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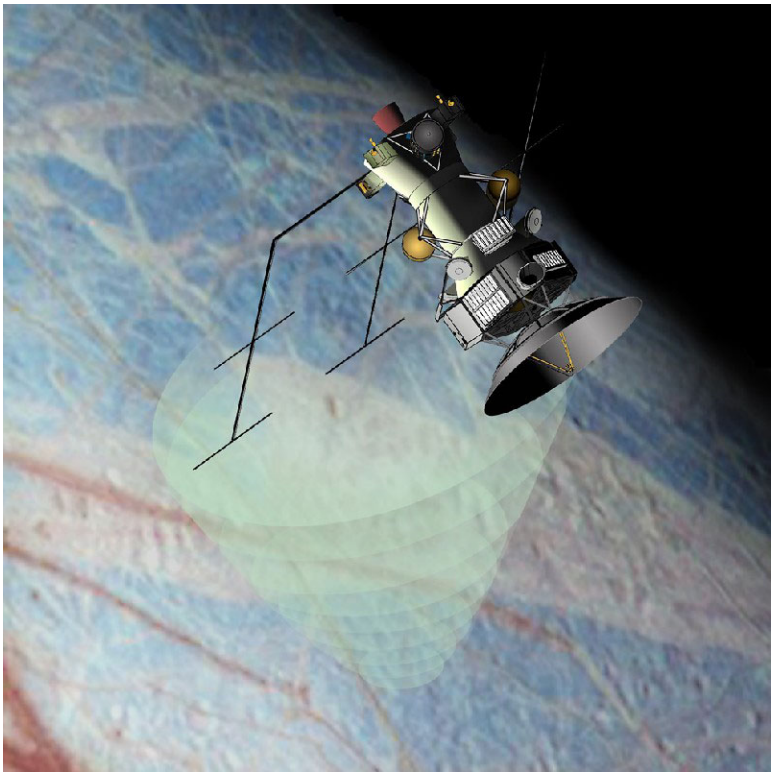

The Europa Orbiter (currently under study) will use a radar sounder to study Europa's icy surface and attempt to determine the thickness of the ice and whether liquid water exists below the ice. Other instruments to study the surface and interior would include an imaging device with multiple filters to map the surface at a resolution of 100 meters and a laser altimeter to measure the topography and characterize the tidal response of the surface. The mission would be launched from the Space Shuttle using an inertial upper stage on a direct trajectory to Jupiter and arrive around 2010. After a year or two of Jupiter orbits, Moon flybys, and orbit corrections, the spacecraft would be put into a 200 km orbit about Europa, where it is expected to last for about one month before radiation damage from the approximately 2 megarad dosage renders the spacecraft unusable. The spacecraft would be equipped with radiation shielding, a 2 meter diameter high-gain antenna, radioisotope generators, and 670 kg of propellant and propulsion systems of its total 950 kg mass. Europa is the subject of a workshop announced in this issue. [http://nssdc.gsfc.nasa.gov/planetary/image/europa_orb.jpg]

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GROUND-BASED ANALOGS OF SPACE FLIGHT (NRA-03-OBPR-06)
NASA research announcement

22 May 2003

A NASA Research Announcement soliciting research proposals using Ground-based Analogs of Space Flight (NRA-03-OBPR-06) is available electronically via the Internet at http://research.hq.nasa.gov/code_u/nra/current/NRA-03-OBPR-06/index.html starting May 22, 2003. The proposal due date is August 11, 2003. This National Aeronautics and Space Administration (NASA) Research Announcement (NRA) solicits studies using ground-based analogs of space flight (e.g., bed rest, closed chamber studies) for the Biomedical Research and Countermeasures (BR&C) Program. The BR&C Program sponsors research which will lead to the development of countermeasures against the negative effects of space flight on humans. This solicitation is open to all categories of organizations, agencies, and institutions. NASA will not fund non-U.S. institutions.

The solicitation will be open for the period through August 11, 2003; proposals may be submitted at any time throughout the period. Paper copies of the Announcement are available starting May 22, 2003 to those who do not have access to the Internet by calling (202) 479-9030 x277 and leaving a voice mail message. Please leave your full name, address with zip code, telephone number with area code, and the NRA number (NRA-03-OBPR-06). The technical point of contact is Bette Siegel, Ph.D., Enterprise Scientist, Code UB, Bioastronautics Research Division, NASA Headquarters, Washington, DC 20546. This notice constitutes a NASA Research Announcement as contemplated in FAR 6.102 (d) (2).

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WORKSHOP ON EUROPA'S ICY SHELL: PAST, PRESENT, AND FUTURE
Lunar and Planetary Institute release

3 June 2003

Purpose and scope

The Workshop on Europa's Icy Shell: Past, Present, and Future will be held on February 6-8, 2004, at the Lunar and Planetary Institute (LPI). The LPI is housed in the Center for Advanced Space Studies, 3600 Bay Area Boulevard, Houston, Texas.

The large jovian satellite Europa is believed to have a subsurface ocean. This ocean could harbor organic chemistry or even biological organisms and is second only to Mars as a target for future exploration. It is also a prime focus of the proposed Jupiter Icy Moons Orbiter (JIMO) mission currently in development. Europa's ocean is currently covered by an icy shell of uncertain thickness and it is this icy shell that controls how the ocean and any biological agents within it interact with the surface of Europa.

The purpose of this three-day workshop is to discuss our current understanding of the icy shell, its physical state and evolution, and its interaction with the putative subsurface ocean. Our aim is to bring together divergent and diverse viewpoints to assess the limits of our current knowledge, to advance our collective understanding of this unique environment, and to foster new ideas and future strategies. All aspects of the icy shell will be considered, including composition, physical state (e.g, thickness, rheology), geologic history, present-day activity, biology, and exploration goals. Observational, theoretical, and speculative presentations are encouraged from the planetary and terrestrial communities.

Workshop format

The workshop will feature invited reviews of relevant data and theoretical constraints, contributed papers, posters, and extended discussion periods. Topical sessions will be held each morning and afternoon. A special issue with papers from this workshop or related research is planned for a major planetary research journal. Tentative plans include a dinner on the second evening.

Future announcements

Further details regarding the program, topics for discussion, opportunities for participation, and guidelines for abstract and poster preparation will be included in the second announcement that will be posted at http://www.lpi.usra.edu/meetings/europa2004/.

Indication of interest

To subscribe to a mailing list to receive electronic reminders and special announcements relating to the meeting via e-mail, please submit an electronic Indication of Interest form by July 30, 2003. Please submit the Indication of Interest even if you do not care about electronic notification of future announcements. The number of e-mails tallied will also serve to facilitate meeting planning.

Contact information

For further information regarding the format and scientific objectives of the meeting, contact:
Paul Schenk
Lunar and Planetary Institute
Phone: 281-486-2157

E-mail: schenk@lpi.usra.edu.

For information regarding meeting logistics, contact:
Sue McCown
Phone: 281-486-2144;
Fax: 281-486-2125;
E-mail: mccown@lpi.usra.edu.

Schedule

July 30, 2003
Indication of interest deadline

September 17, 2003
Second announcement posted at
http://www.lpi.usra.edu/meetings/europa2004/

November 13, 2003
Abstract submission deadline

December 19, 2003
Final announcement with program and abstracts posted at
http://www.lpi.usra.edu/meetings/europa2004/

January 22, 2004
Registration deadline

February 6-8, 2004
Workshop at the Lunar and Planetary Institute in Houston, Texas

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JAPANESE SPACE PROBE HEADED TO MARS RENDEZVOUS
By Stephen Clark
From *Spaceflight Now*

4 June 2003

As other nations launch their stake in this year's wave of Mars exploration, Japan has its own mission that is chugging toward the Red Planet despite encountering a rocky journey. Launched almost five years ago in July 1998, the spacecraft has faced more than its share of troubles. But in spite of that, ground controllers have guided Nozomi onto the right course that should see it arrive in martian orbit either at the end of this year or early in 2004.

Project officials told *Spaceflight Now* there are still several alternatives for an exact date to enter orbit around Mars. Those time frames range from mid-December of 2003 to early January of next year.

Read the full article at
http://spaceflightnow.com/mars/nozomi/030604update.html.

NASA WILL SEND TWO ROBOTIC GEOLOGISTS TO ROAM ON MARS
NASA release 2003-080

4 June 2003

NASA's Mars Exploration Rover project kicks off by launching the first of two unique robotic geologists on June 8. The identical rolling rovers can see sharper images, explore farther and examine rocks better than anything that's ever landed on Mars. The second rover mission, bound for a different site on Mars, will launch as soon as June 25.

"The instrumentation onboard these rovers, combined with their great mobility, will offer a totally new view of Mars, including a microscopic view inside rocks for the first time," said Dr. Ed Weiler, associate administrator for space science at NASA Headquarters, Washington, DC.
However, missions to Mars have proven to be far more hazardous than missions to other planets. Historically, two out of three missions, from all countries that have tried to land on Mars, ended in failure. We have done everything we can to ensure our rovers have the best chance of success."

The first Mars Exploration Rover will arrive at Mars on January 4, 2004; the second on January 25. Plans call for each to operate for at least three months. These missions continue NASA's quest to understand the role of water on Mars. "We will be using the rovers to find rocks and soils that could hold clues about wet environments of Mars' past," said Dr. Cathy Weitz, Mars Exploration Rover program scientist at NASA Headquarters. "We'll analyze the clues to assess whether those environments may have been conducive to life."

First, the rovers have to safely reach Mars. "The rovers will use innovations to aid in a safe landing, but risks remain," said Peter Theisinger, Mars Exploration Rover project manager at NASA's Jet Propulsion Laboratory, Pasadena, CA.

The rovers will bounce to airbag-cushioned landings at sites offering a balance of favorable conditions for safe landings and interesting science. The designated site for the first mission is Gusev Crater. The second rover will go to a site called Meridiani Planum. "Gusev and Meridiani give us two different types of evidence about liquid water in Mars' history," said Dr. Joy Crisp, Mars Exploration Rover project scientist at JPL. "Gusev appears to have been a crater lake. The channel of an ancient riverbed indicates water flowed right into it. Meridiani has a large deposit of gray hematite, a mineral that usually forms in a wet environment."

The rovers, working as robotic field geologists, will examine the sites for clues about what happened there. "The clues are in the rocks, but you can't go to every rock, so you split the job into two pieces," said Dr. Steve Squyres of Cornell University, Ithaca, NY, principal investigator for the package of science instruments on the rovers.

First, a panoramic camera at human-eye height, and a miniature thermal emission spectrometer with infrared vision help scientists identify the most interesting rocks. The rovers can watch for hazards and maneuver around them. Each six-wheeled robot has a deck of solar panels, about the size of a kitchen table, for power. The rover drives to the selected rock and extends an arm with tools on the end. Then, a microscopic imager, like a geologist's hand lens, gives a close-up view of the rock's texture. Two spectrometers identify the composition of the rock. The fourth tool substitutes for a geologist's hammer. It exposes the fresh interior of a rock by scraping away the weathered surface layer.

Both rover missions will lift off from Cape Canaveral Air Force Station, Fla., on Delta II launch vehicles. Launch opportunities begin for the first mission at 2:06 PM (Eastern Daylight Time) June 8 and for the second mission at 12:38 AM June 25, and repeat twice daily for up to 21 days for each mission.

"We see the twin rovers as stepping stones for the rest of the decade and to a future decade of Mars exploration that will ultimately provide the knowledge necessary for human exploration," said Orlando Figueroa, director of the Mars Exploration Program at NASA Headquarters.

JPL, a division of the California Institute of Technology in Pasadena, manages the Mars Exploration Rover Project for NASA's Office of Space Science, Washington, DC.

Additional information about the project is online at
http://mars.jpl.nasa.gov/mer.

A press kit for the mission is available at
http://www.jpl.nasa.gov/news/press_kits/merlaunch.pdf.

NASA Television will broadcast both launches live. NASA Television is offered by some cable providers and is available via the AMC-2 satellite, transponder 9C, located at 85 degrees west longitude, vertical polarization, frequency 3880.0 megahertz. JPL will carry live webcasts of the launches at http://www.jpl.nasa.gov/webcast/mer.

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NASA Headquarters, Washington, DC
Phone: 202-358-1727

George H. Diller
NASA Kennedy Space Center, FL
Phone: 321-867-2468

Additional articles on this subject are available at:
http://www.space.com/missionlaunches/mars_rover_faq.html
http://www.spacedaily.com/news/mars2003-03h.html.

HOW THE MARS ROVER LANDING SITES WERE CHOSEN
By Diane Richards
From *Space.com*

5 June 2003

"It has been a roller coaster ride, let me tell you!" SETI Institute/NASA Ames scientist, Dr. Nathalie Cabrol describes the nerve-wracking process to select a landing site for the NASA's Mars Expedition Rover (MER) mission. At a recent interview in the SETI Institute offices, Dr. Cabrol and Edmond Grin, her scientific partner (and husband), relived the ups and downs of their quest; a visit to an ancient dry lake bed at the end of the Ma'adim Vallis, a huge martian drainage channel.

The combined backgrounds of Cabrol and Grin, in planetary geology and hydraulic engineering, give them a special affinity for the site. Each can visualize the ancient and dynamic processes that most likely formed the martian drainage system with its channels cut by flowing water and the lake into which the water emptied. Cabrol and Grin were some of the earliest planetary scientists to recognize the tell tale features of lakes on the Red Planet.

Read the full article at
http://www.space.com/searchforlife/mars_cabrol_seti_030605.html.

ODYSSEY THERMAL DATA REVEAL A CHANGING MARS
Arizona State University release

5 June 2003

The first overview analysis of a year's worth of high-resolution infrared data gathered by the Thermal Emission Imaging System (THEMIS) on NASA's Mars Odyssey spacecraft is opening Mars to a new kind of detailed geological analysis and revealing a dynamic planet that has experienced dramatic environmental change. The report by THEMIS's science team will appear in an upcoming issue of *Science* and will be released on June 5 in the magazine's online preview, *Science Express*.

"THEMIS is creating a set of data that is going to revolutionize our mapping of the planet and our idea of the planet's geology," said lead author and THEMIS Principal Investigator Philip Christensen, Korrick Professor of Geological Sciences at Arizona State University. "It will keep Mars scientists busy for the next 20 years trying to understand the processes that have produced this landscape."

THEMIS is providing planetary geologists with detailed temperature and infrared radiation images of the martian surface. The images reveal geological details that were impossible to detect even with the high-resolution Mars Orbital Camera on NASA's Mars Global Surveyor, and that have 300 times higher resolution than MGS's Thermal Emission Spectrometer. Among the significant findings noted in the report is the detection of layers in the martian surface that indicate major changes in past environmental conditions.

"With a visible light camera, I can take a picture of a lava flow, but even with the highest resolution cameras that we have today the smallest thing we can see is the size of a bus and in order to do geology I need to have more detail," said Christensen.

"The camera on Mars Global Surveyor takes exquisite images that show layers, but it doesn't tell me anything about composition—is it a layer of boulders with a layer of sand on top? I have no way of knowing. With the THEMIS temperature data, I can actually get an idea because the layers vary—and each layer has remarkably different physical properties."

Daytime and nighttime temperature data can allow scientists to distinguish between solid rock and a variety of loose materials, from boulders to sand and dust. As any beach-goer knows, fine-grained sand heats up more rapidly at the surface than solid stone (which transmits more heat inward) but it also cools off more rapidly at night, when solid materials retain heat.

"We have seen layers, each with dramatically different physical properties, in places like Terra Meridiani," Christensen said. "Why do the physical properties in the different layers change? They change because the environment in which those rocks were deposited changed.

"It's very difficult to say exactly what happened in any particular place, but what we've found is that in many places on Mars it hasn't just been the same old thing happening for year after year for billions of years. These data have been so remarkable and so different from all of our previous experience that it has taken time to sift through the images and figure out what we're seeing."

Among the details that have stood out so far are kilometer-wide stretches of bare bedrock that Christensen notes were unexpected, given the Mars' known dustiness. Large areas of exposed rock indicate that strong environmental forces are currently at work, "scouring" from the surface any past sediment as well as any new material that might be falling from the atmosphere.

Also unexpected is the finding that accumulations of loose rock are common on martian hillsides, indicating recent processes of weathering continuing to affect the planet. "If those rocks had been made a billion years ago, they'd be covered with dust," Christensen pointed out. "This shows a dynamic Mars—it's an active place."

However, despite Odyssey's past findings of significant martian ice deposits, there are also indications that, in many places on the planet, water may not be one of the active causes behind the observed geological features. Analyzing the spectra from the ten different bands of infrared light the instrument can detect, the THEMIS team has begun to identify specific mineral deposits, including a significant layer of the mineral olivine near the bottom of a four-and-a-half kilometer deep canyon known as Ganges Chasma. Olivine, Christensen notes, is significant because it decomposes rapidly in the presence of water.

"This gives us an interesting perspective of water on Mars," he said. "There can't have been much water—ever—in this place. If there was groundwater present when it was deep within the surface, the olivine would have disappeared. And since the canyon has opened up, if there had ever been water at the surface it would be gone too. This is a very dry place, because it's been exposed for hundreds of millions of years. We know that some places on Mars have water, but here we see that some really don't."

Overall, Christensen notes that the emerging diversity and complexity of the planet point to the likelihood of future surprises and keep enlarging the possibilities for discovery on Mars.

"With Odyssey, we are looking at Mars in its entirety, in context. It's remarkable how much this has already changed our view of the complexity and richness of the planet. We discovered that it has a really dynamic geologic history. It has far more ice and water than we thought—we're seeing snow and gullies, layers—and there are also processes involving volcanoes, impact craters and wind. It's a fascinating place."

In addition to Christensen, the authors on the paper include Joshua L. Bandfield, James F. Bell, Noel Gorelick, Victoria E. Hamilton, Anton Ivanov, Bruce M. Jakosky, Hugh H. Kieffer, Melissa D. Lane, Michael C. Malin, Timothy McConnochie, Alfred S. McEwen, Harry Y. McSween, Greg L. Mehall, Jeffery E. Moersch, Kenneth H. Nealson, James W. Rice, Mark I. Richardson, Steven W. Ruff, Michael D. Smith, Timothy N. Titus, and Michael B. Wyatt.

The Jet Propulsion Laboratory, a division of the California Institute of Technology in Pasadena, manages the 2001 Mars Odyssey mission for NASA's Office of Space Science in Washington. Investigators at Arizona State University in Tempe, the University of Arizona in Tucson and NASA's Johnson Space Center, Houston, operate the science instruments. Additional science partners are located at the Russian Aviation and Space Agency and at Los Alamos National Laboratories, New Mexico. Lockheed Martin Astronautics, Denver, is the prime contractor for the project, and developed and built the orbiter. Mission operations are conducted jointly from Lockheed Martin and from JPL. Additional information about the 2001 Mars Odyssey is available on the Internet at http://mars.jpl.nasa.gov/odyssey/.

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Read the original news release at
http://www.eurekalert.org/pub_releases/2003-06/asu-otd060203.php.

Additional articles on this subject are available at:
http://www.space.com/scienceastronomy/mars_surface_030605.html
http://www.spacedaily.com/2003/030605202156.0nrf39vf.html
http://spaceflightnow.com/news/n0306/05odyssey/

MARTIAN SPIDERS
By Greg M. Orme and Peter K. Ness in consultation with Sir Arthur C. Clarke

6 June 2003

Foreword

After our original paper on the spiders was published in the *Journal of the British Interplanetary Society* [1], the following summer on Mars brought us many more spider images [2]. This now means we can see two full summer seasons of the spiders. We have assembled all the spider photos we have in one table [3] placed in order of Solar Longitude, which gives us a sequence of images from two martian years [4]. At the beginning of the table the images are early spring and at the end late autumn. This paper is a much condensed version of our new paper, "Martian Spiders," at *New Frontiers in Science* [5]. Including illustrations this is hundreds of pages long so here we can only touch on some of the points made there.

Chronology

The story of the spiders so far has been an interesting one. The name "spiders" was coined by Malin Space Science Systems. One of the first and most interesting spider photos was M0804688 [6], which was found by Greg Orme in October 2000. Sir Arthur C. Clarke has, since then, promoted these formations as deserving of study from an astrobiological perspective [7]. In the view of the authors, known geological processes fail to explain how the spiders could form and we cannot see how these flaws can be overcome in the future. Biological models however explain the spiders very well, but the conditions appear to be all but impossible for life. With the failure of the geological models, however, some biological activity cannot be ruled out. Temperatures in the spider areas may be near or even over zero for months at a time, and the temperatures vary much less in the polar areas since the sun doesn't set each day.

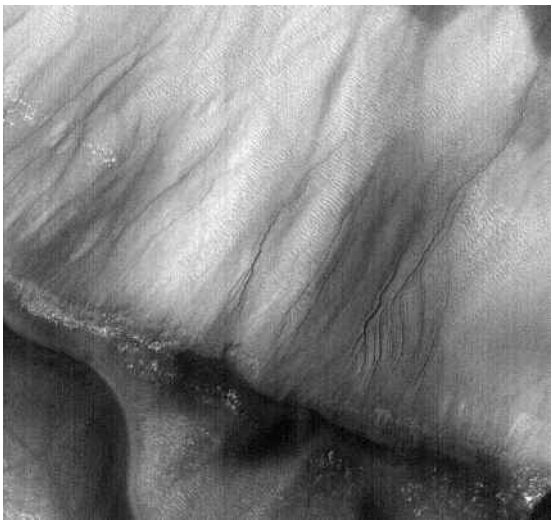
Fibonacci patterns

Spiders seem to follow a mathematical formula called the Fibonacci sequence [8]. This is formed by adding numbers together to make a third number, e.g. 1+2=3, 2+3=5, 3+5=8. So far this pattern is not known to be found in non living formations except by chance. The reason is in the nature of how the pattern is formed, in adding each two preceding numbers to form the next, which is not something that can easily happen in inorganic systems. Plants also have a nearly constant angle between the branches. Spiders also are extremely even in their branch angles, though gravity and the terrain should make these vary randomly [9].

Fibonacci patterns are well known to mathematicians; virtually all plant life uses this as a template for its shapes of branches, flowers and roots [10] [11]. On Earth it is almost a definition of life itself.

Against gravity

Another problem is that the spider branches don't seem to follow gravity. Any kind of fluid naturally tends to follow a path to lower ground, which of course is why rivers don't flow up hill. For example I have orientated M0806802 so the channels seem to flow uphill, which we would know to be impossible on Earth. Spiders however look as if fluids should be flowing uphill all the time [12], which is impossible. On Mars we also see examples of former fluid flows [13] [14] [15] [16] [17], and all that we have seen follow perceived gravity. Indeed from what we know of physics we would be confident that any fluid would always flow down hill with gravity on Mars.


[http://www.martianspiders.com/illustrations/m0806802.jpg]

The spiders on the other hand have branches that seem all but oblivious to the law of gravity. One could give literally thousands of examples from these images where branches point up hill in a delta-shaped formation, and then have branches that also point downhill in the same shape. Studies on ancient deltas and rivers on Mars [18] [19] [20] [21] show no similarity to spiders or spider ravines [22].A fluid flow encountering a hill for example would at least tend to go around it, but branches almost invariably just go straight over them. A fluid would tend to flow into depressions but spiders either avoid them or skirt the rim of them in ways seemingly impossible for fluids to act. Even fluids moving at speed cannot form fine delta shapes uphill, especially up steep slopes.

Russell Crater is a good example of what is believed to be a water flow on Mars [23] [24]. Note the channels flow straight downhill as they would on Earth [25] [26] [27] [28] [29] [30] [31], nothing like spider branches.

The only alternative to a fluid is a solid—such as soil or sand—forming dunes. These also, however, are common at lower latitudes and don't exhibit any tendency to form against gravity [32]. For example, many dunes are found in gullies and craters but none seem to climb the walls or form anywhere but at the bottom. Known martian [33] and Earth dunes also don't look like spiders [34] [35] [36] [37]. Some spider types also seem to follow the tops of ridges, which is the opposite of what gravity should dictate.

Seasonality

When the two martian seasons are combined and the photos assembled in order of Solar Longitude there seems to be a clear progression in the nature of spider formation through the summer. While there are some models which could conceivably allow for formations to grow as the weather became warmer, they cannot form Fibonacci patterns, and cannot move against gravity.

Even if they could somehow grow [38] with the warmer weather they would also have to shrink [39] and often disappear as the weather grew cold and frost returned to the area. Any kind of rock or soil cannot just disappear, and any kind of fluid as it grew colder should have either sublimed months ago, and cannot just sublime now with the cold. In fact, the cold should freeze them in place just as it forms frost on the ground. So spiders break another natural law, that increasing temperature can cause sublimation. Here, lowering temperature would cause sublimation, which should be impossible.

The temperatures in the spider areas come close to zero Celsius in summer [40] [41] [42] [43] [44] [45] [46] [47] [48], and perhaps above zero. The South Pole has a warmer summer than the North because of the eccentric martian orbit [49].

It is hard to estimate the number of spiders in these areas. The MOC has imaged only a small portion of the total and the number of spiders is enormous. It seems reasonable to conclude there are millions of these structures, which indicates their process of formation is robust. It seems that mere coincidence could not account for so many.

[http://www.martianspiders.com/illustrations/e1201762an.jpg] [50]

Image E1201762 illustrates some of the problems with geological models. At "A", the two main branches are approximately at right angles to the sun angle, which can be seen from the shadows, also from the ancillary data [51]. In other spiders this same orientation is often seen, though geological formations shouldn't be able to sense the direction of the sun. The radial pattern is very uniform though the ground is very uneven, normally fluids should be pooling and making irregular shapes on the irregular terrain. Also there is an even darkness around the spiders as if there are smaller branches evenly distributed. "B" shows spiders buried under frost, much smaller as if the branches have withered. The bush "C" seemingly has long branches with tufts of smaller branches at the ends. At "D" the branches climb a small hill even though a fluid flow should just go around it. This in effect is movement against gravity. The bush "E" apparently originates from a small hill, with the central area also at right angles to the sun angle. The large bush has so many branches moving against gravity it is impossible to list them all. For example the branch "G" runs over the top of a hill instead of going around it. A few examples of Fibonacci branching are shown in white, where the angles between the branches are approximately equal [52]. Typically spider branches have very similar angles between them, which gives the overall even impression. In Fibonacci branching, the angles between the branches are usually almost the same everywhere; a fluid flow should have random angles. At "H", branches from 2 different spiders point towards each other. If these were fluid flows then this should be a depression and the liquids would form a pool. That's because the branches should have been pointing down hill so in between them would have to be a depression. There is no indication of this though. "I", "J", "K", and "L" have the same situation, where branches don't join to the ones on the next spider. In fact spider branches almost invariably avoid each other, though fluid flows should join together as they seek lower ground. This was originally imaged as M0902042 and recently re-imaged again as E1301971. Here the Fibonacci branching is even clearer.

Conclusions

The spider features are enigmatic, with little or no correspondence to known geological processes. Their Fibonacci like branching, their growth and decline through the seasons, and branches formed up hills are consistent with a life form, but Mars has an environment that seems impossible for any more than at best microbial life. Spider areas may represent a previously unexplored environment for life where liquid water might exist for long periods. Fibonacci patterns, if not the result of chance, are only known to form in living things. Because of the large numbers of spiders, a mathematical proof to determine whether or not these are Fibonacci branches may be possible.

We see no way spiders can form from fluid flows or dunes because their patterns don't follow the paths gravity dictates. Also there are plenty of known fluid flows and dunes on Mars, many near the spiders which do follow gravity and which look nothing like spiders. There seems then to be no evidence exotic geological processes exist on Mars to form spiders.

References and endnotes

[1] "Spider Ravine Models and Plant Like Features on Mars- Possible Geophysical and Biogeophysical Modes of Origins" Journal of the British Interplanetary Society, 8 February 2002. Vol 55 No 3/4, March-April Edition, Pp 85-108. http://www.martianspiders.com/martianspiders.pdf
[2] http://www.martianspiders.com/newphotos.htm
[3] http://www.martianspiders.com/illustrations/papertable.htm
Figure number refers to our JBIS paper, Comparisons are re-imaged photos also at http://www.martianspiders.com/comparisons/.
Groups are clusters of images close to each other. Groups 1 and 8 are shown here in detail.
[4] Typically the "M" images and "E" images are from separate summers.
[5] http://newfrontiersinscience.com/Members/v02n03/a/NFS0203a.shtml
[6] http://www.msss.com/moc_gallery/m07_m12/images/M08/M0804688.html
[7] http://www.martianspiders.com/Popular%20Science%20%20The%20Banyan%20trees%20of%20Mars.htm
[8] For example: E1201762 , E0800043, M0900157, M0900528, E0801158 , M0806244, M0901352,M0901567,M0903082, E1003496, M1102393
[9] For example, http://www.martianspiders.com/eo1201762b.jpg.htm
[10] For example, http://www.mcs.surrey.ac.uk/Personal/R.Knott/Fibonacci/fibnat.html
[11] This was also covered in our first spider paper:

http://www.martianspiders.com/martianspiders.pdf, note Figures 10 a, b, c , and d.
12] For example: M1103950 M1200159 M1200397 M1200456 E0800043 E1004220 E1102247 E1200329
[13] http://ltpwww.gsfc.nasa.gov/tharsis/aharonson2002_pnas.pdf
[14] http://www.lpi.usra.edu/meetings/lpsc2002/pdf/1870.pdf
[15] http://www.lpi.usra.edu/meetings/lpsc2001/pdf/1182.pdf
[16] "Images from the visible light camera on NASA's Mars Odyssey spacecraft, combined with images from NASA's Mars Global Surveyor, suggest melting snow is the likely cause of the numerous eroded gullies first documented on Mars in 2000 by Global Surveyor."
http://mars.jpl.nasa.gov/odyssey/newsroom/pressreleases/20030219a.html
[17] http://www.lpi.usra.edu/meetings/lpsc2000/pdf/1189.pdf
[18] http://www.lpi.usra.edu/meetings/lpsc2002/pdf/1347.pdf
[19] http://www.lpi.usra.edu/meetings/lpsc2001/pdf/1457.pdf
[20] http://www.lpi.usra.edu/meetings/lpsc2001/pdf/1488.pdf
[21] http://www.lpi.usra.edu/meetings/polar2000/pdf/4026.pdf
[22] http://www.lpi.usra.edu/meetings/lpsc2000/pdf/1162.pdf
[23] "SPRING DEFROSTING IN THE RUSSELL CRATER DUNE FIELD - RECENT SURFACE RUNOFF WITHIN THE LAST MARTIAN YEAR?"
http://www.marsglobalsurveyor.com/firstlight/Samples/Russell/2013_Spring%20Defrosting.pdf
[24]"Narrow gullies interpreted as the result of liquid flows on frozen dunes are observed on 6 MOC images in the latitudes of 40 to 60°S. Among these dunes, a large scale sand dunes reaching an elevation of 600 m above surrounding plains covers the floor of Russell crater (Fig. 1)."
http://www.lpi.usra.edu/meetings/lpsc2002/pdf/1215.pdf
[25] http://fototek.geol.u-psud.fr/~mangold/documents/1534.pdf
[26]"SNOW AND ICE MELT FLOW FEATURES ON DEVON ISLAND, NUNAVUT, ARCTIC CANADA AS
POSSIBLE ANALOGS FOR RECENT SLOPE FLOW FEATURES ON MARS"
http://www.lpi.usra.edu/meetings/lpsc2001/pdf/1809.pdf
[27]"THE AUSTRALIAN PALEOFLOOD MODEL FOR UNCONFINED FLUVIAL DEPOSITION ON MARS."
http://www.lpi.usra.edu/meetings/lpsc2001/pdf/1679.pdf
[28]"COMPARISON OF ICELANDIC AND MARTIAN HILLSIDE GULLIES."
http://www.lpi.usra.edu/meetings/lpsc2002/pdf/1904.pdf
[29]"GULLIES ON MARS: CLUES TO THEIR FORMATION TIMESCALE FROM POSSIBLE ANALOGS FROM DEVON ISLAND, NUNAVUT, ARCTIC CANADA."
http://www.lpi.usra.edu/meetings/lpsc2002/pdf/2050.pdf
[30]"SELECTIVE FLUVIAL EROSION ON MARS: GLACIAL SELECTIVE LINEAR EROSION ON DEVON ISLAND, NUNAVUT, ARCTIC CANADA, AS A POSSIBLE ANALOG."
http://www.lpi.usra.edu/meetings/lpsc2000/pdf/2080.pdf
[31]"SMALL VALLEYS NETWORKS ON MARS: THE GLACIAL MELTWATER CHANNEL NETWORKS OF DEVON ISLAND, NUNAVUT TERRITORY, ARCTIC CANADA, AS POSSIBLE ANALOGS." http://www.lpi.usra.edu/meetings/5thMars99/pdf/6237.pdf
[32]http://mac01.eps.pitt.edu/courses/GEO1701/Marsaeolian_files/frame.htm
[33]For example: M0802949, M1000911 , M1200409 , M1700797, M1701178, M20001670
[34] http://www.lpi.usra.edu/meetings/lpsc2001/pdf/1181.pdf
http://www.lpi.usra.edu/meetings/5thMars99/pdf/6059.pdf
http://www.msss.com/mars_images/moc/abs/polar2000/edgett_etal_dunes.pdf
[35] http://www.geog.ouc.bc.ca/physgeog/contents/11r.html
[36] http://www.olympic.ctc.edu/class/dassail/desert_gallery.html
[37] http://www.ica1.uni-stuttgart.de/~gerd/dunes.html
[38] For example: E0700758 E0800043 M0900157 E0801158 M0900528
[39]For example: M1104046, M1200543, E1200911
[40] See Figure 2:
http://www-mars.lmd.jussieu.fr/granada2003/abstract/titus.pdf
[41] This shows the shrinking of the polar cap at the same time as the spiders are increasing, Figure 2:
http://www.lpi.usra.edu/meetings/lpsc2002/pdf/2071.pdf
[42] "The seasons in Mars's southern hemisphere include short, very hot summers, and longer, cold winters.
The martian orbit is less circular and more elliptical than Earth's, which means for part of the year the planet
is a lot closer to the sun. The southern hemisphere, tilted towards the sun when Mars is closest, has a hotter summer than the other hemisphere. The northern hemisphere is tilted towards the sun when Mars is farther away, and so its summers are not as hot."
http://van.hep.uiuc.edu/van/qa/section/Stuff_about_Space/The_Earth_and_the_Moon/20020322171839.htm
[43] Here the spider areas (mainly on the right side of the inner circle) show a temperature of yellow to orange at Ls 253 degrees, which is -30 to -15 degrees Celsius.
http://www.mars-ice.org/vamp0_Nov27-29(Ls=253)Day_Temp(!Uo!NC).gif
[44] Here at Ls 251 degrees the temperatures show -40 degrees Celsius. Bolometric readings according to Titus can underestimate the temperature by around 20 degrees Celsius if the ground is frost free.
http://www.mars-ice.org/spole_2pm_1.gif
[45] Here the temperatures in green get to near zero from 250 to 300 degrees Ls, which is when the spiders are growing. http://www.mars-ice.org/slat_trends.gif
[46] Here the shrinking of the polar cap is shown to favor the spider areas, which are on the right:
http://www.mars-ice.org/spole97.html
[47] Here Figure 4 shows the temperatures at Ls 309 degrees. The spider areas are very patchy with some areas still very cold but other areas much warmer. The yellow and orange spots in the bottom right part of the inner circle correspond roughly to spider clusters:
http://www.mars-ice.org/iceland.html
[48] "Dark spots appeared as the surface began defrosting in August. Winds occasionally moved the darker material across the surface, leading to dark streaks, NASA said. But all the frost and streaks disappeared by February."
http://www.cnn.com/2000/TECH/space/02/23/mars.thaw/
[49] "The large eccentricity of Mars' orbit also affects the seasons. The current configuration means aphelion occurs during northern-hemisphere summer; as a result, northern summer is up to 30 degrees colder than southern summer, and the amplitude of the seasonal cycle is 110 K in southern mid latitudes but only 55 K in the north."
http://www.mit.edu/people/goodmanj/terraforming/node6.html
[50]http://www.martianspiders.com/illustrations/e1201762an.jpg
[51]http://www.msss.com/moc_gallery/e07_e12/images/E12/E1201762.html
[52]"On a tree when a twig comes out from a branch, the next twig to come out from the branch will be slightly farther out on the branch and will be rotated about the branch at some angle. The next twig will come out farther along the branch, rotated at the same angle."
http://mathforum.org/library/drmath/view/52694.html

GIRL WITH DREAMS NAMES MARS ROVERS "SPIRIT" AND "OPPORTUNITY"
NASA release 2003-081

8 June 2003

Twin robotic geologists NASA is sending to Mars will embody in their newly chosen names—Spirit and Opportunity—two cherished attributes that guide humans to explore. NASA Administrator Sean O'Keefe and 9-year-old Sofi Collis, who wrote the winning essay in a naming contest, unveiled the names this morning at NASA's Kennedy Space Center. "Now, thanks to Sofi Collis, our third grade explorer-to-be from Scottsdale, AZ, we have names for the rovers that are extremely worthy of the bold mission they are about to undertake," O'Keefe said.

Sofi read her essay: "I used to live in an orphanage. It was dark and cold and lonely. At night, I looked up at the sparkly sky and felt better. I dreamed I could fly there. In America, I can make all my dreams come true. Thank you for the 'Spirit' and the 'Opportunity.'" Hers was selected from nearly 10,000 entries in the contest sponsored by NASA and the Lego Co., a Denmark-based toymaker, with collaboration from the Planetary Society, Pasadena, CA.

Collis was born in Siberia. At age two, she was adopted by Laurie Collis and brought to the United States. "She has in her heritage and upbringing the soul of two great spacefaring countries," O'Keefe said. "One of NASA's goals is to inspire the next generation of explorers. Sofi is a wonderful example of how that next generation also inspires us."

Collis' dream of flying now takes the form of wanting to become an astronaut. Meanwhile, she enjoys playing with her older sister, swimming, reading Harry Potter stories, and her family's three dogs and one cat.

Lego President Kjeld Kirk Kristiansen, commenting on the naming contest, said, "The early days of space exploration stimulated the creativity of an entire generation, expanded our imagination and encouraged us to push our limits, making us better and braver human beings. With this project, the Lego Co. wants to bring part of that magic back. Everything we do is aimed at giving children that same power to create, and by involving children in the Name the

Rovers Contest and other related playful learning acttivities, we hope to motivate and inspire the next generation of explorers."

Eleven miles from today's naming ceremony, Spirit, formerly called Mars Exploration Rover A, waited for a launch opportunity on Monday at Cape Canaveral Air Force Station. Opportunity, the second twin in what is still named the Mars Exploration Rover project, is being prepared for its first launch opportunity on June 25.

NASA's Jet Propulsion Laboratory, Pasadena, CA, manages the Mars Exploration Rover project for the NASA Office of Space Science, Washington, DC. JPL is a division of the California Institute of Technology, Pasadena.

Information about the rovers and the scientific instruments they carry is available online from JPL at http://mars.jpl.nasa.gov/mer and from Cornell University, Ithaca, NY, at http://athena.cornell.edu. Information about the naming contest is available at http://www.nametherovers.org.

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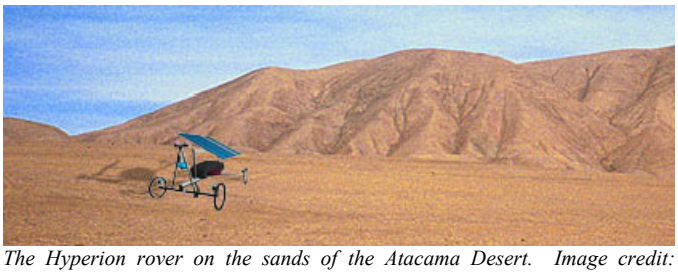
An additional article on this subject is available at
http://www.space.com/missionlaunches/mer_names_030608.html.

THE EDGE OF LIFE
By Henry Bortman
From *Astrobiology Magazine*

9 June 2003

This is the first in a series of articles on a research project, "Life in the Atacama," that recently began in Chile's Atacama Desert. This article will focus on the unique habitats for life that exist in the Atacama and on how the project may guide the search for life on Mars. Subsequent articles will discuss the innovative Hyperion rover that will be used in the project and the specialized life-detection instruments being developed as part of its payload.



The Hyperion rover on the sands of the Atacama Desert. Image credit: Carnegie Mellon University.

Life—as we know it—needs water to survive. It doesn't have to be a lot of water, at least not for microscopic life. Even in most of the world's deserts, in regions where plant and animal life cannot subsist, bacteria and lichen manage to eke out an existence, clinging to life underneath or in the cracks within rocks. These organisms have adapted to living in some of the harshest, most extreme conditions on the planet. But are there places on Earth that are so dry that nothing can live there?

That is one of the questions that a group of scientists studying Chile's Atacama Desert hope to answer during their three-year research project. In the process, they hope to develop better techniques for searching for evidence of life on Mars. Their research project, "Life in the Atacama," is funded by NASA's ASTEP (Astrobiology Science and Technology for Exploring Planets) program.

The Atacama is a vast desert, stretching for some 1000 kilometers (620 miles) south from Chile's northern border with Peru. It is believed to be the driest place on Earth, receiving an average of only one-tenth of a millimeter (four-thousandths of an inch) of rain per year. Some parts of the Atacama haven't seen rain for more than 400 years.

Chris McKay, of NASA's Ames Research Center, is a member of the Life in the Atacama science team. The Atacama, McKay says, is "so dry that in that desert, unlike other deserts that we've studied, it's possible to cross the boundary between life and death, between conditions that are suitable for desert bacteria and desert algae and conditions that are so extreme that they don't appear to be there any more."

Not surprisingly, says McKay, water is the critical factor. "Most places on Earth, it's hard to find a location where there's not enough water [for life]. Even where there's not enough water for plants, not enough water for humans, there's still enough water for bacteria. Everywhere. There's bacteria living in the hottest place in Death Valley—richly living, in fact."

"We all understand intuitively that water is a limiting factor for life, but to find a place where the water is so low that, essentially, no organism has leaned how to live there—that's interesting. One or two odd bacteria seem to pop up occasionally in these very dry places, but we don't know what they are or how they got there."

The Life in the Atacama project will take three years to complete. Each year, researchers will travel to the highland desert. There they will deploy a prototype rover, Hyperion, developed by the Robotics Institute at Carnegie Mellon University (CMU). Hyperion's goal: traverse the Atacama, searching for signs of life and mapping the boundaries between the habitable and the inhospitable. The first of these annual expeditions, a preliminary shakedown of the rover and its scientific instruments, took place in April of this year.

Nathalie Cabrol, who is with the SETI Institute and NASA's Ames Research Center, heads the science team for the Atacama project. "We want to understand if the Atacama represents, really, a limit for life on Earth," says Cabrol. "Previous field experiments were mainly targeting the understanding of the geology and the climate of the field site," Cabrol explains.

The ASTEP research will take an important step forward in the use of robots to search explicitly for life. "What we are trying to do right now is basically to do robotic astrobiology. [We want] to understand better the notion of habitat and the notion of distribution of life," she says. To that end, one of the novel instruments onboard the Hyperion rover will use fluorescent dyes to look for some of life's key molecules: nucleic acids, carbohydrates, lipids and proteins.

Although the Atacama project is in part an effort to understand the limits of life on Earth, it is also a training exercise of sorts for future missions to Mars. "The Atacama," says Cabrol, "has some very interesting parallels to Mars, in that, today, it's a very arid place, but at the end of the last glacial maximum, about 12,000 years ago, it was a wetter place. And you had channels and you had lakes there. And now, the water is gone." So "life had to adapt in a very short period of time. And we want to understand, where did it go and how did it adapt—or if it didn't."

The plan for year three of the project calls for the Hyperion rover to operate independently in the Atacama for several months, traveling autonomously for hundreds of kilometers. (The soon-to-be-launched Mars Exploration Rovers (MERs), by comparison, will travel a total of less than one kilometer each.)

The advantage of the rovers on Earth, says McKay, is their stamina. "There's nothing that they're going to do in the Atacama that we can't do better with graduate students." But not many graduate students would be willing to spend months on end trekking through the Atacama, stopping every few meters to sample the soil.

"If you have a robot that doesn't care too much about staying in the desert and has the right capabilities to perform the task you are asking it to perform, it's better," Cabrol adds.

If in the Atacama, robots are a convenience, on Mars, they are a necessity. "I can't send a graduate student to Mars," says McKay. "We're not going to be sending humans to Mars [any time soon]. So what we have to do is teach these machines to do a job that's very easy for humans but very difficult for machines, which is to understand an environment that they're in, understand where they are, understand what they're seeing, and then to send that information back to Earth so that scientists, looking through the eyes and ears of the machine," can study the environment much as they would if they were able to go there themselves.

If the Life in the Atacama project is successful, scientists will come away with both a better understanding of limits of life on Earth and a better understanding of how to search for life on our neighboring desert world, Mars.

Read the original article at http://www.astrobio.net/news/article490.html.

NEW ADDITIONS TO THE ASTROBIOLOGY INDEX
By David J. Thomas
http://www.lyon.edu/webdata/users/dthomas/astrobiology/astrobiology.html

9 June 2003

Terrestrial extreme environments articles
http://www.lyon.edu/webdata/users/dthomas/astrobiology/online_articles2.html

H. Bortman, 2003. The edge of life. *Astrobiology Magazine*.

M. O. Schrenk, D. S. Kelley, J. R. Delaney and J. A. Baross, 2003. Incidence and diversity of microorganisms within the walls of an active deep-sea sulfide chimney. *Applied and Environmental Microbiology*, **69**(6):3580-3592.

Human space exploration and microgravity effects articles
http://www.lyon.edu/webdata/users/dthomas/astrobiology/online_articles3.html

ESA, 2003. Human mission to Mars: the second aurora working meeting. *SpaceDaily*.

Evolutionary biology and chemistry articles
http://www.lyon.edu/webdata/users/dthomas/astrobiology/online_articles5.html

Associated Press, 2003. Did Earth get an earlier start? *MSNBC*.

S. B. Jacobsen, 2003. How old is planet Earth? *Science*, **300**(5625):1513-1514.

CONTINUING COVERAGE OF THE COLUMBIA DISASTER
By David J. Thomas

9 June 2003

The investigation of the Columbia tragedy continues to make headlines in both space and general media. I have included (below) a non-exhaustive list of links to recent articles on the subject.

http://www.msnbc.com/news/867336.asp?cp1=1
http://www.space.com/missionlaunches/sts107_caib_030604.html
http://www.space.com/missionlaunches/sts107_test_030606.html
http://www.space.com/missionlaunches/sts107_farewell_030606.html
http://www.space.com/missionlaunches/sts107_testover_030606.html
http://spaceflightnow.com/shuttle/sts107/030604foamtest/
http://spaceflightnow.com/shuttle/sts107/030605scrub/
http://story.news.yahoo.com/news?tmpl=story&cid=624&ncid=624&e=2&u=/ap/20030605/ap_on_sc/shuttle_investigation

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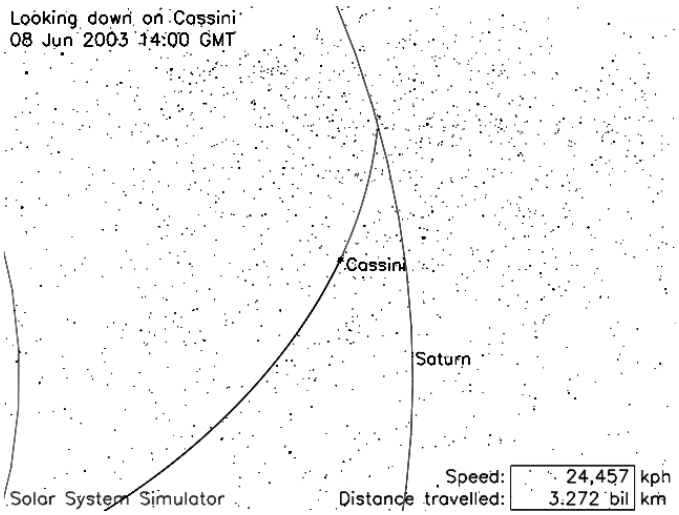
CASSINI SIGNIFICANT EVENTS
NASA/JPL release

29 May - 4 June 2003

The most recent spacecraft telemetry was acquired from the Goldstone tracking station on Monday, June 2. The Cassini spacecraft is in an excellent state of health and is operating normally. Information on the present position and speed of the Cassini spacecraft may be found on the "Present Position" web page located at http://saturn.jpl.nasa.gov/operations/present-position.cfm.



This computer-rendered image was generated by David Seal using his Solar System Simulator.

On-board activities this week included Radio and Plasma Wave Science High Frequency Receiver calibrations, powering on of the Radio Science Subsystem Ka-band Exciter and Ka-band Traveling Wave Tube Amplifier, and uplink of files to load the Composite InfraRed Spectrometer Instrument Expanded Blocks (IEB) to the Solid State Recorders (SSR). Uplink of the file was successful to the prime string, but failed on the on-line string. Currently the prime SSR, SSR-B, contains the proper IEBs and the on-line doesn't. Investigations continue as to why this happened by uploading a group of memory readout commands to obtain information from the CDS sequencing region and statistics.

A preliminary sequence Sequence Change Request (SCR) approval meeting was held as part of the development process for C38. It has been determined that final uplink products will not be necessary. C38 will be uplinked Wednesday June 11th.

The second and final input port for the C39 Science Planning Team (SPT) process occurred this week. The products were merged and delivered to ACS for the end-to-end pointing validation process. The C39 SPT process will be completed on June 13, 2003.

System Engineering (SE) hosted the first Science and Sequence Update Process (SSUP) Verification and Validation (V&V) status meeting. Items reviewed from this past week's activities include SSUP kick-off, stripped subsequence delivery with a focus on who is using the files, how, and does it meet their needs, SCR guidelines/uplink forms system, and the sequence phase list of ancillary files. In addition, SE delivered to V&V the new configuration file management process for use during the SSUP VNV, and the deadline has passed for submission of SCRs for S14 V&V.

The Navigation Team completed the processing of the optical navigation images which were taken during the flight software checkout in C36. The final result was an orbit solution which incorporated both radiometric and optical data. This has validated the end to end processing of optical navigation data from spacecraft execution through to orbit solution. Another test is planned for the C39 sequence, which will use the final release of the multimission image processing software.

Delivery coordination meetings were held this week for the ALF tool version 9, and the command database version 9F. This version will be available with Mission Sequence Subsystem D9.1 to be delivered in July 2003.

Uplink Operations has begun the process of defining the contents of Cassini Information Management System (CIMS) 3.0. While several areas of functionality were already identified, the detailed requirements are now being negotiated with users. The Sequence Team leads have begun training in the use of CIMS. The Imaging Science Subsystem telemetry processor used for making Level 1A products has been updated to handle the circumstance where very poor on-board data compression could lead the ground program to crash.

Cassini is a cooperative project of NASA, the European Space Agency and the Italian Space Agency. The Jet Propulsion Laboratory, a division of the California Institute of Technology in Pasadena, CA, manages the Cassini mission for NASA's Office of Space Science, Washington, DC.

SPACECRAFT AND EXPENDABLE VEHICLES STATUS REPORT: MARS EXPLORATION ROVERS
By George H. Diller
NASA/KSC release

4 June 2003

Mission: Mars Exploration Rover (MER-A)
Launch Vehicles: Delta II
Launch Pad: 17-A
Launch Date: June 8, 2003 [currently delayed until 10 June]
Launch Times: 2:05:55 PM - 2:44:07 PM EDT

The Flight Readiness Review for MER-A was held today in the Mission Briefing Room at KSC. At its conclusion, NASA managers affirmed Sunday, June 8 as the launch date for MER-A. The next major activity is the fueling of the Delta second stage on Thursday, June 5 with its complement of storable hypergolic propellants. The payload fairing was installed around the spacecraft last weekend on Saturday, May 31.

MER-A was hoisted atop the Delta II rocket at Pad 17-A on May 27. A state of health check was successfully completed on May 28. The Flight Program Verification, an integrated vehicle/spacecraft test and the final major test before the launch, was completed on May 29.

The Delta first stage for MER-A was erected on Pad 17-A on April 23. The second stage erection was completed on April 28, and the fairing was installed in the white room on April 30. The solid rocket booster erection began on May 13 with the first set of three motors being attached to the first stage. The second set of three was erected on May 14, and the final set was hoisted into position on May 15. The Simulated Flight Test, an electrical test of the vehicle's systems used during powered flight, was successfully completed on May 21.

Mission: Mars Exploration Rover (MER-B vehicle/MER-1 rover) Launch Vehicle: Delta II Heavy
Launch Pad: 17-B
Launch Date: June 25, 2003
Launch Times: 12:38:16 AM - 1:19:19 AM EDT

Fueling of MER-1 was completed on May 28. Spin balance testing began the next day on May 29 and was completed May 30. Mating to the Delta third stage (upper stage booster) took place on June 12. Transportation to the launch pad is scheduled for June 16. The MER-B vehicle's first stage is on Pad 17-B. Erection of the nine solid rocket boosters was completed May 22. The second stage was hoisted atop the first stage on May 29. There are no issues or concerns at this time.

Contact:
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An additional article on this subject is available at http://spaceflightnow.com/mars/mera/status.html.

KSC'S EXPENDABLE VEHICLE WEB COVERAGE DEBUTS WITH MER-A LAUNCH
NASA/KSC release 41-03

5 June 2003

With the launch of the first rover beginning the Mars Exploration Rover (MER) mission, the Kennedy Space Center Web site is celebrating its first-time online coverage of an expendable vehicle mission. On Saturday, June 7, NASA Direct!'s MER-A programming will kick off with "Preparing for Launch," hosted by Jon Cowart and featuring Launch Weather Officer Joel Tumbiolo, NASA Launch Manager Omar Baez, and MER Manager Matt Wallace. The launch day program, "MER Mission Overview," will be hosted by Tiffany Nail and will include MER Flight Systems Manager Richard Cook and Deputy Project Manager Richard Brace.

Viewers will see informative programming highlighting the objectives of the MER-A launch and the twin rovers' upcoming mission. During both programs, featured guests will answer questions submitted to the NASA Direct! Question Boards from space enthusiasts around the world. The NASA Direct! home page and Question Boards can be viewed online at http://www.ksc.nasa.gov/nasadirect/index.htm.

In addition to NASA Direct!, the KSC Web will provide live countdown coverage from the Virtual Launch Control Center, located at http://www.ksc.nasa.gov/elvnew/mera/vlcc.htm. Coverage will feature real-time updating as milestones occur during the countdown, as well as downloadable and streaming video clips of countdown events. All videos will be provided in RealMedia format, with downloadable clips available in two sizes for users with 56K modems or cable/broadband connections.

MER-A web coverage schedule (all times are EDT and subject to change)

L-1 Day - Saturday, June 7, 2:15 PM
NASA Direct! program: Preparing for Launch
http://www.ksc.nasa.gov/nasadirect/elv/mera/event1.htm

L-0 Day - Launch Day, Sunday, June 8, 12:15 PM [currently delayed until 10 June]
Live countdown coverage begins
http://www.ksc.nasa.gov/elvnew/mera/vlcc.htm

5:15 PM
NASA Direct! program: MER Mission Overview
http://www.ksc.nasa.gov/nasadirect/elv/mera/event2.htm

For the exact time of the start of NASA Direct! programming, please check the NASA Direct! site each program day.

Although coverage events for this mission do not begin until one day prior to launch, the MER-A coverage site at http://www.ksc.nasa.gov/elvnew/mera/index.htm was activated approximately one month before the anticipated launch date. KSC's Expendable Launch Vehicles site at http://www.ksc.nasa.gov/elvnew/elv.htm will always serve as a starting point for coverage of other NASA ELV missions.

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MARS EXPLORATION ROVERS LAUNCH INFORMATION
By Ron Baalke
NASA/JPL release

5 June 2003

We've added additional information about the upcoming MER launches to the MER web site. Information about the Delta 2 rocket is available at http://mars.jpl.nasa.gov/mer/mission/launch_vehicle.html. Detailed information about the launch itself is at http://mars.jpl.nasa.gov/mer/mission/launch_e.html and includes the following sections:
When Is Launch?
How Do I View The Launch?
- View in person
- View on NASA TV
- View over the internet

Detailed Launch Windows
Launch Sequence Events
Launch Sequence Details
Launch Diagrams

A computer-generated animation of the MER mission is available at http://mars.jpl.nasa.gov/mer/gallery/video/animation.html.

CLAMPS AWAY, MARS EXPRESS EASES ITS GRIP ON ITS LANDER
From *ESA Science News*

5 June 2003

Europe's first mission to the Red Planet, continues its successful mission with another successful "high-risk" post-launch milestone. Mars Express engineers breathed a sigh of relief this morning at the European Space Operations Centre (ESOC), in Germany. If a particularly delicate operation had not proceeded as planned, it would have been impossible to deploy the Mars Express lander, Beagle 2, on arrival at Mars.

This crucial operation consisted of releasing Beagle-2's launch clamps. These clamps are extra attachments that ensure the lander stays perfectly fixed to the spacecraft during the launch and is not affected by launch vibrations. After the launch, these clamps are no longer needed, since another mechanism keeps Beagle 2 in place during the six-month trip to the Red Planet.

This second mechanism allows Mars Express to deploy Beagle 2 on arrival at Mars. However, if the launch clamps had not released today, the second mechanism would have failed. "The Beagle-2 mission would have been over before it had even started!" commented ESA Lander Manager, Con McCarthy.

The release of the launch clamps started at 10:10 CEST and lasted about 30 minutes. The release mechanism itself is unusual. Usually, launch clamps contain a firework-like mechanism, but Mars Express had a much gentler release mechanism for Beagle. It consisted of a sleeve over a clamp bolt; an electric current heats the sleeve to about 100°C. At that temperature, the sleeve expands and the bolt snaps. There were three bolts and they all broke in sequence.

"We had to wait two minutes for the expansion of the sleeve which snapped the bolt. The atmosphere in the room was tense and those two minutes seemed to last an eternity! When the first bolt went, a lot of tension was released," says McCarthy.

There are more hurdles ahead but Mars Express is demonstrating that it can deal with the many challenges on the way to the Red Planet.

See the Mars Express launch replay at
http://www.esa.int/SPECIALS/Mars_Express/index.html.

Read the original article at
http://sci.esa.int/content/news/index.cfm?aid=9&cid=32&oid=32396.

Additional articles on this subject are available at:
http://www.space.com/missionlaunches/soyuz_launch_030602.html
http://www.space.com/missionlaunches/express_clamps_030605.html
http://www.spacedaily.com/2003/030603112634.0g3q4gpd.html
http://www.spacedaily.com/2003/030602223329.9yzyx2ug.html
http://spaceflightnow.com/mars/marsexpress/030605clamps.html

MARS EXPRESS NOW 1 MILLION KILOMETERS FROM EARTH
From ESA Science News

6 June 2003

This morning, at 5:30 UT, Mars Express passed the 1 million kilometer mark in distance away from Earth on its journey towards the Red Planet. The spacecraft has successfully completed the first of several trajectory correction maneuvers. It also switched successfully from the low-gain antenna to the high-gain antenna for communication with Mission Control at the European Space Operations Centre in Germany.

- More about Mars Express launch campaign
  http://www.esa.int/marsexpresslaunch/
- More about Mars Express
  http://sci.esa.int/marsexpress/

Read the original article at
http://sci.esa.int/content/news/index.cfm?aid=9&cid=32&oid=32401.

MARS GLOBAL SURVEYOR IMAGES
NASA/JPL/MSSS release

29 May - 4 June 2003

The following new images taken by the Mars Orbiter Camera (MOC) on the Mars Global Surveyor spacecraft are now available:

Gullies in Terraced Crater Wall (Released 29 May 2003)
http://www.msss.com/mars_images/moc/2003/05/29/index.html

Old Arabian Crate (Released 30 May 2003)
http://www.msss.com/mars_images/moc/2003/05/30/index.html

Exhuming Platy Plains (Released 31 May 2003)
http://www.msss.com/mars_images/moc/2003/05/31/index.html

Apollinaris Patera Surfaces (Released 01 June 2003)
http://www.msss.com/mars_images/moc/2003/06/01/index.html

Syria/Claritas Dust Storm (Released 02 June 2003)
http://www.msss.com/mars_images/moc/2003/06/02/index.html

Clouds Over Morning Limb (Released 03 June 2003)
http://www.msss.com/mars_images/moc/2003/06/03/index.html

Small Martian Mesa (Released 04 June 2003)
http://www.msss.com/mars_images/moc/2003/06/04/index.html

All of the Mars Global Surveyor images are archived at
http://www.msss.com/mars_images/moc/index.html.

Mars Global Surveyor was launched in November 1996 and has been in Mars orbit since September 1997. It began its primary mapping mission on March 8, 1999. Mars Global Surveyor is the first mission in a long-term program of Mars exploration known as the Mars Surveyor Program that is managed by JPL for NASA's Office of Space Science, Washington, DC. Malin Space Science Systems (MSSS) and the California Institute of Technology built the MOC using spare hardware from the Mars Observer mission. MSSS operates the camera from its facilities in San Diego, CA. The Jet Propulsion Laboratory's Mars Surveyor Operations Project operates the Mars Global Surveyor spacecraft with its industrial partner, Lockheed Martin Astronautics, from facilities in Pasadena, CA and Denver, CO.

MARS ODYSSEY THEMIS IMAGES
NASA/JPL/ASU release

2-6 June 2003

Hebes ILD (Released 2 June 2003)
http://themis.la.asu.edu/zoom-20030602a.html

Eroded Crater Ejecta (Released 3 June 2003)
http://themis.la.asu.edu/zoom-20030603a.html

Chaotic Terrain (Released 4 June 2003)
http://themis.la.asu.edu/zoom-20030604a.html

Bizarre Crater Mound (Released 5 June 2003)
http://themis.la.asu.edu/zoom-20030605a.html

Lycus Sulci (Released 6 June 2003)
http://themis.la.asu.edu/zoom-20030606a.html

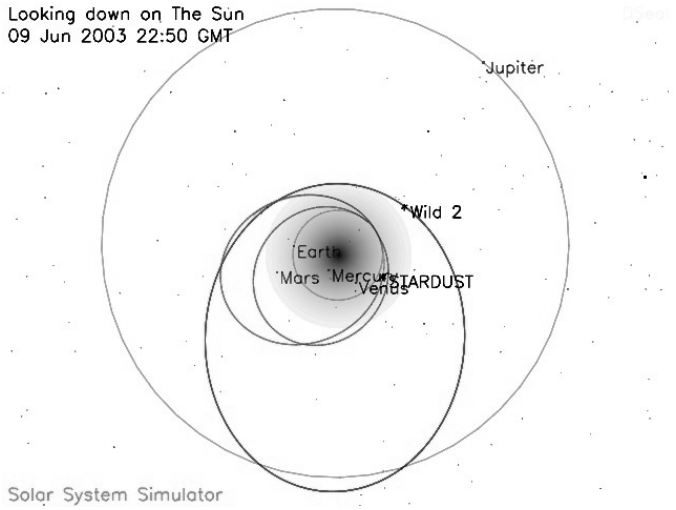
All of the THEMIS images are archived at http://themis.la.asu.edu/latest.html.

NASA's Jet Propulsion Laboratory manages the 2001 Mars Odyssey mission for NASA's Office of Space Science, Washington, DC. The Thermal Emission Imaging System (THEMIS) was developed by Arizona State University, Tempe, in collaboration with Raytheon Santa Barbara Remote Sensing. The THEMIS investigation is led by Dr. Philip Christensen at Arizona State University. Lockheed Martin Astronautics, Denver, is the prime contractor for the Odyssey project, and developed and built the orbiter. Mission operations are conducted jointly from Lockheed Martin and from JPL, a division of the California Institute of Technology in Pasadena.

STARDUST STATUS REPORT
NASA/JPL release

6 June 2003

The Stardust team had a half dozen periods of communication with the spacecraft in the past week. Telemetry relayed from the spacecraft indicates it is healthy and all subsystems continue to operate normally. Information on the present position and orbits of the Stardust spacecraft and comet Wild 2 may be found on the "Where Is Stardust Right Now?" web page at http://stardust.jpl.nasa.gov/mission/scnow.html.



This computer-rendered image was generated by David Seal using his Solar System Simulator.

The Spacecraft Test Laboratory continues a series of test cases designed to stress the spacecraft's Attitude Control Subsystem. These tests are performed in the Spacecraft Test Laboratory and, at present, are exercising the spacecraft's "bang-bang" controller. The "bang-bang" controller is the name for the attitude control strategy the spacecraft will use while inside the coma of Comet Wild 2. The controller has the authority to engage Stardust's primary and secondary thrusters in the event of a large dust particle impact on the spacecraft.

For more information on the Stardust mission—the first ever comet sample-return mission—please visit the Stardust home page at http://stardust.jpl.nasa.gov.

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