Aura launches skyward

By Alan Buis

Aura, a mission dedicated to the health of Earth's atmosphere, successfully launched July 15 at 3:01:59 a.m. Pacific Time from the Western Range of Vandenberg Air Force Base, Calif., aboard a Boeing Delta II rocket. Spacecraft separation occurred at 4:06 a.m. Pacific Time, inserting Aura into a 310-kilometer (193-mile) orbit.

NASA's latest Earth-observing satellite, Aura, will help us understand and protect the air we breathe.

NASA Goddard Space Flight Center manages the Aura mission. JPL developed and manages the Microwave Limb Sounder and Tropospheric Emission Spectrometer. The High Resolution Dynamics Limb Sounder was built by the United Kingdom and the United States. The Ozone Monitoring Instrument was built by the Netherlands and Finland in collaboration with NASA.

"This moment marks a tremendous achievement for the NASA family and our international partners," said NASA associate administrator for Earth science Dr. Ghassem Asrar. "We look forward to the Aura satellite offering us historic insight into the tough issues of global air quality, ozone recovery and climate change.

"This mission advances NASA's exploration of Earth and will also better our understanding of our neighbors in the planetary system," said mission manager Dr. Robert T. Simmon. "Aura joins its siblings Terra, Aqua and 10 more research satellites developed and launched by NASA during the past decade—to study our home planet."

"Many people have worked very hard to reach this point and the entire team is very excited," said Goddard's Rick Pickering, the Aura project manager.

With the launch of Aura, the first series of NASA's Earth Observing System satellites is complete. The other satellites are Terra, which monitors land, and Aqua, which observes Earth's water cycle.

Aura will help answer three key scientific questions: Is Earth's protective ozone layer recovering? What are the processes controlling air quality? How is Earth's climate changing?

In addition, Aura will help scientists understand how the composition of the atmosphere affects and responds to Earth's changing climate. The results from this mission will help scientists better understand the processes that connect local and global air quality.

Each of Aura's four instruments is designed to survey different aspects of Earth's atmosphere. Aura will survey the troposphere, where humans live, through the stratosphere, where the ozone layer resides and protects life on Earth.

The Microwave Limb Sounder is intended to improve our understanding of ozone in Earth's stratosphere, which is vital in protecting us from solar ultraviolet radiation. The Tropospheric Emission Spectrometer is an infrared sensor designed to study Earth's troposphere and to look at ozone and other urban pollutants.

NASA's Earth Science Enterprise is dedicated to understanding Earth as an integrated system and applying Earth system science to improve prediction of climate, weather and natural hazards using the unique vantage point of space.

For Aura information and images, visit http://www.nasa.gov/aurasatellite.html and http://www.nasa.gov/aura.

For more information about the Microwave Limb Sounder, visit http://mls.jpl.nasa.gov.

Mars rovers roll into Martian winter

By Whitney Clavin

As winter approaches on Mars, JPL's Opportunity rover continues to inch deeper into the stadium-sized crater dubbed "Endurance." On the other side of the planet, the Spirit rover found an intriguing patch of rock outcrop while preparing to climb up the "Columbia Hills" backward. This unusual approach to driving is part of a creative plan to accommodate Spirit's aging front wheel.

Spirit, with an odometer reading of more than 3.5 kilometers (2.2 miles), has already traveled six times its designed capacity. Its front wheel has been experiencing increased internal resistance, and recent efforts to mitigate the problem by redistributing the wheel's lubricant through rest and heating have been only partially successful.

To cope with the condition, rover planners have devised a roundabout strategy. They will drive the rover backward on five wheels, rotating the sixth wheel only sparingly to ensure its availability for demanding terrain. "Driving may take us a little bit longer because it is like dragging an anchor," said Joe Melko, a rover engineer at JPL. "However, this approach will allow us to continue doing science much longer than we ever thought possible."

On Thursday, July 15, Spirit successfully drove 8 meters (26 feet) north along the base of the Columbia Hills backward, dragging its faulty wheel. The wheel was activated about 10 percent of the time to surmount obstacles and to pull the rover out of trenches dug by the immobile wheel.

Along the way, Spirit drove over what scientists had been hoping to find in the hills—a slab of rock outcrop that may represent some of the oldest rocks observed in the mission so far. Spirit will continue to drive north, where it likely will encounter more outcrop. Ultimately, the rover will drive east and hike up the hills backward using all six wheels.

"A few months ago, we weren't sure if we'd make it to the hills, and now here we are preparing to drive up into them," said Dr. Matt Golombek, a rover science-team member from JPL. "It's very exciting." For the past month, the Spirit rover has been parked near several hematite-containing rocks, including "Pot of Gold," conducting science studies and undergoing a long-distance "tuneup" for its right front wheel.

Driving with the wheel disabled means that corrections might have to be made to the rover's planned path. This limits Spirit's accuracy, but rover planners working at JPL's rover test facility have come up with some creative commands that allow the rover to auto-correct itself to a limited degree.

As Spirit prepares to climb upward, Opportunity is rolling downward. Probing increasingly deep layers of bedrock lining the walls of Endurance Crater at Meridiani Planum, the rover has observed a puzzling increase in the amount of chlorine. Data from Opportunity's alpha particle X-ray spectrometer show that chlorine is the only element that dramatically rises with deepening layers, leaving scientists to wonder how it got there. "We do not know yet which element is bound to the chlorines," said Dr. Julia Zeitler, a rover science-team member from the Max Planck Institute for Chemistry, Mainz, Germany.

Opportunity will roll down even farther into the crater in the next few days to see if this trend continues. It also will investigate a row of sharp, teeth-like features dubbed "Razorback," which may have formed when fluid flowed through cracks, depositing hard minerals. Scientists hope the new data will help put together the pieces of Meridiani's mysterious and watery past. "Razorback may tell us more about the history of water at Endurance Crater," said Dr. Jack Farmer, a rover science-team member from Arizona State University.

Rover planners are also preparing for the coming Martian winter, which peaks in mid-September. Pronouncing daily sunshine means the rovers will have less solar power and take longer to recharge. Periods of rest and deep sleep will allow the rovers to keep working through the winter at lower activity levels. Orienting the rovers' solar panels toward the north will also elevate power supplies. "The rovers might work a bit more every day, or a little bit more every other day. We will see how things go and remain flexible," said Jim Erickson, project manager for the Mars Exploration Rover mission at JPL.

Apply for a Job

Nifs

Solutions, Science Applications International Corporation, the Research Institute for Advanced Computer Science, Alertness Inc., the Research Institute for Advanced Technology included staff from QSS Group and science teams better meet the logistical challenges.”

and engineers collaborated daily in MER mission control, 240 scientists to date. The citation noted: “At JPL’s most complex planetary rover mission society. In addition, special awards were bestowed to the Investigation Organiz Team that supported the work of the Columbia Accident Investigation Board. A complete list of the winning teams, with synopses of their accomplishments, is available at http://www.nasa.gov/centers/jpl/public/ awards/2004/index.html.

To donate blood you must be at least 18 years old, weigh at least 110 pounds and be in good health. For more information, visit http://www.donorcenter.org/. To employ! will continue to access their specific software release.

at JPL's Occupational Health Services at ext. 4-3319. Occasionally, the LA County Alta Bates Summit Medical Center, 104 Berkshire Place, La Cañada.

The flight instrument arrived at Ball two days later. The instrument’s post-shipment functional and performance verification was completed on July 20 and mechanical integration between the instrument and its Impact on Climate Change” at the University of Colorado's Vosloh Forum, 1570 E.

“Model-Driven Design With UML 2.0”—Session 4—Meeting at noon in Building 183-328. JPL Gun Club—Meeting at noon in Building 301-271.

Ongoing Support Groups

• Alcoholics Anonymous—Meetings are available at http://www.na.org/locations.html. For more information, call the reference desk, ext. 4-1024.

the forthcoming Unified Modeling Language specification, which enhances the ability of the model to model more complex systems. UML 2.1 has added explicit notions of responsibility among participants, an ability to decompose complex systems. The talk is presented by the member of the Open Source Mission Architecture Program at ext. 4-3680 for time and location.

A new job search tool now online

and its Impact on Climate Change” at 7 p.m. Thursday in Von Kármán Auditorium.

Chess—Class—Meeting at noon in Building 208-128. “Model-Driven Design With UML 2.0”—Meeting at 11 a.m. in conference room 180-117.

The instrument’s data are recorded and archived in its on-board computer system and transmitted to scientists in JPL and at other NASA locations. The environmental data are either processed on the ground or sent to the instrument’s instrument data processor (IDP), which reprocesses and analyzes the data and transmits them to NASA’s science team for further analysis.

it is time to address the individuals listed on Page 5 of the Memorandum.

Flexible and Accrual Practices,” located on the Finance and Contract Management Division’s website at http://fcm.ok/ FCM/hr/About/hr_policies/accrual.pdf provides answers to the following questions:

• When were the NBS Toolkit forms during a transitionary period.

• What is the last day I can turn in a Purchase Requisition and have the cost recorded on my project?• What is the last day I can purchase something and have the cost recorded on my project?• What is the last day I can turn in a Travel Expense Report and have it included this year’s cost?• What can the requisitioner do to expedite the costing of procurements?• What will the Finance and Contract Management Division and Acquisition Division do to ensure costs are included in FY 2004? Further questions? Contact one of the individuals listed on Page 5 of the memorandum.

Ongoing Support Groups

• Alcoholics Anonymous—Meetings are available at http://www.na.org/locations.html. For more information, call the reference desk, ext. 4-1024.

The flight instrument arrived at Ball two days later. The instrument’s post-shipment functional and performance verification was completed on July 20 and mechanical integration between the instrument and its Impact on Climate Change” at the University of Colorado's Vosloh Forum, 1570 E.

“Model-Driven Design With UML 2.0”—Session 4—Meeting at noon in Building 183-328. JPL Gun Club—Meeting at noon in Building 301-271.

Ongoing Support Groups

• Alcoholics Anonymous—Meetings are available at http://www.na.org/locations.html. For more information, call the reference desk, ext. 4-1024.

The flight instrument arrived at Ball two days later. The instrument’s post-shipment functional and performance verification was completed on July 20 and mechanical integration between the instrument and its Impact on Climate Change” at the University of Colorado's Vosloh Forum, 1570 E.

“Model-Driven Design With UML 2.0”—Session 4—Meeting at noon in Building 183-328. JPL Gun Club—Meeting at noon in Building 301-271.

CloudSat radar on the move

CloudSat radar on the move

The CloudSat satellite's Cloud Profiling Radar is shown being prepared for shipment on July 14 from JPL to industrial partner Ball Aerospace & Technologies Corp. The flight instrument arrived at Ball two days later.

The instrument's post-shipment functional and performance verification was completed on July 20 and mechanical integration between the instrument and the CloudSat spacecraft was successfully completed on July 21.

CloudSat, part of NIVIS's Earth System Science Pathfinder program, is a mission to study the effects of clouds on climate and weather. The mission will utilize the vertical structure of clouds and cloud properties from space. CloudSat is a partnership between JPL, Colorado State University, the Canadian Space Agency, the U.S. Air Force and the U.S. Department of Energy. Ball Aerospace is building the spacecraft. Launch is planned for April 5 from Vandenberg Air Force Base in California.

The CloudSat satellite's Cloud Profiling Radar is shown being prepared for shipment on July 14 from JPL to industrial partner Ball Aerospace & Technologies Corp. The flight instrument arrived at Ball two days later. The instrument's post-shipment functional and performance verification was completed on July 20 and mechanical integration between the instrument and the CloudSat spacecraft was successfully completed on July 21.

CloudSat, part of NIVIS’s Earth System Science Pathfinder program, is a mission to study the effects of clouds on climate and weather. The mission will utilize the vertical structure of clouds and cloud properties from space. CloudSat is a partnership between JPL, Colorado State University, the Canadian Space Agency, the U.S. Air Force and the U.S. Department of Energy. Ball Aerospace is building the spacecraft. Launch is planned for April 5 from Vandenberg Air Force Base in California.

The CloudSat satellite’s Cloud Profiling Radar is shown being prepared for shipment on July 14 from JPL to industrial partner Ball Aerospace & Technologies Corp. The flight instrument arrived at Ball two days later. The instrument’s post-shipment functional and performance verification was completed on July 20 and mechanical integration between the instrument and the CloudSat spacecraft was successfully completed on July 21.

CloudSat, part of NIVIS’s Earth System Science Pathfinder program, is a mission to study the effects of clouds on climate and weather. The mission will utilize the vertical structure of clouds and cloud properties from space. CloudSat is a partnership between JPL, Colorado State University, the Canadian Space Agency, the U.S. Air Force and the U.S. Department of Energy. Ball Aerospace is building the spacecraft. Launch is planned for April 5 from Vandenberg Air Force Base in California.

The CloudSat satellite’s Cloud Profiling Radar is shown being prepared for shipment on July 14 from JPL to industrial partner Ball Aerospace & Technologies Corp. The flight instrument arrived at Ball two days later. The instrument’s post-shipment functional and performance verification was completed on July 20 and mechanical integration between the instrument and the CloudSat spacecraft was successfully completed on July 21.

CloudSat, part of NIVIS’s Earth System Science Pathfinder program, is a mission to study the effects of clouds on climate and weather. The mission will utilize the vertical structure of clouds and cloud properties from space. CloudSat is a partnership between JPL, Colorado State University, the Canadian Space Agency, the U.S. Air Force and the U.S. Department of Energy. Ball Aerospace is building the spacecraft. Launch is planned for April 5 from Vandenberg Air Force Base in California.

The CloudSat satellite’s Cloud Profiling Radar is shown being prepared for shipment on July 14 from JPL to industrial partner Ball Aerospace & Technologies Corp. The flight instrument arrived at Ball two days later. The instrument’s post-shipment functional and performance verification was completed on July 20 and mechanical integration between the instrument and the CloudSat spacecraft was successfully completed on July 21.

CloudSat, part of NIVIS’s Earth System Science Pathfinder program, is a mission to study the effects of clouds on climate and weather. The mission will utilize the vertical structure of clouds and cloud properties from space. CloudSat is a partnership between JPL, Colorado State University, the Canadian Space Agency, the U.S. Air Force and the U.S. Department of Energy. Ball Aerospace is building the spacecraft. Launch is planned for April 5 from Vandenberg Air Force Base in California.
Lab proposal selected for New Frontiers Program study

NASAs earlier this month announced the selection of two proposals for detailed study as candidates for the next mission in the agencys New Frontiers Program. One of the proposals—a mission that would orbit Jupiter from pole to pole for the first time to conduct an in-depth study of the giant planets—would be led by a JPL principal investigator with significant support from co-investigators and other staff. Dr. Scott Bolton of the Astrophysics Element 3262 is named as principal investigator for the proposed Juno mission. This investigation proposes to use a highly instrumented spacecraft placed in a polar orbit about the planet Jupiter to investigate the existence of an ice-rock core, determine the global water and ammonia abundances in Jupiter's atmosphere, study convection and deep wind profiles in the atmosphere, investigate the origin of the Jovian magnetic field and explore the polar magnetosphere.

Juno's goal is to understand Jupiter's origin and evolution. "As the archetype of giant planets, Jupiter can provide the knowledge we need to understand our own solar system and the planetary systems being discovered around other stars," Bolton said. "Conventional theories for solar system origin and evolution do not explain the new planetary systems being discovered. New theories are being developed to accommodate the new observations of extrasolar planets, while still explaining the existence of our own system in which we live. The stakes are high, as systems like ours may be required to provide planets in which life can originate and evolve. How common are such systems?"

"As our most massive planet and thus the one most similar to the even more massive extrasolar planets being discovered, Jupiter is clearly the critical piece in this puzzle," he added. "When, where and how Jupiter formed may have played a key role in the formation of the other planets, including Earth and the delivery of its endowment of volatiles."

Juno places a spinning spacecraft into an elliptical polar orbit around Jupiter for about one year. The orbit has a very close periapsis, or the point in orbit closest to the planet (about 5,000 kilometers above the cloud tops), initially placed near Jupiter's equator. Juno carries precise, high-sensitivity microwave radiometers that are used to determine the deep global water (oxygen) and ammonia (nitrogen) abundance. The Galileo probe determined that Jupiter has at least three times the amount of heavy elements (relative to hydrogen) than the sun. Unfortunately, Bolton said, Galileo did not measure the abundance of water. The amount of water in Jupiter is of interest because it discriminates among current theories of Jupiter's formation (water in the form of icy planetesimals is probably the carrier for Jupiter's enrichment of heavy elements). The icy planetesimals that mixed with the proto-solar nebula to form Jupiter are fundamentally important because they may have been the primary source of water to our solar system. The microwave radiometry also investigates how deep Jupiter's zones, belts and other atmospheric features go (this is the most basic question of Jovian atmospheric dynamics).

The proposed Juno mission would orbit Jupiter from pole to pole. With its radio science system and magnetometers, Juno proposes to make high-accuracy maps of Jupiter's gravity and magnetic fields by exploring the internal structure, core mass and origin of the dynamo. These measurements tell us a great deal about how, where and when Jupiter formed. Juno also carries an extensive suite of ion and particle experiments and remote sensing to provide the first in-depth investigation of Jupiter's polar magnetosphere and aurora.

Juno's co-investigators from JPL are John Anderson (Section 331K), Samuel Gulick (3220), Candace Hansen (3222), Michael Janssen (3265), Michael Klein (9020), Steven Levin (3265) and Edward Smith (3262). Bolton said other key JPL personnel on Juno include Sami Asmar (Section 321K), Mark Hofstadter (3222), Neil Murphy (3262), Glenn Oort (3222), Daniel Santos-Gasta (3500) and Thomas Spilker (311B). Bolton said other key JPL personnel on Juno include Sami Asmar (Section 321K), Mark Hofstadter (3222), Neil Murphy (3262), Glenn Oort (3222), Daniel Santos-Gasta (3500) and Thomas Spilker (311B).

The second proposal chosen by NASA as a New Frontiers candidate is "Moonrise: Lunar South Pole–Atten Kasin Sample Return Mission," with Dr. Michael Duke of the Colorado School of Mines as principal investigator. This investigation proposes to land two identical landers on the surface near the moon's south pole and to return more than two kilograms (about five pounds) of lunar materials from a region of the moon's surface believed to harbor materials from the moon's mantle.

"These two outstanding proposals were judged to be the best science value among the seven submitted to NASA in 2004," said Dr. Ed Weiler, NASAs associate administrator for space science. "It was a tough decision, but we're excited at the prospect of the discoveries either of them could make in continuing our mission of exploration of the solar system, and what they could tell us about our place in the universe," he added.

Following detailed mission concept studies, due for submission by March 2005, NASA intends to select one of the mission proposals for full development as the second New Frontiers mission by May 2005. The selected New Frontiers science mission must be ready for launch no later than June 30, 2010, within a mission cost cap of $700 million.

Each proposal will now receive up to $1.2 million to conduct a seven-month implementation feasibility study focused on cost, management and technical plans, including educational outreach and small business involvement.

The two selected proposals were submitted to NASA in February 2004, in response to the New Frontiers Program 2003 and Missions of Opportunity Announcement of Opportunity.

The New Frontiers Program is designed to provide opportunities to conduct several of the medium-class missions identified as the top priority objectives in the Decadal Solar System Exploration Survey, conducted by the Space Studies Board of the National Research Council.

NASAs New Horizons mission, which will fly by the Pluto-Charon system in 2014 and then target another Kuiper belt object, was designated the first New Frontiers mission.
**Passage**

**DIANE THOMASON, 52, a retired aerospace engineer, died Jan. 11. She taught JPL engineers in 1996. She was a member of the design and instrumentation team for the Galileo spacecraft. She retired in 1997.

**Letters**

On behalf of my family and myself, I want to thank my friends and co-workers at JPL for their thoughts and condolences on the passing of our dearly loved mother. We are deeply indebted to JPL for the beautiful plant. I also want to thank the JPL co-workers in Sections 348 and 3428 for their sympathy and condolences on my mother. We are deeply indebted to them.

---

** Classifieds**

**For Sale**

**SILK** red & brown wool, imported from China, cashmere, carpet, area, 7 x 10, 5 x 8, 4 x 6, 3 x 5, etc., $50-100. 818-670-2176.

**HOBBIES, CRAFTS** jewelry, basketry, beading, woodcrafts, etc., all with materials included. 714-269-0729.

**FURNITURE** for living/family rm.: curio cabinet, w/4 mauve padded stools; each set $50. 626/447-4734.

---

**Vacation Rentals**

**ARIZONA** cabin, lake view, 4 miles from ski slopes, sleeps 5, $175/nt. 707-243-2401.

---

**Classifieds**

**For Sale**

**SILK** red & brown wool, imported from China, cashmere, carpet, area, 7 x 10, 5 x 8, 4 x 6, 3 x 5, etc., $50-100. 818-670-2176.

**HOBBIES, CRAFTS** jewelry, basketry, beading, woodcrafts, etc., all with materials included. 714-269-0729.

**CLASSIFIEDS** in Old Town, Katalina Island, 109 Heritage, $1,000/nt. 562/952-6221.

**GIFTWARE** in Old Town, Katalina Island, 109 Heritage, $1,000/nt. 562/952-6221.

**MISC: sleeping bag for adult, roll-up, inside shoulder length, never used; electric frying pans, 3, exc. cond., $30 each. 626/791-6101.

**MISC: 8' pool table, $500; tablecloths (2), 90 x 156, $25 each. 626/791-6101.

---

**Classifieds**

**For Sale**

**SILK** red & brown wool, imported from China, cashmere, carpet, area, 7 x 10, 5 x 8, 4 x 6, 3 x 5, etc., $50-100. 818-670-2176.

**HOBBIES, CRAFTS** jewelry, basketry, beading, woodcrafts, etc., all with materials included. 714-269-0729.