Discovery Dispatch

A Quarterly Newsletter of the NASA Discovery Program

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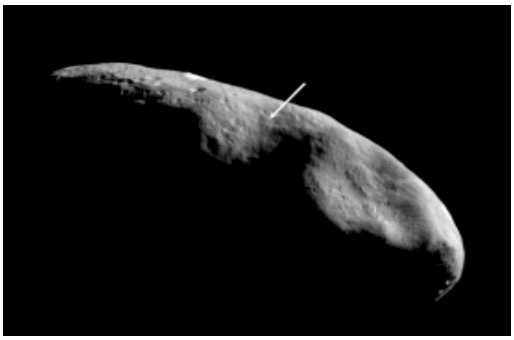
NEARly Fantastic: The Adventure is Over, Let the Data Analysis Begin

On February 28th at 7 p.m. (EST), NASA's Deep Space Network antennas received their last Near Earth Asteroid Rendezvous (NEAR) mission data, bringing to a close the first mission to extensively study an asteroid. Throughout its year-long orbit and landing on Eros, NEAR has delighted the public, astronomy enthusiasts and scientists alike.



The location of NEAR Shoemaker's landing site is shown in this image mosaic taken on December 3, 2000, from an orbital altitude of 200 kilometers (124 miles).

On February 12th , the NEAR Shoemaker spacecraft made such a gentle landing that it continued to send a signal back to Earth. Jumping at the chance to get "bonus science" from the spacecraft, which had already collected 10 times more data than originally planned, NASA granted the team an extension to allow the gamma-ray spectrometer to collect data from an ideal vantage point about four inches from the surface. The spectrometer team quickly redesigned software and uploaded it to the

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A Note From the Program Manager

The Near Earth Asteroid Rendezvous mission came to a more successful conclusion than even the most optimistic among us could have hoped for. It not only survived the controlled descent to asteroid Eros, it landed so gently that it continued to send back a signal to Earth. NASA extended the mission 16 days beyond the February 12th landing to allow the gamma-ray spectrometer to send back more sensitive data on the composition of Eros at and below its surface. It was sad to see the mission come to an end, but now the fun begins for the scientists who are anxious to study the data, including more than160,000 detailed images taken by the NEAR Shoemaker spacecraft.

As one exciting mission ends, another is soon to begin. We are looking forward to the upcoming launch of Genesis in July, a mission to collect solar wind and shed new light on the birth and evolution of our solar system. After three years, the sample collector will return to Earth with a supply of solar particles for 21st century scientific research.

Our second annual Discovery Program retreat was held April 17-19 in San Francisco. The retreat provided an opportunity for interaction among the missions that doesn't otherwise take place and for the missions to learn about the latest happenings in various areas of NASA that affect them all.

Congratulations to the three missions selected to develop concept studies as candidates for the next Discovery mission. The three are:

•Kepler, a space telescope designed to detect Earth-sized planets around stars in the Sun's area of the galaxy.

•INSIDE Jupiter, an orbiter designed to observe and measure processes occurring within the Jovian magnetosphere and atmosphere.

•Dawn, a mission to orbit Vesta and Ceres, two of the largest asteroids in the solar system, each with very different properties.

Also welcome to NetLander, a French-led mission to Mars scheduled for launch in 2007. NASA has decided to fund a Discovery "Mission of Opportunity" for American participation in NetLander to contribute to the seismology, meteorology and geodesy on this first network of scientific stations ever deployed on Mars.

Dave Jarrett

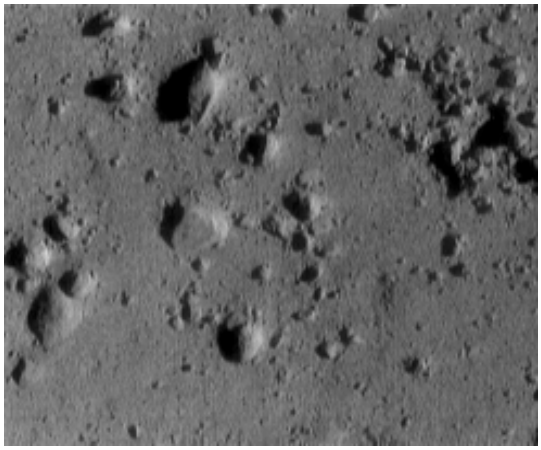
Discovery Home Page

http://discovery.nasa.gov

spacecraft so they could begin collecting elemental composition readings.

The results were spectacular, according to Dr. Jacob Trombka, head of the gamma-ray spectrometer team. “It’s the first feasibility study of how to design an instrument to be used on a rover that could select samples from the surface, look for the presence of water, or map the surface for the purpose of future mining. It will help us more precisely classify Eros and determine the relationship between the asteroid and meteorites that have fallen to Earth.”

This chart shows the gamma-ray spectrum from the surface of Eros after 7 days of measurements following the landing, the first ever collected on the surface of an asteroid.



NEAR Shoemaker’s image of asteroid 433 Eros taken from a range of 250 meters (820 feet). The image is 12 meters (39 feet) across. The cluster of rocks at the upper right measures 1.4 meters (5 feet) across.

Project Scientist Dr. Andrew Cheng said now scientists can begin to study the data, including the more than 160,000 detailed images taken by the spacecraft. “We solved mysteries, we unveiled more mysteries. Now we’re sharing the amazing amount of data that we collected with scientists all over the world, to sort through and debate and hopefully to help us discover facts about Eros and our solar system that no one knows today.”

EARLY MISSION RESULTS

•Combining digital images and data from the laser rangefinder, scientists have built the first detailed map and three-dimensional model of an asteroid.

•Previously scientists had theorized that asteroids were either solid iron or cosmic rubble piles—Eros is neither. Data suggests that Eros is a cracked but solid rock, possibly a fractured chip off a larger body, made of some of the most primitive materials in the solar system.

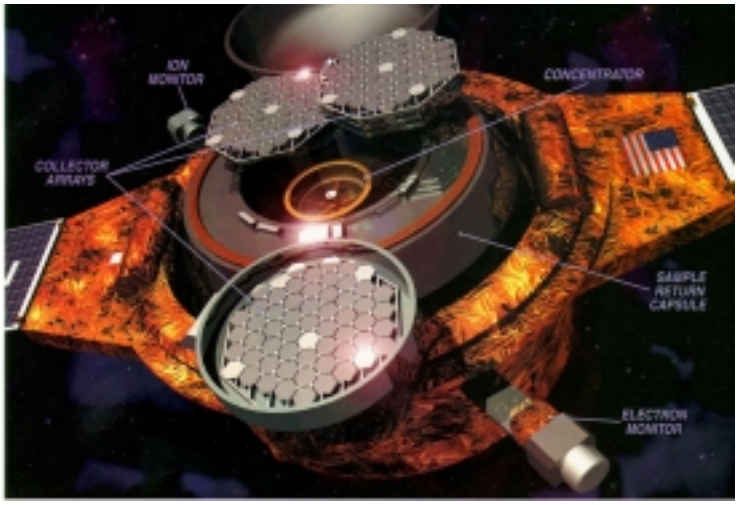
•The regolith on Eros is nearly 91 meters (300 feet) deep in places. Data indicate the regolith has moved downhill, smoothing over rough areas and spilling into craters.

•The cratering on Eros has surprised scientists, with intriguing square ones and many fewer small craters than expected. More than 100,000 craters wider than 15 meters (50 feet) have been counted. Also, the large number of boulders was unexpected, with about one million house-sized or larger boulders

•The last images returned show clusters of boulders, a mysterious area where the surface appears to have collapsed, and extremely flat, sharply delineated areas in the bottoms of some craters, indicating the story of Eros’s composition is still emerging.

Genesis Prepares for July 30 Launch

With shipment to the Kenndy Space Center scheduled for May 30, the launch of the Genesis spacecraft is just around the corner. The excitement is building for the first mission to return samples from space since Apollo, as preparations move into the final stages for the July 30 launch from Cape Canaveral aboard a Boeing Delta rocket.



Genesis Spacecraft

The Genesis spacecraft will be placed into orbit about 1,600,000 km (one million miles) from Earth, around L1, a point between Earth and the Sun where the gravity of both bodies is balanced. Once in orbit, Genesis will spread its collector arrays and begin collecting particles of the solar wind that will imbed themselves in specially designed high purity wafers. After nearly two years, the sample collectors will be re-stowed and returned to Earth for a mid-air recovery of the sample return capsule by a helicopter over the Utah desert. The samples will be stored and cataloged under ultra-pure clean room conditions and made available to the world scientific community for study.

Scientists believe that the planets and the Sun were all formed at about the same time and must have been very similar when the solar system began. Today we know that Venus, Mars and the Earth are very different. Genesis hopes to unlock these mysteries:

•How can we explain the diversity of planetary objects?
•What made Earth different from its planetary neighbors?
•What were the planets composed of in the beginning?

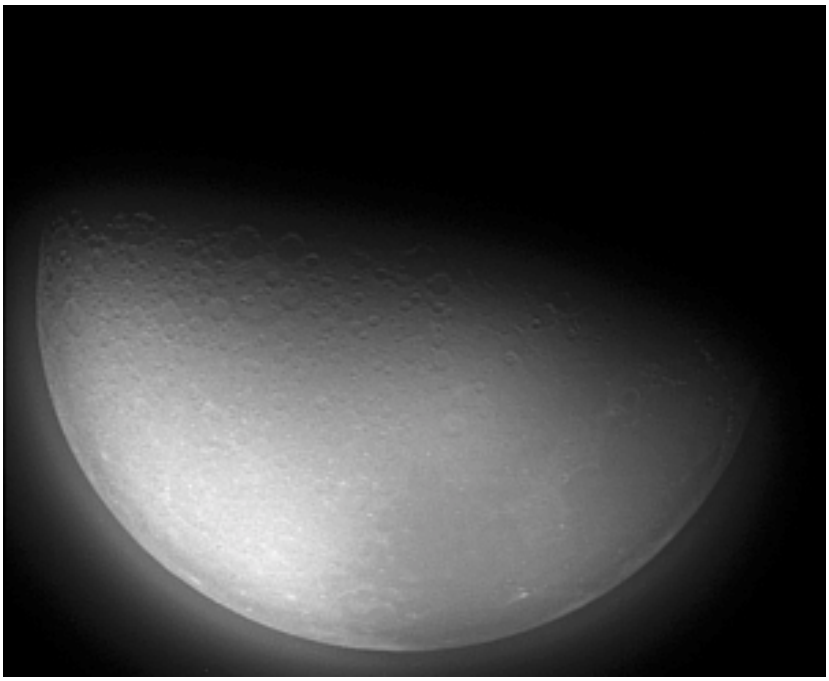
In its quest for answers, Genesis will measure isotopic compositions of oxygen, nitrogen, and noble gases, enabling scientists to better understand the isotopic variations in meteorites, comets, lunar samples, and planetary atmospheres.

Visit the Genesis website for frequent updates as the launch gets closer.

Stardust Gets a Boost from Earth; Clears Cloudy Camera

On January 15, the Stardust spacecraft executed an Earth Gravity Assist, coming within 6,000 km (3,700 miles) of Earth near the southern tip of Africa, to obtain an energy boost using the Earth's grvitational pull to put it on track to intercept the orbit of Comet Wild 2 in 2004. Images of the Stardust spacecraft, streaking across the heavens as it approached Earth, were taken in the United States, Australia, Hungary and Mexico.

Seventeen hours after Earth flyby, Stardust passed about 98,000 km (61,000 miles) from the Moon, taking twenty-one images to provide calibration data of the navigation camera's performance. The camera will be used to navigate Stardust to its encounter with Comet Wild 2, where it will collect more than 1,000 dust particles from the cloud of dust and gas that surrounds the comet and return them to Earth.



This image of the moon was taken by Stardust on January 15, 2001.

After a few months of foggy vision, the Stardust team returned the spacecraft's navigation camera resolution to nearly normal, just before the close flyby of the Earth. During tests late last year, the team noticed blurry images and determined the cause to be possible contamination of the camera due to gases escaping from the spacecraft after launch. They decided to try heating the optical path of the camera to boil away the contaminant covering the lens. After a series of heating cycles, they retested the camera by taking more test pictures, which indicated the problem was resolved.

However, in March, team members noticed a reappearance of the coating, which is similar to frost on a car windshield, and they used the same heating technique again to clean up the optics. Engineers deduced that the clouding of the lens might be due to a substance that evaporates and settles, clinging to the coldest parts of the camera. They believe the heating option will result in improved sensitivity performance and reduced scattered light, thereby providing excellent images at Comet Wild 2. A longer period of heating may clean the optics permanently. If not, heat will be applied again as the spacecraft gets closer to the comet.

CONTOUR On Track for July 2002 Launch

The Comet Nucleus Tour, or CONTOUR, mission, conducted a successful Critical Design Review in December, moving the mission full speed ahead into fabrication, integration and test of the spacecraft and its four science instruments.

The review consisted of various mission elements presenting their design and status before two sets of review boards: one board was part of APL's normal review process and the second was an Independent Assessment Team appointed by the NASA Discovery Program Manager and comprised of experts in various areas of spaceflight missions from industry and NASA. The reviewers probed both the details of the various mission elements and the inter-relationships between the elements to make sure the overall design is sound. Upon completion, both review panels expressed satisfaction that the scientific requirements are being met, the overall design is sound and the project is ready to move to the next phase of implementation.

The main deck of the CONTOUR spacecraft before being added to the frame. The large cut-out hole in the center is where the upper part of the solid rocket motor is located. The two large circular holes on the either side are where the hydrazine tanks are located.

CONTOUR will encounter and study the nuclei of two very different comets, measuring chemical composition, collecting and analyzing dust, and making precise orbit determininations. Its science objectives are to dramatically improve our knowledge of the key characteristics of comet nuclei and to understand how individual comets are alike or different. The nucleus of a comet has been viewed only one time before, when the European Space Agency's Giotto spacecraft glimpsed Comet Halley's nucleus in 1986. CONTOUR will also explain many mysteries of how comets evolve as they approach the Sun and their ices begin to evaporate.

Deep Impact and MESSENGER Move Toward May Project Reviews

The two newest Discovery missions, Deep Impact and MESSENGER (the MErcury Surface, Space ENvironment, GEochemistry, and Ranging mission) both began work in January 2000 and are heading toward their Preliminary Design Reviews in May 2001.

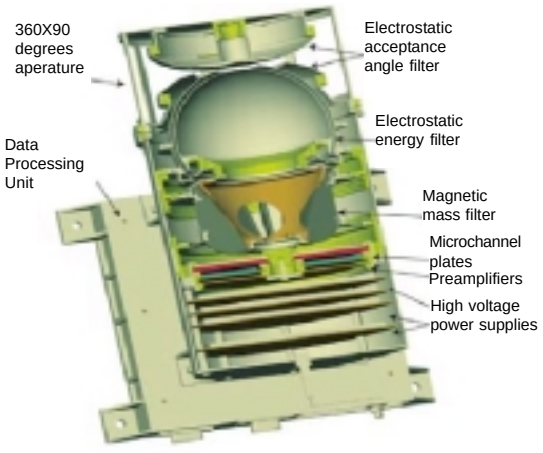
Deep Impact is the first experiment to probe deep beneath the surface of a comet. Scheduled to launch in January 2004, Deep Impact is a two-part spacecraft. The larger "flyby" spacecraft will carry a smaller "impactor" spacecraft to Comet Tempel 1 and release it into the comet's path for a planned collision on July 4, 2005, producing a football field-sized crater, seven stories deep. Ice and dust debris will be ejected from the crater, revealing the fresh material beneath. Cameras on the flyby spacecraft will send back to Earth images of the approach, the impact and its aftermath. The collision will also be observable from certain locations on Earth.

Since work began, the Deep Impact team has redesigned the flyby spacecraft for better spin balance and performance and has redesigned the impactor for improved cratering. An independent review board will determine if the project has sufficient cost, schedule and mass margins to meet strict Discovery requirements.

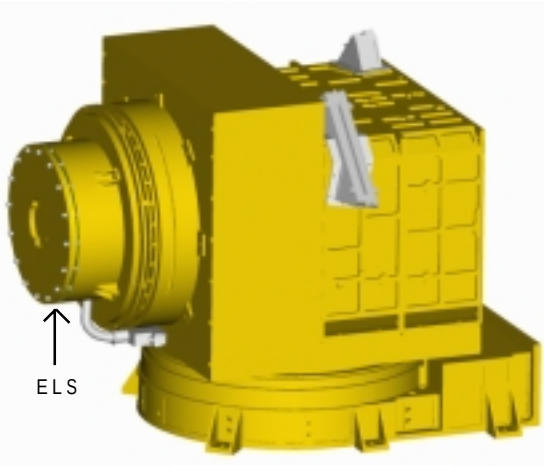
MESSENGER will provide answers to fundamental planetary science questions about Mercury. It is scheduled for a March 2004 launch and insertion into Mercury orbit in April 2009. Since work on the project began, improved trajectory calculations have led to mass increases which will enhance performance and improve robustness. Other studies and tradeoffs have resulted in improvements to the various spacecraft instruments. Instrument design reviews are being held in April, leading up to the spacecraft level review in May.

ASPERA-3 Components Go To Sweden

Two portions of the ASPERA-3 experiment (Analyzer of Space Plasma and Energetic Atoms) being funded by NASA as a Discovery Mission of Opportunity were completed by Southwest Research Institute in early 2001. The Electron Spectrometer, or ELS, is part of the ASPERA-3 main unit and the Ion Mass Analyzer, or IMA, detector subassembly is a separate unit. The



Ion Mass Analyser



ASPERA main unit

IMA was shipped to Sweden in January and the ELS in March, where they will be integrated into the ASPERA-3 instrument, one of seven scientific instruments which will be flown on the Mars Express spacecraft in 2003.

Mars Express is a project of the European Space Agency to search for sub-surface water from orbit and place a lander on the Martian surface. The instruments onboard the orbiting spacecraft will perform remote sensing measurements designed to answer questions about the Martian atmosphere, the planet's structure and geology.

Discovery Dispatch

Written and edited by:
Shari Asplund
Discovery Program Outreach Manager

Layout and production by:
Andy Hernandez
Discovery Program Support Office Intern

National Aeronautics and Space Administration