Dawn is in silent pursuit of Ceres

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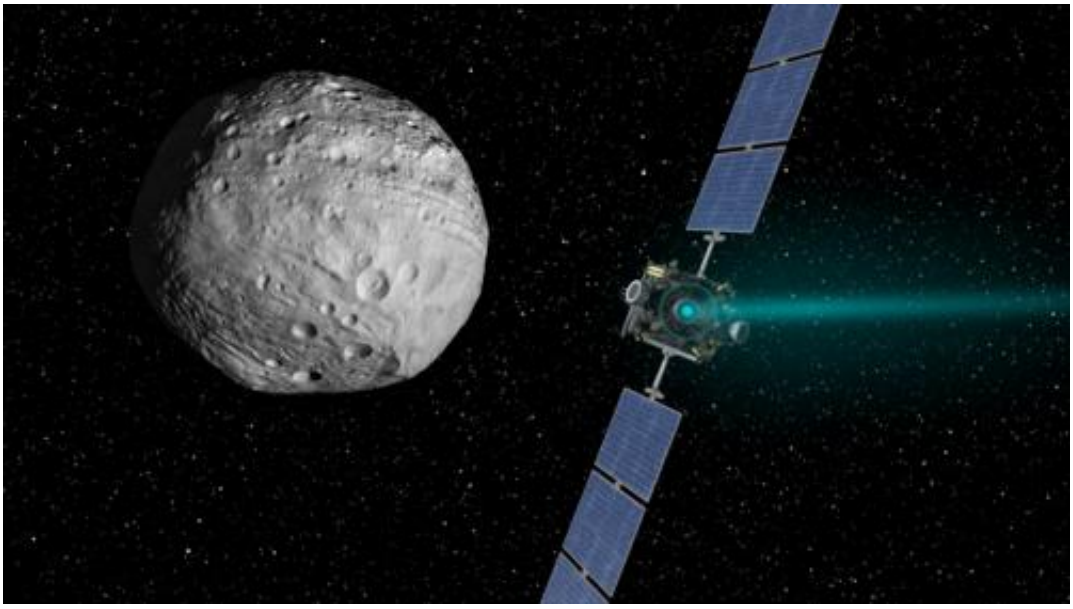


This image of NASA's Dawn spacecraft and the giant asteroid Vesta is an artist's concept. Dawn arrived at Vesta on July 15, 2011 PDT (July 16, 2011 EDT). Credit: NASA/JPL-Caltech

In the depths of the main asteroid belt between Mars and Jupiter, far from Earth, far even from any human-made object, Dawn remains in silent pursuit of dwarf planet Ceres.

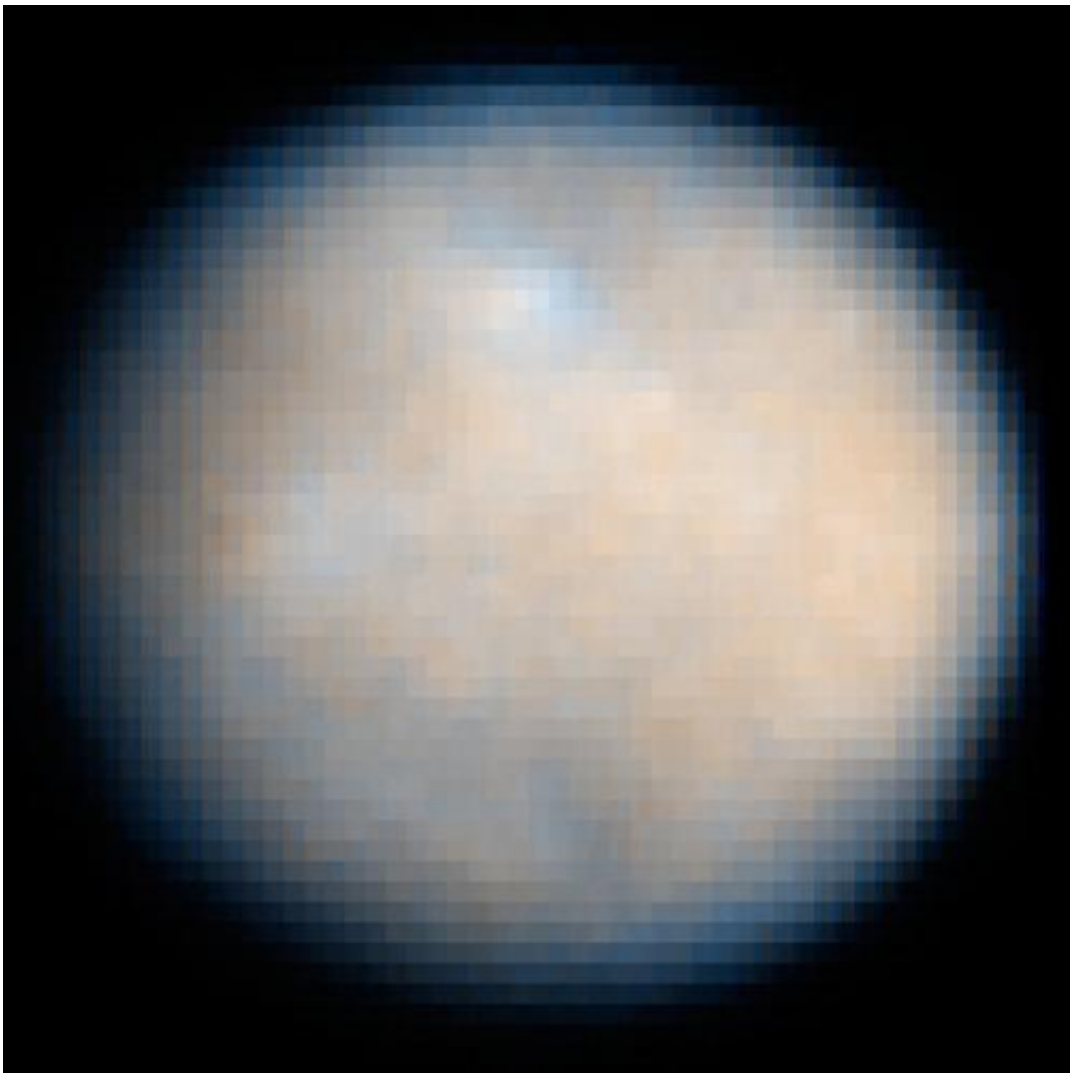
It has been more than six months since it slipped gracefully away from the giant protoplanet Vesta. The spacecraft has spent 95 percent of the time since then gently thrusting with its ion propulsion system, using that blue-green beam of high velocity xenon ions to propel itself from one

alien world to another.

The ship set sail from Earth more than two thousand days ago, and its voyage on the celestial seas has been wonderfully rewarding. Its extensive exploration of Vesta introduced humankind to a complex and fascinating place that had only been tantalizingly glimpsed from afar with telescopes beginning with its discovery 206 years ago today. Thanks to the extraordinary capability of ion propulsion, Dawn was able to spend 14 months orbiting Vesta, observing dramatic landscapes and exotic features and collecting a wealth of measurements that scientists will continue to analyze for many years.

When it was operating close to Vesta, the spacecraft was in frequent contact with Earth. It took Dawn quite a bit of time to beam the 31,000 photos and other precious data to mission control. In addition, engineers needed to send a great many instructions to the distant adventurer to ensure it remained healthy and productive in carrying out its demanding work in the unforgiving depths of space.

Dawn is now more than 20 times farther from Vesta than the moon is from Earth. Alone again and on its long trek to Ceres, it is not necessary for the ship to be in radio contact as often. As we saw in November, the spacecraft now stops ion thrusting only once every four weeks to point its main antenna to Earth. This schedule conserves the invaluable hydrazine propellant the explorer will need at Ceres. But communicating less frequently does not mean the mission operations team is any less busy. Indeed, as we have explained before, "quiet cruise" consists of a considerable amount of activity.



Ceres could feature surface ice at its poles. Image Credit: NASA, ESA, J. Parker (Southwest Research Institute), P. Thomas (Cornell University), and L. McFadden (University of Maryland, College Park)

Each time Dawn communicates with Earth, controllers transmit a second-by-second schedule for the subsequent four weeks. They also load a detailed flight profile with the ion throttle levels and directions for that period. It takes about three weeks to calculate and formulate these plans and to analyze, check, double check, and triple check them to ensure they are flawless before they can be radioed to Dawn.

In addition to all the usual information Dawn needs to keep flying smoothly, operators occasionally include some special instructions. As one example, over the last few months, they have gradually lowered the temperatures of some components slightly in order to reduce heater power. When Dawn stretched out its solar array wings shortly after separating from the Delta rocket on September 27, 2007, its nearly 65-foot wingspan was the longest of any NASA interplanetary probe. The large area of solar cells is needed to collect enough light from the distant sun to power the ion propulsion system and all other spacecraft systems. Devoting a little less power to heaters allows more power to be applied to ionizing and accelerating xenon, yielding greater thrust. With two and a half years of powered flight required to travel from Vesta to Ceres, even a little extra power can make a worthwhile difference to a mission that craves power.

Most temperature adjustments are only two degrees Celsius (3.8 degrees Fahrenheit) at a time, but even that requires careful analysis and investigation, because lowering the temperature of one component may affect another. Xenon and hydrazine propellants need to be maintained in certain ranges, and the lines they flow through follow complicated paths around the spacecraft, so the temperatures all along the way matter. Most of the hardware onboard, from valves and switches to electronics to structural mounts for sensitively aligned units, needs to be thermally regulated to keep Dawn shipshape.

It can take hours for a component to cool down and stabilize at a new setting, and sometimes the change won't even occur until the spacecraft has turned away to resume thrusting, when the faint warmth of the sun and the deep cold of black space affect different parts of the complex robot. Then it will be another four weeks until engineers will receive a comprehensive report on all the temperatures, so they need to be cautious with each change.

In addition to the ongoing work to keep Dawn flying true, some special activities are being developed for later this year, each of which will serve two important purposes: they will yield valuable experience in preparing for operations in orbit around Ceres, and they will provide interesting material for you to read about in future logs. Your correspondent has confidence both in the flight team to design and execute these activities and in readers throughout the cosmos to continue to follow this ambitious mission on its extraterrestrial exploits.

And to ensure that there is plenty to read about for years to come, Dawn's human colleagues are working hard to prepare for exploring Ceres when the spacecraft reaches that remote destination in 2015. As at Vesta, the probe will take advantage of the unique maneuvering capability of ion propulsion to fly to different orbits, each optimized for specific investigations to reveal the complex character of the mysterious world, ensuring a rich and gratifying experience for everyone who wonders about the nature of the solar system. As the plans mature at the end of this year and in 2014, we will delve into them here, just as we presented the Vesta strategy in 2010 and 2011, leading up to the astounding achievements of 2011 and 2012.

Meanwhile, the spacecraft itself, loyally following carefully devised and intricate plans, continues to make good progress, patiently and reliably flying onward. Unknown challenges and unknown rewards lie ahead, and together they promise that this bold mission in deep space will provide humankind with still more inspiring and exciting cosmic adventures.

Dawn is 7.7 million kilometers (4.8 million miles) from Vesta and 56 million kilometers (35 million miles) from Ceres. It is also 2.64 AU (395 million kilometers or 246 million miles) from Earth, or 1075 times as far as the moon and 2.65 times as far as the sun today. Radio signals, traveling at the universal limit of the speed of light, take 44 minutes to make the round trip.

Provided by NASA