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Rovers prepare for winter

By Guy Webster

Right: An image taken in February shows Spirit's view of intricately layered exposures of rock at the feature known as "Home Plate."

Below: Dr. John Callas

JPL'S LONG-LIVED MARS ROVERS DEMAND LOTS OF CARE as they age and the martian winter approaches.

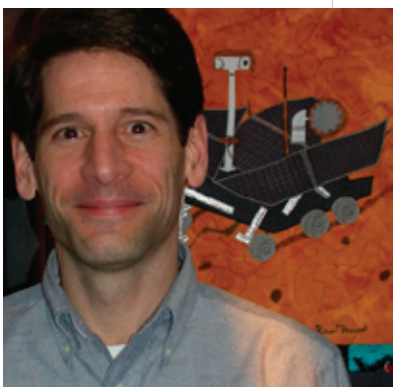
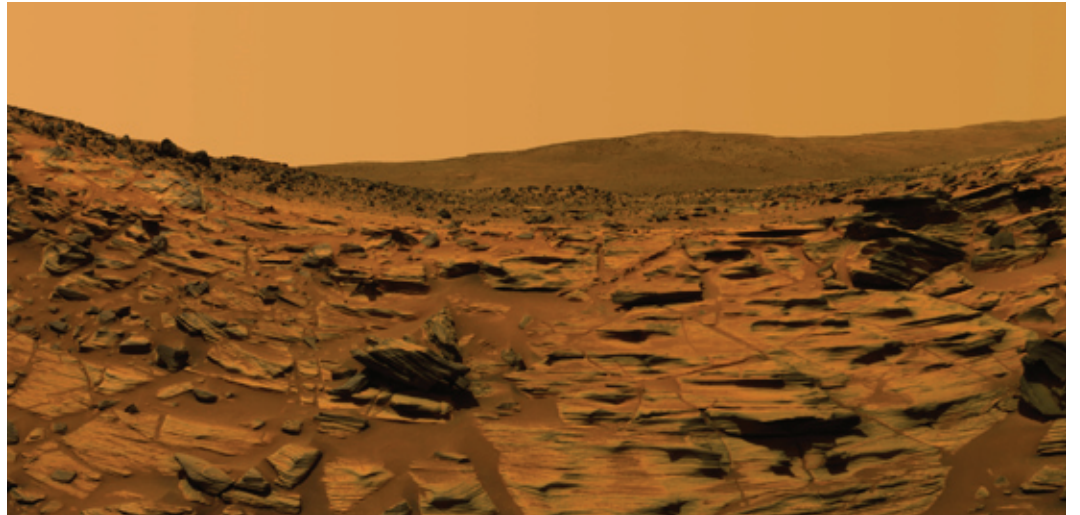
Dr. John Callas, newly named project manager for the Mars Exploration Rover mission, is coordinating the work to meet these challenges. He is a JPL scientist and was named project manager after earlier roles as science manager and deputy project manager for the Spirit and Opportunity rovers.

"It continues to be an exciting adventure with each day like a whole new mission," Callas said. "Even though the rovers are well past their original design life, they still have plenty of capability to conduct outstanding science on Mars. The JPL operations team and the remote science team working on the project are the best in the solar system at what they do. It is a pleasure and a privilege to lead such an outstanding team and great mission."

One of Spirit's six wheels has stopped working. Dragging that wheel, the solar-powered rover must reach a slope where it can catch enough sunshine to continue operating during the martian winter. The period of minimum sunshine is more than 100 days away, but Spirit gets only enough power for about one hour per day of driving on flat ground. And the supply is dropping fast.

Spirit's right-front wheel became a concern once before, when it began drawing unusually high current five months after the January 2004 landing on Mars. Driving Spirit backwards redistributed lubricant and returned the wheel to normal operation. This week, during the 779th martian day of what was originally planned as a 90-martian-day mission, the motor that rotates that wheel stopped working.

"It is not drawing any current at all," said JPL's Jacob Matijevic, rover engineering team chief. One possibility engineers are considering is that the motor's brushes, contacts that deliver power to the rotating part of the motor, have lost contact. The motors that rotate Spirit's wheels have revolved more than 13 million times, far more than called for in the rovers' design.



Spirit's solar panels have been generating about 350 watt-hours of electricity daily for the past week. That is down about 15 percent since February and less than one-half of their output during the martian summer.

The best spot for Spirit is the north-facing side of "McCool Hill," where it could spend the southern-hemisphere winter tilted toward the sun. Spirit finished studying a bright feature called "Home Plate" last week and is driving from there toward the hill. It has approximately 120 meters (about 390 feet) to go. Driving backwards with the right-front wheel dragging, the rover needs to stop and check frequently that the problem wheel has not snagged on anything and caused other wheels to slip excessively. Expected progress is around 12 meters (40 feet) per day under current conditions.

Opportunity is closer to the equator, so does not need to winter on a slope like Spirit. Opportunity spent most of the past four months at "Erebus Crater." It examined layered outcrops, while the rover team determined and tested a strategy for dealing with degraded performance by a motor in the shoulder of its robotic arm. Opportunity left Erebus this week and is on a 2-kilometer (1.2-mile) journey to a giant crater called "Victoria."

Callas has worked on the Mars rovers' mission since 2000 and five other Mars missions since joining JPL in 1987. He succeeds Jim Erickson, who switched to a leadership role with JPL's Mars Reconnaissance Orbiter.

MOVE OVER, SUPERMAN, WITH YOUR X-RAY VISION.

Marine scientists have figured out a way to see through the ocean's surface and detect what's below, with the help of satellites.

Using sensor data from several U.S. and European satellites, researchers from JPL, the University of Delaware and Ocean University of China, Qingdao, have developed a method to detect salty, submerged eddies called "Meddies" that occur in the Atlantic Ocean off Spain and Portugal at depths of more than 1,000 meters (one-half mile).

These warm, deep-water whirlpools, part of the ocean's complex circulatory system, help drive the ocean currents that moderate Earth's climate. The research marks the first time scientists have detected this phenomenon from space, and the first use of a new multi-sensor technique that can track changes in ocean salinity. Results are reported in the April issue of the American Meteorological Society's Journal of Physical Oceanography.

"Since Meddies play a significant role in carrying salty water from the Mediterranean into the Atlantic, new knowledge about their trajectories, transport and life histories is important to understanding their mixing and interaction with North Atlantic water," said Professor Xiao-Hai Yan of the University of Delaware, lead author of the study and co-director of the university's Center for Remote Sensing. "Ultimately, we hope this will lead to a better understanding of their impact on global ocean circulation and global climate change."

First identified in 1978, Meddies are so named because they flow out of the Mediterranean Sea. A typical Meddy averages about 600 meters (2,000 feet) deep and 100 kilometers (60 miles) in diameter, and contains more than 900 billion kilograms (1 billion tons) of salt.

While warm water ordinarily resides at the ocean's surface, the warm water flowing out of the Mediterranean Sea has such a high salt concentration that when it enters the Atlantic Ocean at the Strait of Gibraltar, it sinks to depths of more than 1,000 meters (one-half mile) along the continental shelf. This underwater river then separates into clockwise-flowing Meddies that may continue to spin westward for more than two years, often coalescing with other Meddies to form giant, salty whirlpools that may stretch for hundreds of miles.

"Since the Mediterranean Sea is much saltier than the Atlantic Ocean, the Meddies constantly add salt to the Atlantic," Yan said. Without this

steady salt-shaker effect, he notes, the conveyor belt of ocean currents that help distribute heat from the tropics toward the North Pole might be diminished, resulting in colder temperatures in regions such as New England and northwestern Europe that currently experience more temperate climates.

"There is concern about global climate change shutting down the ocean currents that warm the Atlantic Ocean," Yan said. "The melting of sea ice at the North Pole could add enormous amounts of fresh water to the Atlantic, reducing its salinity enough to slow the sinking of cooler water, which would shut down the conveyor belt of ocean currents that help warm major regions of the planet."

Yan and his team drew on data from several satellite sensors that can read an important signal of a Meddy's presence. Altimeters flying aboard JPL's Topex/Poseidon and Jason satellites and the European Space Agency's European Remote Sensing and Environment (Envisat) satellites measured the height of the sea surface compared to average sea level, revealing the difference in altitude where a Meddy entered the Atlantic.

Specialized microwave radars called scatterometers, including the former NASA Scatterometer on Japan's Midori-1 spacecraft and the current SeaWinds instrument on NASA's QuikScat spacecraft, measured the surface wind over the ocean, providing data needed to remove the surface variability "noise" caused by the wind blowing over the ocean's surface.

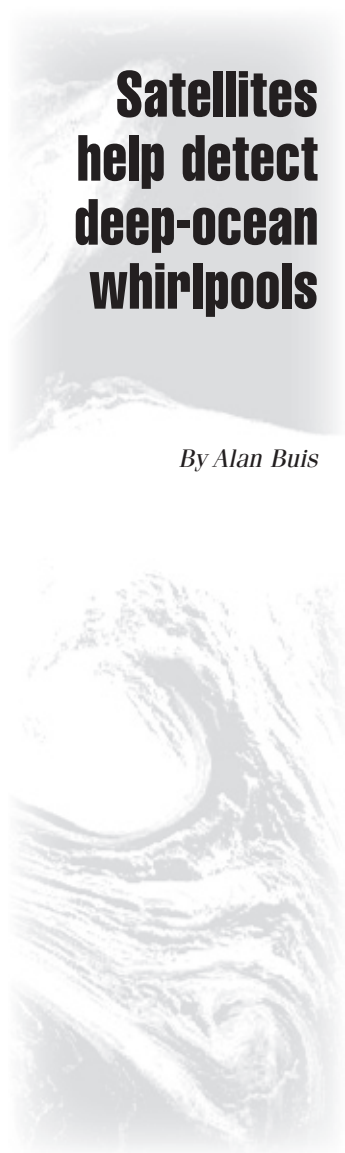
"By carefully removing the stronger surface signatures of upper ocean processes, we were able to unveil the surface signatures of deeper ocean processes, such as the Meddies, to these space-based sensors," said Dr. W. Timothy Liu, QuikScat project scientist at JPL.

The scientists also analyzed data provided by an infrared spectrometer known as the Advanced Very High Resolution Radiometer, which flies aboard National Oceanic and Atmospheric Administration satellites. This instrument maps heat emitted by the ocean's top layer and showed the increase in temperature from a warm Meddy before it began sinking.

While the technique is not yet 100 percent accurate, Yan and his colleagues are continuing to refine it, and are exploring its application to other coastal regions of the world.

Satellites help detect deep-ocean whirlpools

By Alan Buis



News Briefs



National Air and Space Museum, Smithsonian Institution

From left: museum director Gen. J.R. "Jack" Dailey, Steve Squyres, Jim Erickson, awards master of ceremonies David Hartman.

Rover team wins museum award

The National Air and Space Museum Trophy, the museum's highest honor, has been awarded to the team responsible for the ongoing Mars Exploration Rover missions, and pioneer space scientist DR. JAMES VAN ALLEN. The rover team is honored in the category of Current Achievement and Van Allen in the category of Lifetime Achievement. The awards were presented at a private ceremony at the Smithsonian's National Air and Space Museum in Washington on March 9. Established in 1985, the award recognizes outstanding achievement in scientific or technological endeavors relating to air and space technology

Rover mission and the Mars Science Laboratory mission. CYN DY CHINN and ANDREA VANACORE, the JPL One NASA liaisons, made the presentation. The JPL winners are TARA ESTLIN, DAN GAINES, RICHARD MADISON, MICHAEL MCHENRY, HARI DAS NAYAR, ISSA NESNAS, MIHAIL PIVTORAIKO, GREGG RABIDEAU, BABAK SAPIR and I-HSIANG SHU.

Other awardees on the team are CLAYTON KUNZ (NASA Ames), DAVID APFELBAUM and REID SIMMONS (Carnegie Mellon University) and STERGIOS ROUMELIOTIS (University of Minnesota).

The One NASA Peer Award program gives awards to individuals and teams whose achievements support NASA's strategic goals and utilize an approach consistent with the concept of One NASA. Candidates must be nominated by their peers rather than by their supervisors. Employees may not nominate their supervisor.

In addition to winning this award, individual and team awardees are eligible to be considered for the Center Best Award. The JPL Center Best Award winner is then eligible for the NASA Agency Best Award.

To nominate someone or for more information about this award, see <http://hr.jpl.nasa.gov/esr/OneNASA/Index.html>.

Cassini studies Titan

The Cassini spacecraft focused on the atmosphere of Saturn's moon Titan during a March 18 flyby. This was the first time Cassini sent radio waves through Titan's atmosphere to antennas on Earth.

The radio waves revealed characteristics about the atmosphere's temperature, structure and winds. Cassini has never done this before, though JPL's Voyager 1 did a similar experiment in 1980.

For more information, visit <http://saturn.jpl.nasa.gov/home/index.cfm>.

Technology prizes to be awarded

JPL's Office of the Chief Technologist and Office of the Chief Scientist note that the prestigious Economist weekly magazine (<http://www.economist.com/index.html>) is soliciting nominations for its annual technology prizes. Much of the work that JPL does fits in the competition's "No Boundaries" category.

Nominations are due by 5 p.m., Friday, April 7 to Loren Lemmerman (Loren.A.Lemmerman@jpl.nasa.gov), and should include the nominee's name, current affiliation and contact information, and a 100-word summary explaining why the nominee deserves to win the award in a category.

Self-nominations are allowed. Please do not submit your nominations to the Economist directly.

The Office of the Chief Scientist and Chief Technologist will reply to all and select up to three nominations to forward to the Economist from JPL.

Team earns One NASA Peer Award

A One NASA Peer Award was presented on March 9 to the JPL-led Coupled Layer Architecture for Robotic Autonomy (CLARAty) Team, which was recognized by their peers for their efforts to foster NASA-wide collaboration.

The team was honored for the accomplishment of creating and applying a software framework for integrating innovations in robotics into rapid insertion into NASA's flight missions. The team promotes reuse of robotic software by providing a flexible framework to support the development and integration of robotic technologies across centers, the benefits of which have been felt by the Mars Exploration



Photo courtesy of Andrea Vanacore

From left: JPLers Gregg Rabideau, Tara Estlin, Babak Sapir, Issa Nesnas, Michael McHenry, Mibail Pivtoraiko, I-Hsiang Shu, Hari Das Nayar.

Santa Monica wins ocean quiz

Front row, from left: Ingo Gaida, Ben Lucas, Dimitry Petrenko, Bennett Rankin and ZeNan Chang. Back row: JPL Public Services Office Manager Kim Lievense; Anthony Michaels, director of USC's Wrigley Institute for Environmental Studies; Ann Close, associate director.



Photo courtesy of Jocy Williams

A team from Santa Monica High School won a regional competition for the National Ocean Sciences Bowl on March 4. JPL co-hosted regional competitions for the national event with host USC. Coordinated by the Consortium for Oceanographic Research and Education, the event saw student teams answer questions about biology, chemistry, geology and physics of the oceans, as well as navigation, geography and related history and literature. The National Ocean Sciences Bowl invites winning teams from regional competitions to go head-to-head at the finals in Pacific Grove, Calif., May 13-15. Some winning teams will have the opportunity to work beside experienced marine scientists through field trips and other hands-on marine experiences. Other students will win cruises on research vessels, scholarships and scientific equipment. For more information about the National Ocean Sciences Bowl, visit <http://www.nosb.org>.

Special Events Calendar

Ongoing Support Groups

Alcoholics Anonymous—Meets Wednesdays at 11:30 a.m.

Caregivers Support Group—Meets the first Thursday of the month at noon in Building 167-111 (the Wellness Place).

Codependents Anonymous—Meets at noon every Wednesday.

Lambda (Gay, Lesbian, Bisexual and Transgender Networking Group)—Meets the first Friday and third Thursday of the month at noon in Building 111-117. For more information, call Randy Herrera, ext. 3-0664.

Parents Group for Children With Special Needs—Meets the second Thursday of the month at noon in Building 167-111 (the Wellness Place).

For more information on any of the support groups, call the Employee Assistance Program at ext. 4-3680.

Saturday, March 25

Space: *Are We Alone?*—This high-definition film, part of the "Science Saturdays at 2:00" series of family events, will be shown at 2 p.m. in Caltech's Beckman Auditorium. Laura Baker, from Caltech's division of geological and planetary sciences, will introduce the film and lead a post-screening discussion. Tickets are \$5. For more information, call (626) 395-4652 or visit www.events.caltech.edu.

Tuesday, March 28

Caltech Women's Club Preschool Playgroup—Meets in Tournament Park (off Wilson Avenue south of California Street in Pasadena) for children's crafts, songs, stories and play while adults socialize. Group also meets April 4. For more information, e-mail smiller@caltech.edu.

Wednesday, March 29

Banff Mountain Film Festival—Presented by the Caltech Alpine Club, Patagonia Pasadena and the Altadena Mountain Rescue Team at 7:30 p.m. in Caltech's Ramo Auditorium. Tickets are \$12 in advance, \$15 at the door. For more information, call (626) 395-4652 or visit www.events.caltech.edu.

Caltech Women's Club "Wednesday in the Park"—Meets in Tournament Park for playtime for the children and socializing for adults. Rain location is Brown Gym. Group also meets April 5. For more information, e-mail smiller@caltech.edu.

JPL Chorus—Meets at noon in Building 233-303. For more information, call Shary DeVore at ext. 4-1024.

JPL Library Orientation—Stop by Building 111-104 at 11:30 a.m. for an overview of the Library's products and services, and learn how to access numerous electronic resources from your desktop. For more information, call the reference desk, ext. 4-4200.

Thursday, March 30

JPL Golf Club—Meeting at noon in Building 306-302.

"The Remarkable Life of Neil Armstrong"—James Hansen, Auburn University history professor and author of "First Man: The Life of Neil A. Armstrong," will appear from 4:30 to 6 p.m. in von Kármán Auditorium. Sponsored by the Caltech Management Association and Caltech Flying Club.

Friday, March 31

Cesar Chavez Day Celebration—"Legacy of Latin American Art: Past and Present" will be presented by JPL's Amigos Unidos from 11:30 a.m. to 1:30 p.m. in von Kármán Auditorium. Guest speakers will be Dr. Richard Zapanta and Rebecca Zapanta, whose family collection will be displayed.



Sunday, April 2

Chamber Music—Canada's Trio Mosaïque will perform at 3:30 p.m. in Caltech's Beckman Auditorium. Tickets are \$32, 27, 22 and \$18. For more information, call (626) 395-4652 or visit www.events.caltech.edu.

Tuesday, April 4

JPL Gamers Club—Meeting at noon in Building 301-227.

JPL Genealogy Club—Meeting at noon in Building 301-271.

"The Origins of the Universe"—Dr. Stephen Hawking, author of the international best-selling book *A Brief History of Time*, will speak at 8 p.m. in Caltech's Beckman Auditorium. Free admission, but tickets are required. General admission tickets will be distributed on the morning of the lecture only. Please carefully review the complete ticketing procedures, located at www.snipurl.com/hawking06.



Wednesday, April 5

Associated Retirees of JPL/Caltech—Meeting at 10 a.m. at La Cañada United Methodist Church, 104 Berkshire Place, La Cañada. Call (626) 794-1698 to leave a message for an ARC board member.

JPL Chorus—Meets Wednesdays at noon in Building 233-303. For more information, call Shary DeVore at ext. 4-1024.

JPL Library Orientation—Stop by Building 111-104 at 11:30 a.m. for an overview of the Library's products and services, and learn how to access numerous electronic resources from your desktop. For more information, call the reference desk, ext. 4-4200.

Thursday, April 6

JPL Gun Club—Meeting at noon in Building 183-328.

"Using Wind to Build the Megaliths of Ancient Egypt"—Dr. Maureen Clemmons will speak from 4:45 to 6 p.m. in von Kármán Auditorium in this Caltech Management Association-sponsored event. For more information, e-mail cma.announce@jpl.nasa.gov or call Randii Wessen, ext. 4-7580.

Friday, April 7

Caltech Dance Show—At 8 p.m. in Ramo Auditorium. Features include pieces from traditional hula to innovative salsa, from captivating belly dance to contemporary jazz, representing almost every segment of the Caltech community in the cast of more than 50 dancers. Tickets are \$5 (unreserved seating). For more information, call (626) 395-4652 or visit www.events.caltech.edu.

Ladysmith Black Mambazo—Offering native South African musical traditions to the sounds of Christian gospel music, the a capella group will perform at 8 p.m. in Caltech's Beckman Auditorium. Tickets are \$32, \$28 and \$24; \$10 for high school age and younger. For more information, call (626) 395-4652 or visit www.events.caltech.edu.

Sunday, April 9

Caltech Dance Show—At 2 p.m. in Ramo Auditorium. Features include pieces from traditional hula to innovative salsa, from captivating belly dance to contemporary jazz, representing almost every segment of the Caltech community in the cast of more than 50 dancers. Tickets are \$5 (unreserved seating). For more information, call (626) 395-4652 or visit www.events.caltech.edu.

IT WAS WELL BEFORE STAR WARS, EVEN BEFORE STAR TREK, WHEN SCIENCE

FICTION FANS WERE “LOST IN SPACE.” THAT MID-1960s

Lassie’s mom no longer ‘Lost in Space’

ADVENTURE SHOW HAD TV VIEWERS FOLLOWING THE WEEKLY
SPACED-OUT EXPLOITS OF THE ROBINSON FAMILY.



By Mark Whalen

Many JPLers will remember veteran actress June Lockhart, one of the stars of *Lost In Space*, from her way-out spaceship uniform. Now 80, Lockhart has continued her busy career and also has maintained her keen interest in spaceflight. In fact, she has become a space fan, and a good friend to NASA and JPL.

Lockhart, who enjoys coming out to JPL from time to time to cheer on flight teams during some of the Lab’s significant mission events and milestones, played Dr. Maureen Robinson on “*Lost in Space*,” which ran from 1965–68. Of course, she is also well remembered for her role as Ruth Martin, the mom in the series “*Lassie*,” in which she had a six-year run (1958–64).

She got her start in acting in 1938 at age 12, working with her parents, Gene and Kathleen, in the film version of Dickens’ “*A Christmas Carol*.” In the 1940s she worked with the former Western Airlines as a spokesperson, handling radio interviews and tours. This led to a solid movie career before most American homes had televisions.

Lockhart is still going strong, with movies and guest spots on TV series and game shows. Her most recent TV stint was an appearance on the ABC drama “*Grey’s Anatomy*” earlier this year.

She spoke with Universe about her interests in space, both Hollywood- and NASA-style.

Were you a space fan before *Lost in Space*? For example, did you know that JPL was working on pre-Apollo missions to the moon?

Yes, I did keep up with that, but I wasn’t actively involved. Like everyone else, of course, I followed John Glenn’s Earth-orbiting mission, the Mercury 6, in 1962. He was the first American in orbit. At that time, I was working on *Lassie*. When the flight took place, I was in the studio, sitting with Jon Provost (who played Timmy) when Glenn was making his reentry. There was a period of about 15 minutes of silence during his descent. We all held our breaths until we learned he had safely landed.

How did *Lost in Space* come about?

When *Lassie* ended for me in 1964 I did an episode of “*Voyage to the Bottom of the Sea*,” which was a very popular science fiction series about a submarine crew and their adventures. It was produced by Irwin Allen.

Soon after that, CBS hired Irwin to do this new series about a space family and I was one of the first actors he signed. It was originally called “*Space Family Robinson*”—playing off of “*Swiss Family Robinson*”—then changed to “*Lost in Space*.” I loved the script, so I joined in.

What do you think appealed to fans of the show?

It was well cast, and had something for everybody. It was about a family, but the props, special effects and the scientific, futuristic setting made it popular as well. By the way, the interest in the show still exists today. It’s still very popular in syndication and through DVD sales.

What are your best memories of coming to JPL?

I’ve been there four or five times in the last few years—for many of the Mars missions, as well as some of the Cassini flybys and others.



For Mars Pathfinder, in 1997, it was beyond excitement. I brought my granddaughter Christianna to JPL with me, and she got to play in the Mars “sandbox.” Since then, she’s been with me on several other visits there.

For the Mars Exploration Rovers’ landing a couple of years ago, it was marvelous to sit in that room, which felt like it simply lifted off the ground with energy and excitement.

I was invited to come out to celebrate the Mars Reconnaissance Orbiter arrival at Mars earlier this month, but I was working and couldn’t make it.

You are friends with astronaut Bill McArthur, the current commander of Expedition 12, the International Space Station. In fact, he’s a fan of yours. How has that developed?

We had initially met when NASA invited me to the launch of the Discovery mission in 1994. Bill was working in mission control at Johnson Space Center. He remembered me from *Lost in Space*, so we struck up a conversation. We have kept in touch ever since.

In December of last year, I came to JPL to talk to Bill via videoconference. So we chatted for about 20 minutes, about astronomy, what the astronauts eat, their exercise, their daily chores. He was quite a genuine, warm and affectionate person. It was like a conversation you’d have with a pal.

He wanted to show me something on the wall behind him. And there was this big picture of me in my spacesuit from *Lost in Space*. He called me the “poster girl of the International Space Station.” I was just blown away!

And Bill asked for a couple of episodes of *Lost in Space* and a copy of *A Christmas Carol*, so those went up to him in the latest supply ship.

Also, years ago, NASA invited me to Houston for the Space Shuttle Columbia mission in October 1992. So early one morning they sent the crew a wakeup call with “*The World is Waiting for the Sunrise*,” a song written by my father, who in addition to acting was a songwriter and performer. That was thrilling too.

Will you be coming to JPL again soon?

Yes, I hope so. I love coming to JPL; they treat us so beautifully. To be invited to these historic moments is a dream. What JPL and NASA do is a wonderful thing to expose the young mind to. I am dedicated to this program and spreading the word about how important the space program is.

