Baker, also a co-investigator on the MESSENGER mission, is studying Mercury's magnetic field and its interaction with the solar wind, including violent "sub-storms" that occur in the planet's vicinity. Since Mercury is the closest planet to the sun, MESSENGER is equipped with a large sunshade and heat-resistant ceramic fabric to protect it, said Baker.

"The three successful flybys of MESSENGER past Mercury have already rewritten the textbooks about the sun's nearest neighbor," Baker said. "We are pleased by all we have learned about the space environment of the planet. But we think there is so much more to learn -- we've probably just scratched the surface, so to speak."

Baker said the orbit insertion of Mercury will be celebrated by all of LASP, including a solar science team that saw its $28 million instrument crash into the sea March 4 due to problems with a NASA-contracted launch vehicle. "A very important aspect of LASP is that it is like a big family," Baker said. "Everyone shares the joys of success and the sorrow of failure, which has been a blessedly rare occurrence in our history."

"We have all of our appendages crossed for a successful orbit insertion," said Lankton. "MESSENGER is part of NASA's Discovery Program, and I'd be surprised if we don't continue to be surprised. Once we are in Mercury's orbit we are going to be getting a bounty of new data every day."

Dozens of undergraduates and graduate students will be involved in analyzing data as information and images begin pouring back to Earth from MESSENGER, dubbed "the little spacecraft that could" by LASP scientists. "This mission is going to be a field day for students, not only at CU-Boulder, but for students all over the world," said Baker.

CU-Boulder's LASP is the only space institute in the world to have designed and flown instruments that have visited or are en route to every planet in the solar system. LASP also has a student-built dust-counting instrument on NASA's New Horizons Mission, launched in 2006 to Pluto and now approaching the orbit of Uranus.

"LASP has some of the best people in the world pursuing great science, great engineering, wonderful mission operations, and superb administrative and managerial achievement," said Baker. "When such a team is given the facilities and resources to thrive, the sky is the limit. But it all starts with our people, including our students."

The data will be sent via NASA's Deep Space Network to the Applied Physics Laboratory at Johns Hopkins University -- which is managing the mission for NASA -- where mission scientists, including researchers and students at LASP's Space Technology Building at the CU Research Park, will access it electronically, he said.

Provided by University of Colorado at Boulder