

MIJN RUIMTEVAART VERZAMELING DEEL 106

17 MEI 2004 T/M 14 JULI 2004.

REGISTER A T/M Z

A: Atlantis: blz 23001 t/m 23010.

B: Bush: extra geld
voor reis naar Mars: blz 23078.

C: Chinese ruimtevaart: blz 23082, 23083, 23085, 23086, 23094.
Columbia: blz 23010.

H: Hubble Space Telescope: blz 23194 t/m 23200.

I: International Space Station: blz 23080, 23081, 23084,
23087, 23088, 23192.

M: MARS EXPRESS ARRIVEERT OP MARS

De voorbereidingen: blz 23011 t/m 23024,

Aankomst op Mars: blz 23025 t/m 23042,

Beagle-2 zwijgt: blz 23043 t/m 23052,

Mars Express vind water: blz 23253 t/m 23064,

Onderzoek naar Beagle-2: blz 23065 t/m 23077, 23083.

N: NASA breekt historische toren af: blz 23193.

Nieuw sterrenstelsel ontdekt: blz 23092, 23093.

O: Orion nevel: blz 23094.

P: Postzegels: blz 23079.

R: Radiotelescoop bestaat
hoofdzakelijk uit computers:: blz 23090, 23091.

S: **SPIRIT, ROAMING THE RED PLANET**

De voorbereidingen: blz 23084, 23095 t/m 23107,

Landing op de Rode Planeet: blz 23108 t/m 23122,

Columbia 7 herdacht op Mars: blz 23134, 23135,

Eerste foto's + eerste ritje: blz 23123 t/m 23156,

Probleem met Spirit: blz 23157 t/m 23172,

Spirit hervat werk +
eerste onderzoeken: blz 23173 t/m 23192.

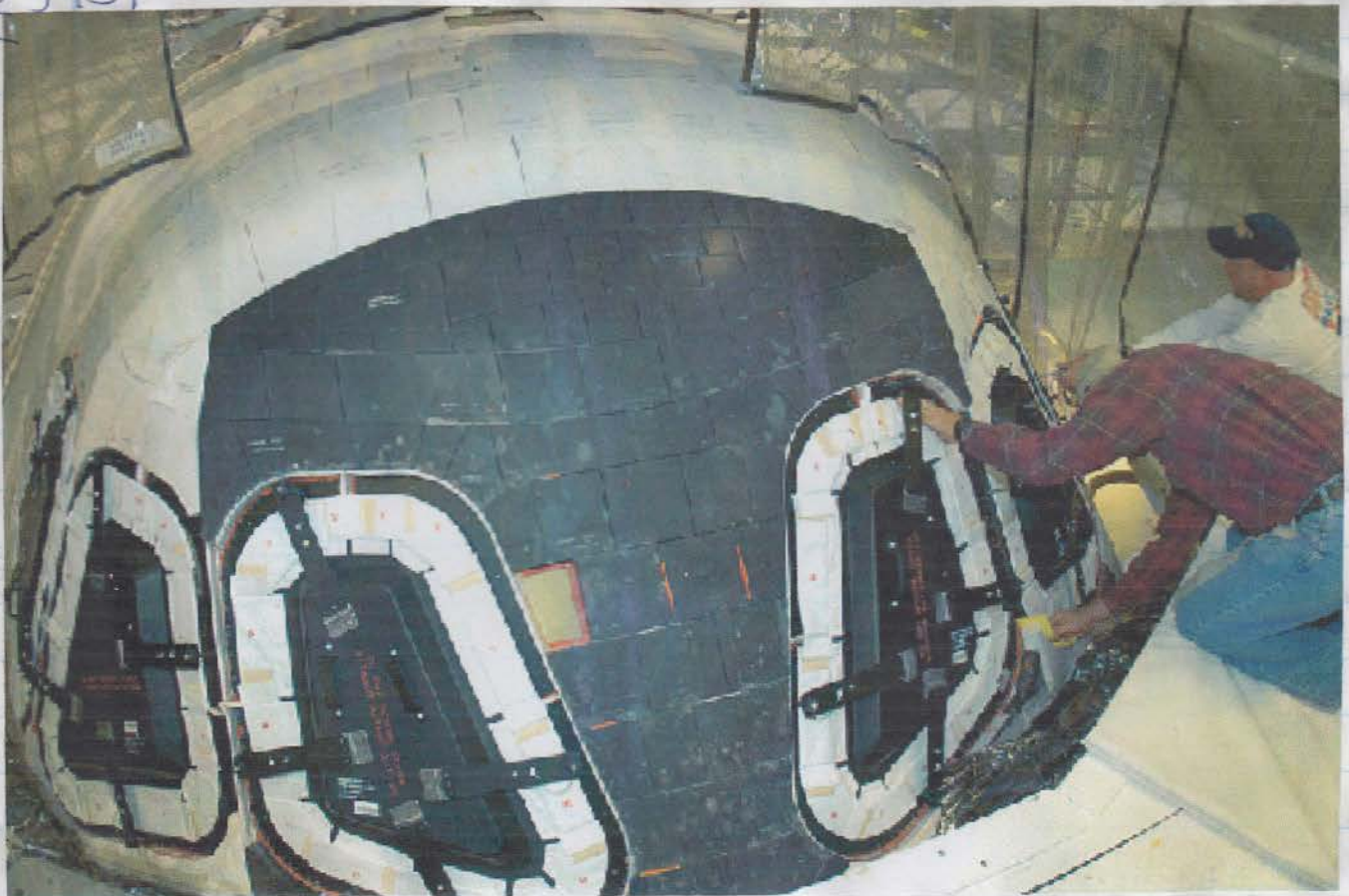
Sterrenkunde: blz 23079, 23089.

V: Venus Express: blz 23084.

82942



82943



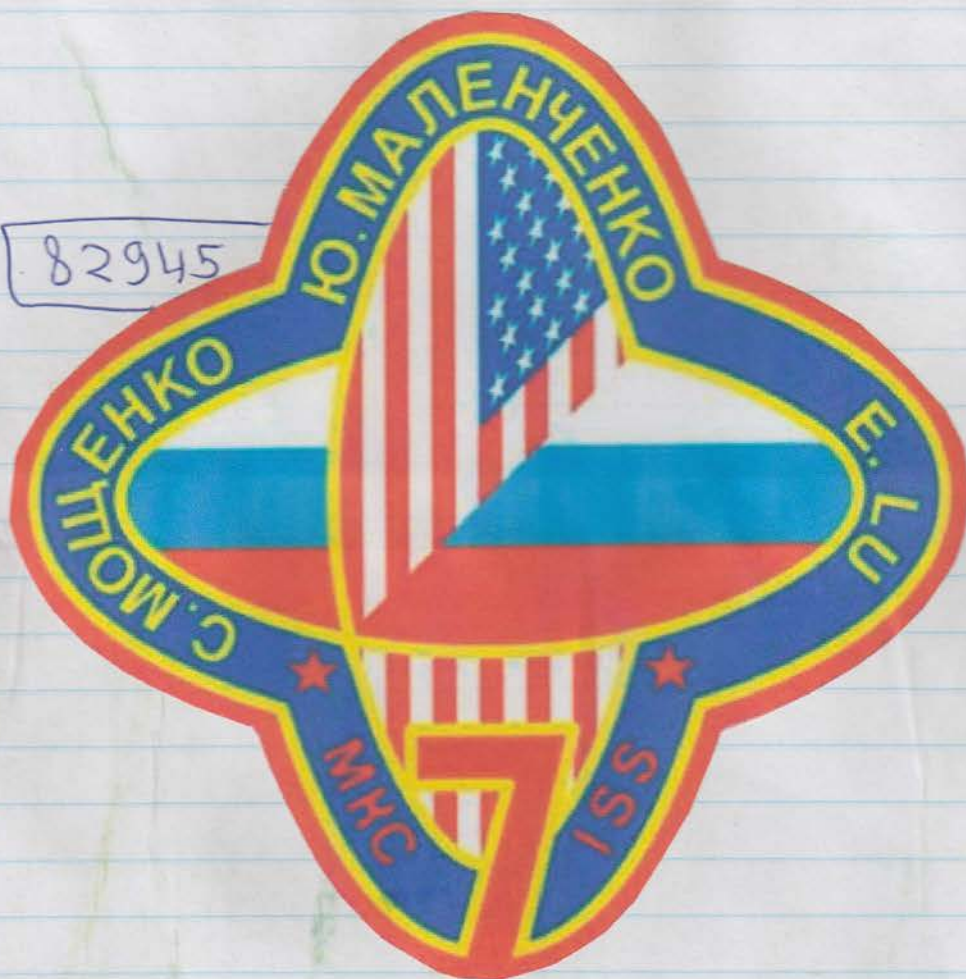
23001

NASA PRESS RELEASE : 03 DECEMBER 2002.

EXPEDITION FIVE BACKUP CREW - MEMBER NAMED TO EXPEDITION SEVEN

Russian cosmonaut Alexander Kaleri has been named to replace Sergei Moschenko as a prime crewmember for Expedition Seven. Kaleri joins astronaut Ed Lu and Russian cosmonaut Yuri Malenchenko in training for the long-term increment aboard the International Space Station next year. Kaleri was a member of the backup crew for Expedition Five, currently returning home aboard Space Shuttle Endeavour. He's also a veteran cosmonaut, having lived aboard the Russian Space Station Mir during three separate long-term missions: 145 days in 1992, 197 days in 1996 and 73 days in 2000. Russian officials proposed the crew change to the Multilateral Crew Operations Panel, and the Panel approved the action on October 10, 2002.

82944



82945

82946

82947

82946



82947



82948



82949

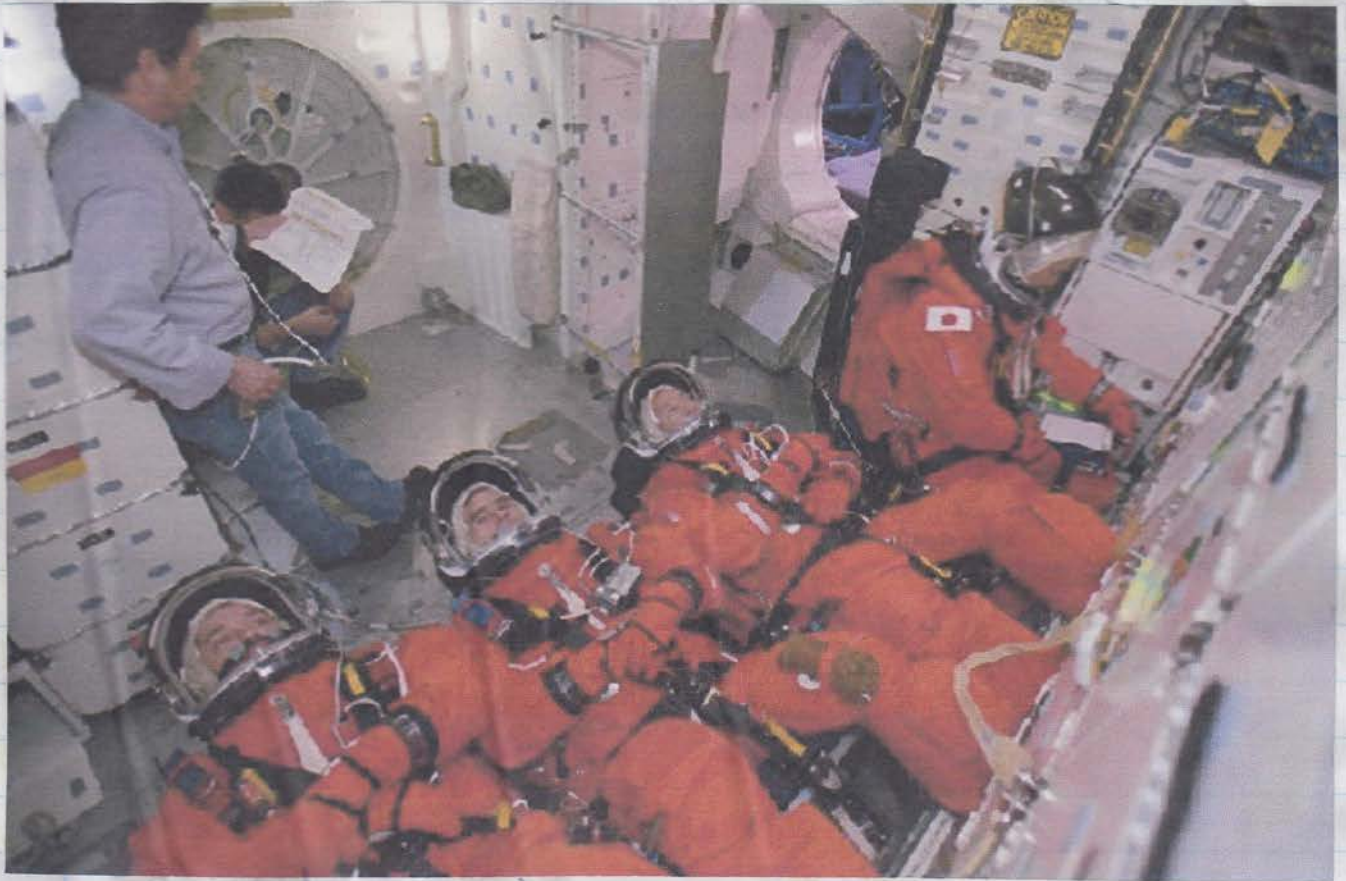


82950



10080

23002



82951

142258

82952

82953



140052

23003



82954



82955

ORLANDO SENTINEL : 09 SEPTEMBER 2003.

NASA TO PREPARE ATLANTIS FOR TEST-RUN FLIGHT IN 2004.

WASHINGTON - The next flight of a space shuttle — when it happens — will be a test run to try out safety modifications that will be added to the fleet in the coming months, NASA officials said Monday. The mission, as scheduled before the Feb. 1 Columbia accident, was supposed to be another step in the construction of the International space station. But although shuttle Atlantis, with astronaut Eileen Collins at the helm, will still dock with the orbiting laboratory, managers are leaning against the idea of using the mission to take a new crew to the station, shuttle-program manager Bill Parsons said at a press briefing in Houston. That's because Collins and her crew, in addition to opening the post-Columbia era for the shuttle, will be asked to perform a host of tests and demonstrations on the new additions to the orbiter. The National Aeronautics and Space Administration, which Monday publicly released its preliminary plan for returning to flight, hopes to have everything from new cameras to an in-orbit repair kit on board by the time of the next launch. William Readdy, NASA's top spaceflight official, said the agency is working on implementing the recommendations issued last month by the Columbia Accident Investigation Board, plus additional changes of its own devising. Readdy and Parsons stressed that although the return-to-flight plan is aimed at a launch window between March 11 and April 16, there is so much work to be done that it's impossible to set a concrete date. "We're going to be safety-driven, not schedule-driven," Readdy said. The mid-March window meets NASA's new requirements for launching the shuttle, including making sure a launch happens in daylight, so the entire trip into orbit can be photographed and filmed. Readdy said the other windows that have been identified so far are between May 19 and June 28, and July 18 and Aug. 26. The plan will continue to evolve as NASA engineers and contractors work on the toughest problems, including preventing the shedding of insulating foam from the massive external tank — the physical root of the wing damage that doomed Columbia — and developing a method to repair the shuttle's thermal-protection system in space. An even thornier issue, Readdy said, is taking the Columbia board's most amorphous recommendation — that NASA needs a cultural and organizational overhaul to replace its "broken" safety culture — and making it happen. "There's a challenge there. There is very much a 'can-do' culture that we'd like to keep. There was a culture that stifled communication that we somehow have to eliminate," he said. "[But] we don't want to throw the baby out with the bath water. We want to value the culture that came back after Apollo and came back after Challenger."

82956

SHUTTLE TEAM AT KENNEDY SPACE CENTER KEPT BUSY WITH ATLANTIS.

CAPE CANAVERAL - Even as NASA carefully lays out its plan to return the space shuttle to flight, workers at the Kennedy Space Center are busy with a list of things to do on each of the surviving spaceplanes. "It's anything but people standing around here looking for work to do," KSC spokesman Mike Rein told SPACE.com.

The next shuttle scheduled for launch is Atlantis. Although the mission's exact details have yet to be decided, KSC workers this week have been active in the orbiter's cockpit removing hardware for inspections, checking out the environmental control system in Atlantis' cargo bay and examining the miles of electrical wiring that snakes through the vehicle. The major effort in the Orbiter Processing Facility hangar centers on Atlantis' wing leading edges and the reinforced carbon-carbon (RCC) panels that shape the front of the wings and are designed to protect the shuttle from the hottest temperatures of re-entry, Rein said. It was a hole in an RCC panel on Columbia -- created by a chunk of foam that fell from the external tank during launch -- that triggered the series of events that led to the Feb. 1 loss of the shuttle and its crew. As a result, much of the return to flight attention is on making sure those RCC panels are in good shape after flying all these years. In fact, the Columbia Accident Investigation Board has required the panels be inspected between future flights. In Atlantis' case, all of the RCC panels were removed and shipped back to their factory for inspections as engineers still are determining the best way to inspect the panels in place on the shuttle wings, yet without damaging the structure. Three of the panels have since been returned from the vendor, are back up to their original standards and are being re-installed, Rein said.

(82957)



(82958)



(82959)



(82960)



(82961)

BBC : 30 SEPTEMBER 2003.

SHUTTLE ON SLOW ROAD TO SPACE.

The day the last box of Columbia's remains reached its final resting place, Kennedy Space Center workers scrutinized wing panels from sister ship Atlantis. It is a small step on the US space agency's (Nasa) long road to return the fleet to flight. The work is arduous and time-consuming. Each of the ship's 44 panels must be removed, packed and shipped to a Texas laboratory for X-ray, ultrasound and eddy current testing, then returned to Florida for re-installation. If Nasa cannot develop ways to inspect the panels *in situ*, that work alone will more than double the amount of time it takes to prepare each ship for flight, from three to about seven months. "Obviously the vendor has got very good, solid techniques they use to do those inspections," said Atlantis vehicle manager Scott Thurston. "Will we ever get to the point where we can do it here? We don't know. We're trying to figure that out." The wing panel inspections are among the return-to-flight criteria drawn up by the board that investigated the fatal 1 February shuttle accident. The board determined Columbia was destroyed and its seven-member crew killed because of a hole in a wing panel that allowed superheated air to blast inside the wing, melting the structure as the shuttle flew through the atmosphere in preparation for landing. The breach was caused by a piece of falling foam insulation during launch. The KSC team knows more work is coming. For starters, engineers are designing a 50-foot extension to the shuttle's robot arm and fitting out the boom with cameras and lasers. Future shuttle crews will use the crane to look for damage in the heat shield tiles and panels. The boom must be designed, manufactured and tested before it is sent to Florida for installation aboard Atlantis, the first shuttle being prepared for flight. Nasa had hoped to launch the ship in March, but acknowledges that date is not possible. A new targeted launch date has not yet been selected. "We're not working the schedules right now," said Thurston. Atlantis is barely visible, cocooned by work platforms, protective blankets and support equipment. Four wrapped wing panels have been reattached to the aluminium structure. Several more U-shaped panels rest on tables below the ship. It is quiet in the hangar, like a sanctuary. Many of the managers, technicians and engineers caring for Atlantis spent weeks combing the fields of Texas and Louisiana picking up Columbia's remains. "It was sobering," said Thurston, who arrived in Texas the day of the accident. "But it was a good feeling that we were bringing her home. She was over lost over a large part of Texas and we were bringing her home." With the investigation into the cause of the accident complete, Nasa moved the debris into a section of the massive Vehicle Assembly Building where it will remain in permanent storage and accessible to researchers for study.

82962

FLORIDA TODAY : 01 OCTOBER 2003

ATLANTIS MAY NOT LAUNCH FOR A YEAR. INSPECTIONS COULD DELAY FLIGHT UNTIL SEPT. 2004.

82963

CAPE CANAVERAL - NASA is set to push its first post-Columbia shuttle launch back to mid-July, but work to make certain Atlantis is safe to fly could ultimately prompt a delay until next September or later. Senior NASA officials will meet Friday and consider whether to move the planning date for the Atlantis flight to July 15 from a date between March 11 and April 6. New on NASA's list of potential work to do: Inspections on the noscap of Atlantis, which is made of the same composite carbon material as shuttle wing panels. NASA and contractor officials now are reviewing records to determine whether the noscap was inspected in its last major structural inspection in 2001. A decision then will be made on what type of inspections should be performed on the noscap, and where those inspections should be done. NASA ultimately could decide to send the noscap back to its Texas manufacturer. It's not clear yet whether that work could be finished in time to launch in mid-July. "It's premature to discuss that until you determine whether removing and inspecting the noscap is the right thing to do from a safety standpoint," said James Hartsfield, a spokesman for NASA's Johnson Space Center in Houston. "But I can tell you that decision will be made on what is appropriate to ensure that Atlantis is safe to fly and nothing else." But officials already are saying any launch date at this point is just a target -- one set primarily for work scheduling purposes. What's more, they say further delays can be anticipated as the agency puts in place new safety enhancements ordered by Columbia accident investigators. "A lot of that development work is still in the early stages, and until it reaches a certain level of maturity, you can probably expect change," Hartsfield said. "A target launch date is a target launch date, and we have said they can move." Atlantis is to be launched to the International Space Station on a mission aimed at testing new orbital inspection and repair techniques as well as other safety enhancements. Among other major challenges facing the agency: manufacturing a boom that will be used to inspect shuttle thermal tiles and wing panels in orbit - an effort that could push the Atlantis flight back to next September or later. Laden with cameras and laser sensors, the boom will play a key role in detecting any damage that might endanger a shuttle crew during atmospheric re-entry. The Columbia accident was traced to a wing panel hole that enabled hot gases to tear the ship apart during re-entry. Investigators recommended that NASA develop a way to perform orbital inspections and repairs on wing panels and thermal tiles before shuttles fly again. NASA is progressing with tile-repair techniques. High-tech caulk guns will be used to fill gouges with a material that cures to a consistency like a pencil eraser and can withstand intense temperatures. Development work on wing-panel patches is going more slowly. NASA has engineered a way to patch holes up to four-inches in diameter with an umbrella-like fastener similar to toggle bolts used to attach hardware to drywall. Also under consideration: Balloon-like bladders containing heat-resistant material, adhesive patches, and metal overlays that can be bolted to wing panels. But none of the methods appear adequate enough to fix the type of 6- to 10-inch hole that investigators think doomed Columbia. The return-to-flight development efforts are complicated by new restrictions that limit the shuttle to daylight launches. Liftoffs also must be timed so the shuttle's external tank is jettisoned on the sunlit side of Earth. The idea is capture sharp images of any damage done during flight. Acceptable windows include a six-week period beginning around July 15 and a month-long period that begins in mid-October. Two, three-day launch opportunities exist in November 2004 and January 2005. But NASA would be unable to launch in late October 2004 or much of November 2004 and January 2005. No launch opportunities exist in February 2005 and March 2005. An effort, however, is under way to determine whether photographic capabilities can be enhanced enough to expand the number of launch opportunities available.

20085

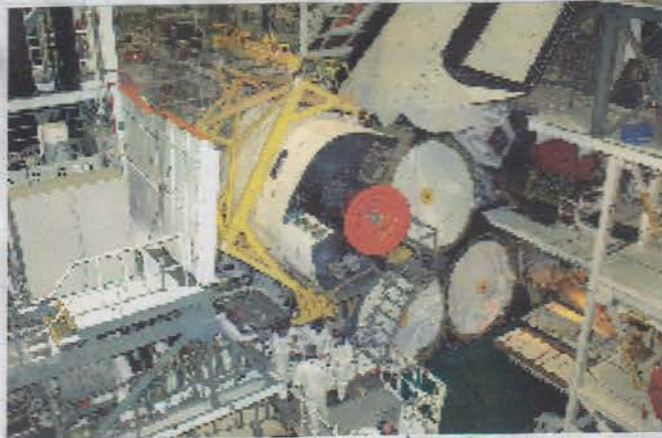
23006



82964



82965



82966

CHECK SIX NASA was poised late last week to delay the target for the space shuttle's return to flight from next March to at least mid-July to better accommodate program changes and vehicle inspections required in the wake of the Columbia accident. Among the work that could be added is the time-consuming removal and precautionary inspection for corrosion of components in the nose cap of Atlantis. The prevention of corrosion caused by Florida's seaside environment is a never-ending battle. But Kennedy Space Center engineers also received good news last week: the internal gearing of the orbiter Discovery's speed brake actuators were found to be just fine after inspectors feared corrosion could have built up (*AW&ST* Sept. 22, p. 25). That means it is also unlikely to have formed in similar areas of Atlantis and Endeavour.

AVIATION WEEK & SPACE TECHNOLOGY/OCTOBER 6, 2003

82967

82968



82969





82970



82971



82973



82973



82974



82975

82976



82976

82977

82977

82978



82979



82980



82979



82982

82981



82982



82983

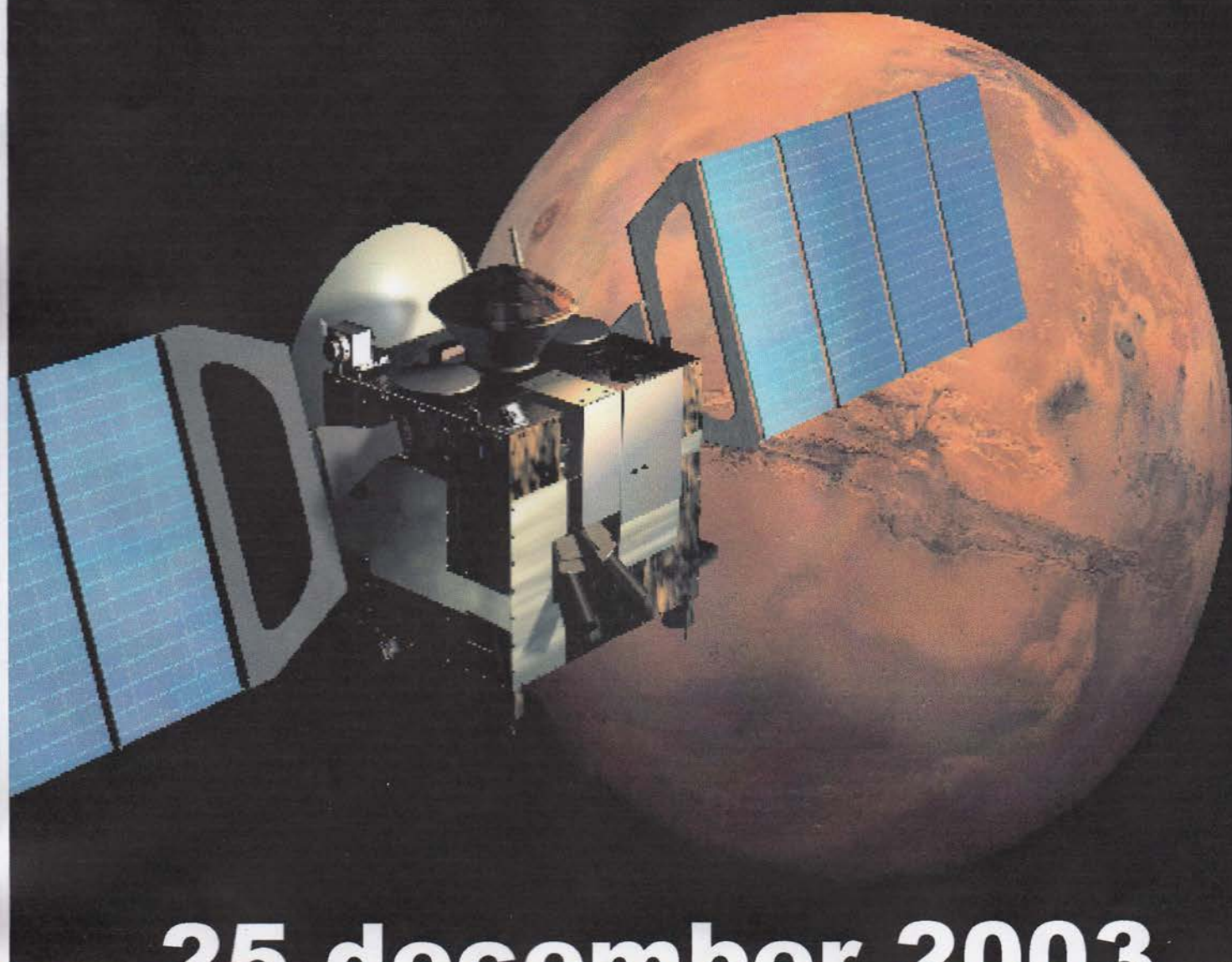


82984



82985

MARS EXPRESS



25 december 2003



ARRIVEERT OP MARS

82986

23011

CRAFT NEAR MARS ORBIT.

CAPE CANAVERAL - A multinational flotilla from Earth is fast approaching Mars, its spaceships on precarious missions to find signs of life or water on the planet. One of the voyagers, a \$200 million Japanese spacecraft, already has been lost -- the victim of a long, troubled journey and problems with its main propulsion system. Now a European explorer is set to make a dangerous dive into Martian orbit on Friday, aiming to send a small robot to the surface on Christmas Eve. Then two U.S. rovers will attempt to land on the dust-swept planet on Jan. 3 and Jan. 25. But if history is precedent, at least one of the remaining craft could be destroyed. Two-thirds of Mars missions have failed since Russia first attempted a 1960 fly-by. "Just getting to Mars is hard. Landing is even more so," said Ed Weiler, associate administrator for space science at NASA headquarters in Washington. Nevertheless, the international make-up of this fleet is buoying the hopes of scientists, engineers and ground controllers around the globe. For the first time, well over a dozen nations -- not just the U.S. and Russia -- have roles in the missions. And if the rest of the ships reach their destinations, the human race will have a shot at unraveling the mysterious history of a barren planet that once was warmer, wetter and more hospitable to life. "It's unprecedented in human endeavor to have so many spacecraft on the way to Mars at once," said Matthew Golembek, a project scientist at NASA's Jet Propulsion Laboratory in Pasadena, Calif. Said Weiler: "The world is going to Mars." A key reason: Mars is closer to Earth than it has been in 60,000 years -- and will be for another two centuries -- a rarity that's the result of the circuitous paths that the planet takes around the sun. Mars now is a mere 34 million miles away, rather than 48 million miles -- its average distance from Earth. Or 284 million miles, its furthest. The shorter trip presented an opportunity so unique that it prompted the 15-nation European Space Agency to launch its first mission to Mars. The U.S. launched two. The nearness enabled engineers to maximize the number of scientific instruments on their spacecraft while minimizing the amount of fuel needed to get there. "If it wasn't for the proximity of the planets, we would not have been able to do any mission at all," said John Reddy, an ESA project engineer. Japan had hoped to get to Mars before the turn of the century. But its Nozomi spacecraft -- named for the Japanese word for "hope" and launched in 1998 -- encountered problems that delayed a planned 1999 arrival and ultimately doomed its mission. Ground controllers lost hope for its Mars mission last week when they could not put the spacecraft on course for a planned drop into orbit today. Nozomi will whiz past Mars and use its instruments to do solar science as it loops around the sun. The new fleet leader: ESA's Mars Express. The \$345 million spacecraft is designed to circle the planet for one Martian year -- or 687 days -- mapping its surface and measuring the chemical make-up of its atmosphere. The Mars Express orbiter also promises to monitor global weather patterns while peering beneath the planet's surface for hidden reservoirs of water. Flying with the European mother ship is a small lander, Beagle 2, named after the British ship Charles Darwin sailed upon in 1831 as he formed his theories on the evolution of life on Earth. Shaped like a giant pocket watch, the 73-pound Beagle will touch down on Isidis Planitia, an ancient basin that straddles the planet's northern plains and southern highlands. Scientists think the basin once might have been awash with water. Their hope is to find evidence of organic compounds -- key ingredients in the universal recipe for life -- within the Martian soil there. "That may indicate that even if we don't have any present life on Mars, we may have had life appear on the surface that then died out over its geologic evolution," ESA project scientist Agustin Chicarro said. Two \$400 million NASA rovers -- launched from Cape Canaveral Air Force Station in June and July, respectively -- will attempt to follow the Beagle lander to the surface. The first, named Spirit, is destined for Gusev Crater, a basin the size of Connecticut that resembles dry lakebeds seen in California's Mojave Desert. A lengthy channel cuts through it, and scientists think the basin might have contained a brimming lake sometime after it formed four billion years ago. The second, named Opportunity, is headed for Meridiani Planum -- one of the smoothest and flattest areas on Mars. There, one of two NASA orbiters already circling the planet has detected abundant stores of hematite, a mineral that normally forms on Earth within bodies of water. At either site, the identical rovers will act as field geologists, employing a sophisticated array of tools and scientific instruments to study rocks. The idea is to find out whether the sites ever were capable of sustaining even primitive life. "If you look at the surface of Mars today, it's a desolate place. It's dry. It's cold. It's barren. It's not an inviting environment for life, and yet we see these tantalizing clues," said project scientist Steve Squyres of Cornell University in Ithaca, N.Y. Among them: the dry lakebeds within Gusev Crater, and the minerals at Meridiani Planum. Said Squyres: "These are giving us hints that in the past, Mars might have been a very different sort of place." The six-wheeled rovers, meanwhile, are uniquely equipped to shed new light on the planet's mysterious past. "They will answer questions about whether the surface once was suitable for life," Weiler said. "And if successful, Spirit and Opportunity will help humans take a giant leap forward in our understanding of Mars' potential for past or current life."

82987

82988

Mars Express zonder problemen op weg naar Mars

Eind oktober toen deze ASTRUIM naar de drukker ging, was alles wel aan boord van deze Europese ruimtesonde. Op 19 december zal de lander (Beagle-2) van de orbiter gescheiden worden. Op 25 december komt het in de Marsiaanse atmosfeer terecht en nog diezelfde dag zal het een zachte landing uitvoeren.

82989

Mars Express journeys on

ESA says that the Mars Express spacecraft en route to orbit the Red Planet in December is behaving in a "nominal manner" despite the solar arrays generating 70 percent of the required power, due to an interconnection problem between the solar arrays and the power conditioning unit.

EUROPE'S MARS-BOUND SPACE PROBES NEAR ARRIVAL.

The Mars Express spacecraft, despite a series of intense solar flares that occurred late October-early November in active sunspots regions, is in good health and is operating normally. The spacecraft flew in the intense radiation environment that resulted from the exceptional solar and geomagnetic activity associated with these regions, temporarily causing disturbances on the star trackers. These disturbances, which were over within a few days, did not cause damage and did not constitute a threat to the mission. The main engine calibration has been performed successfully. Following the trajectory correction manoeuvre performed on 10 November, the spacecraft is now on course to Mars for the upcoming Beagle-2 ejection. The characterisation of the solar array confirmed the nominal performance of this subsystem. Preparations and simulations for Beagle-2 ejection and Mars Orbit Insertion are entering the final stages. The Beagle-2 lander separation will take place on 19 December 2003. It will descend through the Martian atmosphere and land on the planet on 25 December 2003. The Mars Express spacecraft will undergo Mars orbit insertion (MOI) on 25 December 2003. The Interplanetary Cruise payload commissioning phase is now completed. No further payload activities were done in Interplanetary Cruise since the last status report. Several planned payload activities (for example, ASPERA, radio science) have been postponed until after MOI. A Mars observation sequence (imaging and spectroscopy) involving the OMEGA, HRSC and SPICAM instruments is scheduled for the 1st of December. All Beagle-2 checkouts have been successful, as well as a recently completed Beagle-2 lander software upload. Detailed lander surface operations are being finalised for the first few days on the surface of Mars. Some of these operations will be coordinated with high-resolution remote sensing by the orbiter during several flyovers of the Beagle-2 landing site in Isidis Planitia. The planning for Mars commissioning and initial science operations after MOI is progressing nominally. Payload activity timelines are being prepared for the first few months in orbit, with the goal of optimising the scientific return while keeping within the limits of the power budget.

82990

CNN : 12 NOVEMBER 2003.

SPACECRAFT TO LAND ON MARS ON CHRISTMAS DAY.

82991

LONDON - A British-built craft designed to scour the surface of Mars for signs of life is scheduled to land on the planet on Christmas Day, scientists said this week. The Beagle 2 lander is traveling aboard the European Space Agency's Mars Express craft, launched from the Baikonur cosmodrome in Kazakhstan on June 2. Scientists told reporters that the unmanned spacecraft was about 13 million miles from Mars and expected to reach the planet in mid-December. "As of 16:00 (GMT) yesterday, Mars Express is on collision course for Mars," John Reddy, the project's chief electrical systems engineer, said Tuesday. On December 19, the craft will eject the Beagle 2 landing module — a 132-lb shell shaped like an oversized wok and packed with scientific instruments. If all goes to plan, it will parachute to the surface on December 25, flip open and begin conducting experiments. Mars Explorer will orbit the planet for at least one Martian year, 687 Earth days. Its antenna will receive data from Beagle 2 and the orbiter's own instruments and beam it to Earth. Reddy said scientists were "98 percent confident" all would go well. Scientists believe Mars once had water and appropriate conditions for life but lost it billions of years ago, possibly after being hit by asteroids. It is believed that water might still exist on Mars as underground ice. Previous attempts to find signs of life have been inconclusive. Of 34 unmanned American, Soviet and Russian missions to Mars since 1960, two-thirds ended in failure. In 1976, twin U.S. Viking landers searched for life but sent back inconclusive results. Beagle 2 — named for the ship that carried naturalist Charles Darwin on his voyage of discovery in the 1830s — has ambitious scientific aims: It will collect soil and rock samples, dig into Mars to search for organic materials and check the atmosphere for traces of methane produced by living organisms. "We are dealing with the magnetic question of 'is there life on a second planet in the solar system?'" said Colin Pillinger, Beagle 2's lead scientist. "We're talking about the possibility of not being alone in the universe." The mission also will map the planet and use powerful radar to probe below the surface for evidence of water. Mars Explorer is not the only mission heading to the red planet. Two U.S. Mars rover craft are due to arrive in January, and Japan's trouble-plagued Nozomi orbiter, launched in 1998, continues on its way despite technical problems. Mars Explorer is an attempt to demonstrate that Europe can have an effective space exploration program. "I think it's important that Europe has its own way of going and exploring the planets," said David Southwood, the space agency's science director. "It's part of Europe's destiny that it should reach out and start exploring the solar system."

The diminutive Beagle-2 lander is due to settle on the surface of Mars in the early hours of Dec. 25, carrying with it the hopes for what would be an extraordinary gift to humanity—the discovery of life signatures on another planet.

The 73-lb. lander will address "the magnetic question, Is there life on a second

The 73-lb. British Beagle-2 lander is depicted with its solar arrays fanned open and 29-in.-long instrumented arm extended upward. Beagle carries 12 tiny ovens to bake samples for signs of past life to follow up on U.S. Viking data.

planet in the solar system?" said Colin Pillinger, a British Open University researcher who has championed Beagle 2 and is the project lead scientist.

Launched on June 2 from the Baikonur Cosmodrome on a Russian Starsem Soyuz booster, Beagle 2 is sched-

82992

82993



Beagle's Quest
British Mars lander is poised to begin its search for clues to life on the red planet

182994

uled to separate from the European Space Agency's Mars Express orbiter on Dec. 19 when they are still some distance from the planet. Beagle will then fly freely on its own for five days before entering the Martian atmosphere for touchdown on the surface at about 0254 GMT Dec. 25 (9:54 p.m. EST Dec. 24). Mars Express is to enter Martian orbit 6 min. later.

The challenge for Pillinger and his colleagues—besides getting the Beagle safely to Mars, off the orbiter, and down to the surface intact and operational—has been to come up with a research approach that would provide unambiguous indications of life, should it ever have been present on the planet.

Beagle 2, named after Charles Darwin's ship, is to follow up on the 1976 NASA Viking Mars lander life-detection experiments, which some researchers believe may have detected evidence of metabolism. But Pillinger

Beagle, attached to side of ESA Mars Express orbiter, will be separated when the vehicles are five days from Mars. Orbiter has subsurface mapping radar, stereo imaging and spectral sensors.

points out the "Viking life-detection experiments were designed blind." Since scientists then had no previous data from earlier efforts, what emerged was ambiguity, where potentially encouraging results were able to be explained by simple inorganic "chemical effects."

"We've had 20 years to think about the problem," and the outcome has been to avoid "trying to find specific compounds. Our analysis will be for any form of organic matter," he said.

Beagle 2, just the size of a bicycle wheel, will attempt to measure the ratio of carbon isotopes present in Martian rock samples. On Earth, there's a high ratio of carbon 12 to carbon 13 as a result of biological processes. It's this indicator that Beagle 2 will also look for in Martian rock. "It's a more simple, more general experiment than used on Viking," suggested Pillinger.

Attempting to find the lighter carbon isotope on Martian surface rock will also potentially answer concerns and questions regarding the analysis of Martian meteorites, and the apparent presence of organic matter. "We're going to Mars to eliminate the possibility that the samples were contaminated on Earth," he noted.

Before any of the science gets underway, however, Beagle 2 has to identify where it has actually landed, along with providing panoramic imagery of its immediate locale. The Isidis Planitia—a relatively flat, dust-free comet- or asteroid-

impact basin—was selected as the landing site. It should have enough surface rocks to make the area scientifically interesting.

Beagle 2's heat shield will decelerate the spacecraft during the initial atmospheric entry. A pilot parachute will then be deployed, and the shield will be separated by pyrotechnic bolts. The main chute is used to further slow descent until the radar altimeter activates gas-bag inflation at 200 meters (656 ft.).

Once on the ground, the solar panels will unfold automatically, and the lander will then begin to attempt to contact mission control. Initially, this may be via NASA's Odyssey orbiter, until Mars Express is available to act as a data relay once it is established in the correct orbit.

The first possible signal, via Mars Odyssey, will be at roughly 05:15 GMT (12:15 a.m. EST), Dec. 25.

Safely down, with communications established, the Beagle 2's innovative science package will come into its own. Most of the lander's experiments are housed in the Position Adjustable Workbench (PAW), fitted to the end of a robotic arm. The arm provides the Beagle with around a 75-cm. (29-in.) reach. The PAW represents the business-end of Beagle 2 and contains two high-resolution stereo cameras, two types of spectrometers and a microscope, as well as the rock corer-grinder and the mole (*AW&ST* Dec. 11, 2000, p. 76).

Shortly after landing, an initial wide-angle image will be taken using a pop-up mirror. The lander will attempt to send this image back, via Mars Odyssey, as soon as it can. The stereo cameras each have a 48-deg. field of view. The mole was initially intended to be one of the tools to be fitted to a small rover vehicle. The latter item, however, fell victim to the weight constraints governing the Beagle 2 effort, with the burrowing tool finding an alternative home on the PAW. The mole will be able to retrieve subsurface samples up to 2 meters away from the lander.

The cameras will provide the ability to build a 3D model of the area around the lander, and identify areas of interest within reach of the robotic arm. Pillinger suggested that the exact order in which Beagle will carry out its science experiments will depend partly on its immediate surroundings.

Two U.K. facilities will be involved in managing Beagle 2. The Lander Operations Planning Center (LOPC) is situated at the Open University in Milton Keynes in southern England, while the Lander Operations Control Center (LOCC) is based at the National Space

Center in Leicester. The LOPC will determine the science plan for the lander, while the LOCC will establish the command sequences for Beagle 2. These will be sent to the lander via the Mars Express mission control center in Darmstadt, Germany. The Beagle 2 is fitted with a low-gain antenna that transmits at 437 MHz.

Housed in the Beagle 2's main body is the gas

analysis package (GAP), intended to carry out isotopic measurements of material samples, as well as of the Martian atmosphere. Rock and soil samples will be heated gradually in miniature ovens along with oxygen. During this process, the carbon dioxide generated at various temperatures will be measured by a mass spectrometer to identify the ratio of carbon 12 to 13. The GAP has 12 ovens for carrying out the life-science experiments.

The two other spectrometers—a Mossbauer and an X-ray—will be employed to examine the mineral composition of rocks. The Mossbauer Spectrometer, which utilizes gamma radiation, will be used to examine oxidization levels of the Martian atmosphere, while the X-ray Spectrometer will target rock age.

Alongside the life-oriented experiments, the lander houses a number of environmental sensors. These are intended to provide data on the nature of the atmosphere, with readings taken both during the lander's descent and after it's on the surface. *



81085

23074

1000087

SPACE.COM : 03 DECEMBER 2003.

MARS EXPRESS MAKES FIRST PHOTO OF RED PLANET.

The European Space Agency's Mars Express has taken its first picture of the red planet as it gears up for arrival later this month. The photograph was taken by the probe's High Resolution Stereo Camera (HRSC) Dec. 1 and released today. It shows Mars from about 3.4 million miles (5.5 million kilometers) away. It is a very unusual view of Mars, ESA scientists said, because the planet is illuminated in a way never seen from Earth. The Sun shines on part of the western hemisphere, but more than a third of the Martian disk lies in the dark. The dark features at the top are part of the northern lowlands of Mars, where oceans might have existed billions of years ago. The resolution of the image is not the sort that can be obtained from the Hubble Space Telescope or other spacecraft orbiting Mars. But it shows that the Mars Express camera is ready for future tasks.

82995

82996

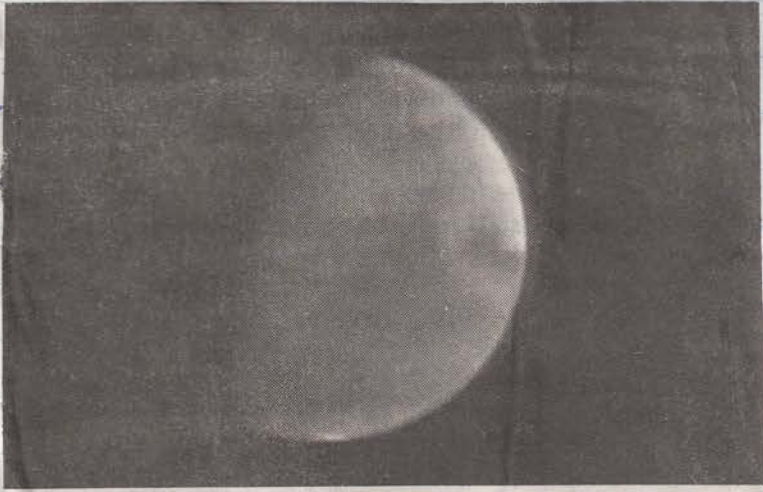


82997



Volkscrant!
06-12-2003.

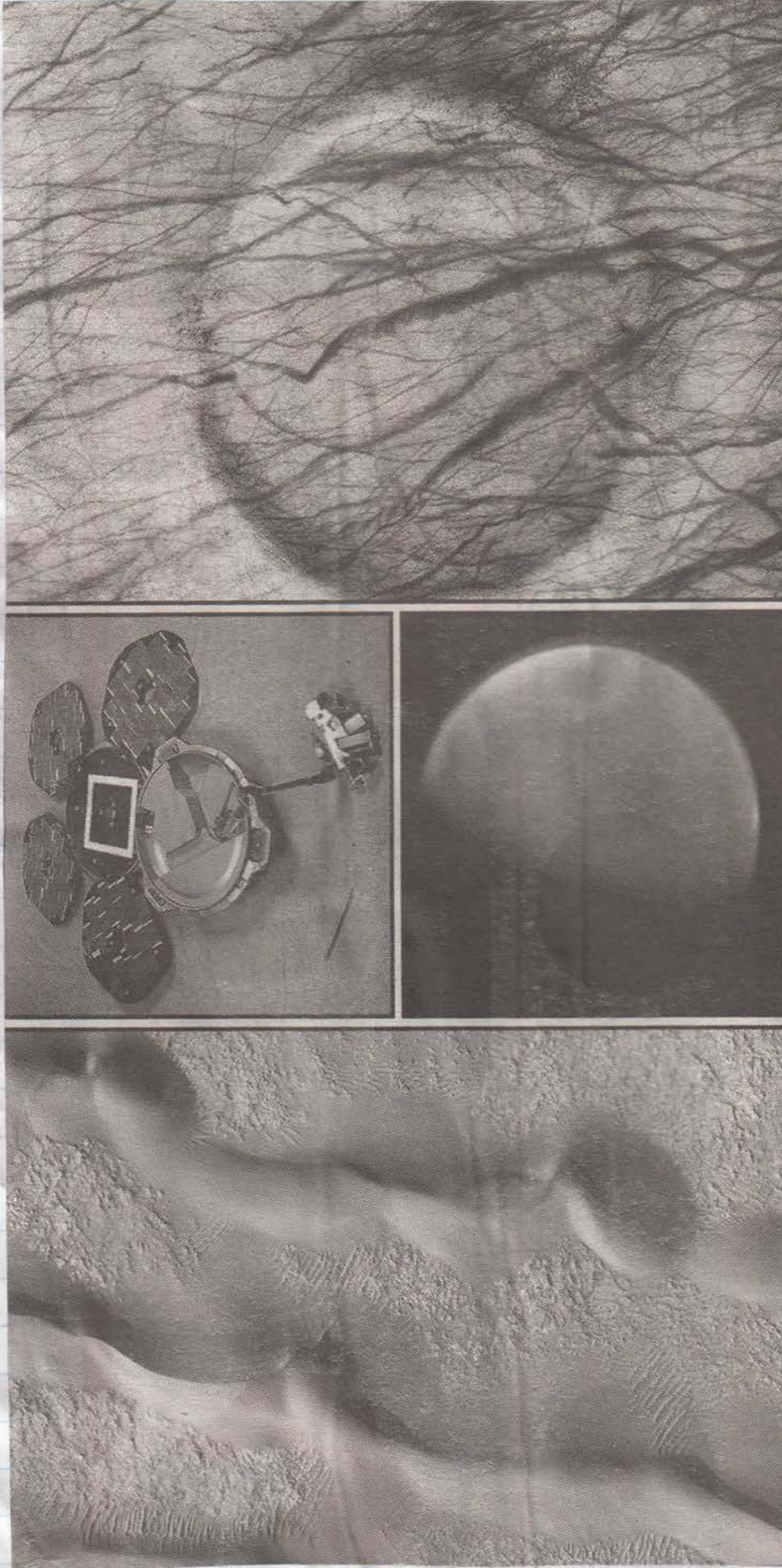
82998



De planeet Mars van een afstand van 5,5 miljoen kilometer, deze week gefotografeerd door de Europese ruimtesonde Mars Express die onderweg is naar de rode planeet. Volgens de plannen landt op eerste kerstdag de Beagle-2 op de planeet voor onderzoek van de bodem en de atmosfeer. Hij moet zich daartoe op 19 december in volle vlucht losmaken van de Mars Express.

01085

23015



Enkele van de foto's die de Mars Express de afgelopen dagen van de rode planeet maakte. Links door wind veroorzaakte duinkammen, rechts een krater met streperige sporen van opwaaiend stof. Midden: de gedeeltelijk verduisterde planeet gezien van een afstand van 5,5 miljoen kilometer en (boven) een model van de Beagle 2, het landingsvaartuig dat kort voor Kerstmis op Mars zal worden losgelaten. foto's EPA en AFP

Mars Express maakt eerste foto's van rode planeet

to's op 1 december, op een afstand van circa 5,5 miljoen kilometer van Mars. Vanaf de aarde is de planeet meestal vol verlicht te zien, maar door de aanvlugroute is op de foto een deel van Mars in duisternis gehuld. Naast succes kampt de missie ook met problemen. Door een verkeerd gesoldeerde stroomkabel leveren de zonnepanelen slechts 70 procent van hun capaciteit. Om energie te sparen hebben technici alle niet noodzakelijke instrumenten uitgeschakeld. De 300 miljoen euro kostende operatie komt er echter niet door in gevaar, zo verklaarde projectleider Michael McKay gisteren.

De leiders van het project zelden er vanuit te gaan dat de missie een succes wordt, maar waarschuwden ook voor complicaties. „Het is niet voor niets dat tot nu toe bijna tweederde van de dertig Mars-missies is mislukt”.

Mars Express werd begin juni gelanceerd en moet met kerst in een baan om Mars zijn. Enkele dagen eerder wordt het landingsvaartuig Beagle 2 losgelaten. Dat landt naar verwachting op 25 december op de planeet. Gezamenlijk gaan ze op zoek naar onder meer water en sporen van leven.

Nast de Mars Express zijn ook nog twee Amerikaanse sondes op weg naar de buurplaneet van de aarde. Zij moeten in januari en februari aankomen en liggen goed op koers. De toekomst van een Japanse missie, die al in 1998 werd gelanceerd, is onzeker omdat de sonde wordt geplaagd door problemen.

Ruiswijk/DARMSTADT
ANP/DPA

Het Europese ruimtevaartuig dat op weg is naar Mars heeft zijn eerste foto's van de rode planeet naar de aarde gestuurd. Dat heeft de Europese ruimtevaartorganisatie ESA gisteren bekendgemaakt.

De Mars Express schoot de fo-

0299

DDL: 04-12-2003

58012

23016

Mars in View

European mission on track for lander separation as it nears its destination

MICHAEL A. TAVERNA/PARIS and DOUGLAS BARRIE/LONDON

The European Space Agency has released first images of the red planet taken by its Mars Express probe and signaled that all systems are go for a planned separation of the Beagle-2 lander on Dec. 19.

The powerful Oct. 28 solar storm that appears to have damaged NASA's Mars Odyssey does not seem to have affected Mars Express (see p. 17). In briefings last week, ESA Project Manager Rudolf Schmidt said solar flares had briefly knocked out the star trackers, but the trackers are now again operating normally. "No problems whatsoever" resulted from the storm, he affirmed.

Similarly, final calculations just completed confirm that "no part of the mission" will be affected by a solar power failure detected shortly after the probe was launched in June, Schmidt said

(*AW&ST* July 21, p. 17). By reconfiguring payload voltages and modifying operating procedures, the mission can live with the 30% power deficit resulting from the failure, he indicated.

Instrument checks were successfully completed earlier this year. Pictures of Earth were taken this fall, and shots of Mars were released on Dec. 3. Software has been in idle state since Nov. 17.

The first critical step in the approach to Mars will occur on Dec. 16, when controllers line up the probe with the lander separation trajectory. Because Beagle 2 has no onboard thrusters to modify the trajectory, this step must be performed with extreme accuracy, flight ops manager Michael McKay noted.

Ejection is planned for Dec. 19, but this date could be pushed back up to two days in the event the release mechanism

83000

does not work as planned, and various fallback scenarios are available. If the lander failed to eject, the probe could still perform its orbital science mission, McKay said, but the added weight and drag would cause virtually all the fuel to be burned during orbital insertion, limiting orbital maneuvers thereafter.

Beagle 2 will take five days to reach the Martian atmosphere, and 7.5 min. to penetrate the atmosphere and reach the surface of Mars, said Colin Pillinger, who is responsible for the landing mission. After automatic deployment of solar arrays and the antenna, lander systems will shut down—except for brief operation of the camera to obtain a star fix—during the first Martian night. This will allow the batteries to recharge.

The camera will be reactivated at the start of the first day to demonstrate that the mission has survived. Activities beyond this point will be determined later, in accordance with local conditions,



Mars Express and its Beagle-2 lander will be the first full mission Europe has ever sent to another planet. Beagle is expected to separate from the orbiter on Dec. 19 and arrive on the Martian surface Dec. 25. The mission is intended to help determine whether life exists or used to exist on the red planet.

Pillinger indicated (*AW&ST* Dec. 1, p. 57). Latest calculations have reduced the likely landing zone from an ellipse 500 km. (310 mi.) long to a 110 X 46-km. area, he said, although he insisted Beagle 2 could alight safely anywhere within the Isidis Planitia basin target site, which is some 1,100 km. in diameter.

After releasing the lander, Mars Express will initiate a 35-min. main engine burn to brake its crash trajectory and commence insertion into its planned orbit. This will take 12 hr. Insertion could be performed by attitude thrusters if the main engine fails.

Instrument commissioning is nominally planned for Jan. 13, but could be shifted depending on conditions, said

mission scientist Augustin Chicarro. The optical payload is to begin initial operations on Feb. 20 and the sounding radar on Apr. 7. Routine operations should commence by mid-April and continue through Nov. 30, 2005, although a three-year extension is planned.

83001

AW&ST:
08-12-2003

81025

23017

SPACE.COM : 16 DECEMBER 2003.

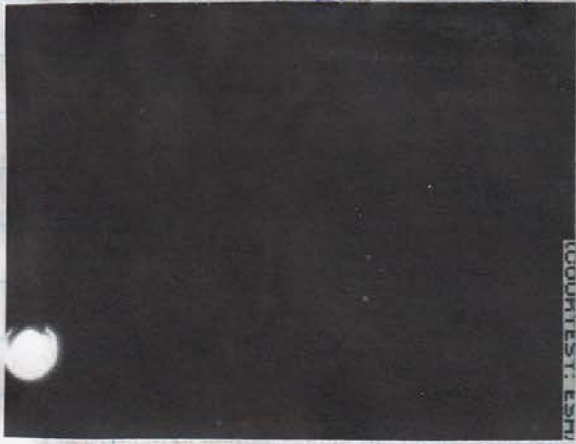
MARS EXPRESS POSITIONED FOR BEAGLE 2 DEPLOYMENT.

PARIS - Ground controllers of Europe's Mars Express satellite on Dec. 16 successfully completed a precision-pointing maneuver to prepare the satellite for a planned Dec. 19 ejection of its small Beagle-2 lander, the mission's flight director said. Michael McKay, flight operations director at the European Space Agency's Esoc space operations center in Darmstadt, Germany, said Mars Express was rotated and its engines briefly fired to increase the satellite's speed as it approaches Mars as part of the maneuver. A breakdown of how Mars Express fits together. The Beagle 2 can be seen sitting on the lid of the craft and the main communications antenna is visible in the lower left. The orbiter carries seven instruments including MARSIS, a low-frequency radar designed to probe the subsurface of Mars for water. Click to enlarge. "This is about the most accurate pointing of a satellite we have ever had to do," McKay said in a telephone interview. "It was successfully completed." Signals to and from Mars Express are delivered via a new 35-meter tracking antenna that the European Space Agency recently installed in New Norcia, Australia, near Perth. Mission managers have narrowed the likely Beagle-2 landing point to an area measuring almost 125 miles (200 kilometers) in width and 31 miles (50 kilometers) in length. After the Dec. 19 ejection of Beagle-2, Mars Express will continue to follow the lander for five days before performing a breaking maneuver that will put it into a 400-kilometer orbit around Mars. The satellite is equipped with radar and optical cameras to study Mars' atmosphere and surface. Beagle-2 is scheduled to land on Mars on Dec. 25 to begin a six-month search for signs of past or present life on Mars.

83002

83003

83004



FLORIDA TODAY : 19 DECEMBER 2003.

BEAGLE 2 ON ITS OWN.

Europe's Mars lander has successfully separated from its partner orbiter and is heading for the surface of the red planet, the European Space Agency announced Friday. Beagle 2, named for Charles Darwin's ship, is the little lander that has been traveling with the Mars Express orbiting spacecraft. at 3:31 a.m. EST Friday, the sequence began to separate the two crafts and push Beagle toward Mars with the help of a loaded spring. The European Space Agency released an image of the flying-saucer-like lander drifting away from the Mars Express. It looked like a small white object on the edge of a big black square. Beagle 2 is to land on Mars early on Christmas Day (Christmas Eve, eastern time), and about the same time, Mars Express will enter orbit. "It's not looking for little green men, but it is looking for matter that might provide evidence of life. It is looking for clues," said David Southwood, the European Space Agency's director of science. Mars Express' course was adjusted earlier this week to be sure Beagle would be on the right trajectory to land on Mars. The Europeans' arrival at Mars precedes the January landings of NASA's Mars rovers, Spirit and Opportunity. Spirit is scheduled to land Jan. 3, and Opportunity should land three weeks later.

83005

F1089

23018

SPACE.COM : 19 DECEMBER 2003

MARS EXPRESS DEPLOYS BEAGLE 2 LANDER.

PARIS - Europe's Mars Express orbiter successfully ejected its Beagle-2 surface probe today, clearing the way for a Christmas Day landing of Beagle-2 and the insertion of Mars Express into orbit around the red planet. Mars Express Mission Manager Michael McKay confirmed separation shortly after noon Central European Time (6 a.m. ET) after having received telemetry data from Mars Express via a satellite tracking station in Australia. McKay's announcement ended a tense two and one-half hours following the automated command for Mars Express to let go of Beagle-2. Because of the time it took for the satellite to re-point its antenna toward Earth, ground teams had no idea whether the initial Beagle-2 release command had been executed. "The mother and baby are both doing well," a relieved David Southwood, director of science at the European Space Agency (ESA), said after the lander's separation was confirmed. "It's been a few tense hours." If Beagle-2 had not separated, the Mars Express satellite would have faced increased difficulties in reaching its intended orbit, and its mission would have been limited by having to carry the 69-kilogram lander. Mars Express will now begin a series of maneuvers that should culminate in a Dec. 25 orbital injection around Mars, another mission-critical sequence that will take the satellite off its current collision course with Mars and permit it to prepare for its mission of using optical and radar imagers to examine the Mars surface and subsurface. Beagle-2 will continue on its collision course, with a planned Dec. 25 entry into Mars' atmosphere and a parachute- and air-bag-softened landing that same day. The lander will then have only a few hours to deploy its solar arrays to gather enough power for its batteries to survive the frigid Martian night, where temperatures can reach minus 40 degrees Centigrade. A first signal that it has survived the landing may be acquired by NASA's Odyssey satellite in orbit around Mars. The all-important signal that Beagle-2 has survived the night will be sent to Mars Express just before 9 a.m. Central European Time (3 a.m. ET) on Dec. 25.

83006



83007

83008



83009



050 85

23019

BEAGLE 2 ON FINAL APPROACH TO MARS.

DARMSTADT - European space controllers sent the Beagle 2 probe on its final approach to Mars on Friday, a critical step in Europe's first mission to explore the red planet for signs of life. The British-built unmanned probe separated from the Mars Express spacecraft, heading for a scheduled Christmas morning landing on the planet's surface. "I'm very proud to say we have made a big step toward getting to Mars, but this is really only the beginning," said David Southwood, the European Space Agency's director of science. In the control room, screens flashed to red to confirm the lander was on its way after separating from the Mars Express, which was launched June 2 from the former Soviet space port in Kazakhstan. "It was a relief, absolutely, we have all been waiting for this moment for a long time and when our screens lit up, we were ecstatic," Mars Express mission official Zeina Mounzer said. The mission is the first to try to determine if there is life on Mars since the United States sent the Viking I landing craft to Mars' surface in 1976. "It's not looking for little green men, but it is looking for matter that might provide evidence of life. It is looking for clues," Southwood had said earlier. Two NASA rovers are right behind, scheduled to land on Mars in early January. The \$400 million, camera- and instrument-laden rovers are designed to analyze Martian rocks and soil for additional clues that could reveal whether the planet was ever a warmer, wetter place capable of sustaining life. Friday's maneuver was the first in a series of critical navigational moves on which the success of the Mars Express mission depends. The spacecraft gently pushes the probe away, setting it spinning to maintain stability as it heads toward Mars. The lander is expected to reach the surface early on December 25. About the same time, engineers plan to fire the main engine on the Mars Express craft for about 30 minutes, putting it into a 250-mile-high orbit. As it circles Mars, the spacecraft will use radar to penetrate the surface looking for layers of water or ice. "This is the first time we will be looking under the surface of Mars using radar from Mars Express," Southwood said. Of 34 unmanned U.S., Soviet and Russian missions to Mars since 1960, two-thirds ended in failure. In 1976, twin U.S. Viking landers searched for life but sent back inconclusive results. Mars is currently orbiting closer to Earth, which has prompted attempts to send probes to the red planet. Earlier this month, Japan was forced to abandon its troubled mission to Mars, which was to determine whether the planet has a magnetic field, when officials failed in their attempts to position their Nozomi probe on course to orbit the planet. The Mars Express, which cost about \$345 million, is an attempt to demonstrate that Europe can have an effective - and relatively inexpensive - space program. Since its June launch atop a Russian Soyuz-Fregat rocket from the Baikonur cosmodrome in Kazakhstan, the Mars Express has weathered solar eruptions that bombarded it with high-energy particles, temporarily disrupting its computers, as well as an unexpected drop in electrical power. The 143-pound Beagle 2 - named for the ship that carried naturalist Charles Darwin on his voyage of discovery in the 1830s - will use a robotic arm to gather and sample rocks for evidence of organic matter and water, while Mars Express orbits overhead. During its working life - planned for one Martian year, or 687 Earth days - engineers hope Mars Express will send back detailed overhead pictures of the planet's surface. Scientists think Mars, which still has frozen water in its ice caps, might have once had liquid water and appropriate conditions for life but lost it billions of years ago. It is thought water may also still exist as underground ice. U.S. officials are discussing a new course of space exploration, and debate has focused on whether the United States should set its sights on returning to the moon or landing on Mars.

83010



83011

83012

FLORIDA TODAY : 23 DECEMBER 2003.

MARS EXPRESS CONTROLLERS REHEARSE FOR EMERGENCIES.

FRANKFURT - A European spacecraft streaked toward Mars on Monday - right on schedule - but mission controllers still rehearsed what could go wrong during the voyage to determine whether life ever existed on the red planet. Mars Express' mission would be jeopardized by any problems with its main engine, which must fire on Christmas Eve (early Christmas in Europe) to propel the spacecraft on its path around Mars. Once in orbit, the craft is supposed to send back 3-D overhead pictures of the planet surface and scan for underground water with a powerful radar. The craft also will relay data from the Beagle 2 probe, which is due to land on the planet hours before the orbital launch. Mars Express was launched June 2 atop a Russian Soyuz-Fregat rocket from the Baikonur cosmodrome in Kazakhstan. With the orbiter successfully on course, engineers are preparing the final commands for activation early Dec. 25 and simulating possible glitches. One of those could involve Mars Express' engine not firing. Controllers have practiced using a variety of different commands to start four thrusters on the craft. "This has been rehearsed over the last months, twice a week. They know they can do it," said Jocelyne Landeau, a spokeswoman for the European Space Agency at mission control in the western German city of Darmstadt. If the thrusters fail, "then we're in trouble," she said. Controllers also conduct daily drills for such emergencies as satellite link breakdowns and computer failures at mission control. The Beagle 2 probe separated from the Mars Express craft Friday, bound for Mars. After parachuting through the atmosphere, the 143-pound probe will use inflatable gas bags to bounce to a soft landing, flip open and begin transmitting a preprogrammed "blip-blip-blip" signal telling controllers it has safely touched down. That transmission has several chances of being picked up. The first will be when NASA's Mars Odyssey spacecraft passes overhead early Christmas Day. "We are working very closely with our colleagues from NASA," Landeau said. "They'll get the data back to Earth, then pass it on to us and we will be able to tell if the landing has taken place."

81085

23020

Europa speurt naar leven op Mars

Spannende kerstdagen dit jaar voor het Europese ruimtevaartbureau ESA. In de kerstnacht maakt de ruimtesonde Beagle 2 een stuiterlanding op Mars. Hoofddoel is het zoeken naar sporen van leven op de rode planeet, mits stofstormen geen roet in het eten gooien.

Geen 'stille nacht, heilige nacht' onder de kerstboom, maar nagelbijten tot vroeg in de ochtend. Zo ziet kerstnacht 2003 eruit in het ESA-vluchtleidingscentrum in Darmstadt. Na een reis van een halfjaar arriveert de Mars Express morgenochtend op zijn bestemming.

De spanning rond Europa's eerste ruimtemissie naar een andere planeet stijgt ten top, want van alle eerdere Marsmissies liep tweederde op een mislukking uit. Ook nu liggen er tal van gevaren op de loer, zoals martiaanse stofstormen die afgelopen weken de kop hebben opgestoken.

Vorige week vrijdag ontdeed de Mars Express zich van zijn 'passagier' de Beagle 2, die nu in vrije val op Mars afstormt. Met 200.000 kilometer per seconde duikt de Beagle 2 kerstnacht in de atmosfeer van de planeet. Hitteschild en parachutes zorgen voor de nodige afremming, totdat zich op een hoogte van 200 meter boven het oppervlak drie airbags ontplooiën. Die moeten de val breken, zodat het toestel na een aantal keren stuiteren definitief tot rust komt. Naar verwachting pikt de vluchtleiding in Darmstadt eerderstend het eerste radiosignaal van de lander op. Maar dan mogen stofstormen de sonde niet

uit zijn koers blazen of beschadigen. Tegelijk met de landing van de Beagle 2 wordt het 'moederschip' de Mars Express in een baan rond de rode planeet gemanoëuvreed.

Hadden tot dusver Amerikanen het voortouw in de exploratie van het zonnestelsel, met de Mars Express reikt

nu ook Europa naar de planeet. De ambities zijn hoog. want ESA wil de draad oppakken waar Amerika hem in 1976 heeft laten liggen. Toen landden Viking 1 en 2 op de rode planeet en zochten tevergeefs naar tekenen van biologische activiteit. Ondanks dat negatieve resultaat gaven de wetenschappers de hoop niet op om leven op Mars aan te treffen. Ooit stroomde er namelijk water



Computeranimatie van de Beagle 2, die na de landing begint met het speuren naar eventuele levensvormen op de beroemde rode planeet. foto NASA

over de planeet, heerste er een milder klimaat en was ook de atmosfeer dichterbij dan nu. Tal van uitgedroogde stroomgebieden op het Marsoppervlak getuigen daarvan. Niemand weet waarom het klimaat later verslechterde, maar misschien is in het warme en vochtige verleden van Mars leven ontstaan dat zich nog steeds op beschutte plekken kan handhaven. Om deze en andere vragen te beant-

de energievoorziening ontvouwt zich een beweegbare robotarm voorzien van meetinstrumenten zoals camera's, een weerstation en spectrometers om de samenstelling van het oppervlaktegesteente te bepalen.

Verder beschikt de Beagle 2 over een mechanische 'mof' die zich tot een diepte van anderhalve meter in de bodem graaft om monsters te nemen. De lander, berekend op een levensduur van zes maanden, kijkt vooral naar koolstof in de Marsbodem. Koolstof komt in verschillende soorten voor, zoals het normale koolstof-12 en het iets zwaardere koolstof-13. Levende organismen maken bij voorkeur gebruik van koolstof-12, zodat een verhoogd gehalte van deze koolstof-isotoop wijst op biologische activiteit. Behalve nog levende organismen kan deze methode ook fossiele levensvormen detecteren die al lang zijn uitgestorven.

Snelle resultaten hoeven we zeker niet te verwachten. Eerst worden de Beagle-metingen zorgvuldig geanalyseerd, en dat neemt op zijn minst weken in beslag. Volgende maand krijgt de rode planeet opnieuw bezoek. Dan van twee Amerikaanse karretjes, Spirit en Opportunity gedoopt, die al rijdend over Mars op zoek gaan naar sporen van water. Maar het speuren naar leven laten de Amerikanen deze keer over aan Europa.

woorden, zoekt de Mars Express vier jaar lang vanuit zijn baan rond de rode planeet ondermeer naar ijs in de bodem en andere sporen van water. De meeste ogen zijn echter gericht op de Beagle 2, genoemd naar het schip waarmee

Charles Darwin honderd-zeventig jaar geleden de wereld rondzeilde. Leidde de reis van de Beagle 1 uiteindelijk tot de evolutietheorie, met de Beagle 2 honen de wetenschappers voor het eerst buitenaards leven op het spoor te komen. De Beagle 2 komt neer in Isidis Planitia, een laaggelegen bekken dat vermoedelijk ooit gevuld was met water. De schotelvormige sonde klappt na de landing als een ouderwets zakhorloge open. Behalve vijf zonnepanelen voor

HOUSTON CHRONICLE - 23 DECEMBER 2003

LONG ODDS, HIGH HOPES FOR BRITISH MARS PROBE.

The long odds facing Great Britain's Mars-bound Beagle 2 spacecraft have not dimmed Everett Gibson's enthusiasm one bit. One of two Americans on Beagle 2's multinational science team, the 63-year-old planetary geochemist from NASA's Johnson Space Center is one of the world's foremost experts on lunar soil and other extraterrestrial materials. In 1996, Gibson was on a small team of scientists led by colleague David McKay that offered controversial evidence for past Martian life. The team claimed discovery of fossilized bacteria and signs of biogenic waste lodged in the crevices of an ancient meteorite of Martian origin. The claim has since been largely rejected by other experts, who argue the NASA-led team cannot eliminate the Earth as the source of bacteria in the fallen meteorite or that natural processes unrelated to biological activity were responsible for the traces of waste. "Maybe we were right. Maybe we were wrong. But I think we were right," said Gibson. "Beagle may give us a signature that may prove it even better." Beagle 2 is the first of three U.S. and European robotic spacecraft that will soon attempt to land on Mars. Part of the European Space Agency's Mars Express orbital mission, the \$68 million, 73-pound Beagle 2 lander was developed to search for signs of present or past life in the planet's soil and air, findings that would help to bolster the claims made by Gibson and his teammates. The British spacecraft was jettisoned from its Mars Express mothership on Friday and will attempt a risky descent to the Martian surface late Wednesday. The historical odds of success are low. Only three of the dozen spacecraft developed by the United States and the former Soviet Union or Russia to land on Mars have successfully reached their destination and carried out scientific tasks. Beagle 2 is Britain's first attempt. The tiny lander carries no propulsion system of its own and only a modest electrical power supply, so before it could be released the Mars Express had to be lined up on a collision course with the planet for last week's release. Mars Express will alter its trajectory Wednesday to avoid an impact and steer into orbit around Mars. Once on its own, Beagle 2 has just six days of battery power. If the lander is to survive, it must descend to the Martian surface during that period and deploy four disk-shaped solar panels to convert sunlight into much-needed electricity. "I know the risks, and I'm very optimistic. You have to be," said Gibson. "You have a goal that, if it succeeds, has a wonderful payoff. That payoff gives you answers to that question: Are we alone in the cosmos? There is no greater question for a scientist to help answer." Gibson and his associates knocked on that door seven years ago. The potato-size Martian meteorite he helped to examine was recovered from the Allan Hills region of the Antarctic in 1984 by the National Science Foundation. Eventually the 4.2-pound rock made its way to the Johnson Space Center for preservation and study. Just one of 29 known fragments of Mars found on the Earth, the meteorite was carbon-dated as being 4.5 billion years old. From their two years of analysis, NASA experts determined the rock's origins were from the Martian subsurface. Somewhere between 3.6 billion and 4 billion years ago, the rock was shattered by a powerful blow from a meteor impact that cracked the structure, allowing water to flow through the crevices and leave the evidence of suspected microbial activity. The Red Planet was struck again with an even more powerful blow by an asteroid or comet 16 million years ago, the experts believe. The force this time was enough to blast the fragment off of Mars and into an orbit around the sun that crossed the Earth's path. The meteorite fell onto the South Pole 13,000 years ago. The chemical composition of air trapped in tiny globules in the meteorite matched those in samples of the Martian atmosphere analyzed by NASA's Viking 1 and 2 missions that landed on Mars in 1976. Only one spacecraft has successfully landed on the Martian terrain since: NASA's 1997 Pathfinder mission. Beagle 2 could be next, followed by NASA's twin \$410 million robotic geologists, Spirit and Opportunity, on Jan. 3 and 24. Relying on parachutes and airbags to slow its descent and cushion its landing, Beagle 2 will attempt to touch down at Isidis Planitia, a 900-mile-wide depression near the Martian equator that may once have served as a reservoir for water. If so, Isidis Planitia may host bacterial activity or its remnants within reach of the stationary spacecraft's robot arm. Equipped with a small laboratory, the probe will snatch, drill or dig for a dozen small samples of Martian soil or rock with the mechanical limb. The arm is equipped to reach out more than 6 feet and drill down more than 3 feet. Once tucked in a small oven within the lander and heated in oxygen, the samples will release a byproduct, carbon dioxide gas. An analyzing instrument will examine the gas samples for two chemically stable forms of carbon, the isotope Carbon-12 with a dozen neutrons in its nucleus and Carbon-13 with 13 neutrons. Biological processes on the Earth prefer Carbon-12, and the presence of the lighter isotope on Mars would imply the existence of living or dead microbes. Similar assessments are planned to look for forms of hydrogen, nitrogen and oxygen favored by biological activities on the Earth. The lander's gas analyzer will also attempt a potentially more exciting discovery by looking for the presence of methane. Another carbon-based waste product, it could be a byproduct of current biological activity. "If we detect traces of methane, it will be a major discovery," said Gibson. With its very thin atmosphere, Mars has no way of blocking high levels of the sun's ultraviolet radiation from reaching the planet's surface, where it would wipe out most methane gas within a 300-year period. If Mars is now a dead planet, experts should expect negligible concentrations of methane. If the gas is present, the planet may be biologically active, though researchers will have to rule out the possibility the methane is linked to unseen volcanic processes. Beagle 2 is the brainchild of Colin Pillinger, a planetary scientist at England's Open University and a longtime colleague of Gibson. Pillinger is credited with overcoming enormous obstacles to develop the mission, not the least of which was finding novel means to finance it in a country that has traditionally shunned space exploration. "The whole idea was conceived by Colin, and with his tenacity he pulled it off, getting the funding and getting a ride to Mars," said Gibson. "It's a wonderful story in modern-day science." But even with a successful landing, potential new obstacles await. NASA's Viking 1 and 2 missions of more than a quarter century ago also attempted life-detection experiments on Mars. Unfortunately, the otherwise highly successful Viking missions failed on that score. Pillinger's campaign to convince the European Space Agency to include Beagle 2 in its plans for a Mars orbiting probe called Mars Express began a year after the 1996 Mars meteorite announcement. Eventually, the English researcher earned a ride to Mars for his spacecraft -- but not the financing. Undaunted, he searched for and received financial support from unusual segments of Britain's private sector. The McLaren Formula 1 auto racing team furnished the high-strength carbon composite aeroshell that will protect the spacecraft as it descends into the Martian atmosphere. If it lands successfully, the probe will announce its arrival with a series of nine musical notes composed by Blur, a British rock band that became a sponsor. NASA chipped in as well. The British lander was tested earlier this year in a vacuum chamber at NASA's Johnson Space Center, where some of the landing conditions were simulated. NASA's Mars Odyssey spacecraft, an orbital sentry that has been circling Mars since late 2001, is poised to relay news of Beagle's landing back to Europe through the American global deep space communications network. Still, the \$68 million investment was low by traditional aerospace standards. The spacecraft does not have the normal backup hardware. The solar power system is so modest that only one scientific instrument can be operated at a time. Nonetheless, Gibson plans a long stay at Beagle 2's European headquarters, where he and Pillinger will serve as the mission's principal investigators. "We are going to look under a rock, deep underground. I want to see the difference between the outside and the inside of a rock," said Gibson. "I hope we get some data that supports the idea Mars is not a dead planet. I believe we will succeed."

183014

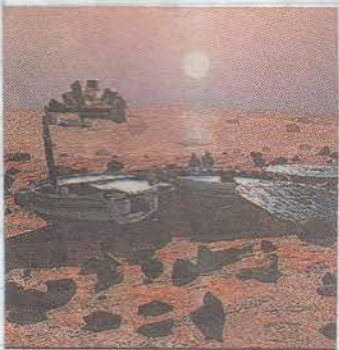
-51-85
2005

183013

18088

23022

83058



Europa zoekt leven op Mars

83015

Esa wünscht sich rote Weihnacht

Count down für Mars-Mission

Alles andere als besinnlich wird es Heiligabend im Europäischen Raumflugkontrollzentrum in Darmstadt zu gehen. Während anderenorts Geschenke ausgepackt werden, blicken Techniker und Forscher dort gebannt in den Nachthimmel. 150 Millionen Kilometer entfernt von ihnen befindet sich die europäische Sonde „Mars Express“ kurz vor dem Ziel. In der Nacht zum ersten Weihnachtsfeiertag soll ihr Landegerät „Beagle 2“ auf dem Mars aufsetzen. Damit erreicht eine der ehrgeizigsten Raumfahrtmissionen der vergangenen Jahrzehnte ihren Höhepunkt.

Den Plänen der Europäischen Weltraumagentur Esa zufolge wird „Beagle 2“ um 3.45 Uhr MEZ nahe beim Mars-Äquator niedergehen. Um den Aufprall abzufedern, werden kurz zuvor drei riesige Airbags mit

83016

Gas aufgepumpt, die den Lander komplett umschließen. Wie ein Gummiball wird „Beagle 2“ dann bis zum Stillstand auf der Oberfläche auf- und niederhüpfen. Nach dem Entleeren der Airbags erwarten „Beagle“ frostige Temperaturen: Der Durchschnittswert auf dem Mars liegt bei minus 60 Grad. Der Klima-Schock fällt noch heftiger aus, weil zuvor beim Eintritt in die Marsatmosphäre durch die Reibung Temperaturen von bis zu 2000 Grad herrschen. Übersteht „Beagle“ die Schockfrostonung, klappt er nach der Landung wie eine Taschenuhr seine Solarpaddel zur Energiegewinnung aus. Dann könnte auf der Erde im Laufe des Donnerstagsvormittags das erste Signal eintreffen, dass alles geklappt hat.

Als erste Botschaft haben die Esa-Techniker ein Lied programmiert, dass die britische Pop-Gruppe „Blur“ eigens für die Mission komponiert hat. Auf die kosmischen Klänge wird eine riesige Antenne warten, die die Esa in Westaustralien erst vor kurzem errichtet hat. Ob die Mission gelingt, werden weltweit Millionen von Menschen im Internet verfolgen.

83017

Rheinische Post: 24-12-2003

SPACE.COM : 24 DECEMBER 2003

MARS EXPRESS, BEAGLE 2 ON FINAL FOR RED PLANET ARRIVAL

83018

PARIS - Ground teams controlling Europe's Mars Express orbiter today braced the satellite for its insertion into Mars orbit, heating its fuel tanks and shutting down its on-board computer to prepare for tonight's all-important maneuver into an equatorial orbit around the Red Planet. "We are perfectly on schedule and all the spacecraft's systems are performing well," flight operations director Michael McKay said in a telephone interview from the European Space Agency's Mars Express control center in Darmstadt, Germany. "You could cut the tension with a knife here now as we prepare for a few interesting hours," McKay said. The probe is less than 12,400 miles (200,000 kilometers) from Mars and is expected to be just 257 miles (414 kilometers) above the planet's surface when its main engines are fired to avoid collision and place the spacecraft into an elliptical orbit. The 34-minute engine firing is scheduled to begin at 9:47 p.m. EST (0247 GMT Thursday). Using NASA's Deep Space Network of Earth station antennas, the Mars Express team should know within minutes whether the orbital insertion has been successful, McKay said. The Beagle-2 lander, which separated from Mars Express on Dec. 19, has been hurtling toward Mars just ahead of Mars Express and is scheduled to enter the Mars atmosphere just before 9 p.m. EST (0200 GMT Thursday). The first possible signal of whether the lander has survived the journey will be delivered by a signal captured by NASA's Mars Odyssey satellite, already in orbit over Mars. Odyssey will have between 10 and 20 minutes to receive a Beagle-2 signal before passing out of view. Confirmation of Beagle-2's health should be available to ground teams by 1:30 a.m. EST (0630 GMT) Thursday if Odyssey picks up anything. If no signal is received, project managers will be in the dark on the lander's status throughout the frigid Martian night. In what Beagle-2 managers have said will be the make-or-break moment of the mission, the lander's signal the next morning could be picked up by Britain's Jodrell Bank Observatory shortly before 6 p.m. EST (2300 GMT) Thursday. Mars Express and Beagle-2 are both designed to look for evidence of present or past life on Mars.

83058

23023

Riskante fase voor Marslanding

83020

Door onze redactie wetenschap
 ROTTERDAM, 24 DEC. Morgenochtend vroeg om 3.54 uur Nederlandse tijd zal de Britse Marslander 'Beagle-2' neerdalen op Mars. Rond 4.00 uur wordt ook begonnen de ESA-satelliet 'Mars Express' in zijn definitieve elliptische baan om Mars te brengen. Volgens de teams die de 'Beagle-2' en de 'Mars Express' begeleiden werken alle systemen op dit moment goed en liggen beide toestellen op de juiste koers.

Pas tegen 8 uur 's ochtends (Nederlandse tijd) kan voor het eerst zekerheid komen over het succes van de landing van de Beagle-2. De Beagle-2 kan om 6.30 uur het bericht van veilige aankomst doorgeven aan de Amerikaanse 'Mars Odyssey' die op dat moment overvliegt. Anderhalf uur later kan de Odyssey zijn signalen doorsturen naar de aarde.

De landing is zonder twijfel het meest riskante deel van de reis van de Beagle-2. Essentieel is dat de hittedekken goed werken en dat de parachute precies op tijd (drie minuten en 45 seconden voor

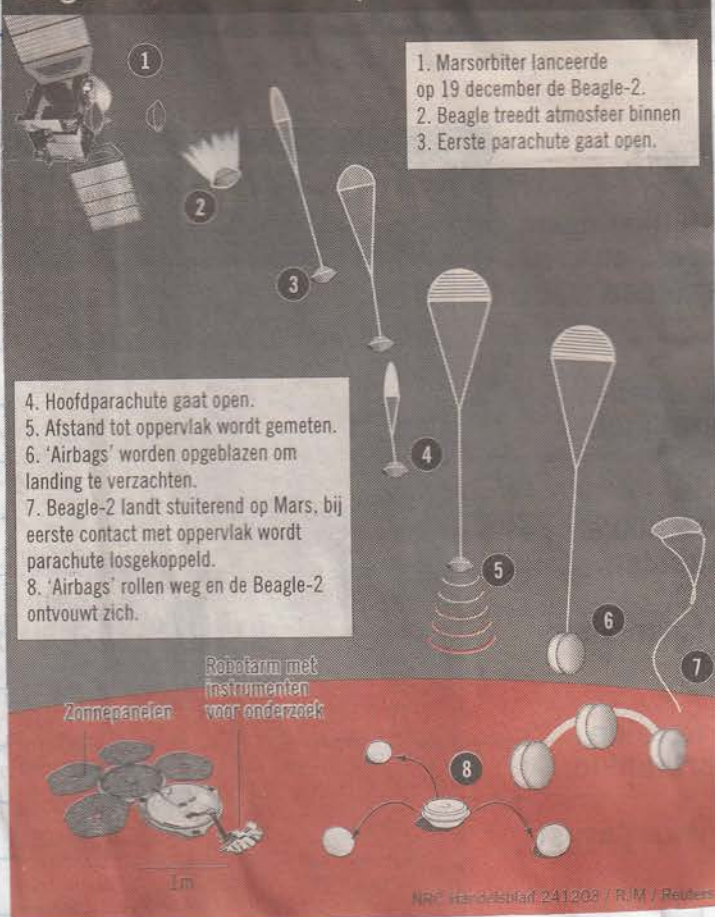
'touch down', op 2.600 meter hoogte) opengaat (De Beagle-2 heeft geen remraketten). Vijftien seconden voor de landing moeten drie reusachtige luchtkussens (airbags) zich vullen om de klap van de landing op te vangen. Direct daarna wordt de parachute afgestoten. Waarschijnlijk zal de Beagle-2 ongeveer twaalf maal stuiteren voor hij tot rust komt. Zodra de luchtkussens zijn afgestoten klap de lander open en kunnen de zonnepanelen de bijna leeggelopen accu's weer gaan bijladen.

De Beagle-2 zal speuren naar tekenen van leven op Mars en geologisch en meteorologisch onderzoek verrichten. Het moederstation 'Mars Express' van de Europese ruimtevaartorganisatie ESA doet dat vanuit de ruimte.

De Amerikaanse ruimtevaartorganisatie NASA wil op 4 en 24 januari twee rijdende onderzoekstoestellen op Mars zetten.

Laatste nieuws over 'Beagle-2' resp. 'Mars Express' op internet via www.beagle2.com en mars.esa.int. Nederlandse tijd is GMT plus 1 uur.

Beagle-2 landt vannacht op Mars



83019

NRC Handelsblad: 24-12-2003

On course for Mars

The spotlight will be on Mars more than ever before this Christmas when a small UK designed and built probe reaches the Red Planet after travelling more than 250 million miles.

On 19 December Beagle 2 will be released from the Mars Express spacecraft – its home since leaving the Earth in June 2003 – to begin the last leg of its journey from the Martian atmosphere to the surface of the planet.

After five days of hurtling towards Mars at speeds of around 14,000 mph, Beagle 2 will reach its final destination around Christmas day, where teams of scientists and engineers at the UK's Jodrell Bank Observatory will anxiously await their Christmas wish – a signal from Beagle 2 on the surface of Mars.

Europe's Mars Express and Beagle 2 are not alone in their efforts to search for signs of life – past or present – on Mars. An international flotilla of spacecraft destined for the Red Planet are also making the most of Mars' closest brush with Earth in almost 60,000 years, with two US rovers and a Japanese probe set to explore Mars in early 2004.

NASA's Mars Exploration Rovers, Spirit (MER-A) and Opportunity (MER-B), were launched in June and July 2003, and are on course to arrive at the Red Planet in January 2004, embarking on a 90-day mission to search for signs of water on Mars.

Japan's Nozomi was launched in July 1998 for a mission that was scheduled to arrive at Mars the following year but due to a series of problems will now only arrive in orbit in early 2004.

These latest international missions join Mars Global Surveyor and Mars Odyssey. Silently circling the Red Planet, these NASA orbiters have provided a wealth of data which has been vital in the development and planning of the new 2004 missions.

This issue of *Spaceflight* contains extended coverage of these momentous events in planetary exploration. Starting on page 22, *Spaceflight* looks at the pioneering science and sophisticated technology behind Europe's first planetary mission.

83021

85085

23024

SPACE.COM : 25 DECEMBER 2003.

BEAGLE 2 REMAINS SILENT AS MARS EXPRESS CIRCLES RED PLANET.

PARIS - A super-sensitive British radio telescope failed to pick up a signal from the Beagle-2 Mars lander tonight, deepening fears that the robot designed to look for life may have surrendered its own before setting to work. Ground teams will make another attempt Friday at picking up Beagle-2 signals at 1:15 p.m. EST (1815 GMT) when NASA's Odyssey satellite orbiting Mars overflies what is thought to be Beagle-2's landing zone. A first pass by Odyssey early Thursday morning also came up with no Beagle-2 signals. Beagle-2 managers had brushed off the first Odyssey disappointment as relatively inconsequential. The satellite, they said, may simply have missed Beagle-2 during its 20-minute overflight, or the lander's transmit antenna may have been pointed away from Odyssey. But tonight's failure of the 76-meter-diameter Lovell Telescope at the University of Manchester's Jodrell Bank Observatory to capture a Beagle-2 signal is another matter. "I wasn't too worried about the missed link with Odyssey, but it starts getting serious if Jodrell Bank cannot get a signal either," said one mission manager. "But you never want to give up hope." Beagle-2 is thought to have entered Mars' atmosphere shortly before 10 p.m. EST Wednesday (0300 GMT Thursday). It was designed to deploy a series of parachutes, jettison its heat shield and then inflate several air bags before bouncing to a stop on an area near Mars' equator. The air bags would then be cut off, freeing Beagle-2 to flip itself open, pocket-watch style, and send a signal to Odyssey. Flight managers of Europe's Mars Express satellite, which successfully entered Mars orbit today after releasing Beagle-2 on Dec. 19, said they had narrowed Beagle-2's likely landing area to an ellipse just 30 kilometers wide and 5 kilometers long in an area called Isidis Planitia. Beagle-2 would have only a few hours to deploy its solar arrays and pick up badly needed power for its batteries before settling in for a frigid Martian night. Sunrise on Mars today was at 8 p.m. GMT. Beagle-2 program designer Colin Pillinger, of Britain's Open University, had repeatedly said the signal from Beagle-2 that it had survived the night with its batteries functioning would be the first proof that the lander would embark on its mission. Jodrell Bank's Lovell Telescope had been specially fitted with filters to reduce the noise from terrestrial sources, the better to concentrate on a signal from Beagle-2's minuscule 5-watt transmitter, a simple beep-beep sound that has been described as similar to Morse code. "We're just basically waiting on a phone call," Beagle-2 project spokesman Peter Barratt said in a telephone interview, referring to word from the Lovell Telescope's operators that they had picked up Beagle-2 transmissions.

830 22
830 23

SPACE.COM : 25 DECEMBER 2003.

MARS EXPRESS ARRIVES IN ORBIT, NO WORD YET FROM BEAGLE 2.

DARMSTADT - Europe's Mars Express went into orbit around the Red Planet early Thursday, the mission's flight director said, and controllers' first attempt to find out if the craft's companion had landed safely on the Red Planet was unsuccessful. Officials had hoped that NASA's Mars Odyssey orbiter would pick up the signal from the Beagle 2 lander, which had earlier been set on its descent into the Mars atmosphere. "We have had the information from Odyssey and it does not contain any data from Beagle," said Peter Barratt, a spokesman for the Beagle 2 mission in London. However, he added, "we are quite confident" that the landing will still be confirmed. Controllers had been encouraged earlier because they received a signal from a small antenna aboard the lander's companion craft, the Mars Express as it emerged from behind Mars on schedule at 5:11 a.m. on Christmas Day, orbiting the planet. Flight director Michael McKay cautioned that the signal did not reveal if the spacecraft was working. Mars Express reappeared following a maneuver in which it fired its engine to slow it enough for Mars' gravity to pull it into orbit. The craft will relay data from the Beagle 2 lander if it starts transmitting from the planet's surface. The signal "was the first good indication that the burn went well," McKay said. Confirmation that the maneuver was successful was expected in another few hours as controllers rotated the main antenna on Mars Express, which was reversed for the orbit maneuver, to face Earth. Mars Express turned Beagle loose six days ago. Working in tandem, the lander and orbiter are meant to look for signs of past or present life on Mars. The lander was scheduled to enter the upper Martian atmosphere at 3:45 a.m. (9:45 p.m. Wednesday EST). Now that the Odyssey failed to make contact, Britain's Jodrell Bank Observatory will try to pick up the lander's call signal at 5:45 p.m. EST on Christmas Day. Parachutes and gas bags were to cushion the Beagle's impact after its fiery 7 1/2-minute descent through the Martian atmosphere. The 143-pound lander, shaped like an oversized wok, must open its solar panels and charge its batteries using the sun's energy before it can communicate -- sending a call signal composed by British band Blur. Since separation, the British-built Beagle has neither received commands nor sent back data to mission control, a cluster of buildings surrounded by snow-dusted woods at the edge of Darmstadt in western Germany, Mars Express won't be able to make contact with Beagle until Jan. 3 because its initial orbit is too high and will have to be adjusted. Beagle, named for the ship that carried naturalist Charles Darwin on his voyage of discovery in the 1830s, is equipped with a robotic arm to sample surface rock and soil. Mars Express is expected to orbit overhead for at least a Martian year, or 687 Earth days, probing as deep as 2.5 miles below the surface with a powerful radar to look for underground water. It will also map the surface with a high-resolution stereo camera. Mars' surface is dry and cold, with ice caps of frozen carbon dioxide, or dry ice. Scientists believe that billions of years ago the planet may have been warmer and had enough liquid surface water to support life, which might have survived in cavities underground. The planet's surface has features that some think could be dry riverbeds and ancient coastlines. But getting a working spacecraft to Mars has proven frustratingly difficult. Of 34 unmanned American, Soviet and Russian missions to Mars since 1960, two-thirds have ended in failure. The United States successfully landed two Viking craft in 1976 and Mars Pathfinder in 1997, but two years later lost the Mars Polar Lander during descent. Japan this month abandoned a Mars mission after failing to position the Nozomi probe on planetary orbit. NASA's Spirit, one of two identical robot explorers, is expected to land Jan. 3. Its sibling, Opportunity, is scheduled to settle on the opposite side of the planet Jan. 24. If all goes well, Beagle is expected to transmit its first pictures from Mars as early as Dec. 29-Dec. 31. The first radar pictures from Mars Express are expected in the spring.

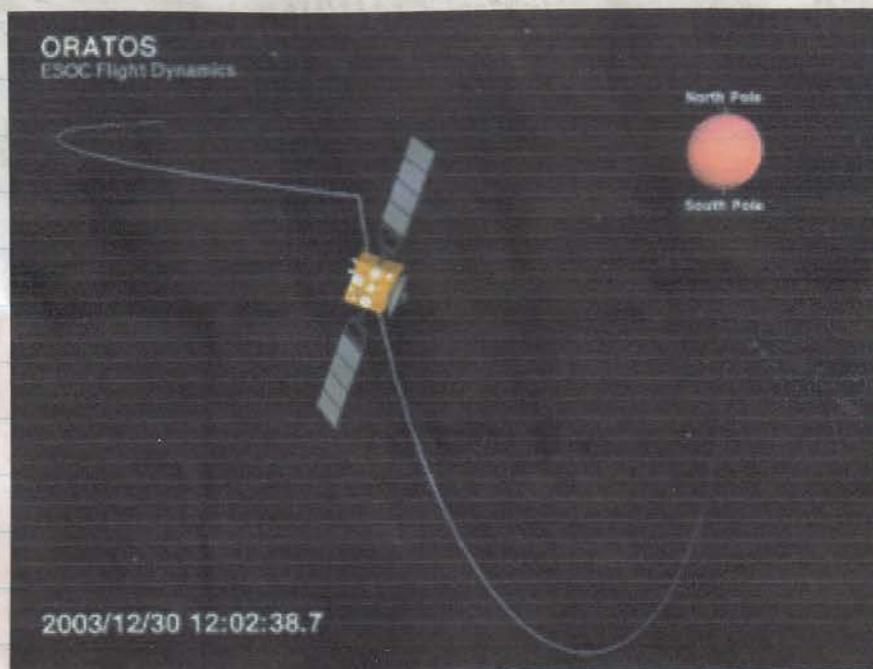
05085

230 25

SPANNING ROND LANDING MARSLANDER.

DARMSTADT - Technici van de Europese ruimtevaartorganisatie ESA hebben donderdagochtend tevergeefs gewacht op een signaal van de Marslander Beagle 2, die rond 04.00 uur op de rode planeet zou landen. Het is de eerste Europese solomissie naar Mars. Een eerste poging van de Beagle om omstreeks 7.30 uur (Nederlandse tijd) contact te maken is mislukt, liet de Britse projectleider Colin Pillinger donderdagmorgen weten. Pillinger toonde zich enigszins teleurgesteld, maar zei "dat het niet het eind van de wereld is". De Britse radiotelescoop Jodrell Bank kan mogelijk later op de dag (om 23.00 uur Nederlandse tijd) een signaal van de Marslander opvangen. Moederschip Mars Express koppelde de Beagle 2 vrijdag 19 december met succes los, maar het laatste stuk van de reis van de lander is het meest riskante. Tot op heden is ongeveer tweederde van de missies naar Mars mislukt. Donderdagochtend bleek wel dat de Mars Express zelf in een goede baan rond de planeet is gebracht, een essentieel onderdeel van de operatie. Dit maakte projectleider Michael McKay bekend. In Nederland houdt de Mars Society in de kerstnacht open huis in Rotterdam. "We hebben computers ingeplugd en volgen via een online verbinding wat er in Darmstadt gebeurt, maar tot nu toe is het een beetje magertjes", aldus voorzitter Artemis Westenberg van de organisatie die zich inzet voor onderzoek naar de rode planeet. De webcam die gericht staat op de vluchtleiding in Darmstadt geeft volgens haar maar af en toe beelden door. Bij Westenberg zaten 's nachts ongeveer tien belangstellenden. "Sommigen zijn hier al jaren mee bezig. Die willen het nieuws niet missen, ook al valt er nu nog niet al te veel te beleven."

83024



83025

CNN : 26 DECEMBER 2003.

BEAGLE QUIET, BUT MARS ORBITER A SUCCESS.

DARMSTADT - Even though a Mars probe has failed to signal it has landed, scientists at the European Space Agency said on Friday the primary mission goal to put a satellite in orbit around Mars was achieved. Officials at ESA headquarters in Darmstadt remained hopeful that the British probe Beagle 2 that was scheduled to land on Mars on Christmas Day will still send a signal to indicate it has arrived. But they were stressing that even if Beagle 2 is not found, the Mars Express mothership that brought the 34 kg (75 pound) probe to Mars had successfully been guided on to an orbit around the red planet, where it will study Mars for two years. The 300 million euro (\$375 million) mission has in any event been groundbreaking -- the first fully European mission to any planet and hailed as a triumph for British ingenuity and European space exploration. "The landing probe on Mars is in essence the icing on the cake," said Gerhard Schwehm, an ESA planetary mission official in Darmstadt. "For the scientists here the orbiter is the most important part of the mission." After a six-month, 100 million-km (63 million-mile) journey from Earth to look for signs of life on the planet, the Mars Express will circle the planet on an orbit between 250 km and 12,000 km. It will study the surface of the planet, its geology, its weather, and also analyse the atmosphere and its gravity. The Mars Express will use special radar that will enable it to scan up to five metres below the surface -- and explore areas beneath the Mars surface where traces of water may be found. "Mars Express is okay and in a good orbit," said ESA director of technical support Gaëlle Winters. "Mars Express has been a great success as it is in a stable and very good orbit. We hope the mission is going to be an even greater success yet," said Germany's Research and Technology Minister Edelgard Bulmahn on Thursday. The failure to pick up a signal from Beagle 2 has raised fears that the probe, no bigger than an open umbrella, had met the same fate as so many craft before it and ended its life as scrap metal strewn across the Martian landscape. Mission scientists say Beagle 2 might have been blown off course by dust clouds and storms which sweep the surface. Alternatively, its antennae might be pointing in the wrong direction for the rocket to pick up its signal. The worst case scenario is that it disintegrated on landing or burned up as it hurtled towards the planet's surface. Beagle 2's British scientists had gathered in London in the early hours of the morning, hoping to hear the probe broadcasting its signature tune across space. But it remained silent and scientists were forced to wait 16 hours for a second chance to detect the probe -- this time using the giant Jodrell Bank telescope in central England. That bid also failed and the chances of finding the probe in one piece appear to be fading. Scientists will make their next bid to trace it at 1815 GMT on Friday, using a mission rocket orbiting the planet. They can try again at regular intervals over the next few weeks but with each failed attempt, hopes for the mission grow slimmer. In Darmstadt, scientists were still optimistic. The probe is packed with state-of-the-art scientific instruments designed to scrape, bore and bake dust and rock samples to look for signs of life for six months. But Mars is a formidable foe. Of the previous 11 probes dropped on to the planet's surface, only three have survived.

83026

23026

SPACE.COM : 26 DECEMBER 2003.

MARS EXPRESS DOING FINE AS HUNT FOR BEAGLE 2 CONTINUES.

PARIS - NASA's Mars Odyssey satellite today made a second attempt at picking up signs of life from Europe's Beagle-2 Mars lander, again without success. But Beagle-2 program managers vow they are not giving up hope that the lander, which presumably arrived on Mars' surface early Christmas Day, has survived and will ultimately send word to one of the several antennas seeking confirmation that it is functioning. "It's like sending somebody a love letter, and you know they got it and you're waiting for a response," said Professor Colin Pillinger, the day after the tiny craft was supposed to have landed on the surface of Mars, opened its solar panels and called home. Pillinger, chief scientist for the Beagle, told a news conference the team was just beginning the search for the craft. "The mood here is still optimistic," Beagle-2 project team spokesman Peter Barratt said in a telephone interview. "And remember that the Mars Express satellite will begin looking for Beagle-2 soon and that satellite was specially designed to pick up Beagle-2 signals." The European Space Agency's Mars Express spacecraft successfully entered Mars orbit on Christmas Day. Starting Jan. 4, it will begin searching for Beagle-2. Until then, NASA's Odyssey craft will continue to make daily passes over the area where Beagle-2 is presumed to have landed in search of the 33-kilogram robot, which is designed to search for evidence of past or present life on Mars. Also each day, Britain's 76-meter Lovell radio telescope, at the University of Manchester's Jodrell Bank Observatory, will listen for Beagle-2 signals for an hour or more each evening. "Our understanding is that we have access to Jodrell Bank pretty much as long as we need," Barratt said. "They have been very supportive." The Jodrell telescope's next Beagle vigil is tonight, ending at 7 p.m. EST (2400 GMT). Meanwhile, the good news is that Mars Express did successfully enter orbit over the Red Planet. In addition to acting as a communications relay station for Beagle-2, it also is to map the Martian surface and search for water with a powerful radar that can scan several miles underground. In the coming days, controllers must change the orbit of Mars Express from a high elliptical one around the equator to a lower polar orbit that will let it establish contact with Beagle. Pillinger said the mother ship could offer the best hope of reaching Beagle as, unlike Odyssey and the Jodrell telescope, its communications were specifically designed to hear the probe's transmissions. "Those contacts are already programmed in, so we have got the on board computer and would be silly to waste them or in any way, shape or form give up until we have used them," he added. Pillinger said both the Mars Odyssey link and communications using Jodrell Bank were untested. "You have to liken this to the early days of mobile phones," he said. "We've got one mobile phone, one mobile phone mast and one satellite, and we have to match these things up and it's not that easy." The success of the Mars Express orbit was a big boost to the European program. European Research Commissioner Philippe Busquin called it a "fantastic achievement," whether scientists get any transmissions from the Beagle 2 craft or not.

83027

BBC : 26 DECEMBER 2003.

NEW BID TO LOCATE BEAGLE FAILS.

The prospects for the Beagle 2 lander on Mars look increasingly gloomy after a radio sweep of the planet failed to detect any sign of the UK-built probe. The Jodrell Bank telescope in Cheshire scanned Mars for two hours late on Thursday, but no signal was picked up indicating the lander was alive. Scientists remain optimistic despite the silence and further efforts will be made to contact Beagle on Friday. The big fear is the probe could have crashed into the Martian surface. "Jodrell Bank listened out for Beagle 2 tonight, but did not detect a transmission," said team spokesman Peter Barratt. Nasa's Mars Odyssey craft will pass over the landing zone at 1815 GMT on Boxing Day. The US space agency orbiter has already tried once to hear a transmission from Beagle - and failed. Researchers must hope it has better luck on the second fly-over. The Beagle 2 lander was supposed to have dived into the Martian atmosphere at 0245 GMT on Christmas Day and reached the surface about seven minutes later; its impact softened by parachutes and gas-filled bags. The scientific team are expecting a pre-planned signal from the disc-shaped robotic probe, informing Earth it survived the fiery entry. A picture of itself and the surrounding terrain should also be among the early data returns. Even if Mars Odyssey fails on Friday to capture and relay the Beagle transmission, the search for the British lander will go on. Both Jodrell and Odyssey will have other opportunities in the coming days to sweep the Martian surface for signs of the 70-kg robotic probe. In addition, the Beagle team have been offered the services of another large radio telescope at Stanford in California to assist the search. And Mars Express (Beagle's mothership) should also be in position soon to try to make contact with its "baby". The success of Mars Express in obtaining an orbit around the Red Planet has certainly cheered European scientists as they endure the agony of waiting for word on Beagle. Controllers at the European Space Agency's (Esa) operations centre at Darmstadt, Germany, clapped and hugged each other when a big screen showed blips indicating they had regained the orbiter's data feed after it emerged from behind Mars following its first circle. Powerful camera "At least the initial checks show that the spacecraft is in very good condition," said flight director Michael McKay. The orbit of Mars Express must now be refined so it can take up its science mission - and make contact with Beagle if it truly is operational on the surface. "The arrival of Mars Express is a great success for Europe and for the international science community. Now, we are just waiting for a signal from Beagle 2 to make this Christmas the best we could hope for," said David Southwood, head of Esa's science directorate. Mars Express is the major part of the European mission - Beagle was a late add-on - and will search for water, ice and key chemicals buried under the Martian surface. It has a powerful stereo camera system which could in early January, if all else fails, search the planet for signs of Beagle's parachutes and airbags. Beagle scientists will update the media on their search for the lander on Friday morning, London time.

83028

23027

CNN : 27 DECEMBER 2003.

SCIENTISTS CLING TO HOPE BEAGLE 2 WILL PHONE HOME.

LONDON - Europe's first Mars probe remained silent for a third day, but scientists clung to the hope Saturday that the Beagle 2 spacecraft had landed safely on the Red Planet and would respond to a call from its mother ship in about a week. "We haven't yet played all our cards," said David Southwood, the European Space Agency's director of science. "The baby, we believe, is down on the surface and the mother is very anxious to get in touch." The British-built Beagle was turned loose by the Mars Express more than a week ago and was scheduled to land on the surface of Mars on Christmas Day and begin searching for signs of life. But repeated efforts that began Thursday to pick up a signal from the probe, using the powerful radio telescope at Jodrell Bank Observatory in England and NASA's orbiting Mars Odyssey, have failed. Scientists now hope Mars Express will be able to contact Beagle once it enters its correct orbit January 4. "We reckon our best chance of a communication ... is to wait until Mars Express is available for use," chief Beagle scientist Colin Pillinger said. Mars Express was designed to beam back data gathered by Beagle, and Pillinger said its communications were specifically set up to hear the probe's transmissions. In the coming days, controllers must change Mars Express' orbit from a high one around the equator to a lower polar orbit that will let it establish contact with the probe. "With Mars Express we will be using a system that we have fully tested and understand," Southwood said. "I'm not writing it off right now and I don't think anyone should. We're hanging in there." The scientists have maintained an optimistic line in the face of repeated disappointment and hope the probe touched down safely, aided by a parachute. The 143-pound Beagle, shaped like an oversized pocket watch, was supposed to unfold its solar panels and transmit a signal confirming its arrival within hours of landing. But Jodrell Bank has twice scanned the planet's surface in vain, and Mars Odyssey has failed to pick up a signal in three overflights. Scientists believe the probe may have landed off course in an area where communication is difficult. They say its antenna may not be pointing in the direction of Odyssey and fear Beagle's onboard clock has suffered a glitch, resulting in the probe sending signals at the wrong times. Getting a working spacecraft to Mars has proven frustratingly difficult. Several vehicles, most recently NASA's 1999 Mars Polar Lander, have been lost on landing. The Soviet Mars-3 lander touched down safely in 1971 but failed after sending data for only 20 seconds. Working in tandem, the Beagle and Mars Express are meant to look for signs of past or present life on Mars. Beagle has robotic arm to take soil and rock samples, including a grinder to clean weathered surfaces and a drill to probe inside rocks. Mars Express is expected to orbit overhead for at least a Martian year, or 687 Earth days, probing as deep as 2 1/2 miles below the surface with a powerful radar in its search for underground water. It also will map the surface with a high-resolution stereo camera

183029

85088

83030

TELEGRAAF : 27 DECEMBER 2003.

OOK DERDE POGING TOT CONTACT MET BEAGLE MISLUKT.

LONDEN - Ook na drie mislukte pogingen hadden Europese ruimtedeskundigen vrijdag nog goede hoop contact te krijgen met de Mars-verkenner Beagle 2, die als alles goed is gegaan donderdag op Mars is geland. Nadat eerst de NASA-sonde Mars Odyssey, die al om Mars heen cirkelde, en daarna de radiotelescoop van het Jodrell Bank Observatorium in Engeland er niet in geslaagd waren het signaal van de Beagle 2 op te vangen, was vrijdagavond opnieuw alle hoop gevestigd op de Mars Odyssey. Maar de Amerikaanse sonde wist de verkenner weer niet te traceren. Het hoofd van het wetenschappelijke team, Colin Pillinger, zei dat er nog dertien nieuwe kansen komen voordat de Mars Express, het moederschip dat de Beagle een week geleden heeft afgeworpen, op 4 januari in een positie komt om contact te maken. Een van die kansen werd vrijdagavond nog benut door de radiotelescoop van het Jodrell Bank Observatorium opnieuw het oppervlak van Mars te laten afzoeken. Bovendien zou een radiotelescoop in Californië helpen zoeken naar de verkenner. De Mars Express is donderdag in een baan om Mars gebracht, een belangrijk succes voor het Marsproject van het Europese ruimtevaartbureau ESA. Behalve met apparatuur voor het opvangen van de signalen van de Beagle is de sonde uitgerust met krachtige radarapparatuur waarmee kilometers door het Marsoppervlak heen kan worden 'gekeken'. De komende dagen moet de Mars Express van een hoge, elliptische baan over de evenaar in een lagere baan over de polen van Mars worden gebracht. Vanuit die positie moet hij in staat zijn de signalen van de Beagle 2 op te vangen. Omdat de Mars Express speciaal is ingesteld op contact met de verkenner, biedt die de meeste kans van slagen, zei Pillinger. De Beagle 2, die slechts 67 kilo weegt, had parachutes en airbags aan boord om de landing zo zacht mogelijk te laten verlopen. Redenen waarom de Mars Odyssey en de telescoop niets van hem hebben gehoord kunnen zijn dat de antenne van de Beagle 2 de verkeerde kant uit wijst of dat zijn radiofrequentie is verstoord tengevolge van de lage temperaturen op Mars. Het project van de ESA is bedoeld om te zoeken naar sporen van leven op Mars. Het is de bedoeling dat de Mars Express minstens een Marsjaar, 687 dagen, rond de planeet blijft cirkelen om dagelijks informatie van de Beagle 2 door te geven aan de aarde. De Beagle is voorzien van robotarmen waarmee hij bodemonderzoek kan verrichten. Als de Beagle 2, genoemd naar het schip waarmee Charles Darwin in 1830 op onderzoek uitging, daadwerkelijk op Mars is geland, heeft de sonde de vierde geslaagde landing op Mars volbracht. De drie eerdere landingen werden uitgevoerd door het Amerikaanse ruimtevaartbureau NASA

FS085

23028

Marslander Beagle zwijgt in alle toonaarden

183031

Wetenschappers van de Europese ruimtevaartorganisatie ESA breken zich het hoofd over het lot van de op 2 juni van dit jaar gelanceerde Marslander Beagle 2.

183032

183033

Het peperdure 'onderzoekslaboratorium' Beagle 2 zou in de vroege ochtend van eerste kerstdag met behulp van een parachute en airbags een 'zachte' landing op Mars hebben moeten maken, maar er werd geen enkel levensteken van de Beagle 2 vernomen.

Urenlang luisterden de ESA-medewerkers in het operationele hoofdkwartier in het Duitse Darmstadt tevergeefs naar de Blur-tonen uit het heelal. Nieuwe pogingen werden 's avonds rond 23.00 uur ondernomen. Ook toen zweeg de Beagle 2 - genoemd naar het onderzoekschip waarmee Charles Darwin in de negentiende eeuw zijn reizen maakte - als het graf. Nadat het op tweede kerstdag nog steeds stil was gebleven, begonnen de ESA-onderzoekers zich af te vragen wat er mis kon zijn gegaan. Er is nog altijd geen bevredigend antwoord op die vraag gevonden. Het had er allemaal zo veelbelo-

vend uitgezien. Volgens plan werd de Beagle 2, gehuld in een schild dat hem tegen de hitte van de intrede in de dampkring van Mars moest beschermen, op vrijdag 19 december door het moederschip Mars Express afgestoten in de richting van de Rode Planeet. De Mars Express zelf was bestemd om rondjes rond de planeet te gaan draaien. De Beagle 2 had op de planeet moeten landen om daar grondonderzoek te verrichten en ook te speuren naar de aanwezigheid van leven op en in het Marsoppervlak.

Zo had het moeten gebeuren: met een snelheid van bijna 20.000 kilometer per uur moest de Beagle 2 de dampkring induiken, waarna de snelheid in vijf minuten tot 350 kilometer per uur zou worden vertraagd. Daarna zou zich na afstoting van het hiteschild een remparachute ontvouwen en vervolgens zouden er rondom het 'Marslab' luchtkussens worden opgeblazen om de schokken

van de landing op te vangen. Voorzien was dat het geheel stuitend op het Marsoppervlak zou terechtkomen. De remparachute en de airbags zouden vanzelf worden afgestoten. Als een grote platte oesterschelp, zo groot als het wiel van een jongensfiets, diende de Beagle 2 zich volgens plan open te vouwen, waarbij zonnepanelen en een instrumenteel deel zichtbaar zouden worden.

Er kan van alles mis zijn gegaan. Wellicht was de hoek van intrede in Mars' dampkring niet goed. Als die ook maar iets te klein is geweest, kan het hiteschild hebben gefungeerd als een platte zeilsteen die teruggekaatst werd de ruimte in. Ook kan de parachute zich te vroeg of te laat hebben ontvouwd, waardoor de Beagle 2 te pletter is geslagen. Hetzelfde kan gebeurd zijn als de stootkussens iets te laat of te vroeg of onvolledig snel zijn opgeblazen.

De wetenschappers geven zich nog niet gewonnen, maar ze zijn geheel afhankelijk van radiosignalen, afkomstig van een oranjeachtig 'sterretje' dat 's avonds aan de zuidelijke hemel te vinden is. En van een stukje Blur-muziek.

183035
183036

DDL: 27-12-2003

Beagle 2 mogelijk geland in krater

LONDEN ANP

De mogelijkheid bestaat dat de Marslander Beagle 2 bij de landing in een krater is terechtgekomen. Dat heeft professor Colin Pillinger, maker van de Beagle 2, gisteren verklaard.

Het gat waarin de Beagle misschien is terechtgekomen, is tot nog toe onbekend op de landingszone Isidis Planitia op de planeet Mars. Het gat zou ongeveer een kilometer groot en 700 meter diep zijn. Eerder opperden deskundigen dat de Marslander is neergestort of een klapotte antenne heeft.

Experts maken overuren om de radiostilte te verbreken. De hoop van de wetenschappers is gevestigd op volgend weekeinde. Op 4 januari moet het moederschip Mars Express zijn eindbestemming bereiken en daarvandaan contact maken met Beagle 2.

De Marslander had vorige week op de rode planeet moeten arriveren. Tot nu toe is geen enkel signaal vanaf de rode planeet ontvangen.

Ook de radiotelescoop van het sterrenkundig onderzoekscentrum van Astron in Dwingeloo heeft de afgelopen dagen geprobeerd een levensteken op te vangen van de Beagle. Volgens een woordvoerder is op eigen initiatief gezocht op de frequentie van de laatste communicatie tussen de Beagle en de marssatelliet Mars Express. Tevergeefs, want de Nederlandse telescoop ontving geen enkel signaal van de marslander.

De telescoop in Dwingeloo is de enige in Nederland. De gigantische installatie bestaat uit veertien schotelvormige antennes. Elke schotel heeft een middellijn van 25 meter en kan op elk punt aan de hemel worden gericht.

183034

183038

Beagle 2 zwijgt in alle talen

LONDEN ANP/AFP

De jongste pogingen om contact te krijgen met de marslander Beagle 2 zijn opnieuw mislukt. De Lovell-radiotelescoop in het Britse Jodrell Bank heeft voor de tweede achtereenvolgende nacht geen signaal van de lander ontvangen. Dit hebben ruimtewetenschappers zaterdag laten weten.

DDL: 29-12-2003

183039

Ook de satelliet Mars Odyssey van de Amerikaanse ruimtevaartorganisatie NASA kreeg geen contact met de marslander. Wetenschappers stelden dat daartoe zaterdag tussen 07.17 en 08.37 (Nederlandse tijd) een mogelijkheid was. De Beagle 2 moest donderdagochtend op Mars aankomen. Maar tot nu toe is er geen teken van de lander vernomen. Gevreesd wordt dat de Beagle 2 op de rode planeet te pletter is geslagen.

DDL: 30-12-2003

183037

23029

183038

'Zachte' landing op Mars van Beagle-2 lijkt mislukt

Door onze redactie wetenschap
ROTTERDAM, 27 DEC. De beoogde 'zachte' landing op Mars van de Britse Marsverkenner 'Beagle-2' lijkt te zijn mislukt. Sinds het moment waarop de lander neerdaalde, donderdagochtend vroeg, is geen enkel teken van het toestel ontvangen. Het moederstation, de satelliet Mars Express van de ESA, is naar alle waarschijnlijkheid zoals bedoeld in een baan om Mars gekomen. De Beagle-2 had op Mars naar tekenen van levensprocessen moeten speuren.

Ook vannacht, toen de reusachtige Lovell-radiotelescoop van Jodrell Bank Observatory luisterde naar directe signalen van het uiterst zwakke zendertje (vermogen 5 watt) van de Beagle-2, is niets vernomen. Hetzelfde geldt voor andere radiotelesopen die is gevraagd naar de Beagle te luisteren. De Amerikaanse NASA-satelliet Mars

Odyssey, die tot 4 januari als relaisstation functioneert, gaf evenmin signalen door. Na 4 januari moet de Mars Express, die tegen die tijd in zijn definitieve baan moet zijn gebracht, de functie van de Odyssey overnemen.

Het Britse team dat de Beagle-2 begeleidt, onder leiding van de hoogleraar Colin Pillinger, heeft de moed nog niet opgegeven. In de Beagle-computer staat vóór 4 januari nog een twaalftal uitzendingen geprogrammeerd. Er zijn tal van redenen te bedenken waarom nu nog geen signalen worden gehoord zonder dat een later succes is uitgesloten. Zo zou de klok van de computer van slag kunnen zijn waardoor op andere tijden wordt uitgezonden dan gepland. Maar privé hebben wetenschappers toegegeven te vrezen dat de Beagle-2 is verongelukt of zich niet naar behoren heeft geopend.

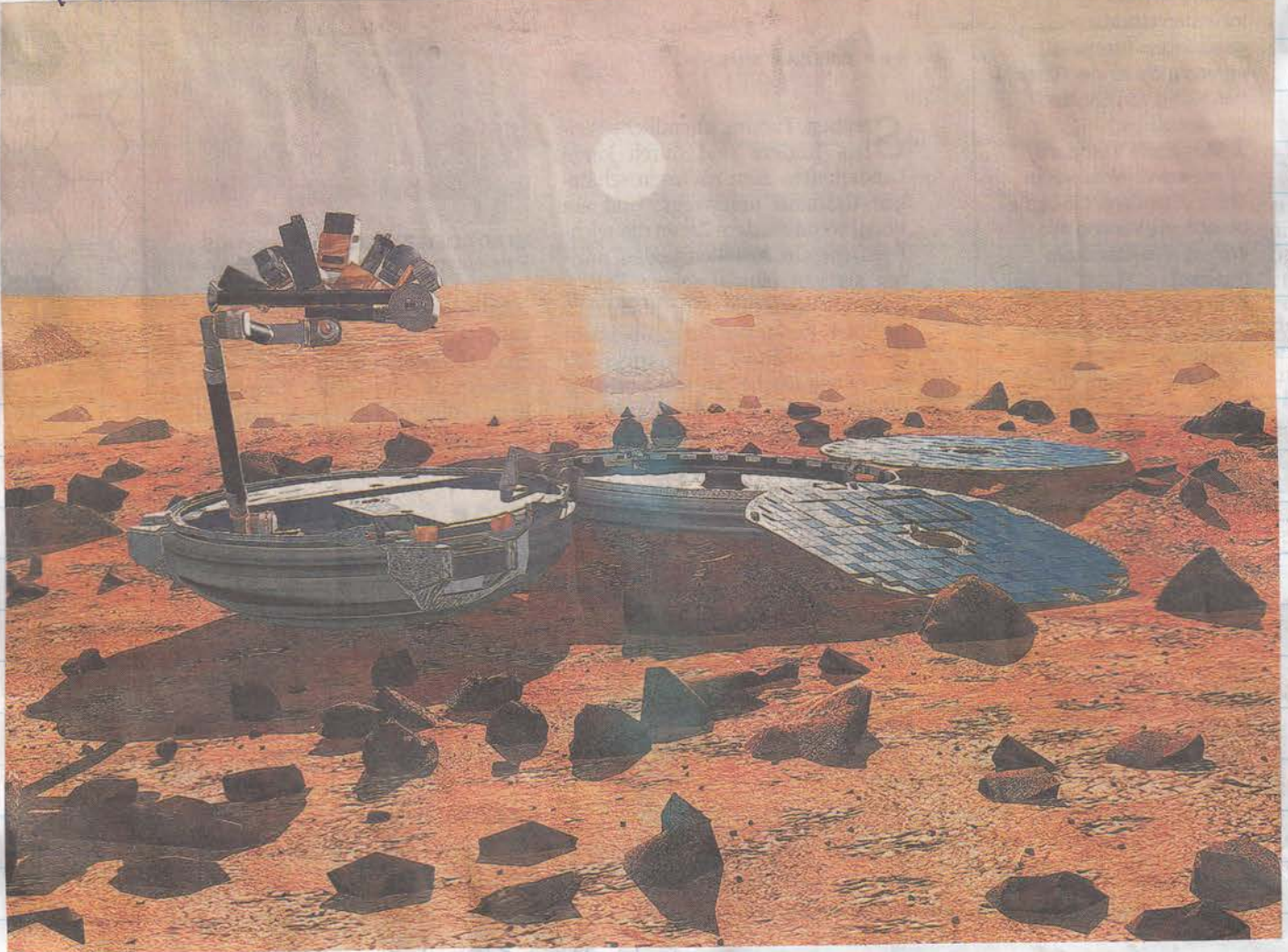
Hoewel de Beagle-speurtocht naar 'leven' het meest tot de verbeelding spreekt, is de missie van de Mars Express van de Europese ruimtevaartorganisatie ESA technisch en wetenschappelijk gezien belangrijker. De Mars Express zal vanuit zijn baan om Mars veel geologisch en meteorologisch onderzoek doen. Ook zijn uiterst gedetailleerde terreinverkenningen mogelijk met behulp van een stereocamera die voorwerpen met afmetingen van slechts twee meter kan zien.

Er is een kleine hoop dat deze camera de verongelukte Beagle kan herkennen aan de grote remparachute of de drie 'airbags' die de landingsklap hielpen opvangen. Op zondag 4 januari en zaterdag 24 januari hoopt de Amerikaanse NASA twee rijdende robots op Mars neer te zetten: de Spirit en de Opportunity.

NRC Handelsblad:

27-12-2003

83041



23030

Bericht uit de ruimte

Nummer 47 - 28 december 2003

Mars Express en Beagle 2

Op het moment van schrijven hebben de vluchtleiders nog steeds geen signaal opgevangen van de Beagle-2 die op 25 december op de planeet Mars geland is. Uit baananalyse is gebleken dat de Beagle in ieder geval op de planeet terecht moet zijn gekomen. Vluchtleiders hebben bepaald dat toen de lander op 19 december door de Mars Express werd losgelaten dit zo nauwkeurig gebeurde dat de zogenaamde landingsellips (het gebied op de planeet waarin de lander terecht zou moeten komen) met 31 bij 5 kilometer ongeveer zes maal kleiner was als verwacht. In dit opzicht stond niets een geslaagde landing in de weg. Beagle-2 moet neergekomen zijn in Isidis Planitia, net iets ten noorden van de Martiaanse evenaar. Volgens berekeningen is de Beagle-2 op 25 december om 02:48 uur in de bovenste lagen van de Martiaanse dampkring terecht gekomen. Door de snelheid van meer dan 20.000 kilometer per uur moet het hitteschild roodgloeiend zijn geworden, terwijl de sonde in hoog tempo snelheid verloor. Daarna moest een loodparachute de sonde verder vertragen, totdat de hoofdparachute veilig kon worden ontplooid. Terwijl de Beagle zonder het valscherms naar het oppervlak afdaalde, zou het hitteschild moeten worden afgeworpen en de drie airbags worden opgeblazen. Op het moment dat de airbags de grond raakten, werd de parachute losgekoppeld, en heeft de Beagle in de airbags enkele sprongen over het oppervlak gemaakt alvorens het tot stilstand kwam. Dit moment zou naar verwachting ongeveer zes minuten na de intrede in de atmosfeer zijn. Vervolgens zouden de airbags van het landertje losgekoppeld moeten zijn, waarna ze wegrollen en leegliepen. De Beagle-2 zou nu op het oppervlak liggen en zich als een horloge moeten openklappen, waarna de antenne en de zonnepanelen zich zouden ontplooiën. Voor alle duidelijkheid, dit was het geplande landingscenario, maar doordat er na de landing geen signalen van de Beagle werden opgevangen is het onduidelijk of de landing al dan niet geslaagd is. Om 05:30 uur passeerde de Amerikaanse sonde Mars Odyssee over de landingsplaats van de Beagle. Dit was de eerste gelegenheid om een signaal van de lander op te vangen, maar niets werd gehoord. In de late avond van 25 december werd de krachtige radiotelescoop van Jodrell Bank gebruikt om te zoeken naar het zwakke signaal van de Beagle. Ook de dagen daarop werden afwisselend de Mars Odyssee en de Jodrell Bank radiotelescoop gebruikt, maar niets werd vernomen van de Beagle. Het lag altijd al in de bedoeling dat alle communicatie met de Beagle via de Mars Express zou verlopen, maar deze zal pas vanaf 4 januari over de landingsplaats vliegen. De vluchtleiders hopen dat ze dan meer geluk hebben. In tegenstelling tot de Mars Odyssee is de zender/ontvanger van de Mars Express speciaal aangepast om te communiceren met de Beagle. Verder zou het kunnen zijn dat door lage temperaturen de frequentie van het signaal van de Beagle iets verschoven is en buiten de frequentieband valt waarop de Odyssee luistert. De Mars Express is op 25 december succesvol in een sterk elliptische baan om Mars gebracht. Een minuut voordat de Beagle aan haar intrede in de atmosfeer begon, werd de motor van de Mars Express gedurende een half uur ontstoken, waarna de sonde in een baan tussen 400 en 188.000 kilometer rond de planeet kwam. Vanaf 30 december zullen diverse manoeuvres worden uitgevoerd om de baan geleidelijk aan te passen tot de geplande operationele baan.

83042

CNN: 30 DECEMBER 2003

NEW ORBITER HEADS TO MARS POLES.

FRANKFURT - Mission controllers on Tuesday redirected Europe's Mars Express orbiter closer to the red planet's poles, taking a crucial first step to push it into a lower orbit where it will be able to listen for its missing Beagle 2 surface probe. Officials at the European Space Agency's mission control center in Darmstadt, south of Frankfurt, adjusted the orbit by firing the main engine of Mars Express for five minutes at about 0800 GMT, spokesman Bernhard von Weyhe said. The maneuver "has been completed very successfully," he said. The British-built Beagle 2 is believed to have reached the Martian surface early on Christmas Day, its impact softened by gas bags and parachutes. But several attempts to hear its signal have not been successful -- the latest Tuesday when NASA's Mars Odyssey failed on its sixth try, picking up no signs of life on a sweep of the landing site between 0724 and 0844 GMT. Efforts by researchers using powerful radio telescopes at the Jodrell Bank observatory in England and Stanford University in California have also come up empty. Odyssey is due to try again Tuesday night, but von Weyhe said the chances of success would be increased "100 times" once Mars Express is in a position to hear its partner craft starting January 7. Tuesday's maneuver allowed controllers to move Mars Express, launched into orbit around Mars on December 25, from some 188,000 kilometers (117,000 miles) over Mars' equator to roughly the same height, but over the planet's poles. The craft will be progressively lowered over the next week, when it is to sweep as low as 200-250 kilometers (125-155 miles) from the surface -- allowing Mars Express to use its powerful radar to search for signs of water or ice on the planet during expected two years of surveying. Officials also consider Mars Express their best chance to find the British-built Beagle, since their radios have been tested together and shown to link up. "The probability of communications is 100 times higher than having Mars Odyssey try," von Weyhe said, adding that "the probability of finding Beagle from Earth is very low." While Beagle's silence has worried the mission team, Mars Express' flight has gone smoothly, with the spacecraft making the tricky entry into Martian orbit flawlessly on Christmas Day. The mission, launched from Kazakhstan atop a Russian booster rocket June 2, is intended to look for signs of past or present life on Mars, which scientists think may once have had enough water to sustain living organisms. Mars Express also will map the surface with a high-resolution camera and relay data from Beagle, if it is found. The 67-kilogram (143-pound) Beagle, if it reached the surface intact, is to sample soil and rocks with a mechanical arm searching for indications of organic matter.

83043

580 89

23031

BBC : 29 DECEMBER 2003.

BEAGLE MIGHT BE IN A CRATER.

Beagle 2 may have fallen down a crater on Mars recently discovered near where the lander was due to touch down, scientists on the project have claimed. The crater has been discovered in Isidis Planitia, a flattish basin on Mars where Beagle was due to land. Scientists said there was a remote possibility it landed in the crater, which may be about one kilometre wide. If this is so, there is "no way" it can communicate with Earth, but scientists stressed this scenario was "unlikely". Beagle 2's creator Professor Colin Pillinger said this was the "absolutely worst case scenario." But he added: "We'd have to be incredibly unlucky that it went right down this crater." The crater is roughly in the centre of the "landing ellipse" on Mars where Beagle was supposed to have landed on Christmas Day. It has shown up in pictures from Mars Global Surveyor, which is in orbit around the planet. Malin Space Science Systems, which operates the camera aboard Mars Global Surveyor, identified it and sent the picture to the Beagle team late last night. If Beagle did in fact disappear into this crater on its descent, it could be potentially disastrous for the mission. A rough landing on the sides of the crater - which could be as much as 700 metres deep - could have damaged the lander. A crater might also cast a shadow that would make it nearly impossible for Beagle to "power up" using its solar panels. The crater is surrounded by rocky debris, which may also have pierced Beagle's airbags or prevented it from opening its solar panels properly. However the Beagle team stresses that this is just one of the current scenarios it is looking at. Meanwhile, science minister Lord Sainsbury, who was at a Beagle news conference in North London, gave the strongest indication yet that the UK Government would help fund the European Space Agency's (Esa) Aurora programme. "We need to be working with Esa to ensure that, in some form, there is a Beagle 3 that takes forward this technology. I very much hope that the Aurora programme which is currently being developed by Esa will take forward this kind of exploration." Future European Mars exploration comes under the umbrella of the Aurora programme - Esa's bold vision to land probes, and perhaps eventually, astronauts on the Red Planet. The ExoMars mission, set for 2009, would investigate the biology of the planet, paving the way for a more ambitious proposal to bring samples of Martian rock back to Earth for analysis. Of Beagle 2, Lord Sainsbury added: "While we're disappointed that things have not gone to plan, we're determined that the search should go on. "Both the search to make contact with Beagle 2 and also to answer the long-term question about whether there is life on Mars." All attempts to contact the lander with the Mars Odyssey craft in orbit around the Red Planet and with large radio telescopes on Earth have drawn a blank. Scientists have now set up a "tiger team" of top experts to work through all possible reasons for the silence. The group, based at the British National Space Centre, has a full-sized engineering model of Beagle and reams of technical documents and drawings to hand. It has drawn up a list of "blind" commands to send to Beagle that might prompt it to respond. "These commands are blind in the sense we have no idea if they are getting through - but we're going to try," said senior Beagle team scientist Professor Alan Wells. On 31 December, after the tenth attempt made to contact it, Beagle will switch over into a mode called communication search mode 1 (CSM 1). This will allow it to recognise whether it is dawn or dusk on Mars by measuring the power coming from the solar arrays. If it is still alive, Beagle will begin transmitting more regularly and will also be able to accept blind commands. "We're working under the assumption that Beagle 2 is on the surface of Mars and for some reason cannot communicate to us," said Beagle mission manager Dr Mark Sims. "The team has come up with a method of fooling the receiver into accepting commands without having to talk back to the orbiter," Dr Sims added. The Beagle 2 team has just agreed with Nasa a plan to reconfigure its Odyssey probe - which is currently in orbit around Mars - to begin sending blind commands on 31 December. By 5 January, Beagle will have switched over to communication search mode 2 (CSM 2), which will allow it to communicate with its "mother ship" Mars Express, which carried the "pocket watch" lander to the Red Planet. Mars Express will then be in a prime position to communicate with Beagle and scientists think this is their best hope of raising the robot. Scientists had suspected that a clock error might have meant Beagle 2 was simply transmitting at the wrong time, explaining the inability of the US orbiter and the telescopes to pick up its signals. Dr Sims said that the tiger team had now "probably" ruled out a clock error. He added that other slips of Beagle's onboard time could have been caused by a software glitch or by copying data between different parts of its memory. Other scenarios include a failure of the pocket watch design to open fully; a failure to deploy properly the solar "petals" that charge the Beagle battery system and obstruction of the antenna. Both the radio telescopes at Jodrell Bank in the UK and at Stanford University in the US listened out for Beagle late on Sunday - but with no positive result. One obvious explanation for silence is that Beagle was destroyed as it attempted to land on Christmas Day, but no one connected with the Esa mission is prepared yet to contemplate this awful possibility. Operations to get in contact with Beagle via Mars Express will begin in earnest on 6 January. At the moment Mars Express is heading away from the planet, preparing for a major engine burn on Tuesday that will sweep it back into a polar orbit of Earth's near neighbour.

830 44

54038

SPACE.COM : 30 DECEMBER 2003

MARS EXPRESS CONTROLLERS REPOSITION ORBITER.

FRANKFURT - Mission controllers on Tuesday redirected Europe's Mars Express orbiter closer to the Red Planet's poles, taking a crucial first step to push it into a lower orbit where it will be able to listen for its missing Beagle 2 surface probe. Officials at the European Space Agency's mission control center in Darmstadt, south of Frankfurt, adjusted the orbit by firing the main engine of Mars Express for five minutes at about 3 a.m. EST, spokesman Bernhard von Weyhe said. The maneuver "has been completed very successfully," he said. The British-built Beagle 2 is believed to have reached the Martian surface early on Christmas Day, its impact softened by gas bags and parachutes. But several attempts to hear its signal have not been successful. NASA's orbiting Mars Odyssey searched again Tuesday after five successive days of silence, but there was no immediate word on the results. Efforts by researchers using powerful radio telescopes at the Jodrell Bank observatory in England and Stanford University in California have also come up empty. Tuesday's maneuver allowed controllers to move Mars Express, launched into orbit around Mars on Dec. 25, from some 117,000 miles over Mars' equator to roughly the same height, but over the planet's poles. The craft will be progressively lowered over the next week, when it is to sweep as low as 125-155 miles from the surface -- allowing Mars Express to use its powerful radar to search for signs of water or ice on the planet during expected two years of surveying. Officials also consider Mars Express their best chance to find the British-built Beagle, since their radios have been tested together and shown to link up. "The probability of communications is 100 times higher than having Mars Odyssey try," von Weyhe said, adding that "the probability of finding Beagle from Earth is very low." While Beagle's silence has worried the mission team, Mars Express' flight has gone smoothly, with the spacecraft making the tricky entry into Martian orbit flawlessly on Christmas Day. The mission, launched from Kazakhstan atop a Russian booster rocket June 2, is intended to look for signs of past or present life on Mars, which scientists think may once have had enough water to sustain living organisms. Mars Express also will map the surface with a high-resolution camera and relay data from Beagle, if it is found. The 143-pound Beagle, if it reached the surface intact, is to sample soil and rocks with a mechanical arm searching for indications of organic matter

783045

18038

23032

Funkstille

83046

Raumfahrt Der Europäischen Raumfahrtagentur Esa ist es noch nicht gelungen, ein Signal des Mars-Landers „Beagle 2“ einzufangen. Derweil befinden sich zwei US-Sonden im Anflug auf den Roten Planeten.

Wo ist „Beagle 2“? Noch immer ist es der Europäischen Weltraumagentur Esa nicht gelungen, ein Signal des Landegeräts einzufangen. Funkstille zwischen Mars und Erde.

„Das ist schon enttäuschend, aber nicht das Ende der Welt“, urteilte gestern Chef-Wissenschaftler Collin Pillinger, schwankend zwischen Hoffnung und Niedergeschlagenheit. Dabei hatte doch alles so erfolgreich begonnen.

Am ersten Weihnachtsfeiertag um 3.47 Uhr mitteleuropäischer Zeit war „Beagle 2“ mit gut 20 000 Kilometer pro Stunde planmäßig in die dünne Mars-Atmosphäre eingetreten. Gebremst und abgesichert von Fallschirmen und Airbags hätte er sieben Minuten später seinen Landeplatz mit 60 Kilometern pro Stunde erreichen sollen.

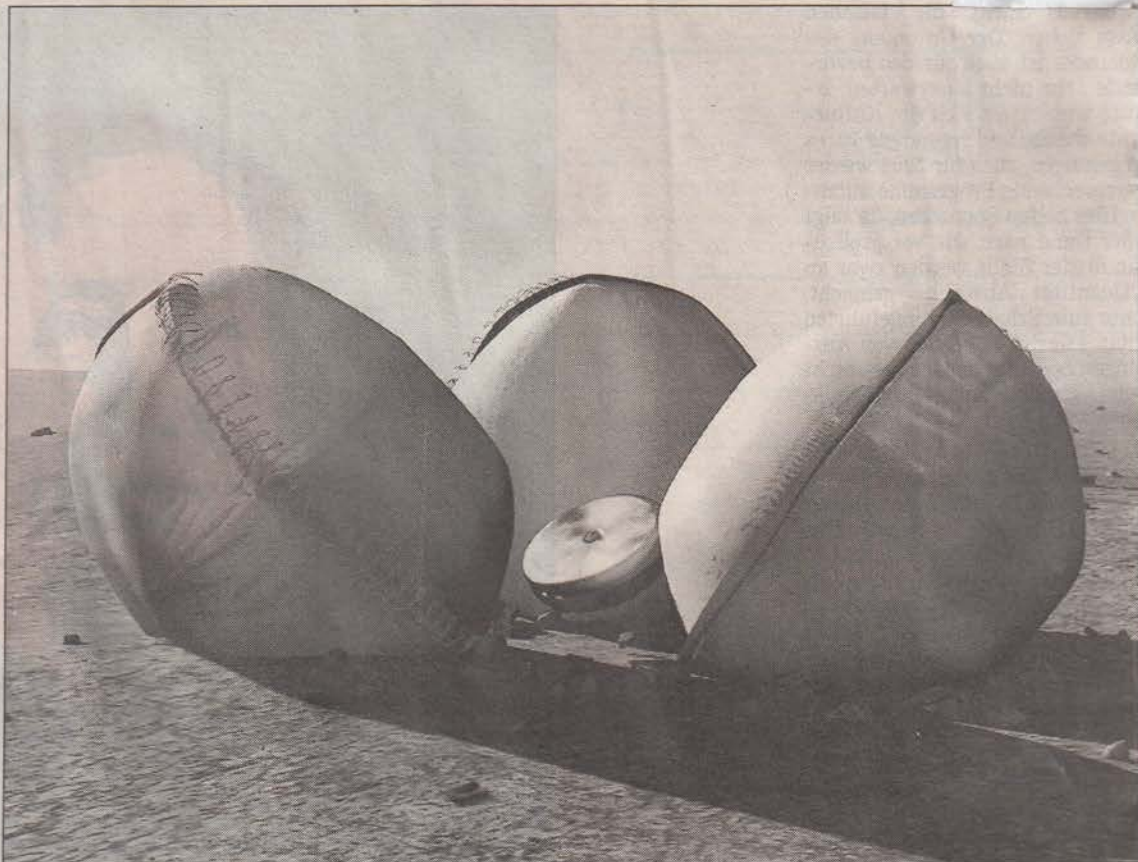
„Mars-Express“ erfolgreich

Ob er das geschafft hat, weiß zur Stunde niemand. Die erwartete Funkbestätigung – „the Beagle has landed“ – blieb aus. Und während seine Mutter-Sonde „Mars-Express“ erfolgreich in die vorgesehene Umlaufbahn um den Planeten eingebogen ist, bleibt „Beagle“ verschollen.

Im Raumfahrt-Kontrollzentrum der Esa (Esoc) in Darmstadt gab sich Flugdirektor Mike McKay gestern überzeugt, dass der kleine Roboter die Mars-Oberfläche zumindest erreicht hat. „Mars-Express hat ihn auf einen sehr, sehr präzisen Kurs gebracht. Er ist auf jeden Fall in die Mars-Atmosphäre eingetreten.“

Was ist danach geschehen? Vielleicht wird man es nie erfahren – wie auch die Amerikaner bis heute nicht wissen, was mit ihrem „Polar Lander“ passiert ist, den sie am 3. Dezember vor vier Jahren verloren. Damals lag der Mars-Roboter noch zwölf Minuten vor der Landung genau auf Kurs. Auf das erlösende „Ankommen!“-Funksignal wartete die Nasa indes vergeblich.

Alle nur denkbaren Unfallursachen spielten die Nasa-Forscher damals durch, genauso wie es jetzt die europäischen Esa-Kollegen tun: Bruchlandung der Sonde, falsche Po-



So hätte es aussehen müssen: „Beagle 2“, von Airbags gesichert, nach seiner Landung auf dem Mars. Foto: ddp

sition, verklemmte und nicht ausfahrbare Sonnensellen, zerstörte oder falsch ausgerichtete Antenne, Verschwinden in einer Marsspalte und vieles mehr. Die Nasa forschte erfolglos nach „Polar Lander“. Bei der Esa ist man jedoch noch weit davon entfernt, „Beagle 2“ aufzugeben. „Es gibt noch ein Dutzend Gelegenheiten, Daten des Landers zu empfangen“, heißt es vom Kontrollzentrum.

Hoffnungsvoll weitermachen – das gilt auch für die Nasa: Derzeit befinden sich zwei weitere Mars-Lander der USA im Anflug auf den Roten Planeten. Die Sonden haben wertvolle Fracht an Bord: zwei so genannte Mars-Rover, die „in etwa die Masse und die Geschwindigkeit der großen Galapagos-Schildkröten aufweisen“, beschreibt sie Steve Squeres, Haupt-

Wissenschaftler der Doppel-Mission „Principal Investigator“.

Die Mars-Mobile müssen auf der Planetenoberfläche erst einmal sanft gelandet und getestet werden, ehe sie

Weich gelandet

Seit 1960 hat es zahlreiche Versuche – vor allem der Sowjetunion und der USA – gegeben, den roten Nachbarplaneten der Erde mit Flugkörpern zu erreichen. Die meisten schlugen fehl, erst 1976 gelang den USA die erste weiche Landung einer Sonde auf dem Mars.

an verschiedenen Positionen ihrer Forschungsaufträge erledigen könne. Das erste der Vehikel soll von der im vergangenen Juni gestarteten Sonde „Spirit“ (Geist) schon am 3. Januar abgesetzt werden, das zweite vor dem im Juli abgeschossenen „Opportunity“ (Gelegenheit) am 25. Januar. Insgesamt kostet die Doppelmission zum Roten Planeten rund 650 Millionen Dollar. Weitere 200 Millionen Dollar kommen als Betriebskosten Ende 2004 dazu. Es steht also viel auf dem Spiel.

Das ungewisse Schicksal des „Beagle 2“ lastet zusätzlich auf den Nerven der Nasa. Deren Forschungs-Chef Weiler sagte dann auch: „Es ist schwer genug, zum Mars zu fliegen. Dort richtig aufzusetzen, ist noch schwerer.“

Rheinische Post: 27-12-2003.

23033

Invasion of Mars

83047



23034

tu
re
or
al
ta-
en.
im
as
ne
en
ie-
in-
so
m-
in-
de

830 48

Mankind's first great Mars adventure of the 21st century began with spacecraft launches from Earth in the first half of 2003. Such opportunities occur every 26 months when the Sun, Earth and Mars form a straight line. However, because the orbits of both planets are elliptical, not all such 'oppositions' are equal. During this year's opposition, Mars and the Earth have been especially close, the closest in fact for nearly 60,000 years. And so the benefits for space agencies are clear – swinging from one planet to the other takes less time and fuel. This is one of the prime reasons why so many missions are visiting the Red Planet in 2003 – two NASA Rovers and the Japanese Nozomi will arrive shortly after Mars Express. These new adventurers will join two other NASA orbiters, Mars Global Surveyor and Mars Odyssey, which have been on the scene since 1997 and 2001, respectively. For the first time too, Europeans are now closer to Mars, at least metaphorically speaking than ever before. The first planetary mission managed entirely by Europe, Mars Express, is on schedule to arrive before Christmas, going into orbit around the planet on 19 December, having first released the Beagle 2 lander designed to search for Martian life after landing on the surface on Christmas day.



Simulation of Beagle 2 on the Martian surface.

All rights reserved Beagle 2

23035

83049



Europe's first planetary mission

Mars Express has been speeding silently through space since its launch from Baikonur on 2 June 2003. With its cubic structure, wrapped in black thermal insulation and about a man's height in length, it could be described as a giant 'space insect' with its two silver solar panels extending like wings.

The Beagle 2 lander travels attached to one side, folded up rather like a very large pocket watch. Moving away from the Earth at an average speed of three km per second, the spacecraft has conserved energy, doing almost nothing until about a week before its arrival at Mars. Right now there's little activity on board. But silence and low activity are not the norm for this Mars mission. During the summer ground controllers were still checking out the spacecraft configuration, as well as the post-launch survival of the seven instruments onboard. Some very delicate operations took place, during which a major part of the mission was at stake.

One of them was to release the special clamps holding Beagle 2 in place during the launch. "These clamps were extra means of making sure that the lander stayed perfectly

attached to the spacecraft during the launch," said Con McCarthy, Beagle 2 Principal Systems Engineer.

"Releasing them three days after the launch was a very critical operation, because if the clamps were not released correctly Beagle 2 could not be ejected on arrival at Mars, and Mars Express would go into orbit around the planet with the extra 65 kg of the lander on top."

This extra weight could have affected Mars Express operations considerably, not to mention the fact that the lander's mission would have ended before it even began.

The mission is not called Mars Express by chance – it has been developed quicker than any other comparable planetary mission. The design and development phase took less than four years, compared with up to six years for previous similar missions.

Calculations had shown that the best combination of fuel use and travel time could only be achieved by launching Mars Express in the period between 23 May and 21 June 2003. "If we had missed the launch window, there was an 'emergency opportunity' on 28 June,

with some re-arrangements in the mission. If we missed that one, we would have had to wait until 2007," said Rudi Schmidt, Mars Express Project Manager.

Diary of a Mars mission

One way of gaining an insight into how the Mars Express team dealt with their extremely tight schedule is to take a peek at their diary...

Leaving for Baikonur

"As the date for shipping the spacecraft to Baikonur draws closer, the stress and tension levels have increased dramatically, of course. Delays of minutes rather than hours, or even days, now take on a new and sometimes frightening significance," wrote John Reddy, Principle Electrical Systems Engineer for Mars Express, back in February. At that time, all development, integration and testing activities were being completed at the Toulouse facilities of Astrium, the Mars Express prime contractor. By mid-March, the spacecraft had to be transported to Baikonur, almost fully integrated. "Time waits for no man, or spacecraft," said Reddy.

83050

83051

83052

23036

Experienced planners well know that time is merciless, especially when unforeseen problems show up. This is why last-minute surprises always need to be included in the schedule. In fact, this extra provision allowed the Mars Express team to cope perfectly with its own last-minute problem.

"Just before the spacecraft was due to leave Toulouse, engineers discovered a fault in one of the electronics modules," said Rudi Schmidt. "Of course, it was the most difficult box to remove from the spacecraft! When you open an electronic box in a spacecraft, you can't imagine how many wires and connections there are. It's very easy to mess something up, so you must be extremely careful."

In the end, changing the box did not create any extra problems. The team had been working with the first days of the launch window in mind; so they simply moved the launch date back by just a few days.

The launch campaign

The spacecraft, the lander and all their accoutrements, gathered into a 100-tonne cargo shipment onboard two Russian Antonov planes, arrived at Baikonur on 20 March. A two and half month launch campaign then began. Baikonur became the temporary home of more than 70 people from all over Europe, mainly from companies such as Astrium, Starsem (responsible for the launch) and Alenia (in charge of the assembly and testing programme).

Work at the launch site went on for 12 hours a day, seven days a week. As the average age of the team was 40, most of them are too young to remember the excitement that surrounded the first missions to Mars in the 1960s. Nevertheless, the launch team still felt the thrill of working on a mission heading for the Red Planet.

"Being here, we sometimes feel like pioneers too," wrote Don McCoy, Mars Express Assembly Integration and Verification Engineer, on 2 May. "It's been hard work to play our part in getting Mars Express ready to go to Mars, but we are all happy to be a part of it! The schedule to get the spacecraft ready in time for the launch is very tight. There is no room for error!"

The first weeks of the launch campaign were devoted to tests. Only when the 'all clear' was given, did the team take the final steps to get the spacecraft ready, with the installation of the thermal blankets and the solar arrays.

Science

By the end of April, the spacecraft was ready to be fuelled with propellant, a delicate process that lasted for a whole week and took place in

Pioneering new ways of working

Mars Express has been developed quicker than any other comparable planetary mission, and at about half the cost. It took only one year to go from engineering concept to the start of development, compared to the usual five years, and it has cost 300 million Euros, compared to Rosetta's one billion Euros.

What is the secret? It lies in the new managerial approach being used, which includes distributing tasks and responsibilities differently within the whole team, and the re-use of existing hardware.

Mars Express Project Manager Rudi Schmidt explained: "Giving more responsibility to industry was a key factor. The Project Team allowed industry to take decisions faster than in the past.

"Also, we have enabled industry to interact directly with the launch-service provider and the scientific community. This speeds up the decision making process and frees manpower for other tasks. Realising that all three – ESA, industry and the launch service provider - are in the 'same boat' to Mars, we have managed to establish an excellent team spirit from the very beginning, which has helped a lot during times of high stress or technical problems."

However, safety of the mission was never compromised. "To ensure that quality did not suffer, we imposed a rigorous review process. We also carried out a complete test programme to ensure that we get a very reliable spacecraft. Although we had immense time pressure towards the end of the project, we did not drop any of the planned tests to save time. I call this a fast design phase followed by a thorough testing activity," added Rudi.

Integration of Beagle 2
with Mars Express.

Astrium



83054

82038
83053

83055

82038
23037

183058

the Hazardous Process Facility. The next step was to mount the spacecraft on Fregat, the Soyuz upper-stage rocket, and then the whole structure onto the Soyuz launcher. This 'marriage' process took place on 24 May.

The whole structure was subsequently rolled out to the pad four days before launch. "Seeing everything taking shape as scheduled was the best reward for all of us, after having put so much effort and dedication in the launch campaign," said Michael Witting, Mars Express Launch Campaign Manager.

When Mars Express was finally ready for launch, what could the team still do in the days before launch? The answer is rehearse, rehearse and rehearse again. "Once the spacecraft was mounted on the rocket and sitting on the launch pad, it doesn't mean we could sit back. We still had to perform several operations to get it ready for its voyage.

"Mars Express is a very complex satellite and we wanted a perfect send-off. We spent about eight hours talking to it via computers to configure it," wrote Don McCoy.

The future

Of course the most interesting part of the mission is not yet written in any diary. Full activity on board the spacecraft will resume six days before arrival at Mars with the ejection of the lander.

That operation will also be one of the 'hold-your-breath' type. Beagle 2 must land on a region called Isidis Planitia, a flat sedimentary basin straddling the northern plains and the southern highlands of Mars.

The landing area has the shape of a large ellipse, 300 km long and 150 km wide. But Beagle 2, which weighs only 65 kg, is too light to carry a steering mechanism, and it will be unable to receive commands from Earth. So, how will it manage to land where planned?

The answer is simple: engineers have calculated very precisely where and at what speed Beagle 2 has to be ejected from the Mars Express orbiter. Putting theory into practice, however, won't be as simple. The operations leading up to Beagle 2's release will take two days, and engineers regard it as one of the most complex phases of the whole mission.

"Beagle 2 is fixed to the spacecraft with a spin-up and eject device," explained Rudi Schmidt. "This device will be released by firing a pyrotechnic charge six days prior to Mars arrival which will give Beagle 2 a certain forward speed – about 0.5 m per second – and a rotation at the same time. The rotation has pretty much the same effect as with a child's spinning top, stabilising Beagle 2 while it flies towards its landing site on the surface."

The mechanism and its operation is complicated. A lot of testing has gone into ensuring that it reliably releases Beagle 2 from the orbiter. Mission controllers at the European Space Operations Centre (ESOC), in Darmstadt, Germany, have been training for months with simulators that resemble sophisticated computer games.

However, a failure when in orbit around Mars will cost you much more than a few points! After ejecting the lander, the Mars Express orbiter will be on a collision course with the planet. Three days before arrival, therefore, ground controllers must manoeuvre the spacecraft onto the right trajectory.

They will also reduce its speed by 1.3 km per second to allow the planet's gravity to 'capture' Mars Express and put it into Mars orbit. Several manoeuvres will still have to be performed to get the spacecraft into its final operational orbit. The latter is highly elliptical, taking Mars Express from within just 260 km of the Martian surface, to more than 11,000 km away from it at its furthest point.

In the meantime, while the orbiter is still getting into its chosen orbit around Mars, Beagle 2 will have already touched down on the planet's surface. The landing will also be a very complicated and challenging operation, given that the lander will enter the Martian atmosphere at a speed of several thousand kilometres per hour.

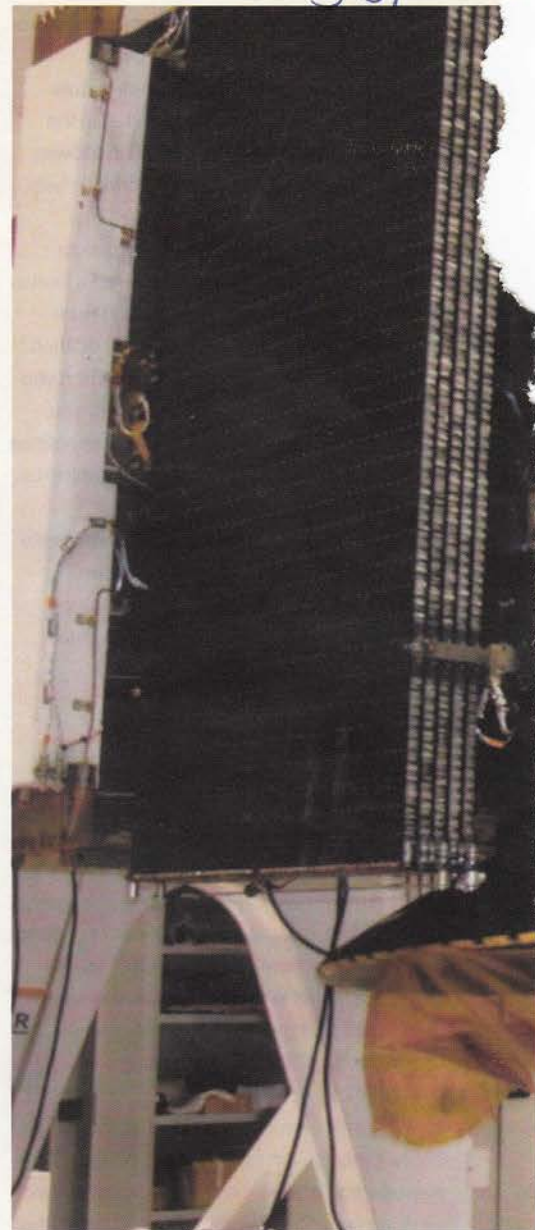
Friction with the planet's atmosphere will slow it down to about 1600 km an hour, at which point parachutes will be deployed. Just before it reaches the surface, large gas-filled bags will inflate to protect the lander as it bounces. Once the lander comes to a halt, the bags will be ejected and scientific operations can begin.

One of the reasons why Isidis Planitia was chosen is that it is not too rocky to preclude a safe landing, but rocky enough to be interesting for the experiments. Isidis Planitia has few steep slopes, it is not too dusty and its elevation is low enough to provide enough atmospheric depth to allow the parachutes to brake the lander's descent in the thin Martian atmosphere.

After landing, Beagle 2 will begin emitting a 'beeping' signal, which will be picked up by the Jodrell Bank radio telescope in England. Arrival of this 'life sign' from Beagle will tell the engineers that it has landed successfully.

Several 'overflights' by Mars Express and NASA's Mars Odyssey will be needed to determine its exact position. One or two days after the landing, and once the outer case has been opened and the solar panels unfurled, Beagle will start making observations.

The Payload Adjustable Workbench (PAW)



at the end of the robotic arm, where most of the instruments are located, will unfold and rotate to give its two stereo cameras a panoramic view. With the help of these and other images, rocks and soil samples will be selected and analysed in detail.

In the meantime, the orbiter will be imaging the entire planet at very high resolution in 3D and in full colour. It will also scan the subsurface with a radar altimeter, looking for water and ice, and map the mineral composition of the surface with great accuracy.

Then it will be the turn of the scientists. Data from the orbiter will be returned to Earth via the 35-metre dish at New Norcia, near Perth, Australia. From there, they will be sent to ESOC and then to the instrument scientific teams.

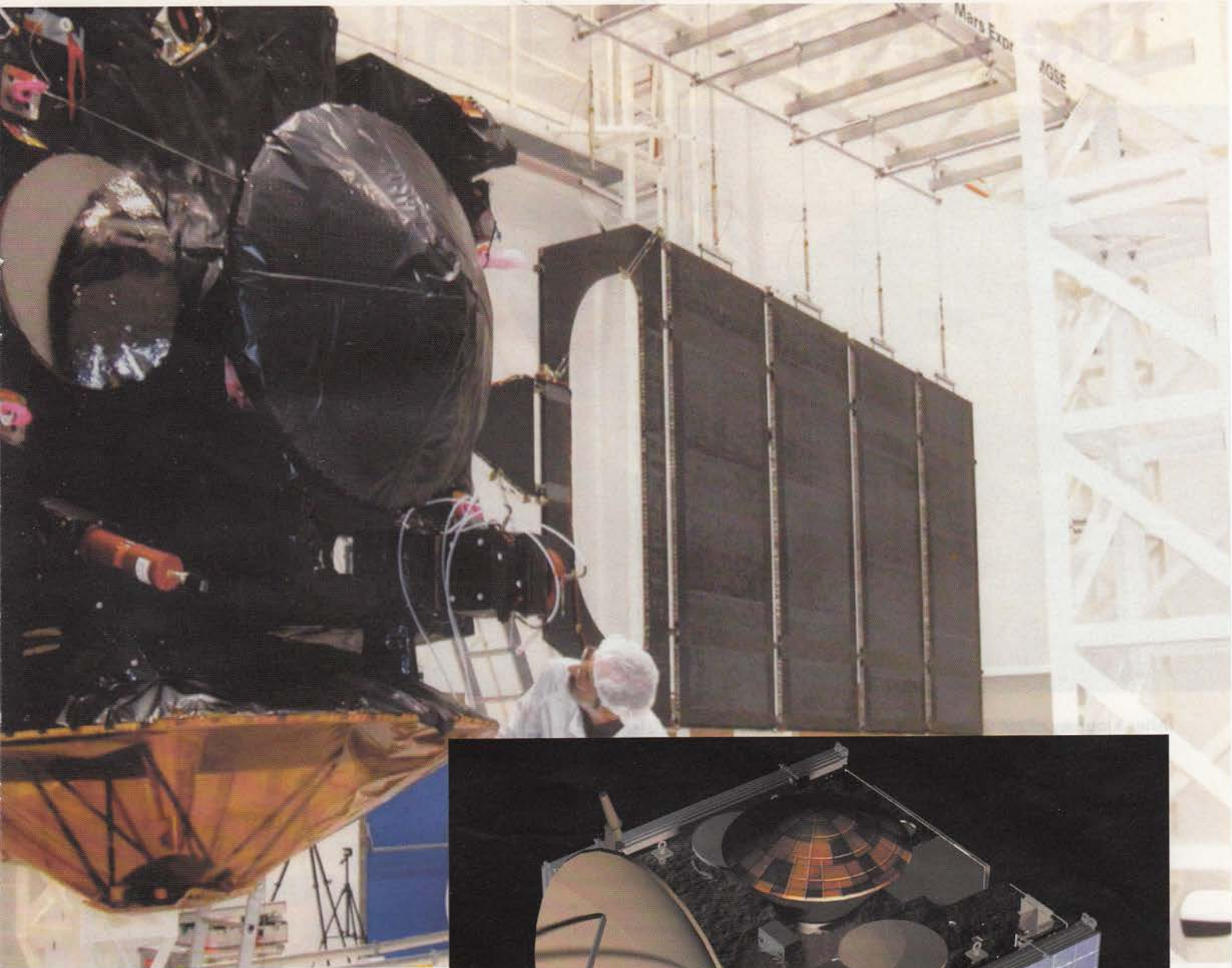
Data from the lander will also be relayed via the orbiter, except for some periods when NASA's Mars Odyssey will pick up Beagle 2

183056

183057

183059

23038



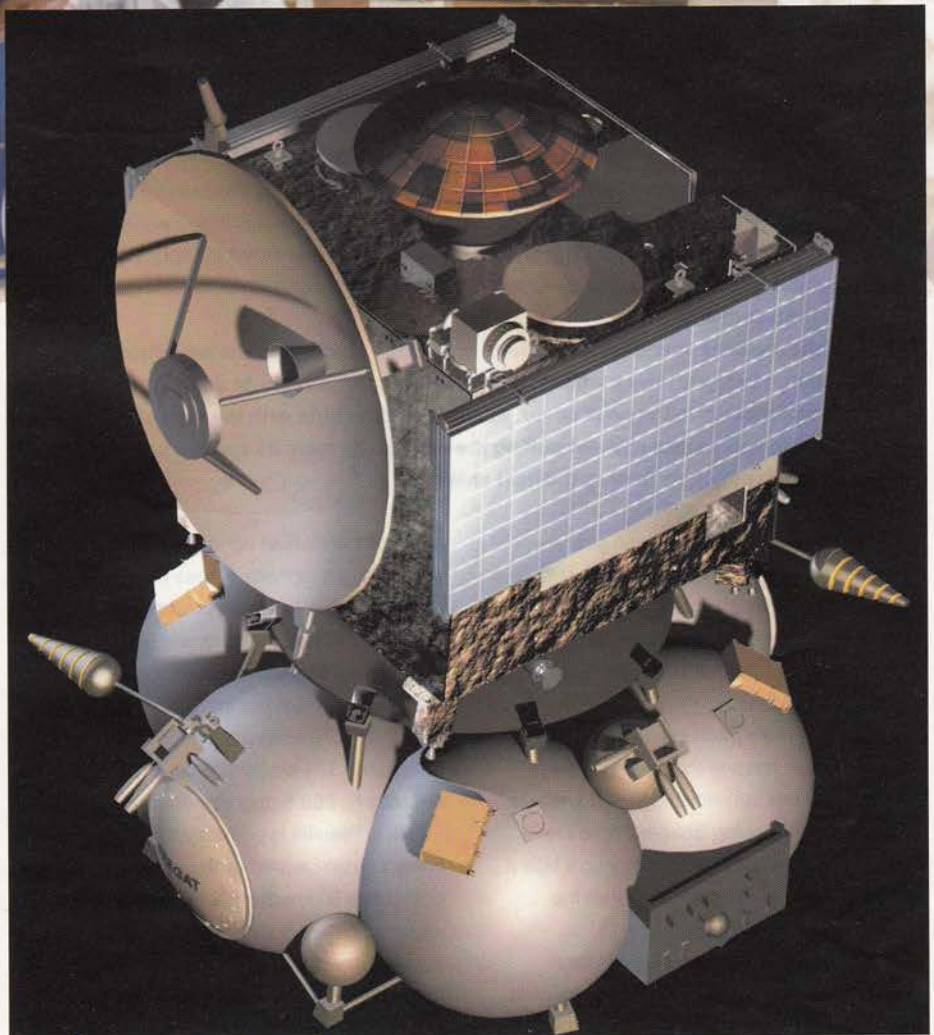
Solar array deployment on the Mars Express spacecraft and (right) graphic depicting Mars Express attached to the Fregat upper stage prior to separation. ESA

data and send them to Earth. This will happen during the first 10 days after the landing, when Mars Express and Beagle won't be able to 'see' each other.

So what will Mars Express and Beagle 2 discover? Maybe water, maybe life... "In any event we will get the most thorough view of the planet ever, which is of fundamental importance," said Agustin Chicarro, ESA's Mars Express Project Scientist. "In the global international effort to explore Mars, Mars Express is a key mission, since it will provide the framework within which all further Martian observations will be understood."

Acknowledgement

The basis of this article first appeared in ESA Bulletin 115, August 2003.



83060

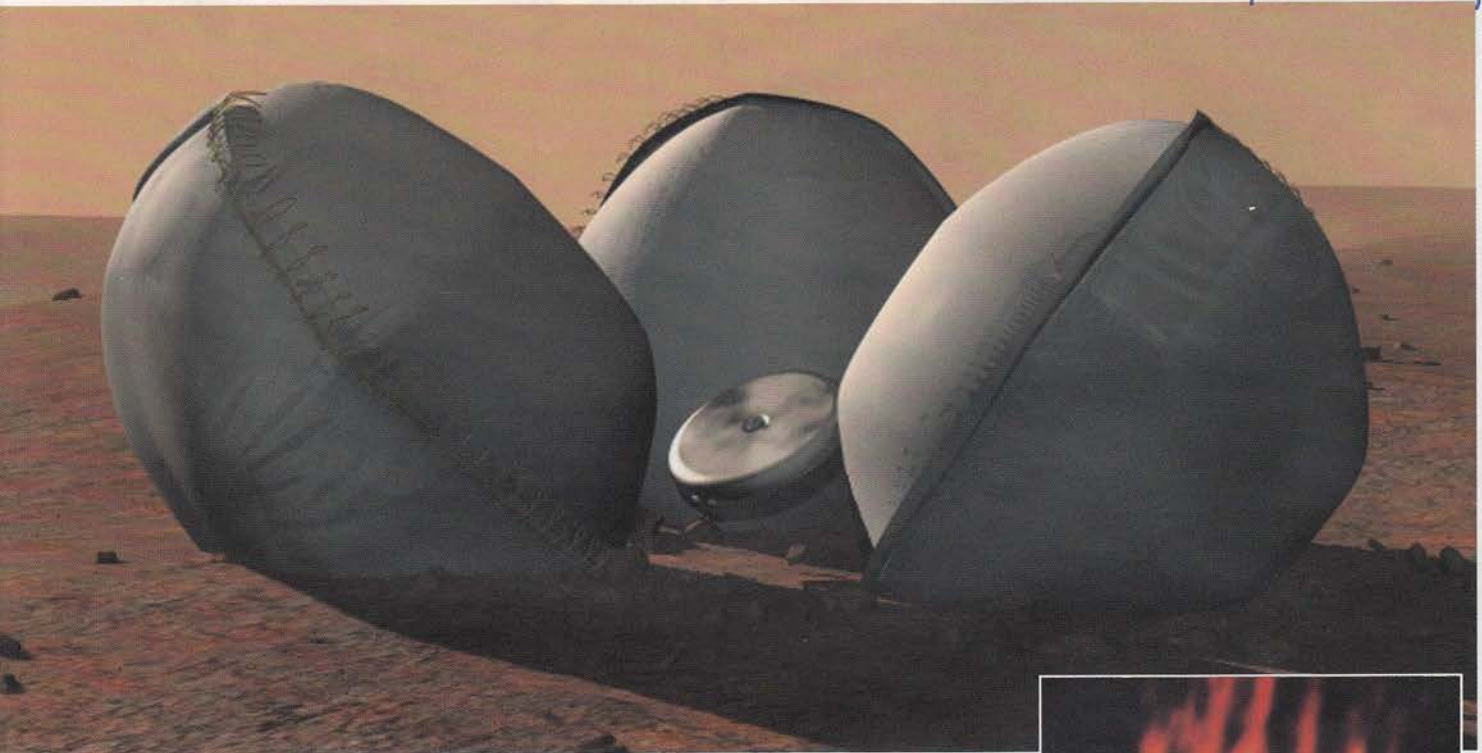
83061

23028

23039

The Beagle has landed

83062



After a journey of 250 million miles, and five days before Beagle 2 is due to enter the atmosphere on Christmas day, the whole of Mars Express will be lined up as accurately as can be managed with the projected landing site.

Beagle 2 will be separated from the spacecraft using a spring mechanism which pushes the lander away whilst making it spin on its axis for stability. The whole process is carried out by a 1.6 kg device called the spinup and eject mechanism (SUEM).

With Beagle 2 hurtling towards the surface at 14,000 mph, Mars Express will be free to make the manoeuvres to place itself in orbit. It will be a critical point in the mission for both halves of the Mars Express project. If separation does not occur Beagle 2 cannot land with the orbiter attached but equally so the orbiter will not continue in its efforts to map Mars from high above its surface.

During the descent phase the heat shield brakes the lander from its interplanetary velocity, energy being lost by frictional heating. Firing the parachute deployment device (PDD) through a patch in the back cover, deploys a pilot chute with the task of dividing the space craft into two sections whilst pulling the main chute from its stowed position. Pyrotechnic bolts explode to drop the heat shield.

The gas-bags are inflated by a gas generator at 200 m above the surface (as detected by a radar altimeter) and on first contact the device releases the main parachute so that the lander can bounce away from underneath the canopy.

When the whole package comes to rest, a system of laces holding the three gas-bags onto the lander is cut allowing them to reform and roll away, dropping Beagle 2 onto the surface. Irrespective of which way up it falls a hinge will open the clam shell to start the science phase of the mission.

Beagle 2 will land in a region of Mars named Isidis Planitia. This is a 1500 km wide embayment into the highlands that occupy

much of the Martian equatorial region and southern hemisphere, whose northeast side opens onto the low-lying plains that cover most of the planet's northern hemisphere.

It cannot be predicted exactly where Beagle 2 will come to rest but there is a 99 percent probability of it lying within an ellipse measuring 174 km by 106 km centred at 11.6 degrees N, 269.5 degrees W.

Isidis Planitia is probably a very ancient impact basin caused by the collision of a comet or a 50 km diameter asteroid onto the surface of Mars some three to four billion years ago. Subsequently its floor may have become flooded by volcanic lava before being further buried by sediment derived from the



Beagle 2 has three airbags which will separate to release the lander onto the surface of the Red Planet. Inset: artist's impression of fiery entry into Martian atmosphere.

Photos: all rights reserved Beagle 2

surrounding highlands. A major factor in selecting Isidis as the landing site is that it is low lying (to give the parachutes chance to work), and slightly north of the equator (to take advantage of the relatively warm spring nights and thus minimise the thermal stress on Beagle 2's electronics).

So far as can be deduced prior to landing, the surface within the landing ellipse is hardened dust with about 15 percent of the area covered by rock fragments, mostly smaller than house bricks in size.

The most detailed images available from

83065

83068

83067

23040

previous Mars orbiter missions show details as small as a couple of metres across. These reveal a few ridges and numerous cones occupying about 10 percent of the total area and each a few hundred metres across that may have been produced by small explosive volcanic eruptions. If so, they indicate the presence of ice in the local subsoil, making Isidis Planitia an appealing place to search for signs of life.

So what will the view from the lander reveal? Most likely a stone-strewn plain. There is only a one in 10 chance of landing on a volcanic cone, and perhaps a one in five chance of a nearby cone being visible from the lander. There is an even smaller chance of landing among substantial sand dunes, though small wind-blown drifts of dust are perhaps more likely.

The camera's vantage point on a relatively short robotic arm may not be great for distant views, but we expect to get fascinating close-ups of individual rock and soil specimens prior to studying them with Beagle 2's considerable array of analytical devices.

Isidis is also being considered as the location for one of NASA's future Athena rovers which are also landing in gas-filled bags and subject to the same engineering constraints as Beagle 2.

Beagle 2's scientific payload, which weighs just 10 kg, consists of six instruments and two dedicated tools with which to study the Martian surface and subsurface materials, and a robotic sampling arm with five degrees of freedom.

The eight experiments can be divided into two categories: those mounted directly on the lander platform – namely the Gas Analysis Package (GAP) and the Environmental Sensor Suite (ESS) – and those housed within an innovative structure called the Payload Adjustable Workbench (PAW) located at the end of the robotic arm – namely the Stereo Camera System (SCS), the Microscope (MIC), the X-ray Spectrometer (XRS), the Mössbauer Spectrometer (MBS), and a set of tools that includes the Rock Corer Grinder (RCG), the Planetary Underground Tool (PLUTO), and other support equipment such as a sampling spoon, a torch and a wide-angle mirror. The science-payload/ landed-structure ratio is about 1:3, the highest of any planetary lander to date.

GAP, which is accommodated in the lander's base, will make both quantitative and qualitative analyses of sample composition, as well as precise isotopic measurements.

It can process atmospheric samples as well as material acquired by the sampling tools in the form of soil or rock chippings, which are

deposited into one of eight miniaturised ovens. Gases can be analysed directly (eg those present in the atmosphere), after their release from samples by heating, or as by-products of chemical processing (eg CO₂).

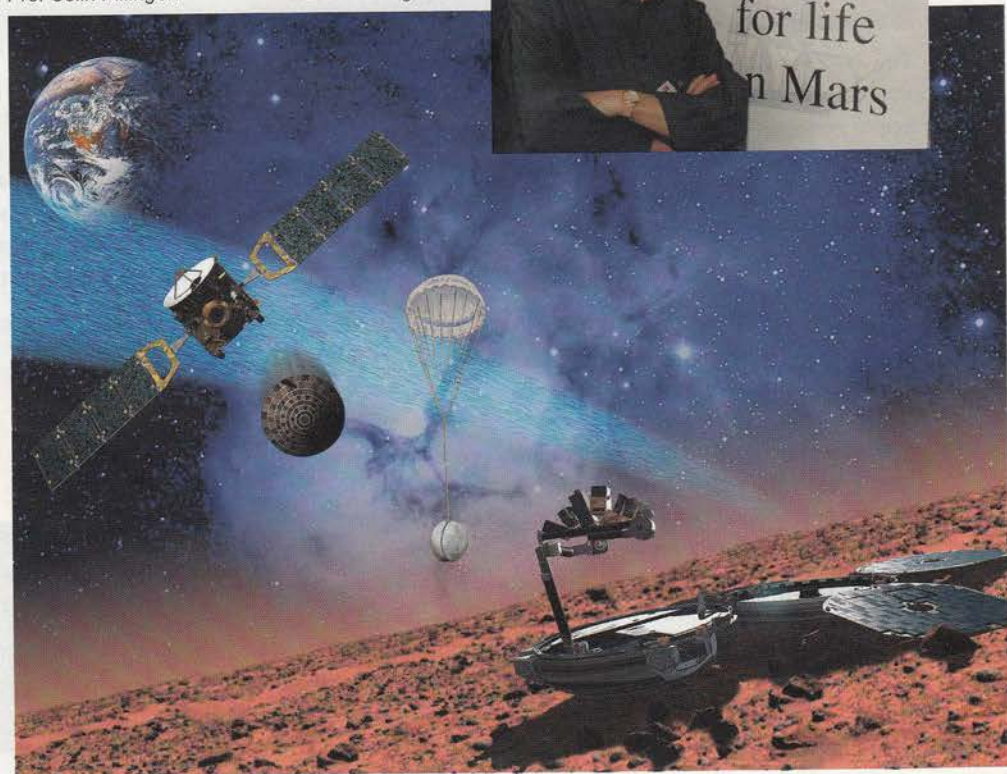
GAP can therefore investigate: processes associated with atmospheric evolution, circulation and cycling, the nature of gases trapped in rocks and soils, low-temperature geochemistry, fluid processes, organic chemistry, formation temperatures and surface exposure ages, and can also assist in isotopic rock dating.

ESS will contribute to characterisation of the landing site and permit meteorological studies using the data from 11 sensors scattered throughout the lander platform and the PAW. Measurements of the ultraviolet radiation flux at the surface together with the oxidising capability of the soil and air will provide insights for exo-biological investigations.

Measurements of atmospheric temperature, pressure, wind speed and direction, dust saltation and angle of repose will complement the in-situ environmental experiments.

SCS, which consists of two identical CCD cameras and integrated filter wheels, will be used back on Earth to construct a Digital Elevation Model (DEM) of the landing site from a series of overlapping stereo image pairs. The DEM will then be used to position the PAW with respect to promising target rocks and soils.

The landing-site investigations will include
Artist impression depicting the various stages of Beagle 2's ground-breaking mission and (inset) Prof Colin Pillinger. Astrium/Beagle 2



panoramic 360 deg imaging, multi-spectral imaging of rocks and soils to determine mineralogy, and close-up imaging of rocks and soils to infer their texture. Observations of the day and night sky, the Sun, the stars, and the Martian moons Deimos and Phobos will allow the assessment of such atmospheric properties as optical density, aerosol properties, and water-vapour content.

The observation of the lander's surfaces and atmospheric effects will allow the dust and aerosol properties of the Martian atmosphere to be assessed.

MIC will investigate the nature of Martian rocks, soils and fines on the particulate scale (few microns), providing important exobiological data in the form of direct evidence of microfossils, microtextures and mineralisations of biogenic origin if present.

By identifying the physical nature and extent of the weathering rinds/coatings on rocks and soils, it will also contribute to geological characterisation of the landing site. Atmospheric and the global planetary studies will also benefit from the more detailed knowledge of dust morphology.

MIC will be the first attempt to directly image and assess individual particles with sizes close to the wavelength of scattered light on another planet. The acquisition of complete

83068

83071

23041

83070

83069

sets of images for each target will allow the 3D reconstruction of sample surfaces in both the visible part of the spectrum and the ultraviolet.

The primary goal with XRS is to determine, in-situ, the elemental composition, and by inference, the geochemical composition and petrological classification, of the surface materials at the landing site.

It can detect major elements (Mg, Al, Si, S, Ca, Ti, Cr, Mn and Fe) and trace elements, and uses X-ray fluorescence spectrometry to determine the elemental constituents of rocks. It can perform radiometric dating of Martian rocks in-situ.

MBS will allow a quantitative analysis of iron-bearing materials in Martian rock and soil materials. Such measurements are particularly important due to the abundance of Fe-bearing minerals on Mars and their formation being

linked to the history of water on the planet.

It will also provide information about rock weathering in general and oxidation in particular. The MBS-generated spectra will allow the characterisation of the mineralogical makeup of rocks and soils, and hence a petrological classification. The MBS also complements the in-situ geochemical and petrological work, and provides support for the GAP measurements.

The RCG, located on the PAW, addresses the latter's need for access to 'fresh', pristine material on a suitably prepared rock surface to avoid the effects of weathering rinds and geometric effects that can seriously compromise instrument performance.

It allows the removal of the altered material and produces a flat, fresh surface suitable for the spectrometer measurements. After the in-

situ analyses have been completed, a ground sample will be extracted using the device's coring action, and delivered to the GAP's inlet port for further chemical analysis.

The PLUTO subsurface sampling device is another PAW tool, which can retrieve soil samples from depths down to about 1.5 m and, depending on the terrain, from under a large boulder. This capability is very important for Beagle 2's exobiological investigations because materials preserving traces of biological activity lie deep within the soil or rocks, where they are unaffected by solar-ultraviolet radiation. PLUTO will make in-situ temperature measurements as a function of time and depth as it penetrates below the surface, and will also allow the soil's mechanical properties and layering to be assessed.

International missions to Mars

Japan targets atmosphere



The Japanese probe Nozomi.

ISAS

The Japanese Mars orbiting aeronomy mission Nozomi could still become the first spacecraft to the study of the Martian upper atmosphere after a trouble-plagued flight.

In mid-November a Japanese space official tried to alleviate fears - that the probe would be unable to enter its planned orbit when it reaches Mars on 14 December - by stating that the probability of hitting Mars was "about one percent" even without any orbit corrections.

Ground controllers now plan to fire Nozomi's steering engines on 9 December followed by a further rocket firing six days later.

Nozomi was launched in July 1998 and was supposed to reach Mars by the end of the following year. However, in December 1998 a main engine firing went wrong.

Two corrective burns had to be made and, by the time the probe was back on its proper course, its remaining fuel wasn't enough to brake itself into the desired survey orbit once it arrived at Mars in October 1999 - and so it flew past.

Japanese controllers were left with the option of working out a flight plan to bring it back to Mars but at a gentler approach speed, requiring four more years of coasting and a pair of Earth fly-by manoeuvres in December 2002 and June 2003.

NASA's twin geologists

The Mars Exploration Rovers (MER) will search for answers about the history of water on Mars. Key to the mission's scientific goals is to search for and characterize a wide range of rocks and soils that hold clues to past water activity on Mars, and the spacecraft will be targeted to sites that appear to have been affected by liquid water in the past.

MER-A, or Spirit, was launched on 10 June 2003 followed by MER-B, or Opportunity just under a month later on 7 July.

Spirit is on course to arrive at Mars' Gusev Crater on 4 January 2004, and three weeks later, Opportunity is due to arrive at a level plain called Meridiani Planum on the opposite side of Mars from Gusev. Each rover will examine its landing area for geological evidence about the history of water there, key information for assessing whether the site ever could have been hospitable to life.

After the airbag-protected landing craft settle onto the surface and open, the rovers will roll out to take panoramic images. These will give scientists the information they need to select promising geological targets that will tell part of the story of water in Mars' past. Then, the rovers will drive to those locations to perform on-site scientific investigations over the course of their 90-day mission.

The lander's petals will unfold and the rover will drive onto the surface of Mars. NASA



83075

23042

BBC : 05 JANUARI 2004.

D-DAY BECKONS FOR MISSING BEAGLE

The European Space Agency is to make a last-ditch attempt on Wednesday to locate the missing Beagle 2 probe. Mission scientists are pinning their hopes on Beagle's mothership, Mars Express, which will fly over the presumed landing site at 1213 GMT. Numerous attempts to communicate with the lander through the US satellite Mars Odyssey and radio telescopes on Earth have all ended in failure. If Mars Express cannot find Beagle, the mission will be classed as lost. The comparison between Beagle's arrival at Mars and that of the US space agency's (Nasa) probe Spirit could not be more stark. While Spirit sent back spectacular images of the barren, dust-strewn surface of Mars within hours, nothing has been heard from Beagle since 25 December. Scientists are now focusing on three main reasons for Beagle's continued silence: a software glitch, a problem with the probe's receiver or transmitter, or the growing possibility that it was destroyed on landing. But the British experts behind the Beagle project, and their counterparts at the European Space Agency, have refused to give up hope. "If there's any chance for Beagle, we can pick it up. If not tomorrow, within the next few weeks," said Alan Moorhouse, spacecraft operations manager at the European Space Operations Centre in Darmstadt, Germany. "We don't give up yet." Hopes now rest on the communications link between Mars Express and Beagle 2, the only method of contact that has been fully tested. Mars Express carried the 60-kilogram lander most of the way to the fourth planet, and the two spacecraft are well used to "talking" to each other. There is a possibility that Mars Odyssey and radio telescopes have been unable to contact the £45m probe because of an incompatibility problem. Mars Express - Europe's first sole mission to Mars - has been unable to search for its lost "baby" until now because it has not been in the correct orbit. On Wednesday, at around midday (GMT), it will swoop over the vast plain, Isidis Planitia, where Beagle should have landed, at a height of 375 km (233 miles) above the surface - the closest it can get. Mars Express will send out a radio signal to the probe in the hope that Beagle will hear it and cry out. Continued silence would be a huge blow for the mission. But there are other chances on 8, 9 and 10 January for flyovers of about five to eight minutes each time. On 9 January, the orbiter will fly down the centre of the landing zone and use its high-resolution stereo camera to hunt for signs of Beagle's parachutes and airbags. Other passes by Mars Express on January 12 and 14 are potentially much longer, providing even better possibilities to talk to Beagle 2. "We haven't in any shape or form given up on Beagle 2," said lead scientist Professor Colin Pillinger. At some point, however, mission officials will have to concede defeat. Mars Express, which has been somewhat overshadowed by the misfortune of its passenger, is due to start mapping the planet in unprecedented detail and searching for underground water. "It is a call for the scientists involved with the mission to make that trade-off," said Dr Moorhouse.

Na (83077) 80

08038/

83077

Lord Sainsbury, Britain's science minister, had it exactly right—and exactly wrong—when he commented on the initial failure of the Beagle 2 lander to communicate from the surface of Mars after its descent on Dec. 25. Sainsbury properly called for a Beagle 3 project under the auspices of the European Space Agency's Aurora planetary exploration program. It is encouraging to see British leaders vigorously pushing space-based science again after 40 years of quiescence.

But he was wrong when he noted the "high-risk" nature of Beagle 2, and cautioned, "we must avoid the temptation in future to only do low-risk projects." Certainly risk is an element in any undertaking as difficult as a robotic landing on Mars. Yet Sainsbury is mistaken if he believes Europe's future in space should follow the Beagle 2 model. While the professors who put the mission together must be commended for the energy and ingenuity they brought to bear, they were forced by government penury to design, build and test on the cheap. That pushed their project beyond high risk into foolhardiness.

NASA learned that lesson with the two "faster-better-cheaper" probes it launched to Mars in 1998. Both the orbiter and lander failed because, as the inevitable outside-expert post-mortem had it, the U.S. agency overdid the "cheaper" part of the equation by about 30%. Fiscal cir-

Beagle 2 Silence: Penury Scores Again?

cumstance drove the Beagle 2 designers to ignore even the most explicit lessons of NASA's Mars Climate Orbiter and Polar Lander, including the need for some sort of telemetry during descent that might have given designers of fu-

ture landers at least some idea of what went wrong. It is hard to know just how cheap Beagle 2 was, since project leader Colin Pillinger won't say how much the lander cost, out of fear that those who donated hardware and expertise to its development would be beset by hordes of high-tech beggars with equally high-risk dreams. By comparison, ESA freely admits it spent about 300 million euros (\$375 million) on Mars Express, the orbiter that dropped off Beagle 2 for landing before it went into orbit around the planet. That, too, can be characterized as a cheap mission in an arena that saw NASA's \$1-billion Mars Observer vanish without a trace in 1993. But ESA project managers avoided excessive risk by using hardware proven on other missions, while spending what it took on testing.

We hope Mars Express will find Beagle 2 when it moves into position to use its more-compatible radio receiver this week. But come what may, a proper balance of cost and risk has enabled ESA to join the exclusive club of Mars explorers, while the high-risk Beagle 2 will have left the U.K. barking up the wrong tree even in the unlikely event it is found functioning on the planet's surface.

10008-10 AWST 05-01-2004

04108

23043

Beagle 2 bleibt weiter stumm

83078

DARMSTADT (afp/rtr). Die Aussichten auf eine Kontaktaufnahme mit dem europäischen Mars-Landegerät „Beagle 2“ werden immer geringer. Auch bei einem niedrigen Überflug der europäischen Marssonde Mars Express über das Landegebiet gelang es gestern nicht, ein Signal von „Beagle 2“ aufzufangen. Dabei hatten die Wissenschaftler große Hoffnungen in diesen Tag gesetzt: In 315 Kilometern Höhe flog die Muttersonde „Mars Express“ über das Gelände, wo das verschollene Landegerät vermutet wird. ESA-Wissenschaftsdirektor David Southwood machte keinen Hehl aus seiner Enttäuschung: Er habe eine „traurige Nachricht“, verkündete er am Nachmittag im Kontrollzentrum in Darmstadt. Aufgeben wollen die Wissenschaftler trotzdem noch nicht. In den kommenden Wochen will die ESA mehrere Anläufe starten, Beagle 2 doch noch zu finden.

Rheinische Post:

08-01-2004.

83079

P181 tt-TV1 181 vr 02 Jan 23:40:11

Ruimtevaart

MARSLANDER BEAGLE 2 BLIJFT STOM

Een nieuwe poging om de spoorloze Marslander Beagle 2 te vinden, heeft geen resultaat opgeleverd.

Wetenschappers uit Darmstadt in Duitsland hebben via een overvliegende Amerikaanse satelliet een signaal uitgezonden dat de klok van het ruimtetuig moest herstarten. Maar voorlopig is dat nog niet gelukt.

De Europese moedersatelliet komt pas zondag in de juiste baan om Mars. Dan kunnen de deskundigen nog een nieuwe poging wagen.

Belgie neemt deel aan het Brits-Europese Marsproject met twee experimenten.

Volgende Binnenland Economie Inhoud

Beagle 2: Sargdeckel bald zu?

83080

Mars-Mission Europäischer Geländeroboter weiterhin verschollen

Einen Tag nach der erfolgreichen Mars-Landung hat die US-Raumsonde „Spirit“ gestern Aufnahmen vom Roten Planeten zur Erde geschickt. Wie die Nasa im kalifornischen Pasadena mitteilte, bereitet sich das Gefährt auf die erste Erkundungstour vor. Der deutsche Raumfahrtexperte Harro Zimmer äußerte sich unterdessen verhalten zu den Aussichten, das europäische Landegerät „Beagle 2“ noch zu orten.

Bereits kurz nach seiner Landung hatte der kleine US-Roboter Spirit Schwarz-Weiß-Fotos zur Erde gefunkt. Die Qualität der farbigen Aufnahmen sei zudem dreimal besser als die der Pathfinder-Mission im Jahr 1997, so die Nasa-Techniker. Mit seiner Bord-Antenne soll Spirit demnächst die Fotos mit Übertragungsraten von über 11 000 Bit pro Sekunde direkt zur Erde schicken. Auf dem Umweg über Satelliten können die außerirdischen Ansichtskarten sogar

mehr als zehn Mal so schnell gesendet werden. Mit Spannung erwarten die Forscher der Nasa den ersten Ausflug von Spirit. In etwa neun Tagen soll das solar-betriebene Gefährt sich auf die Mars-Oberfläche wagen. Die Aussichten seien gut, so Jennifer Trospen, die den Einsatz beaufsichtigt. Spirit sei gut gelandet, es lägen keine größeren Steine im Weg.

Bevor am 25. Januar das zweite US-Marsgefährt, „Opportunity“, genau auf der gegenüber liegenden Planetenseite landen soll, wird es auch für die Europäer noch einmal ernst: Morgen überfliegt die Raumsonde „Mars Express“ der Europäischen Raumfahrtagentur (Esa) in nur 375 Kilometern Höhe jene Stelle, wo der europäische Geländeroboter „Beagle 2“ vermutet wird. Die Europäer würden dann „das entscheidende Ohr an Beagle 2 legen“, sagte Zimmer. „Noch haben wir ihn nicht beerdigt.“ Wenn Mars Express dann noch

immer kein Signal empfangen, „können wir den Sargdeckel zumachen“.

Das britische Marsgefährt ist seit der geplanten Landung am 25. Dezember verschollen. Zimmer verwies darauf, dass die Nasa für ihre Mission vier Mal mehr Kapital eingesetzt habe als die Esa und deshalb nicht von einem echten Wettrennen gesprochen werden könne. Die US-Behörde lässt sich ihre Marserkundung diesmal 820 Millionen Dollar (gut 650 Millionen Euro) kosten.

Drei Monate lang sollen 250 Experten mittels Spirit und Opportunity in bis zu 400 Millionen Kilometer Entfernung von der Erde nach Spuren von Leben suchen. Die Esa-Experten müssen sich möglicherweise mit der Vogelperspektive des Mars Express begnügen. Aber auch dessen Spezialgeräte können mit Radaraufnahmen bis zu vier Kilometer unter der Planetenoberfläche Wasser und Eis nachweisen.

Rheinische Post: 06-01-2004.

58083

23044

DAG VAN DE WAARHEID VOOR BEAGLE 2.

RIJSWIJK - Woensdag wordt de dag van de waarheid voor de marslander Beagle 2. De Europese ruimtevaartorganisatie ESA heeft al haar hoop gesteld op de Mars Express die om 13.15 uur (Nederlandse tijd) voor het eerst recht over de vermiste verkennerslijgt. Als het moederschip de zwijgende Beagle niet kan vinden, geldt de marslander als verloren. Beagle kwam op eerste kerstdag op de rode planeet aan, maar heeft sindsdien niets meer van zich laten horen. De talloze pogingen om via de Amerikaanse satelliet Mars Odyssey en radiotelescopie op aarde contact te krijgen leverden geen enkel levensteken op. De overvlucht van Mars Express, op een hoogte van 375 kilometer, is echter de "eerste optimale gelegenheid" om contact te krijgen, aldus de ESA. De verbinding via het moederschip geldt als het betrouwbaarst, omdat zij volledig op elkaar zijn afgesteld. De communicatie tussen beide grondig is getest. Mocht er woensdag geen teken van leven zijn, dan volgen er de komende dagen nog meer pogingen. "Het is niet alleen een kwestie van bliepjes oppikken, Mars Express kan ook nog commando's geven", aldus een woordvoerder van ESA in Noordwijk. Verder zal de camera van het moederschip vrijdag de omgeving fotograferen. ESA hoopt dat op de beelden de parachutes en airbags zijn te zien. "Als we vrijdag nog niets weten, is het voorbij". Wetenschappers concentreren zich op drie mogelijke redenen voor het zwijgen van de Beagle. Er kan een storing in de software zijn of een probleem met de communicatieapparatuur van de lander, maar de ESA heeft steeds meer de idee dat de ruim 60 miljoen euro kostende Beagle tijdens de risicovolle landing op de planeet is vernietigd. De lander heeft - of had - instrumenten om in de grond te boren en de omgeving af te schrapen naar sporen van mogelijk leven. De vermissing van de Beagle, een belangrijk onderdeel van de eerste Europese missie naar een andere planeet, staat in scherp contrast met de Amerikaanse robot Spirit. Die maakte zondag een perfecte landing op Mars en stuurt inmiddels haarscherpe foto's van de omgeving naar de aarde.

BBC : 07 JANUARI 2004.

NO BARK HEARD FROM BEAGLE 2 PROBE.

The British-built Mars probe Beagle 2 has failed to call Earth, dashing hopes that its mothership Mars Express would establish contact with the robot. Wednesday's attempt to reach Beagle was considered the last - and best - hope of locating the missing lander. But the European orbiter picked up no signal as it passed over the presumed landing site at 1213 GMT, mission controllers in Germany have announced. If other attempts to communicate fail, the mission will be classed as lost. At a news conference held at 1500 GMT in Darmstadt, Germany, Professor David Southwood, head of science at the European Space Agency (Esa), gave journalists the sad announcement. "We did not get any content of a signal or indeed a signal from the surface of Mars," he said. "This is not the end of the story; we have many more shots to play. But I have to say, this is a setback. I have to say it makes me very sad." Professor Colin Pillinger, lead scientist on the Beagle team, was disappointed but was determined not to give up yet. "We will play to the final whistle. It only takes a fraction of a second to score a goal. Let's not give up yet. But it really is a moment when we have to start looking at the future as well. "There was no RF [radio frequency] signal seen by Mars Express," said Dr Mark Sims, mission manager on Beagle 2. Further flyovers of the presumed landing site by Mars Express will occur on 8, 9, 10, 12 and 14 January. But Prof Pillinger said Mars Express' transmitter may have to be shut off if contact has not been made after 22 January. Other attempts may be made with the Jodrell Bank telescope after Beagle switches into a another communications backup mode on 2 February. "My personal view is if we have not received a signal within 5-10 days after that event, we have to assume Beagle is lost," Dr Sims explained. "We're still playing - still playing for the final whistle - but we might have to score two because the other team have scored an away goal and equalising ain't going to be enough." "The prospects took a dive today. Until today, I had a candle alight for Beagle, but today I feel it's guttering in the wind," Professor Southwood told BBC News Online. Although this is not the last chance to contact Beagle, Wednesday's conference was marked by much talk of future missions. Previously, scientists had insisted on focussing on options for the recovery mission. After digesting the news, Prof Pillinger extolled the merits of continuing with British space research. "I think this is the time when such managers start thinking along the lines of what am I going to say to the chairman and the board in the morning. "What you expect to say, really and truly is: 'I have a fantastic team here. If you give me a little bit more support and instead of playing just the occasional cup run like this, we could be playing in the Premier Division." "Let's go back to Mars with Beagle 2. Let's have a second voyage," he later told BBC News 24. But the next time, we must have redundancy by having more than one lander." "The big prize isn't won, yet. There's still everything to play for. Seeking past and present life on Mars is still available for us," Prof Pillinger said. On 9 January, the orbiter will use its high-resolution stereo camera to hunt for signs of Beagle's parachutes and airbags. A spectrometer on Mars Express may also be able to search for signs of ammonia in the atmosphere from Beagle's airbags.

83081

83082

MARS EXPRESS FAILS TO CONTACT BEAGLE 2.

DARMSTADT - Europe's Mars Express orbiter failed to pick up a signal from the Beagle 2 probe on Wednesday leaving a disappointed mission control without sign from the lander since it was spun off toward the Red Planet in mid-December. Flying 315 kilometers (195 miles) above the site where the probe was to have landed, Mars Express reported no transmissions from the Beagle 2, which was programmed to emit a steady beep-beep-beep after it bounced to a soft landing on air bags. "Today in conditions we thought were very good for getting direct communication between Mars Express and Beagle 2, we did not get any contact," said David Southwood, the European Space Agency's director of science. "This is not the end of the story, but I have to say this is a setback. It makes me feel very sad." European scientists have said that Beagle 2's mothership provides the best chance of getting in touch with the 67-kilogram (143-pound) probe, after several failed attempts by NASA's Mars Odyssey orbiter as well as British and U.S. radio telescopes. The European Space Agency, on its first Mars mission, has been upstaged by NASA, whose probe landed safely over the weekend on the Red Planet. Both missions are aimed at determining if there was ever life on Mars. Mars Express will mostly devote the coming days to try to contact the Beagle 2. If it is not successful, it will turn to other tasks after Monday while seeking contact more sporadically, Southwood said. Even if Beagle 2 is lost, Mars Express will still be able to carry out 2/3 of the planned experiments. The orbiter is equipped with a powerful radar that can probe beneath the surface for indications of water or ice that may have once supported living organisms. The first photos are expected early next week, which could also help provide confirmation that Beagle 2 actually landed, Southwood said. "Obviously I'm pessimistic right now. It's been a blow. But I'm not writing Beagle off yet," Southwood said. Scientists have acknowledged that the British-built Beagle 2 may have tumbled down a crater on the rocky Martian surface. As the Europeans desperately tried to figure out what happened to the probe, their NASA colleagues were broadcasting the first full-color photos of the Martian surface taken by the Spirit rover.

193083

118020

83085

83084

Europese ruimterobot Beagle blijft zwijgen

DARMSTADT ANP

De marslander Beagle 2 blijft spoorloos. De Europese ruimtevaartorganisatie ESA is er ook gisteren niet in geslaagd om contact te krijgen met de zwijgende sonde. Dat heeft de organisatie in het controlecentrum in Darmstadt gezegd.

De kansrijkste poging op een levensteken van de Beagle, door middel van het moederschip Mars Express, leverde gisteren geen enkel signaal op. „We moeten ervan uitgaan dat de Beagle is vernietigd of in een krater is terechtgekomen”, zei projectleider Mike McKay. De ruimterobot kwam op eerste kerstdag op de rode planeet aan, maar heeft sindsdien niets meer van zich laten horen. De talloze pogingen om via de Amerikaanse satelliet Mars Odyssey en radiotelescopieën op aarde contact te krijgen, leverden geen enkel levensteken op. De passage van de Mars Express, op een hoogte van 375

kilometer, was de „eerste optimale gelegenheid” om verbinding te leggen, aldus de ESA. De verbinding via het moederschip geldt als het betrouwbaarst, omdat zij volledig op elkaar zijn afgesteld. De komende dagen volgen meer communicatiepogingen. „Het is niet alleen een kwestie van bliepjes oppikken, Mars Express kan ook nog commando's geven”, aldus een woordvoerder van ESA in Noordwijk. Verder zal de camera van het moederschip morgen de omgeving fotograferen. ESA hoopt dat op de beelden de parachutes en airbags te zien zijn. „Als we dan nog niets weten, is het voorbij.” Wetenschappers concentreren zich op drie mogelijke oorzaken van het zwijgen van de Beagle. Er kan een storing in de software zijn of een probleem met de communicatieapparatuur van de lander, maar de ESA sluit niet uit dat de ruim 60 miljoen euro kostende Beagle tijdens de risicovolle landing te pletter is geslagen.

Hoop op signaal van Marslander Beagle opgegeven

Van onze verslaggever AMSTERDAM

De Europese Marslander Beagle 2 blijft spoorloos. Het moederschip Mars Express, dat woensdag voor het eerst over de landingsplek vloog, kreeg geen contact met het voertuig. 'We moeten ervan uitgaan dat de Beagle is vernietigd of in een krater terecht is gekomen', zei vlucht leider Mike McKay in het vluchtleidingscentrum in Darmstadt.

De Beagle 2 heeft sinds zijn aankomst op Mars, op eerste kerstdag, niets van zich laten horen. Alle hoop was op de passage van de Mars Express gevestigd, op 375 kilometer hoogte. Het communicatiesysteem van het moederschip is speciaal op de Beagle afgestemd, en is daar op aarde grondig voor getest.

Dit in tegenstelling tot de Amerikaanse sonde Mars Odyssey en enkele aardse radiotelescopieën, die eerder vergeefse pogingen deden signalen van de Beagle op te pikken.

Bovendien kan het moederschip niet alleen signalen ontvangen, maar ook commando's naar de lander toe sturen. De vlucht leiders hoopten op die manier de Beagle weer tot leven te wekken.

DDL:

08-01-2004

Volkscrant!

08-01-2004

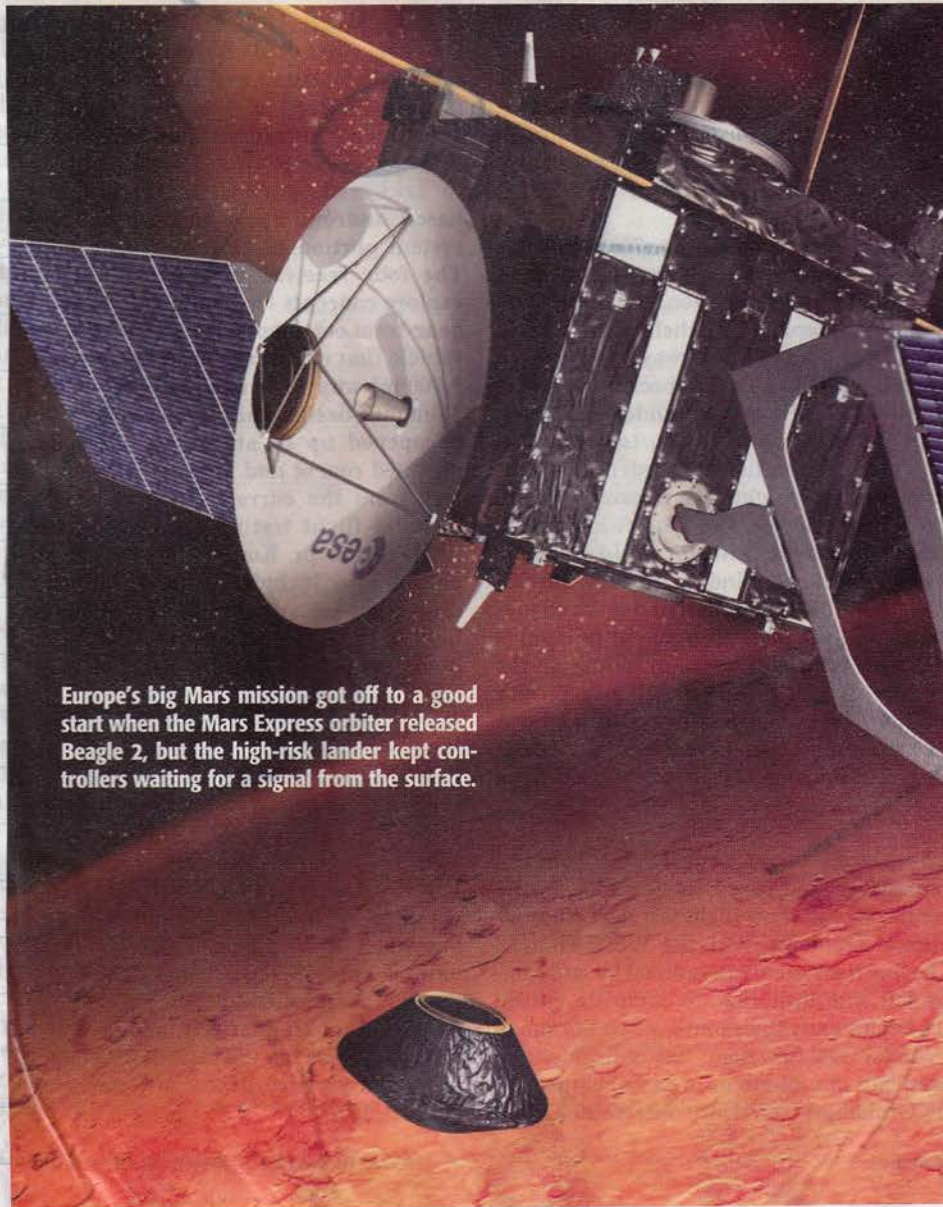
211085

23046

BEAGLE STRAYS

ESA's Mars Express seen as best hope to locate the missing British lander

DOUGLAS BARRIE/LONDON and FRANK MORRING, JR./WASHINGTON



Europe's big Mars mission got off to a good start when the Mars Express orbiter released Beagle 2, but the high-risk lander kept controllers waiting for a signal from the surface.

83086

53048

23047

Spacecraft controllers in Darmstadt, Germany, have given the European Space Agency's Mars Express orbiter an unwanted if not entirely unexpected first mission following its successful arrival at the red planet—trying to pick up a signal from Britain's Beagle 2 lander that rode the orbiter to Mars and then was silent after it descended into the atmosphere.

A 4-min. burn of its 400 N main engine on Dec. 30 shifted Mars Express from the equatorial capture orbit it entered on Dec. 25 into a highly elliptical polar orbit inclined 86 deg. to the planet's equator. A second planned burn Jan. 4 would bring the orbiter over the Beagle 2 landing site in the Isidis Planitia Basin on Jan. 7 at an altitude of 315 km. (170 naut. mi.).

From that vantage point Beagle 2 managers hoped the ESA orbiter would be able to receive the first indication that the lander was functioning on the surface and relay it to Earth. After its entry into the Martian atmosphere at 2:47 a.m. GMT Dec. 25 (9:47 p.m. EST Dec. 24) the 73-lb. lander failed to communicate using timed signals and untested links through NASA's Mars Odyssey orbiter and the Jodrell Bank Observatory in the U.K.

Beagle 2 was designed to shift into "communication search mode 1" following 10 unsuccessful attempts to communicate on a preprogrammed schedule via Odyssey or Jodrell Bank. Using the increased current generated by its solar arrays at dawn as a signal that it would be safe to transmit without consuming precious battery charge, the lander would broadcast more frequently and be open to "blind" commands from Earth.

In addition to Jodrell Bank, Beagle 2 controllers have already used a radio telescope at Stanford University in California to listen for signals. The Westerborg telescope in the Netherlands and the Effelsberg telescope in Germany were also available to listen if needed, but Mars Express was considered the best opportunity for a linkup because of its proximity and because its radio has



Mars Express returned an image of the Beagle 2 lander moving away following its Dec. 19 separation (top), but the lander failed to communicate after it entered the planet's atmosphere. Controllers later shifted Mars Express into polar orbit as planned.

been tested with the one on Beagle 2. Based on the Mars Express orbit established by the Dec. 30 burn, the first chance the European orbiter might pick up a signal from Beagle 2 came on Jan. 4. Subsequent opportunities preprogrammed into Beagle 2 were to occur on Jan. 6 (11:00 a.m.-12:20 p.m. GMT), Jan. 12 (3:10-4:30 a.m. GMT), Jan. 13 (3:18-4:38 p.m. GMT) and Jan. 17 (5:50-7:10 p.m. GMT).

"The 6th and 12th are when Mars Express is maneuvering into its final orbit, so they are not optimum for Beagle 2 communications," said Mark Sims, Beagle 2 mission manager. "The 13th and 17th are very good opportunities for Mars Express."

That assumes the spacecraft survived its risky plunge to the planet's surface, and was working as programmed after landing. An "Analysis and Recovery Think Tank" was set up at the Univer-

sity of Leicester's Lander Operations Control Center to brainstorm possible failures and recoveries after Beagle 2 failed to signal early in its programmed sequence.

Possibilities with some hope of recovery included a landing off course or with the lander tilted, and a failure of the solar arrays to open fully. Imagery from NASA's Mars Global Surveyor taken 20 min. after the scheduled landing time showed fine weather, but it also revealed a previously unobserved 1-km. crater that could have caused trouble on touchdown.

Like NASA's 1997 Mars Pathfinder lander and the two Mars Exploration Rovers set to touch down this month, Beagle 2 was designed to take a direct descent approach to the surface using a heat shield, drogue and main parachutes to slow down and inflatable bags to cushion its landing. The entire sequence from entry to surface should have taken 7 min.

Mars Express released Beagle 2 right on target for its unpropelled descent on Dec. 19 and later sent an image of the lander moving away from it (see top photo, above). But after that the lander was on its own, relying on its internal clock to conduct the landing autonomously some 9 light-min. from Earth. The failure analysis team also was studying the possibility that the onboard timing may have slipped or was lost altogether because of a software failure.

If the lander survived, deployed its arrays to collect power before its batteries expired and can be recovered by the team at Leicester, its primary mission will be to measure the ratio of carbon isotopes present in Martian rock samples. Beagle 2 scientists would consider a high ratio of carbon 12 to carbon 13 in the samples rooted up with a spring-loaded digger attachment dubbed the mole as an indicator of biological processes (*AW&ST* Dec. 1, 2003, p. 57).

Beagle 2's cost was small by space exploration standards, reportedly about 50 million pounds (\$89 million), although the project has not released figures. While the design team took innovative steps to hold down expenses, the danger of doing so was well understood.

"We've always recognized that Bea-

83087

83088

FH025

23048

gle 2 was a high-risk project, and we must avoid the temptation in future to only do low-risks projects," said Lord David Sainsbury, the U.K. minister of science and innovation.

The potential loss of Beagle 2 overshadowed the early success of Mars Express, which made ESA only the third space agency after NASA and the Soviet Union's Space Research Institute to reach Mars orbit. Built for about 300 million euros (\$372 million), including its launch on a Russian Soyuz/Fregat vehicle, the 2,305-lb. spacecraft is planned to spend at least one Martian year of 687 Earth days mapping the planet's atmosphere, surface and subsurface to a depth of a few kilometers.

From an elliptical orbit that will bring it as close as 259 km. to the surface, Mars Express should be able to produce a full-planet 3-D map in full color with its high-resolution stereo camera, which was designed to capture images as fine as 2-meter (6.5-ft.) resolution in selected areas. A visible and infrared mapping spectrometer will map surface mineralogical composition with a resolution of 100 meters, while an ultraviolet and infrared atmospheric spectrometer is to produce seasonal maps of ozone and water vapor over the entire planet.

ADDITIONAL atmospheric analysis will be conducted by a planetary Fourier spectrometer, which will measure the vertical pressure and temperature of carbon dioxide and look for water, carbon monoxide, methane and formaldehyde. An energetic neutral atoms analyzer will study the interaction of oxygen and hydrogen atoms with the solar wind in the planet's outer atmosphere. The spacecraft will also use its own radio waves back to Earth to study the Martian ionosphere, atmosphere, surface roughness and interior as reflected in the gravity field.

Mars Express carries a 40-meter-long antenna for its subsurface sounding radar altimeter, which will use low-frequency radio waves to map the thickness of sand deposits below surface dunes, as well as other subsurface structures and materials including water and ice. In addition to characterizing the basic planetology of Mars, ESA has adopted the same follow-the-water approach with Mars Express that NASA uses to prospect for evidence of life there.

"A major goal for Mars Express is to find out whether there is or has been life on Mars and where the water is and how much we have on the planet at present," said Agustin Chicarro, ESA's Mars Express project scientist.

Marslander Beagle 2 is verloren

DARMSTADT, 8 JAN. De marslander Beagle 2 blijft spoorloos. De Europese ruimtevaartorganisatie ESA is er ook gisteren niet in geslaagd om contact te krijgen met de zwijgende sonde. De meest kansrijke poging op een levensteken van de Beagle, via het overvliegende moederschip Mars Express, leverde gisteren opnieuw geen enkel signaal op. „We moeten er vanuit gaan dat de Beagle vernietigd is of in een krater terecht is gekomen”, zei projectleider Mike McKay in het Duitse Darmstadt.

NRC

Handelsblad:

08-01-2004.

Hoop op teken van Beagle 2 vervliegt

DARMSTADT — De hoop op een teken van marslander Beagle 2 is nagenoeg verloren. De Europese ruimtevaartorganisatie ESA is er ook gisteren niet in geslaagd om contact te krijgen met de zwijgende sonde, zo heeft de organisatie gisteren gemeld. „We moeten er vanuit gaan dat de Beagle vernietigd is of in een krater terecht is gekomen”, zei projectleider Mike McKay. De Beagle arriveerde op 25 december op Mars, maar heeft sindsdien niets meer van zich laten horen.

Spits:

08-01-2004.

83088

23049

83091

Marslander Beagle 2 blijft spoorloos

DARMSTADT — De marslander Beagle 2 is nog steeds zoek. De Europese ruimtevaartorganisatie ESA is er ook gisteren niet in geslaagd om contact te krijgen met de zwijgende sonde. Dat heeft de organisatie in het controlecentrum in Darmstadt gezegd.

De kansrijkste poging op een levenstekken van de Beagle door mid-

del van het moederschip Mars Express, leverde gisteren geen enkel signaal op. „We moeten ervan uitgaan dat de Beagle vernietigd is of in een krater terecht is gekomen”, zei projectleider Mike McKay.

Beagle kwam op eerste kerstdag op de rode planeet aan, maar heeft sindsdien niets meer van zich laten horen. De talloze pogingen om via

de Amerikaanse satelliet Mars Odyssey en radiotelescopen op aarde contact te krijgen leverden geen enkel levenstekken op.

De overvlucht van Mars Express, op een hoogte van 375 kilometer, was gisteren de „eerste optimale gelegenheid” om contact te krijgen, aldus de ESA. De verbinding via het moederschip geldt als het betrouwbaarst, omdat zij volledig op elkaar zijn afgesteld en de communicatie tussen beide grondig is getest.

Nu er gisteren geen teken van leven is gegeven, volgen er de komende dagen toch nog meer pogingen. „Het is niet alleen een kwestie van bliepjes oppikken, Mars Express kan ook nog commando's geven”, aldus een woordvoerder van ESA in Noordwijk. „Als we vrijdag nog niets weten, is het voorbij.”

Wetenschappers concentreren zich op drie mogelijke redenen voor het zwijgen van de Beagle.

Er kan een storing in de software zijn of een probleem met de communicatieapparatuur van de lander, maar de ESA heeft steeds meer het idee dat de ruim € 60 miljoen kostende Beagle tijdens de risicovolle landing op de planeet is vernietigd. De lander heeft - of had - instrumenten om in de grond te boren en de omgeving af te schrapen naar sporen van mogelijk leven.

Spits; 08-01-2004.

Beagle

Darmstadt - De eerste foto's van het Europese moederschip Mars Express hebben nog geen spoor vertoond van de marslander Beagle 2. Volgens het controlecentrum heeft het moederschip geen enkel signaal van de marslander ontvangen toen het over de landingsplaats vloog.

83092

DDL;
13-01-2004

02028

CNN; 10 JANUARI 2004.

NEW BID TO FIND LOST MARS PROBE.

83093

DARMSTADT - Further attempts are being made to contact the Beagle 2 Mars probe, which has been missing since Christmas Day. Scientists have tried on several occasions to find the lander since it was spun off towards the red planet in mid-December, but without success. Europe's Mars Express orbiter will again fly over the landing site on Saturday and on Monday to try to pick up a signal. Flying 315 kilometers (195 miles) above the site where the probe was to have landed, Mars Express last week reported no transmissions from the probe, which was programmed to emit a steady beep-beep-beep after it bounced to a soft landing on air bags. European scientists believe Beagle 2's mothership will give them the best chance of contacting the 67-kilogram (143-pound) probe, after several failed attempts by NASA's Mars Odyssey orbiter as well as British and U.S. radio telescopes. Despite the setback, Mars Express will continue to carry out experiments on whether Mars ever supported life. The orbiter carries a powerful radar that can probe beneath the planet's surface for indications of water or ice. The fate of the British-built Beagle 2 -- part of Europe's first mission to Mars -- remains unclear. Scientists suspect it possibly tumbled down a crater on the rocky Martian surface. As the Europeans tried to find the probe, their NASA colleagues broadcast the first full-color photos of the Martian surface taken by the Spirit rover, which landed safely last weekend on the planet.

02028

04025

23050

SPACE.COM : 11 JANUARI 2004.

EUROPE'S LATEST BID TO CONTACT MARS PROBE FAILS.

LONDON - The European Space Agency's Mars Express orbiter failed to contact the Beagle 2 probe in its latest attempt on Saturday, British scientists said. Mars Express flew over Beagle's designated landing site on Mars at about 1404 GMT but heard no signal, mission scientists said. Hopes of finding the British-built lander, which was due to touch down on the Red Planet on Christmas Day, are fading fast. Scientists said Mars Express would make another pass over the landing site early on Monday and would listen for a signal. After that, the orbiter will move to less advantageous communicating position. Beagle 2 has not been heard from since it separated from the mothership in mid-December, despite contact efforts by Mars Express, NASA's Mars Odyssey orbiter and British and U.S. radio telescopes. The diminutive, 143-pound lander was equipped with a mechanical arm to sample Martian soil and rocks. Mars Express will orbit the planet for at least one Martian year -- almost two Earth years -- using its radar to search for signs of water or ice which may once have sustained living organisms.

830 94

CNN : 11 JANUARI 2004.

ATTEMPTS TO CONTACT MARS PROBE FAIL.

LONDON - The latest attempt to contact a British-led mission to Mars from its orbiting mothership failed on Saturday, compounding the growing fears that the Beagle 2 probe crashed during its landing on Christmas Day. A spokeswoman for the mission said that no signal had been detected when the mothership, the Mars Express, passed above the probe's presumed landing site at 1404 GMT. "I can confirm no signal was detected, the next opportunity will be on the 12th," she said, adding that the communication should be better on the 12th than in the last two days due to its position. The gloom surrounding the first all-European mission to Mars contrasts with the elation at NASA, which has received high-definition pictures in the last few days from its robot explorer Spirit which landed safely on the Red Planet last week. After the 12th, the Express will pass over the landing site again on the 14th. The last attempt will be made in February. The failure to pick up a signal increased fears that the probe, no bigger than an open umbrella, has suffered the same fate as many craft before it and ended up as scrap metal strewn across Mars. But Professor Colin Pillinger, the lead scientist on the mission, has repeatedly said he refuses to give up.

83095

Still Astray

As hope fades for recovering Beagle 2 lander, European mission team turns to orbiter

MICHAEL A. TAVERNA/PARIS and DOUGLAS BARRIE/LONDON

Engineers have not given up hope of establishing a communications link with Europe's Beagle 2 lander, but are already shifting most of their attention to the accompanying Mars Express orbiter, which was inserted into Martian orbit last Dec. 19 without a hitch.

Using NASA's Mars Odyssey and radio telescopes on Earth, mission controllers had tried to pick up a signal from Beagle 2 following touchdown on the Martian surface on Dec. 25 (AW&ST Jan. 5, p. 22). They had placed considerable hope in a new attempt on Jan. 7 using Mars Express, whose communications system, unlike that on Odyssey, underwent end-to-end tests with Beagle 2.

But this attempt, performed after a series of orbit-lowering and inclination-trim maneuvers on Jan. 4-6 that brought the orbiter to within 315 km. of the lander's planned landing site in the Isidis Planitia basin, also came up short.

Renewed overflights of the Beagle 2 landing site by Mars Express were planned for Jan. 8-10 and Jan. 12, the day considered the most propitious. Further attempts will be made if needed, said the European Space Agency's science director, David Southwood. "[Jan. 7] was the first good opportu-

nity, but there will be others. It'll be quite a few more weeks before we cease trying." However, he acknowledged that "the odds took a dive" after Jan. 7.

If, as seems increasingly likely, this proves unsuccessful, then scientists may face having to wait until perhaps early February to see if Beagle 2 uses its last back-up mode, auto-transmit, to determine if the lander has actually survived atmospheric entry and descent. Were nothing to be heard within 5-10 days, the assumption would be that Beagle has been lost.

While emphasis will now shift to mission science using orbiter instruments, in parallel, the Mars Express team will continue to analyze data and attempt to come up with additional recovery modes to find Beagle 2 if those already programmed prove inadequate, Southwood said.

In the absence of telemetry that could determine what happened, it is impossible to say to what extent the lander has survived reentry and retains a sufficient battery charge. Although Beagle 2 is too small to be seen, mission controllers hope to locate its airbags or parachutes using the orbiter's high-resolution stereo camera, which is scheduled to send first images this week.

83096

AP NEWS : 19 JANUARI 2004.

NEW ORBITER EYES "GRAND CANYON" ON MARS.

BERLIN - Europe's Mars Express orbiter has sent back its first high-resolution pictures of the planet's surface, capturing in detail part of a huge Martian canyon, the European Space Agency said Monday. Mars Express went into orbit around the red planet on December 25 on the first European Mars mission. About two weeks later, NASA landed its Spirit rover on the Martian surface. Both missions are searching for signs of past or present water activity or life. Over the past week, European controllers have focused on calibrating its on-board instruments -- including, in addition to its high-resolution stereo camera, a powerful radar that will search beneath the surface for signs of water or ice that may once have sustained living organisms. On Monday, they published the camera's spectacular first image, shot from 275 kilometers (170 miles) above the surface and showing a bright-red cross-section of Mars' Valles Marineris -- the planet's "Grand Canyon." The ESA described the first pictures, shot at a resolution of 12 meters (39 feet) per pixel, as "very promising." The image, it said, shows "a landscape which has been predominantly shaped by the erosional action of water," with surface features including mountain ranges, valleys and mesas. Mars Express is set to orbit the planet for at least one Martian year -- almost two Earth years. The orbiter carries two-thirds of the European Mars mission's experiments, among them instruments that will search for ultraviolet atmosphere. Carrying its companion Beagle 2 lander, Mars Express was launched last June from the Baikonur cosmodrome in Kazakhstan. The lander, released toward the surface by the orbiter December 19, hasn't been heard from since its own scheduled landing on Christmas Day.

83097

AP NEWS : 20 JANUARI 2004.

EUROPEAN MARS ORBITER SENDS BACK FIRST HIGH-RESOLUTION PICTURES OF PLANET.

BERLIN - Europe's Mars Express orbiter has sent back its first high-resolution pictures of the planet's surface, capturing in detail part of a huge Martian canyon, the European Space Agency said. Mars Express went into orbit around the Red Planet on Christmas Day on the first European Mars mission. About two weeks later, NASA landed its Spirit rover on the Martian surface. Both missions are searching for signs of past or present life. Over the past week, European controllers have focused on calibrating its on-board instruments -- including, in addition to its high-resolution stereo camera, a powerful radar to search beneath the surface for signs of water or ice that may once have sustained living organisms. On Monday, they published the camera's spectacular first image, shot from 170 miles above the surface and showing a bright-red cross-section of Mars' Valles Marineris -- the planet's "Grand Canyon." The ESA described the first pictures as "very promising." The image, it said, shows "a landscape which has been predominantly shaped by the erosional action of water," with surface features including mountain ranges, valleys and mesas. Mars Express is set to orbit the planet for at least one Martian year -- almost two Earth years. The orbiter carries two-thirds of the European Mars mission's experiments, among them instruments that will search for ultraviolet atmosphere. Carrying its companion Beagle 2 lander, Mars Express was launched last June from the Baikonur cosmodrome in Kazakhstan. The lander, released toward the surface by the orbiter Dec. 19, hasn't been heard from since its own scheduled landing on Christmas Day.

83098

83098

83099

113 113 RTL 4 vr 23 jan 16:28:46

rtl nieuws

Mars Express vindt bovengronds ijs
Het Europese ruimteschip Mars Express heeft ijs ontdekt op de zuidpool van Mars. Het is voor het eerst dat er ijs op het oppervlak is gevonden, meldt de Europese ruimtevaartorganisatie ESA.

De Amerikaanse satelliet Mars Odyssey verzamelde in maart 2002 al gegevens die erop wezen dat veel water als ijs onder het oppervlak van Mars zit.

Vloeibaar water is in ieder geval op aarde een belangrijke voorwaarde voor leven geweest. Wetenschappers proberen daarom aanwijzingen te vinden dat ook op Mars water heeft gestroomd.

12085

23052

Mars blijkt echt rood



• Dit is een van de allereerste foto's die de Europese ruimtesonde Mars Express van het oppervlak van de planeet Mars heeft gemaakt. De foto, die is genomen van 275 kilometer afstand, toont een deel van de rode Valles Marineris, de Grote Canyon. Het Europese Ruimtevaartbureau ESA noemt het beeld veelbelovend omdat het „een landschap is

dat door erosie door water is ontstaan". De Mars Express moet onderzoek doen naar sporen van water en ijs op Mars en zal tenminste één Marsjaar – bijna twee jaar op aarde – rond de planeet draaien. De satelliet werd vorig jaar juni gelanceerd vanaf het ruimtevaartcentrum Bajkonoer in Kazachstan.

83100

83101

5302H

23053



83101

58023

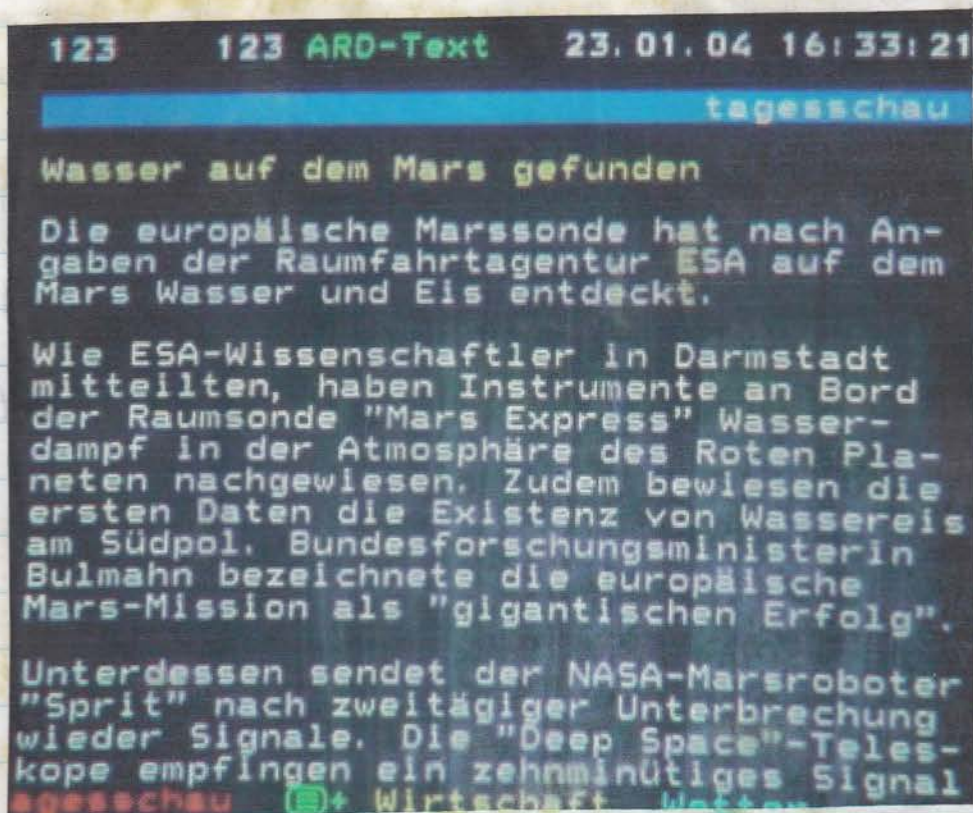
23054

CNN : 23 JANUARI 2004.

EUROPE PROBE DETECTS MARS WATER ICE.

The European orbiter Mars Express detected ice at the Red Planet's south pole, mission officials at Darmstadt, Germany, said Friday. NASA's Mars Odyssey, also an orbiter, confirmed water ice at the north pole, along with dry ice -- frozen carbon dioxide -- in 2002. It picked up signs of hydrogen at the south pole, the first indication that water ice might be found there. Mars Express confirmed Odyssey's suspicions about the south pole. "We have already identified water vapor in the atmosphere," scientist Vittorio Formisano said. "We have identified water ice on the soil on the south polar caps." Mars Express headed off for the fourth planet on June 2 specifically to look for water. It carried with it the European Space Agency's rover, Beagle 2, but that craft was never heard from after its expected Dec. 25 landing. Express, however, attained its final operational orbit in the last week and has continued its scientific mission. Express made an unsuccessful attempt to contact Beagle 2 earlier this month when it passed near the rover's landing site.

83102



88

83103

AP NEWS : 23 JANUARI 2004.

EUROPEAN PROBE SPOTS WATER ICE AT MARS POLE.

DARMSTADT - A European spacecraft found the most direct evidence yet of water in the form of ice on Mars, detecting molecules vaporizing from the red planet's south pole, scientists said Friday. The quest for water on Mars -- which could indicate life -- fascinated scientists for centuries. The Mars Express, launched last year by the European Space Agency, made the discovery with its infrared camera while circling the planet's south pole. Scientists long believed the planet's poles contain frozen water, but previous findings -- including NASA's Mars Odyssey orbiter's evidence of large amounts of ice -- were based more on inferences, European scientists said. While the Mars Odyssey indirectly showed the presence of water at the pole using temperature monitors, the European camera has for the first time been able to "literally map the polar cap" using infrared technology that shows where water molecules are present, scientist Jean-Pierre Bibring said. "You look at the picture, look at the fingerprint, and say this is water ice," said agency scientist Allen Moorehouse. "This is the first time it's been detected on the ground. This is the first direct confirmation." James Garvin, lead scientist for NASA's Mars exploration program, told The Associated Press on Friday that Mars Express offered further confirmation of what scientists have long known: "Mars is a water planet." At a news conference earlier, he said the Europeans' findings were "not unexpected." "In terms of the impact, that's wonderful results," Garvin said. "It's instant science, and I think the science community is going to want some time to think about what that means in the context of what we're learning." If Mars once had surface water, it had the potential to support life, although members of the European project stressed it was too early to draw conclusions. In 2001, NASA's Mars Odyssey turned up evidence of lots of ice mixed with the soil, as little as 18 inches from the surface. Phil Christensen, an Arizona State University professor involved in NASA's Mars projects, said the European findings bolstered such data. "That is a very nice confirmation of the other measurements that have been previously made," he told AP by telephone.

83104

23055



83105

83106



3103

3104

ESA/DLR/FU Berlin (G. Neukum)

58022

23056

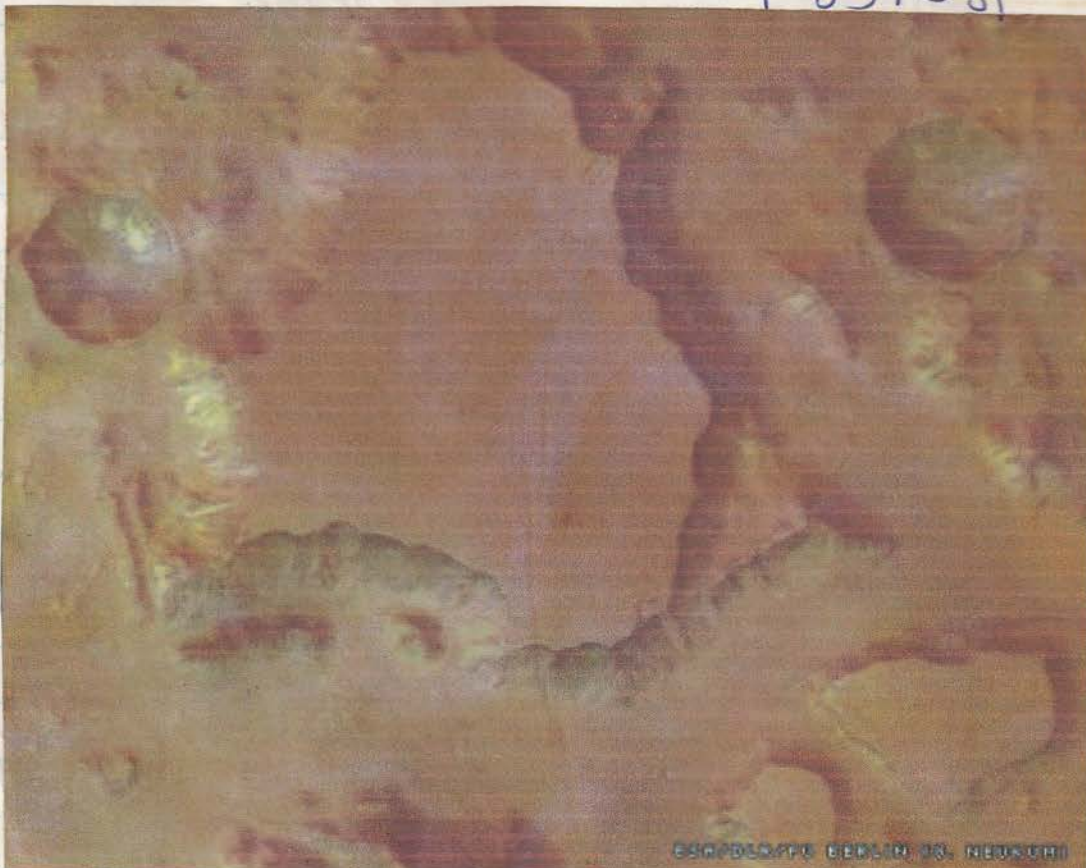
FLORIDA TODAY : 23 JANUARI 2004.

EUROPEAN SCIENTISTS CONFIRM PRESENCE OF WATER ICE ONE MARS.

DARMSTADT - Europe's Mars orbiter has confirmed the presence of ice water on the red planet's surface for the first time, the European Space Agency said today. Agency scientists said the discovery was based on analysis of vapors of water molecules detected by the infrared camera aboard the Mars Express orbiter circling the planet. "You look at the picture, look at the fingerprint and say this is water ice," said agency scientist Allen Moorehouse. "This is the first time it's been detected on the ground. This is the first direct confirmation." NASA's Mars Odyssey has turned up evidence that there is lots of ice mixed with the soil, as little as 18 inches from the surface. However, ESA's science director David Southwood said previous conclusions were based on indirect measurements, such as the detection of hydrogen traces, and that the European finding was more concrete. "Previous measurements have been indirect and this is the first time we have direct indications of molecules that are present in water," Southwood said. "Of course finding anything that has to do with water on Mars is a sort of holy grail. This is certainly better than anything we've had so far." However, the director of NASA's Mars exploration program disputed the Europeans' claim that their discovery was new. "Our Odyssey spacecraft that has been orbiting Mars since 2001 did discover vast amounts of frozen water in the northern and southern latitudes. And we were surprised by the fact that there was so much, and so close to the surface," Orlando Figueroa, director of NASA's Mars exploration program, told CNN today. "So it's not new news but we are happy to see that their satellite is also able to pick up where it exists." If Mars once had surface water, it had the potential to support life - though Moorehouse, the project's manager of spacecraft operations, cautioned that it was too early to draw conclusions. Agency officials said that their discovery confirmed something that scientists long suspected. It's been looked at for such a long time and it's been inferred there was water" at the south pole, said Jean-Pierre Bibring of the European Space Agency. "This is the first time we can really see vapors of the molecules themselves," Bibring said. More than 40 years of Mars exploration have yielded inconclusive evidence of whether the planet ever had liquid water. Two U.S. orbiters, Mars Global Surveyor and the 2001 Mars Odyssey, have also been circling the planet searching for indications of water in the Martian past. In October, a team of scientists reported Odyssey had detected on the surface of Mars copious amounts of a mineral that's easily weathered away in the presence of water. That suggested Mars has been a dry wasteland. Weeks later, a second team reported evidence to the contrary after Global Surveyor beamed back images that show features apparently created by the meandering flow of rivers. The European Space Agency's Mars Express orbiter is part of Europe's first mission to Mars. Mars Express hit orbit on Christmas Day and began transmitting its first data from the planet this month, starting with high-resolution pictures of the surface that captured in detail a huge Martian canyon

83107

83108



ESA/DPSC/PPD/BB/LLD/DR. NEUKIRCH

53028

23057



ESA/DFLR/FU BERLIN CO. NEUKUM

83109

83110

BBC : 23 JANUARI 2004.

MARS SEEN IN UNPRECEDENTED DETAIL.

The European Space Agency has released the early results from its Mars Express probe now orbiting the Red Planet. The data include a batch of remarkable pictures taken at very high resolution. The images show what appear to be sediments left in the bottoms of river-cut valleys, and details as fine as dust blowing over the rims of craters. "This is no ordinary spacecraft," said David Southwood, Esa's head of science. "This is only the beginning. There is more to come in the next two years." The science results were released at a news conference at Esa's Space Operations Centre in Darmstadt, Germany. The event took place as the US space agency attempted to make full contact with its Spirit Mars rover, which has inexplicably stopped sending data back to Earth. The European orbiter's instruments have also revealed new information about the stores of water-ice at the planet's south pole and the way it is mixed in with frozen carbon dioxide (CO2). In addition, Esa scientists say they can see, for the very first time, water being lost from Mars' atmosphere. But it is the images taken with the probe's High Resolution Stereo Camera that have generated the greatest excitement. The camera can see details down to two metres and German researchers working on the mission have even constructed computer-generated movies from the pictures to show what it would be like to fly over the Red Planet in an aircraft. The camera's lead scientist, Gerhard Neukum, from the Free University in Berlin, said Mars Express had already imaged nearly two million square kilometres of the Martian surface. The area, covered at a resolution of 10 to 15 metres per pixel, was equivalent to the land coverage of France, Germany, Italy, Spain, Portugal and Austria combined, he said. His team has already received more than 100 gigabytes of processed data - most of which has not even been looked at yet. "We have done some instant science and I think we can firmly say 'yes, there was water acting on the surface of Mars,'" Professor Neukum said. His pictures show what appear to be sediments left in water-cut valleys and at the bottoms of craters which other instruments on the probe will now try to identify. There were also features that had been pictured that appeared to be evidence of glaciation, he added. It is still very early in the two-year mission of Mars Express, but project scientists say they are thrilled with the initial returns of data they are getting from the spacecraft. "We have already identified water vapour in the atmosphere and water-ice in the soil on the southern polar cap," said Vittorio Formisano, who looks after the probe's Planetary Fourier Spectrometer. "We can identify water directly on the planet," added Jean-Pierre Bibring, from the Institute of Space Astrophysics, Orsay, France. "It's mixed with CO2 essentially but if we go to areas which are a little warmer where there is no CO2, we have remaining water there." At the end of the mission, he said, scientists should know the precise volume of water-ice still remaining on the planet's surface. The US space agency's Mars Odyssey orbiter has already given a strong indication that there is water-ice on the southern pole. Its assessment comes from the use of a gamma ray spectrometer, which detects hydrogen, which with oxygen makes up water. The Mars Express data amounts to a confirmation, because it arrives at the same conclusion but by a different technique: its Omega spectrometer analyses visible and infrared light rather than the gamma part of the energy spectrum. Rickard Lundin, from the Swedish Institute of Space Science, is studying how the Sun is eroding the Martian atmosphere with an instrument called the Energetic Neutral Atoms Analyser. "It shows us the 'planetary wind' which essentially describes water escape - but in an indirect way because what we see coming [off Mars] is oxygen and the oxygen is most likely coming from water." Mars Express arrived at the Red Planet on 25 December. It operates from a polar orbit that takes it between 300 and 11,000 km from the planet's surface. European scientists want the mission to:

- map the mineral composition of the surface at 100-m resolution
- map the composition of the atmosphere and determine its global circulation
- determine the structure of the sub-surface to a depth of a few kilometres
- determine the effect of the atmosphere on the surface
- and determine the interaction of the atmosphere with the solar wind

At the heart of the mission is the desire to understand the history and current state of water on the planet which may say something about the presence of life - currently or in the far-distant past. So far, Mars Express has performed flawlessly. The one disappointment has been the loss of its lander probe, Beagle 2. The British-built robot has not been heard from since it fell through the Martian atmosphere on Christmas Day.

F2085

23058

Aanwezigheid water Mars bevestigd

DARMSTADT De Europese kunstmaan Mars Express heeft concreet bewijs gevonden voor de aanwezigheid van ijs op Mars. Al eerder was vastgesteld dat er water op Mars is, maar het meest concrete bewijs daarvoor is nu geleverd, stelt de ESA.

Voor de ontdekking werd gebruik gemaakt van een spectrometer aan boord van de Mars Express. Daarmee wordt de minerale samenstelling van de Marsbodem in kaart gebracht.

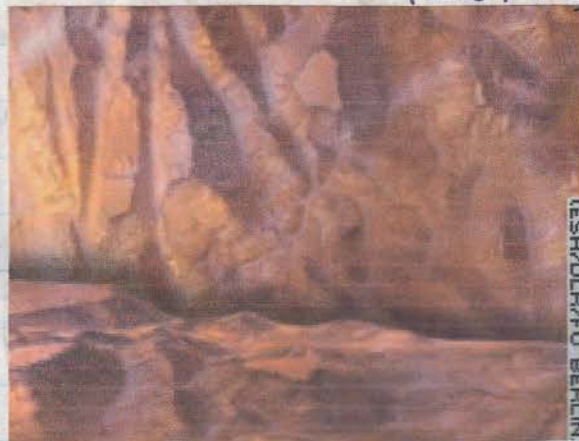
De Mars Express draait sinds Kerstmis in een baan om de planeet en heeft veel waardevolle foto's verstuurd. De missie van de ESA-robot Beagle-2 op Mars liep daarentegen op een mislukking uit.

83111

83112



83113



ESA snakte naar vondst Mars-water

DARMSTADT
VERVOLG VAN PAGINA 1

De vondst van water is een snel succes voor de jonge Mars-missie van de ESA, die nu ook beschikt over zeer gedetailleerde foto's van de rode planeet. Het ijs dat het ruimteschip Mars Express heeft ontdekt, ligt aan de oppervlakte van Mars en wordt vrijwel niet bedekt door kooldioxide. Andere metingen bevestigen ook de sterke aanwijzingen voor grote hoeveelheden water in de vorm van ijs onder de oppervlakte van de planeet.

Het vinden van water was een van de centrale opdrachten van de Mars Express, die eind december in een baan rond de planeet werd gebracht. Water is een voorwaarde voor levensvormen en de vondst van ijs versterkt de hoop dat de wetenschappers ook stromend water op de planeet aantreffen. „Een grote dag”, juichte de ESA, die eerder een grote te-

genslag te verduren kreeg door het verlies van de lander Beagle 2. Deze verdween tijdens de landing op Mars een maand geleden.

De ESA gaf gisteren ook een serie foto's vrij. Op de beelden die Mars Express de afgelopen weken heeft gemaakt, zijn onder meer een diepe slenk en landschappen te zien met scherpe details zoals stof dat over de rand van een krater wordt geblazen.

De Mars Express heeft inmiddels meer dan 100 gigabytes aan informatie doorgestuurd. Het grootste deel daarvan is nog niet eens door wetenschappers bekeken. Informatie van het Amerikaanse ruimteschip Mars Odyssey wees al eerder op de waarschijnlijkheid dat zich ijs op de zuidpool van Mars bevindt, maar definitief bewijs was er tot nu toe niet. De aanwezigheid van ijs op de noordpool, bedekt met kooldioxide, is wel al aangetoond. Een woordvoer-

der van de Amerikaanse ruimteorganisatie NASA noemde gisteren de vondst van water op zich dan ook niet nieuw, maar zei wel blij te zijn dat de Mars Express de precieze locatie kon aanwijzen.

Voor de NASA was het ook in een ander opzicht een goede dag, omdat de Amerikaanse ruimtesonde Spirit, die zich op Mars bevindt, weer signalen naar de aarde heeft gezonden. Donderdag kreeg de robot, die op 4 januari op de planeet was geland, pech. Maar een ruimteantenne bij Madrid in Spanje ving gisteren weer een signaal van de sonde op. Dat signaal was wel abnormaal zwak. Als alles goed gaat, krijgt de Spirit morgen gezelschap van een tweede Amerikaanse robot genaamd Opportunity. Als de hitteschilden het houden, de remraketten op het juiste moment worden ontstoken en de airbags de val breken, moet de Opportunity morgenochtend zes uur Nederlandse tijd op Mars landen.

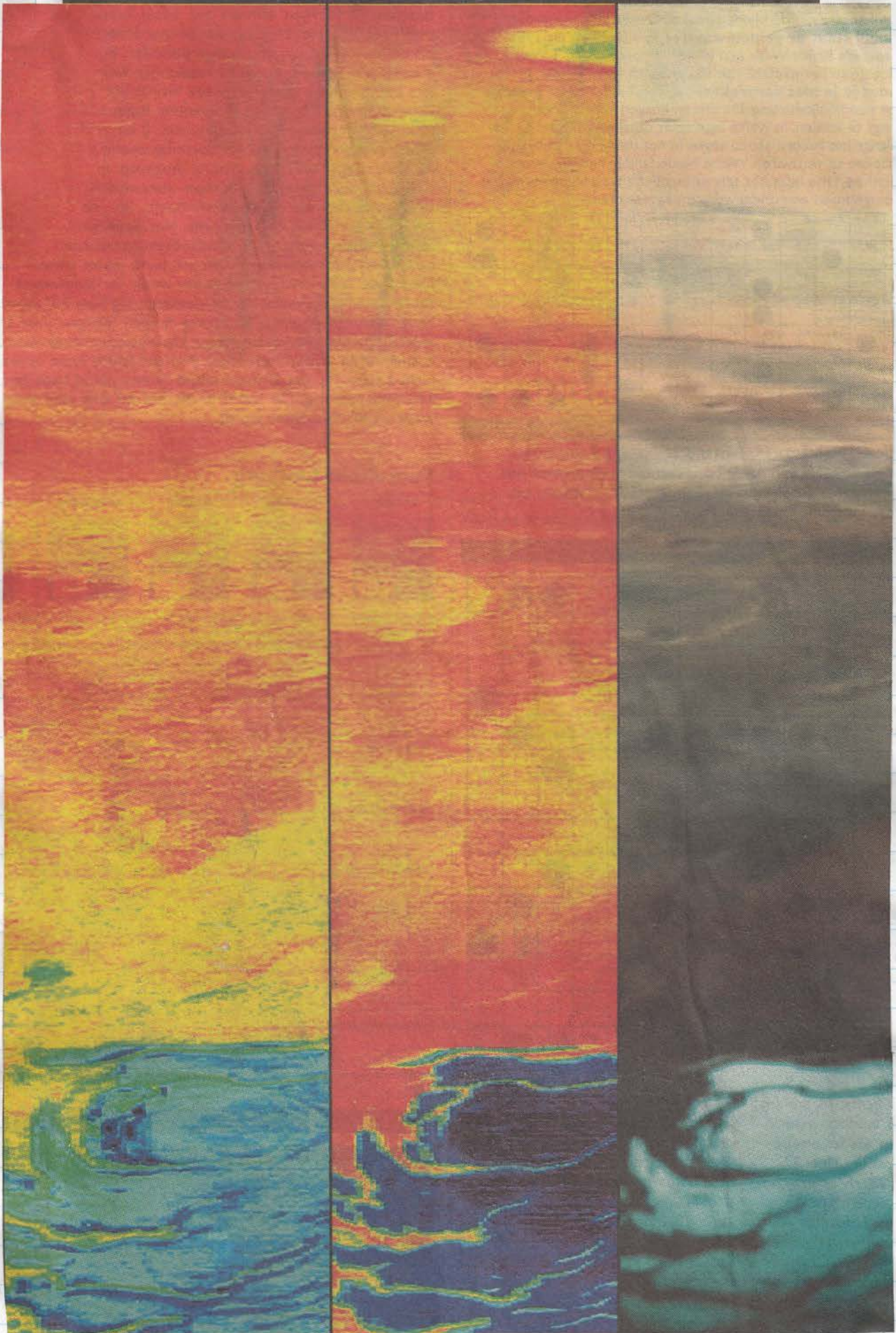
83114

DDL: 24-01-2004

DDL: 24-01-2004

23059

WATER OP MARS



Op de zuidpool van Mars bevindt zich bevroren water. Dat blijkt uit deze foto's die het Europese ruimteschip Mars Express heeft genomen van de rode planeet. De foto links toont een eerste observatie, in het midden is met behulp van speciale apparatuur bevroren koolzuur zichtbaar gemaakt, terwijl op de rechter foto ijs is te zien.

83115

02085

DDL: 24-01-2004

23060

SPACE.COM : 24 JANUARI 2004.

MARS EXPRESS CONFIRMS WATER ICE ON RED PLANET.

The European Mars Express orbiter has confirmed the existence of water ice in the south polar cap of Mars. The craft also beamed back a detailed photo of a channel on the red planet that might have long ago been created by flowing water. Scientists have long known that Mars' north polar cap is composed mostly of water ice. Previous observations by NASA's Mars Global Surveyor (MGS) had experts convinced the south polar cap contained water ice, too. In fact there appears to be a vast store of frozen water mostly buried under a blanket of carbon dioxide ice, commonly called dry ice. Some of the dry ice melts away during summer in the southern hemisphere of Mars, exposing sheets of water ice below -- that's what MGS had found photographic evidence for. In other observations made by NASA's Mars Odyssey probe over the past couple of years, scientists have found strong evidence for water ice buried in the Martian soil away from the permanently frozen polar caps. Odyssey revealed hydrogen in quantities scientists interpret to imply water ice. Now Mars Express has made the first direct detection of a chemical signature of the water ice at the south pole. Officials said today they had essentially seen the vapors of water at the surface. "You look at the picture, look at the fingerprint and say this is water ice," said Allen Moorehouse of European Space Agency. "This is the first time it's been detected on the ground. This is the first direct confirmation." The images were captured by the satellite's Omega imager, a combined camera and spectrometer that divides light into its components, like a prism and analyzes the chemicals involved in producing the light. Jean-Pierre Bibring of the Space Astrophysics Institute of Orsay, France, one of Omega's developers, said the instrument's ability to read the spectral "signature" of water and carbon dioxide ice has laid to rest any doubt. At a press briefing in Darmstadt, Germany, Bibring said that up to now, "relatively thin evidence has been presented as a reality. Here we have the [water] molecule itself that we can see from Omega's ability to reveal the composition of the solids and gases on the Mars surface. I wouldn't call it a discovery." In a bit of international sparring, some NASA scientists said the finding was expected and confirmed what was known. The European orbiter also returned a new high-resolution image of a channel called the Reull Vallis. Scientists suspect it might have been formed long ago by flowing water, but some researchers say other material -- perhaps carbon dioxide, lava or muddy mixtures -- could have created the many channels on the red planet. The designer of Mars Express' High-Resolution Stereo Camera says the new image shows dry channels where water once flowed. In an interview, Gerhard Neukum of Germany's Free University of Berlin said it is too early to determine the composition of the black-colored substance at the bottom of the now dry river beds. "These images' black areas are not shadows," Neukum said of the first pictures captured by the orbiter on Jan. 15. "It is material that was deposited at the bottom of these rivers." Asked how he could be certain that the winding gashes in Mars' surface were in fact river beds, he said: "There is no other phenomena that we know of that would produce these effects. It is fair to say we are sure this is evidence of once-flowing water on the surface of Mars." Neukum also said the colors of the images produced by the stereo camera is as realistic as possible and are not enhanced to provide additional details. "What you are seeing is real," he said. Altogether, Mars appears to contain significant amounts of water, but so far what's been found is all frozen. No firm evidence yet exists that there is or ever has been liquid water on Mars, a condition scientists say is essential for life. NASA's robotic rover missions are designed to search for signs of lakes or oceans that might once have covered the planet. Mars Express is just beginning its science operations. It will settle into its final and proper orbit on Jan. 28. The Beagle 2 lander, which traveled to Mars on the Express, has yet to respond to hails from Earth.

83116

83117



ESA/DLR/FUO BERLIN CC. 1999/2000

83116

23061

sdass

Wasser auf dem Mars! Europäische Sonde liefert hier den Beweis

Darmstadt - Die europäische Sonde „Mars-Express“ entdeckte auf dem roten Planeten Wasser - die Grundlage allen Lebens. „Das ist ein ganz großer Tag für die europäische Raumfahrt und für die bemannte Raumfahrt sehr wichtig“, sagte ein ESA-Mitarbeiter. Wenn Menschen auf den Mars gingen, müssten sie kein Wasser von der Erde mitbringen. Mit der Sonde wurden zum ersten Mal Lage und Volumen von gefrorenem Wasser auf dem Mars-Südpol nachgewiesen. Außerdem wurde Wasserdampf in der Atmosphäre des Planeten festgestellt.



Der Kanal Reull Vallis wurde von Wasser geformt. „Mars-Express“ machte das Foto aus 273 km Höhe



Auf der Infrarot-Aufnahme ist das Eis (blau) klar zu erkennen

Der gleiche Abschnitt wie links, aufgenommen mit einer normalen Kamera

83118

Bild: 24-01-2004

83119

23062

Mars Express overtreft verwachtingen

83120

Succes ruimtesonde 'belooft veel voor de toekomst'

(83121)

Niet eerder werd het bewijs voor water op Mars zo onomstotelijk geleverd als door de Europese ruimtesonde. De verwachtingen voor verder onderzoek zijn hooggespannen.

Van onze medewerker
Govert Schilling
NOORDWIJK

De Europese ruimtesonde Mars Express heeft op de rode planeet bevroren water gevonden - ijs dus. Geen verrassing, want er waren al langer aanwijzingen voor. Maar niet eerder werd het bewijs zo onomstotelijk geleverd, vindt de Europese ruimtevaartorganisatie ESA. 'Dit is het eerste directe bewijs van watermoleculen op Mars', zei wetenschapsdirecteur David Southwood van ESA vrijdag op een persconferentie in het Duitse Darmstadt.

Uit metingen van de Amerikaanse Viking-sondes bleek 25 jaar geleden al dat er ijs op Mars voorkomt. Alleen op de noordpool weliswaar, maar toch. De witte poolkappen van de rode planeet bestaan namelijk voornamelijk uit koolzuurijis, bevroren kooldioxide. Als dat 's zomers verdampt, blijft er een kleine, permanente kap van gewoon waterijs over, zo bleek uit temperatuurmetingen van de Vikings.

Mars Express heeft het waterijs nu ook op de zuidpool gezien. Ook heeft de sonde de verdeling van het ijs voor het eerst nauwkeurig in kaart gebracht. Maar nog opmerkelijker zijn de spectaculaire foto's die Mars Express van de planeet heeft gemaakt. De haarscherpe beelden van de hoge-resolutie stereocamera stelen de show op de persconferentie.

De foto's, genomen van zo'n driehonderd kilometer hoogte, tonen details van tien meter groot. De camera heeft al bijna twee miljoen vierkante kilometer vastgelegd. Op de foto's zijn geulen en andere sporen van water- en ijs-erosie gevonden. Ook werd een waterval van rood Marsstof gefotografeerd op de helling van een vulkaankrater.

De camera is slechts een van de zeven gevoelige instrumenten van ESA's Marskustmaan. De eerste resultaten van Mars Express overtreffen alle verwachtingen. Europa mag trots zijn, aldus de Duitse minister van Onderwijs en Wetenschap, Edelgard Bulmahn, die ergast was op de presentatie in het vluchtleidingscentrum in Darmstadt.

Mars Express kwam op 25 december 2003 aan. Van de meegevoerde lander Beagle 2 is nooit meer iets vernomen, maar het moederschip zelf is inmiddels probleemloos in een baan over de noord- en zuidpool van Mars gebracht. Vanuit die omloopbaan gaat de ruimtesonde de komende jaren de hele planeet onderzoeken.

Een volgende belangrijke stap komt in april, wanneer de radarantenne van Mars Express in gebruik wordt genomen. Daarmee kan ook ijs diep in de bodem opgespoord worden. De Amerikaanse Mars Odyssey heeft indirecte aanwijzingen gevonden dat het om grote hoeveelheden gaat. Mars

Express moet daar uitsluitsel over geven.

Daarnaast hopen wetenschappers er met behulp van Mars Express achter te komen of er langgeleden ook zeeën en oceanen van vloeibaar water op de planeet zijn geweest. Als Mars een paar miljard jaar geleden warmer en natter was, is er misschien ooit leven ontstaan.

Volgens ESA's wetenschapsdirecteur David Southwood vormen de eerste resultaten nog maar het topje van de ijsberg. 'Dit belooft heel veel voor de toekomst', zegt hij. Augustin Chicarro, wetenschappelijk projectleider van Mars Express, beaamt dat. 'Vanaf hier kan het alleen maar beter worden.' Het verlies van Beagle 2 lijkt al bijna vergeten.

Volkskrant:
24-01-2004.

83122

IJs op Mars: gelijkspel NASA-ESA

83125

De Europese sonde Mars Express heeft ijs gevonden op Mars. Dit is het eerste concrete bewijs voor water op de rode planeet, zo maakte de Europese ruimtevaartorganisatie ESA vrijdag bekend in het Duitse Darmstadt.

Als het ijs ooit in vloeibare vorm over de planeet heeft gestroomd, kan er leven zijn ontstaan. Het is echter te vroeg voor dergelijke conclusies, waarschuwt ESA.

Er bestaan al langer aanwijzingen voor ijs op Mars, maar volgens de Europeanen zijn die alle 'indirect'. Die eerdere aanwijzingen zijn onder meer afkomstig van de Amerikaanse sonde Mars Odyssey. Volgens de Amerikaanse NASA is de Europese vondst dan ook 'geen nieuw nieuws'. Het bericht van ESA is een

nieuw wapenfeit in de strijd om Mars, die op Aarde wordt gevoerd. Onder een wetenschappelijk vernislaagje slaan NASA en ESA elkaar met persconferenties om de oren, waarin zij mooie foto's en vondsten openbaren.

Europa moet het doen met de Mars Express na het verlies van de lander Beagle 2. Daar is sinds de landing op Mars, op kerstochtend, niets meer van vernomen.

NASA heeft wel met succes een lander op Mars neergezet, de Spirit. Die is sinds woensdag echter ernstig in de problemen. Gisteren werd voor het eerst in twee dagen weer een zeer zwak signaal opgevangen. Voor het leven van de lander wordt gevreesd.

83126

83123

83124

Opdoers

23063



Een van de vele haarscherpe foto's die de Europese ruimtesonde heeft gemaakt van watergeulen op Mars.

83127



83128

edoes

23064

EUROPE'S BEAGLE 2 MARS PROBE STAYS OMINOUSLY SILENT.

LONDON - As Europe's first Mars probe remained stubbornly silent, British scientists announced a "last resort" plan Monday of switching off the missing Beagle 2's computer system for an overhaul. Beagle 2 has not been heard from since it separated from the mother ship in mid-December, despite contact efforts by the European Space Agency's orbiter Mars Express, NASA's Mars Odyssey orbiter and British and U.S. radio telescopes. Colin Pillinger, lead scientist on the Beagle 2 program, said Mars Express passed over the probe's landing site twice over the weekend, but nothing was heard. Pillinger said his team would ask NASA to send a command from its Mars Odyssey orbiter on Tuesday to tell Beagle 2 to switch off its own computer and reload its software. "We are now working on the basis that this is a corrupt system and the only way we might resurrect it is to send such a command and completely reload the software, if it's still alive," Pillinger said at a news conference in London. "Of course, that is a very dangerous command to send because if the thing is AWOL, or even if it's there, it may never respond to it, so it's pretty much a last resort," he added. If Odyssey fails, Pillinger said that Mars Express may also attempt to do the same thing on Feb. 2 or 3. Pillinger said that his team would press on with the search for the missing probe, despite the bleak outlook. "It would be incredibly useful to us to know how far in its mission it got because we are ... dedicated to trying to re-fly Beagle 2 in one way, shape for form," he said. Mars Express has had a more successful mission. Scientists at the European Space Agency said last week that Mars Express had found the most direct evidence yet of water in the form of ice on Mars, detecting molecules vaporizing from the Red Planet's south pole. Scientists have long believed the planet's poles contain frozen water. NASA scientists, meanwhile, are trying to pinpoint their own problems with its Spirit rover that last week cut off what had been a steady flow of pictures and scientific data. But American scientists are hopeful of pinpointing the problem and say Spirit could resume normal operations in two to three weeks. They also are celebrating the arrival of pictures over the weekend from Spirit's identical twin, Opportunity, which was sent to the other side of the Red Planet.

83129

New Agenda for Europe

High-cost objectives in milspace, applications arena could blunt space exploration ambitions

MICHAEL A. TAVERNA/PARIS

83130

European reaction to U.S. President Bush's space exploration plan was positive but not enthusiastic—perhaps an acknowledgment that finding funds for such an ambitious endeavor will be a hard sell.

European Research Commissioner Philippe Busquin greeted the proposal warmly, as did France's research minister Claudie Haignere. European Space Agency Director General Jean-Jacques Dordain called it "good news for Europe," and offered to earmark the agency's nascent Aurora solar exploration program as Europe's contribution.

In fact, Dordain said ESA had been briefed on the U.S. initiative well in advance, and a meeting is scheduled in March to address specific elements of Europe's contribution. These could include Mars orbiter/lander and sample return missions and related technology projects already under study (*AW&ST* Oct. 13, 2003, p. 32).

The ESA chief remarked that two initial European Moon and Mars missions

were launched last year. Although the Beagle 2 Mars lander has apparently been lost, the accompanying orbiter was injected into orbit without a hitch and last week released the first stunning images from its high-resolution stereo camera (see photo).

However, there is considerable doubt

Aurora will be **competing** against a number of other **big ticket** programs

about Europe's ability to finance such a program. Dordain said the bulk of funding for Aurora would come from the winddown of development spending for the International Space Station (ISS). "All ISS partners have always considered that there would be a post-ISS [program]," Dordain said.

ESA officials noted that the first phase

of Aurora, expected to cost 900 million euros (\$1.1 billion) over five years, will represent less than 7% of the ESA budget. In contrast, the ISS accounted for 25% of the ESA budget in 2003.

However, ESA is also counting on a healthy contribution from the European Union, which is henceforth linked to

ESA through a framework cooperation agreement that has already helped spawn the Galileo satellite navigation system. A white paper approved last December foresees a considerable rein-

forcement of cooperation between the organizations in the future, although some issues tied to stalled EU constitutional talks remain unresolved.

The closer links are reflected in a medium-term strategic plan, Agenda 2007, released by ESA last month, that would serve as a stepping-stone to a long-term space program intended to double the

22085

23065

size of Europe's space effort (*AW&ST* Dec. 1, 2003, p. 33; June 30, 2003, p. 43).

According to the road map set out in Agenda 2007, the EU could provide indirect support for Aurora and the ESA science program by assuming more of Europe's basic space infrastructure costs, as it agreed to do last year for the Ariane launch system. The document foresees that the EU would bear 150 million euros per annum in additional costs over the next four years.

However, backing for such a scenario is far from assured. Two of ESA's four biggest contributors, Germany and Italy, face ballooning budget deficits and have been in no hurry to join Aurora. Only 14 million euros have been allocated for the project so far, and ESA has had trouble pushing through 25 million euros in bridge funding to keep work going until a full go-ahead, expected next year.

Furthermore, Aurora will be competing against a number of other big ticket programs, some of which are likely to be considered higher priority. A major thrust of Agenda 2007 will be applications programs considered critical to Europe's strategic and economic future. These include Galileo—the deployment and operating phases of which are not yet fully funded—the Global Monitoring for Environment and Security (GMES) network and an as-yet undefined broadband undertaking to bridge Europe's digital divide.

Another top priority will be military space, which as part of Europe's changing geopolitical environment is now des-

EUROPEAN SPACE AGENCY



This 3D photo from Europe's Mars Express is of Mars' Grand Canyon, Valles Marineris. It is the first image of this size—120,000 sq. km.—showing the planet in high-resolution.

tinued to become both an ESA and EU responsibility (*AW&ST* June 23, 2003, p. 36). Agenda 2007 for the first time places defense squarely in the ESA domain. And then there is Europe's future Launcher Preparatory Program, and the technology effort needed to support it.

The cost of these new endeavors is still being tallied. But GMES alone is expected to cost 750 million euros per annum when it hits full stride in 2007 (*AW&ST* Dec. 8, 2003, p. 38).

Last, Busquin expressed concern that Bush's space exploration plan could compromise continuation of the ISS. Dordain said agreements committed the U.S. to fully deploy the station, but acknowledged "there are concerns thereafter."

An additional worry will be how to pay for delays related to the Shuttle disaster. Europe's first ATV space tug is now likely to be launched in late 2004 or early 2005, instead of September as planned. Its Columbus orbital laboratory is expected to be postponed two years. Dordain said he would look into employing engineering teams on Aurora or other programs to minimize extra costs.

183131

SPACE.COM : 04 FEBRUARI 2004

WITHOUT A TRACE :

WHEREABOUTS OF BEAGLE 2 REMAIN A MYSTERY.

183132

Gone without a trace. The British-built Beagle 2 lander remains lost in action after attempting a landing on Mars late last year. The probe was ejected from the European Space Agency's Mars Express Orbiter now circling the red planet. A Mars Global Surveyor (MGS) Mars Orbiter Camera (MOC) high-resolution view of the Beagle 2 landing area was released January 30. Malin Space Science Systems of San Diego, operator of the MOC, issued the search imagery. Within a close up image of Isidis Planitia -- the December 25 landing zone of the Beagle 2 -- there is no obvious sign of Beagle 2 -- but the photo only covers a fraction of the area in which the probe might have landed. Making the search for Beagle 2 more difficult is that the atmosphere of Mars became dusty at the end of 2003. Increased dust in the martian atmosphere can degrade the high-resolution imagery taken by the MOC. The search for Beagle 2 has involved using both MOC imagery and data from another NASA orbiter, the Mars Odyssey. The Beagle 2 team requested the help of Malin Space Science Systems, hoping that such a search might spot the probe's parachute, a heat-protecting aeroshell discarded above the touchdown zone, or even the lander itself. "There are no obvious indications for lander elements within the high resolution MOC image," notes a report on the Beagle 2 web site: www.beagle2.com/ "Of course, there is only a small chance that Beagle 2 actually landed in this part of the ellipse," the Beagle 2 team reported. Highly reflective items such as the Beagle 2 parachute or the lander itself should be visible by the MOC camera. The Beagle 2 team had their hopes raised given the successful use of the MOC camera to spot NASA's Spirit lander, its parachute, and aeroshell within Gusev Crater. The hardware stood out, in part, by the fact that a reddish veneer of dust particles has not yet made it difficult to discern fresh spacecraft elements on old, dusty martian terrain. Using orbital imagery to figure out what went wrong with Beagle 2 remains a high priority. Similar in fate to NASA's Mars Polar Lander in 1999, the British lander did not relay signals to its operators about whether specific milestones during its entry, descent and landing were achieved. It is conceivable that the Beagle 2 failed during its high-temperature entry over Mars. MOC observations could, at a minimum, verify whether Beagle 2's parachute had deployed. Given that find, a next stage would be to locate Beagle 2's three airbags and possibly the lander itself. "Depending on what we may eventually see from these observations, it may be possible to dramatically narrow the search for causes of Beagle's mishap," the Beagle 2 team reported.

2005

23 06

Beagle 2 points way to UK space future

The UK Science Minister Lord Sainsbury unveiled the Government's new three-year space strategy at the end of the year, citing the Beagle 2 Mars lander as a benchmark for the UK's ambitions in space.

He announced the plan as the British-built lander prepared for the final stages of its journey at Mars shortly before its separation from the ESA Mars Express.

The strategy sets out three objectives:

- Enhancing the UK's standing in astronomy, planetary and environmental sciences
- Stimulating increased productivity through promoting the use of space in government, science and commerce
- Developing innovative space technologies and systems to deliver sustainable improvement in quality of life.

Lord Sainsbury said: "A key objective to

this strategy is to build on the UK's outstanding record of scientific discovery. Space is recognised as one of the essential tools that will help us understand the Earth, the Solar System and the Universe.

"The Government's decision to invest in Beagle 2 demonstrated our commitment to achieving these aims through innovative and cutting-edge solutions. Beagle 2 is a benchmark project which will provide the UK with scientific and industrial capabilities for the future."

The strategy sets out how the UK will deliver its objectives through 'world-beating' services and technologies and achieve greater use and market acceptance of all types of space services in the UK.

It emphasises the importance of researchers and commercial companies

working in close partnership to open up opportunities in telecommunications and global positioning systems.

The UK will continue its policy of investing selectively in space and of focussing on achieving its objectives cost-effectively, and through international partnerships. The strategy is primarily focussed on the next three years, but for the first time it also sets out the long-term perspective to 2015.

A study last year into the size and health of the UK space industry showed that turnover had increased by 17 per cent to £2.9 billion, with employment up 14 per cent. The UK has world-class expertise in many areas including telecommunications, small satellites, Earth observation and radar technologies.

03033

Mars in 3D

European scientists shrug off lander loss as they tally exciting results from orbiter

MICHAEL A. TAVERNA/PARIS

Initial results from Europe's Mars Express orbiter are putting smiles back on the faces of the European scientific community, still smarting from the apparent failure of the accompanying Beagle 2 lander in December.

Scientists began activating the seven instruments on board Mars Express, launched last June, on Jan. 4. With the exception of the sounding radar, which will not be deployed until Apr. 20, all instruments are functioning nominally, the European Space Agency's (ESA) science director, David Southwood, said at the presentation of the first results here on Jan. 23. The initial operating phase is to begin on Feb. 20, and routine operations, on May 8.

The successful start overshadowed the

likely loss of the Beagle 2 and helped spur enthusiasm, particularly in the U.K., for a follow-on landing mission.

Much of the elation was centered on a new set of images released by ESA on Jan. 23, showing canyons, badlands, mesa formations and other features in astonishing detail. The images, like initial shots made public a week earlier, were taken by a high-resolution stereo camera (HRSC)—the first to be employed on a Mars mission (*AW&ST* Jan. 26, p. 25).

The HRSC contains nine CCD linear detectors allowing it to take nine image swaths at a time—three for stereo, two for photometry and four for color bands. The three stereo arrays look at nadir, forward and aft, so a spot on the ground is viewed from three positions. A super-

03134

23188

081085

23067

resolution channel (SRC) has a 1,024 X 1,032-pixel 2D detector that uses computer enhancement for finer detail. Shots clearly outlining the slopes of canyons, mountains and craters illustrated the oblique viewing capability afforded by the 3D camera (see photo p. 5).

IMAGERY OF MOVING dust sheets flowing into a volcanic crater highlighted the resolution, which is 10-15 meters (33-49 ft.) per pixel for most of the stereo and color data, and 2.3 meters per pixel in SRC mode. Some other Martian cameras, including one on Mars Global Surveyor, have featured higher resolution levels, but the multichannel resolution on Mars Express is unparalleled.

ESA scientists noted that images showed traces of water everywhere, including sediment deposits in former river valleys, signs of glaciation, karst-like formations and other evidence of water transport. Pictures were also taken of the south pole, where the presence of water was identified by past NASA missions, but have not been processed yet. Although widespread water history was already evident from the previous missions, the level of detail of that presence provided by Mars Express is unprecedented and will permit much closer

This photo taken by the HRSC camera shows sedimentary deposits (dark shaded area) in a former river valley. Scientists hope to study their composition later with the IR sensor.

study of hydrospheric phenomena, Southwood said.

Among the photos released, covering 1.87 million sq. km. (722,000 sq. mi.) of Martian surface and 100 gigabytes of processed data, was an image covering a swath up to 4,000-km. wide that ESA claimed was the largest high-resolution image taken in solar system exploration.

According to HRSC team leader Gerhard Neukum of the Free University of Berlin, which developed the camera, the four HRSC color bands (red, green, blue and infrared) show "true" colors, using standard red-green-blue filters, with some added processing for picture brilliance and morphology only—which he said was another Martian "first." The only exception is the IR band, which must make filter corrections, but this channel has yet to be switched on, he added.

The IR sensor's ability to discriminate between mineral types is expected to provide more clues as to the nature of the sedimentary deposits and other telltale formations, said Neukum, affirming that the HRSC will provide "the most comprehensive set of data since Viking."

Other parts of the instrument package also gave ESA scientists cause for jubilation:

- Omega, a combined visible camera and infrared spectrometer intended to provide a global mineral map of the Martian surface, performed an initial pass over the south pole on Jan. 18. The instrument found that most of the polar ice contains water mixed with carbon dioxide, but that some pure water ice deposits exist. Instrument scientist Jean-Pierre Bibring of France's Institute of Astrophysics acknowledged that these findings had been previously inferred from indirect evidence. However, he said, this was the first time they had been observed directly, which would permit accurate quantitative measurements. Bibring said the Omega instrument had also confirmed that the ice cap is perennial, and not a seasonal phenomenon.

- The PFS, a high-resolution planetary

- Aspera, a plasma and energetic neutral atom analyzer, demonstrated a difference between the inflow of solar wind and the outflow of the planetary wind. Rickard Lundin of the Swedish Institute of Space Science cautioned that results were still preliminary, but suggested that the slow escape of volatile elements through the atmosphere could be the prime explanation for the disappearance of water on Mars, and could have a bearing on similar mechanisms on Earth.

- Spicam, a lightweight ultraviolet and infrared spectrometer, performed what Jean-Loup Bertaux of the French Astronomy Service said was the first solar occultation to be carried out on the red planet. The occultation, which permitted the distribution of water vapor and ozone in the atmosphere to be measured simultaneously, showed a relation between the accumulation of water vapor and the depletion of ozone, another phenomenon with lessons for Earth. Spicam also



Fourier spectrometer, confirmed these findings and found that the distribution of carbon dioxide is different in the northern and southern hemispheres of Mars. The PFS—which Vittorio Formisano of the Institute of Interplanetary Space Physics in Rome said is the first to be deployed on Mars—also produced some unexpected results that will have to be analyzed further, after calibration, to determine their meaning. It picked up some solar lines that are absent in the most widely used solar spectrum, but did not observe some lines that were predicted.

produced a vertical profile of the temperature and density of carbon dioxide in the atmosphere—another first, Bertaux said—which could help engineers model aerobraking and aerocapture techniques for future missions.

MARs, an advanced radio transmitter-receiver, performed its first bistatic radar experiment on Jan. 21, using a 70-meter Deep Space Network antenna in Australia. A direct radio science tracking experiment began on Jan. 23. ☉

Michael A. Dornheim contributed to this report from Los Angeles.

83135

23068

Edo 85

BRITISH, EUROPEAN SPACE AGENCIES OPEN INQUIRY INTO BEAGLE 2 LOSS.

PARIS - The European and British space agencies on Feb. 11 announced the creation of a board of inquiry to determine how future Mars missions might avoid the fate of the lost Beagle 2 lander, which has not been seen or heard from since its Dec. 19 separation from the Mars Express orbiter. So little is known about what happened to Beagle 2 -- it is presumed to have entered the Martian atmosphere and landed on Dec. 25 -- that the inquiry will focus less on specific causes of the mission's failure than a broad survey of Beagle 2's financing, development and testing. The board of inquiry will be led by European Space Agency (ESA) Inspector General Rene Bonnefoy and is expected to report its findings by the end of March. Despite numerous attempts to locate and contact Beagle 2 since late December by NASA's Odyssey satellite, by ESA's Mars Express and by ground-based antennas listening for a Beagle 2 signal, no signs of Beagle 2 life have been registered since its Dec. 19 separation from Mars Express. Mission managers at Britain's University of Leicester and Open University have said that they would have to accept the loss of the lander by mid-February if no signal were received. Beagle 2 was designed to search for signs of past or present life on Mars. Its funding, totaling some 49 million euros (\$61.25 million), was paid by ESA, the British government and Beagle 2 prime contractor Astrium Ltd. of Stevenage, England. Despite its ambitious mission goals, the lander's limited budget and weight limits as a piggyback passenger on Mars Express prohibited the inclusion of any backup systems. Any single failure during its descent to Mars, or during the deployment of its parachutes, air bags or solar arrays, could have caused the loss of Beagle 2.

83136

BEAGLE 2 LANDER FAILURE INVESTIGATION FORMALLY BEGINS.

Launched on a shoestring budget, its size tightly confined, the British Beagle 2 lander headed to Mars for a highly-ambitious mission to look for evidence of life. A Christmas Day touchdown on the Red Planet was planned, but the craft never phoned home and subsequent weeks of searching turned up only silence. On Wednesday, the UK Science Minister Lord Sainsbury and the European Space Agency announced a joint investigation would be conducted into the failure of the Beagle 2 lander. The Beagle 2 Management Board met in London last Friday and declared the spacecraft was lost. "I believe such an inquiry will be very useful. The reasons identified by the Inquiry Board will allow the experience gained from Beagle 2 to be used for the benefit of future European planetary exploration missions," said Lord Sainsbury of the Department of Trade and Industry. "ESA is a partnership of its Member States and sharing the lessons learnt from good and bad experiences is fundamental in cooperation," added ESA Director General Jean-Jacques Dordain. The space agency's inspector general, Rene Bonnefoy, will chair the investigation board. The UK deputy chairman will be David Link, a former director of science and radar observation at Matra Marconi Space, now EADS-UK. Officials said the board is being set up under normal ESA procedures by the inspector general. Because the inquiry is into a British-built lander, it will report to Lord Sainsbury as well as to the director general of ESA. Members being named to the board will have no direct involvement in the Beagle 2 mission, ESA said. The group is expected to begin work shortly and report by the end of March. ESA's Mars Express orbiter carried Beagle 2 during launch and the multi-month cruise across space. Just days before arriving at Mars, Beagle was deployed to make its descent. Investigators will attempt to determine what caused Beagle's failure. The board's terms are as follows:

1. Technical Issues

Assess the available data/documentation pertaining to the in-orbit operations, environment and performance characterization, and to the on-ground tests and analyses during development; identify possible issues and shortcomings in the above and in the approach adopted, which might have contributed to the loss of the mission.

2. Programmatics

Analyze the programmatic environment (i.e. decision-making processes, level of funding and resources, management and responsibilities, interactions between the various entities) throughout the development phase; identify possible issues and shortcomings, which might have contributed to the loss of the mission. In addition, Beagle engineers and officials are conducting their own investigation. "The project team has begun an in-house investigation into all the technical aspects of Beagle 2 to establish those areas of greatest risk and what might be done to alleviate them in a future mission," Beagle officials announced in a statement. "It will make all the information available to the official ESA/UK government inquiry announced by Lord Sainsbury."

83137

Bericht uit de ruimte.

Nummer 48 - 15 februari 2004

Het zonnestelsel in / Mars Express en Beagle-2.

83138

Op 30 december en 4 januari maakte de Europese sonde Mars Express twee belangrijke manoeuvres om in een polaire baan om de rode planeet te komen. Vanuit deze nieuwe baan had de Mars Express een beter zicht op de landingsplaats van de Beagle-2, maar helaas werden geen signalen van de vermiste lander ontvangen, zodat moet worden aangenomen dat deze als verloren kan worden beschouwd. Vanaf 5 januari begon de Mars Express met het verrichten van wetenschappelijke waarnemingen en het maken van de eerste hoge resolutiefoto's. Al twee weken na de aanvang van het wetenschappelijke programma, konden wetenschappers onomstotelijk de aanwezigheid van waterijs in de zuidelijke poolkap vaststellen. Al in 2002 had de Amerikaanse Mars Odyssee sporen van het element waterstof gevonden, maar tot dusver dacht men dat al het water alleen in permafrostlagen enkele meters onder het oppervlak van Mars voorkwam.

Beagle Litter

With hopes for Beagle 2 Mars Lander all but gone, U.K. scientists begin to tout successor

DOUGLAS BARRIE/LONDON and MICHAEL A. TAVERNA/FRANCE

British scientists and industrialists are beginning to consider options for a follow-on mission to the Beagle 2 Mars lander, which could see up to three lander vehicles sent to the red planet by 2007.

With scant chance the Beagle 2 will be found in an operational state, scientists and industry are now beginning to argue that the effort needs to be built on, even though the final element of the mission is almost certainly a failure.

Exactly just how difficult it will be to garner government and industry support for such a program, and what form any follow-on takes however, remains to be determined.

Scientists and engineers have begun to unofficially explore alternatives for a follow-on mission, be it a Beagle 3, or Beagle 2A, B and C. A mission in 2007 might require a dedicated lander-bus, unlike the present effort where the Beagle 2 piggy-backed on the Mars Express mission.

European Space Agency Director of Science David Southwood cautioned that the proposed Beagle 3 initiative should be construed as a broad objective, rather than a replica of Beagle 2. "There's no question we have to go back [to the surface of Mars], and we have to move really fast. But no specific mission is yet planned."

Southwood said engineers were more likely to study how some of the ingenious burrowing, picking and chemical analysis technologies, developed for Beagle 2, could be reused on future missions planned within ESA's Aurora planetary exploration program. One possibility would be the rover earmarked for the ExoMars mission, set for 2009.

"We have to begin to accept that Beagle 2, if it is on the Martian surface, is not active," Colin Pillinger, the lead project scientist, said.

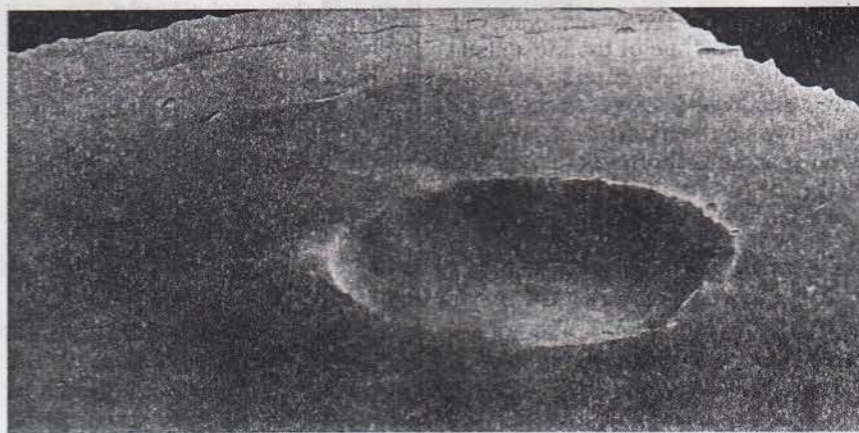
The lander separated from Mars Express Dec. 19, and was due to touchdown on Mars during the early hours of Dec. 25, GMT, on the Isidis Planitia. Numerous attempts to locate and communicate with the Beagle 2, however, have proved fruitless.

The mission team made a "last ditch" effort in early February to try to locate

and bring Beagle online. A command was sent to shut down the lander's onboard processor, assuming it was at all functional, working on the basis that the problem was with a corrupt computer. There was a very slim chance the Beagle's main computer would then restart.

Following these unsuccessful attempts a meeting was held at British National Space Council Feb. 6 to assess the mission. In the wake of this, an ESA-led inquiry was announced Feb. 11.

As the Beagle's scientific and industrial partners move to make a case for a follow-on effort, Pillinger underscores just how useful it would be to "know how



While Mars Explorer continues to provide top-quality imagery of the Martian surface, such as this volcanic crater, it has so far found no sign of the Beagle 2 lander.

far in this mission we got." He added that he was "dedicated to reply the mission in some way, shape, or form."

The team is hoping either the Mars Express orbiter or Malin Space Science Systems will be able to provide imagery of the Beagle 2 landing site on the surface. The lander's main parachute, in particular, is large enough to be picked up. Pillinger pointed out Malin has already produced images of the Spirit lander site, and that the company has already begun to search for the Beagle, should it have made it to the surface.

Attempts by the British Jodrell Bank Observatory, using a specially constructed cryogenically-cooled 401-MHz

receiver to pick up any signal from Beagle, have also come to naught, so far.

"We've collected 37 gigabytes of data, but there has been nothing [from Beagle] there, I'm very sad to say," commented Ian Morison, team leader at the observatory. He, like Pillinger, is a keen advocate of a further mission, admitting, "I hope there will be some Beagle pups."

"We are already making two enormous lists," noted Pillinger. "What might have gone wrong, and what we wouldn't do next time."

Determining whether or not Beagle successfully negotiated the descent by locating its landing site would at least allow the team to draw some conclusions as to the efficacy of the lander parachute and inflatable bags.

Once the lander had separated from the Mars Express and begun its descent, the team had no way of knowing its state. Pillinger admits, "We would have liked to have had a radio signal, but we didn't have the mass resource . . . or an orbiter in the right place."

The ESA director refuted any notion that the comparatively limited Beagle 2 budget was the root of the near-certain mission failure. The real culprit, in his opinion, was the program approach. The lander was added to the Mars Express instrument package at the last minute with insufficient interface control on the part of ESA, and efforts to reinforce the interface setup after the fact could not fully correct this shortfall, he said.

"The scientists were needlessly distracted by technical details. You can't fly by the seat of your pants on projects this complex."

Nevertheless, Southwood insisted that the Beagle 2 team had done an outstanding job under difficult circumstances. Notably, he said, they delivered the lander package on time, unlike a good many other scientific teams involved in ESA missions.

83139

23070

Op 11 februari werd de marslander Beagle 2 officieel verloren verklaard. Maar er is nog hoop. De al meer dan een eeuw verloren gewaande Beagle 1 - het schip waarop Charles Darwin rond de wereld zeilde - is na 154 jaar ineens opgedoken: vier dagen nadat zijn moderne opvolger werd opgegeven.

Toeval of niet: professor Colin Pillinger - de goedlachse Engelse wetenschapper met de enorme bakkenbaarden - is bij beide projecten betrokken. Zij het dat hij

Niet op Mars maar in Essex: de Beagle

alleen het droeve nieuws van de verloren Beagle 2 mocht brengen, terwijl zijn vriend en collega professor Robert Prescott de spectaculaire vondst van de Beagle 1 wereldkundig mocht maken.

De timing lijkt echter perfect. De vondst van de oude Beagle is een opsteker voor Pillinger na de zeperd met de Marslander.

Alleen zit er een addertje onder het gras. Het is niet helemaal zeker of het schip dat onder een dikke modderlaag in de monding van de rivier Roach in Essex is ontdekt, ook daadwerkelijk de oorspronkelijke Beagle is.

De Beagle was een brik - een van de meest voorkomende oorlogsschepen in de negentiende eeuw. Het schip werd in 1820, na dienst te hebben gedaan bij de marine, omgebouwd tot een hydrografisch onderzoeksschip onder commando van kapitein Robert Fitzroy.

In 1831 begon het schip met een vijf jaar durende ontdekkingsreis rond de wereld. Eén van de passagiers was de jonge

bioloog Charles Darwin. Zijn observaties - in Zuid-Amerika en op de Galápagos eilanden - werden de basis voor diens revolutionaire evolutietheorie.

De Beagle kreeg na terugkeer in 1836 een nieuwe bestemming als patrouillevaartuig van de Engelse douane en deed dienst langs de kust van het graafschap Essex. Vanuit zijn basis op de rivier de Roach moest het schip smokkelaars zien op te sporen die in het doolhof van kanalen, riviertjes en kreken aan de waterrijke oost-Engelse Noordzeekust opereerden.

Het schip diende later vermoedelijk als woning voor douane-ambtenaren totdat het in 1870 werd geveild en voor 525 pond in handen kwam van de lokale kooplieden Murray en Trainer. Zij ontmantelden het bovendien van het schip en verkochten de bruikbare spullen.

Pillinger heeft in 2002 stamboom-onderzoek gedaan om afstammelingen van Murray en Trainer te vinden, maar kwam niet verder dan een achterkleinzoon in Australië. Prescotts team ontdekte uit documenten echter een jaar later de locatie van de werf waar het schip zou zijn gesloopt. Met grondradar werd op deze plek onder een drie tot zes meter dikke modderlaag een houten gevaarte gevonden dat qua omvang en structuur op een brik lijkt. 'Omdat er geen schepen bekend zijndie hier daarvoor of daarna nog zijn ontmanteld, moet dit de Beagle zijn', zegt Prescott stellig.

Maar hij sluit niet uit dat het een ander schip is. Het team van Pillinger en Prescott zal zijn werk daarom voortzetten. In de komende maanden zal met grondradar verder onderzoek worden gedaan. Opgraven wordt lastig, denkt Prescott. Hij hoopt wel een houtmonster te kunnen bovenhalen om meer zekerheid over de echtheid te krijgen.

83140

Volkscrant:

21-02-2004

SPACE.COM : 08 MAART 2004.

SCIENTISTS EXAMINE IMAGE OF MARS BEAGLE 2 LANDER.

LONDON - European scientists said Monday they are examining an image of its Beagle 2 Mars lander, taken moments after it separated from its mothership and later was lost, that also shows an unidentified object. The mysterious blot on the photograph is being scrutinized as one of several potential reasons for the failure of the mission - Europe's first attempt to land a probe on the Red Planet. Mission controllers said they were also considering the possibility that Beagle 2 simply crashed onto the surface of Mars because its atmosphere was less dense than expected. Scientists said they are examining photographs of the landing site that show four bright spots, dubbed the "string of pearls," that might be the remains of Beagle 2. Beagle 2 has not been heard from since it was ejected from the European Space Agency's Mars Express orbiter in mid-December. The 143-pound probe did not respond to scheduled attempts to contact it on Dec. 25 and has remained silent ever since. Mission controllers admitted defeat last month after repeated attempts at communication and last-ditch changes to programming. Mark Sims, Beagle 2 mission manager, showed fellow scientists an image of the lander as it spun away from Mars Express, depicting both a bright spot in the shade of the side of the lander and an entirely separate object. Sims said the image was still being analyzed to determine whether the marks are significant or simply a result of the imaging process. "The bright object and the glint on the side of Beagle 2 may be nothing, they may be everything," Sims said. Sims added that the "string of pearls" images may also simply show artifacts of the imaging process. One theory about the missing probe gaining credence is that Mars' atmosphere was not as dense as expected - so Beagle 2 may simply have been going too fast for its parachute and air bags to ensure a soft landing. That idea is supported by evidence from NASA, which also reported a less-dense atmosphere than expected on the entry of its first rover, Spirit, on Jan. 3. NASA succeeded in getting its vehicle down safely because of Spirit's multiple chutes and robust air bag system. Both the U.S. and European missions were devised to look for geologic evidence that Mars was once a wetter place that might have been hospitable to life. While the NASA mission was aimed entirely at landing Spirit and its companion, Opportunity, on Mars, the British-built Beagle 2 was not the focus of the ESA's mission. Instead, it was to get its Mars Express into orbit around the planet. "The first lesson we can learn is that landing on Mars is difficult enough if you have a dedicated mission," said Colin Pillinger, the lead scientist on the expedition. "It's even more difficult if you have a mission where you are a hitchhiker on someone else's ride." Beagle 2 controllers had little choice about the timing or location of the probe's descent onto Mars. Both were determined by the trajectory of Mars Express. Images of the landing site have revealed that there were more hazards in the area - including craters and dust storms - than anticipated. There were also huge funding differences between the European and British projects. NASA's cost \$820 million, while the ESA joint project cost just over \$370 million. Pillinger is already searching for more funds and sponsorship for a revival of Beagle 2. He wants another mission sending more than one probe to Mars as early as 2007.

83141

BBC : 08 MAART 2004.

BEAGLE DESCENT POSSIBLY TOO FAST.

A heat shield was designed to protect Beagle during descent. The Beagle 2 lander could have crashed into Mars because the atmosphere on the planet was less dense than expected. Mission scientists told a London meeting the probe may simply have been going too fast for its parachute and airbags to bring about a soft landing. The Royal Society conference also heard photographic evidence had found four bright spots, dubbed the "string of pearls", on the surface of the planet. Scientists are studying the images to see if they show the lander's remains. They want to know if the spots are the probe's airbags and chute or are merely an artefact of the imaging process. The Beagle team, led by Professor Colin Pillinger, told the society the latter was probably the case. Readings of the Martian atmosphere taken on the day Beagle 2 was due to land were obtained by the Mars Express orbiter, using its Spicam Ultraviolet and Infrared Atmospheric Spectrometer. "The Spicam data shows that there was considerably reduced atmospheric density at 30-40km above the surface," said Beagle 2 mission manager Dr Mark Sims. "We now need to find out where (on Mars) that measurement was taken. If that was true of the Beagle 2 landing site we might have ended up with a situation where we didn't turn the radar altimeter on." This radar altimeter was supposed to prompt Beagle to deploy its airbags once it reached 200m above the surface. But if Beagle was travelling too fast, they might not have deployed. The data shows that there was considerably reduced atmospheric density at 30-40km above the surface. Without airbags to cushion the landing, Beagle 2 would simply have crashed into the Martian dust. However the Spicam data from Mars Express is contradicted by readings from Nasa's Mars Odyssey spacecraft, which did not show greatly lowered atmospheric density on Mars. Dr Sims said that if Beagle's chute deployed properly it would have been travelling towards the surface at 16m/s. A failure involving the parachutes higher in the atmosphere might have meant Beagle approached Mars at up to 6km/s. Dr Sims said turbulence high in the atmosphere could also have caused the craft problems as it approached the surface. Beagle 2 was targeted to land in a large lowland basin called Isidis Planitia at 0254 GMT on 25 December. It was designed to look for past or present life. No signal has ever been detected from the craft to indicate it got down safely, and all attempts to locate the probe with Mars orbiters and radio telescopes on Earth have failed. The idea that Beagle may have had too high a velocity as it approached the surface of Mars is not a huge surprise. The US space agency also reported a less dense atmosphere than expected on the entry of its first rover, Spirit. This was explained by the dust storm activity on the planet at the time which acted to warm the atmosphere. The Nasa vehicle managed to get down safely thanks to its chute, retro-rockets and robust airbag system. Even so, the entry parameters for the second rover, Opportunity, were changed as a result. This was deemed particularly important because Opportunity was aimed at a higher altitude target. The meeting was also told that an unidentified object could be seen in the image taken immediately after Beagle was ejected from its mothership, Mars Express, five days prior to the landing attempt. Scientists said this needed further investigation.

83142

EUROPEAN SPACE AGENCY NEWS RELEASE : 18 MAART 2004

WATER AT MARTIAN SOUTH POLE.

Thanks to ESA's Mars Express, we now know that Mars has vast fields of perennial water ice, stretching out from the south pole of the Red Planet. Astronomers have known for years that Mars possessed polar ice caps, but early attempts at chemical analysis suggested only that the northern cap could be composed of water ice, and the southern cap was thought to be carbon dioxide ice. Recent space missions then suggested that the southern ice cap, existing all year round, could be a mixture of water and carbon dioxide. But only with Mars Express have scientists been able to confirm directly for the first time that water ice is present at the south pole too. Mars Express made observations with its OMEGA instrument to measure the amounts of sunlight and heat reflected from the Martian polar region. When planetary scientists analysed the data, it clearly showed that, as well as carbon dioxide ice, water ice was present too. The results showed that hundreds of square kilometres of 'permafrost' surround the south pole. Permafrost is water ice, mixed into the soil of Mars, and frozen to the hardness of solid rock by the low Martian temperatures. This is the reason why water ice has been hidden from detection until now - because the soil with which it is mixed cannot reflect light easily and so it appears dark. However, OMEGA looked at the surface with infrared eyes and, being sensitive to heat, clearly picked up the signature of water ice. The discovery hints that perhaps there are much larger quantities of water ice all over Mars than previously thought. Using this data, planetary scientists now know that the south polar region of Mars can be split into three separate parts. Part one is the bright polar cap itself, a mixture of 85% highly reflective carbon dioxide ice and 15% water ice. The second part comprises steep slopes known as 'scarps', made almost entirely of water ice, that fall away from the polar cap to the surrounding plains. The third part was unexpected and encompasses the vast permafrost fields that stretch for tens of kilometres away from the scarps. The OMEGA observations were made between 18 January and 11 February this year, when it was late summer for the Martian southern hemisphere and temperatures would be at their highest. Even so, that is probably only -130 degrees Celsius and the ice that Mars Express has observed is a permanent feature of this location. During the winter months, scientists expect that carbon dioxide from the atmosphere will freeze onto the poles, making them much larger and covering some of the water ice from view. Mars Express and OMEGA will now continue looking for water ice and minerals across the surface of the planet. In May, another Mars Express instrument, the Mars Advanced Radar for Subsurface and Ionospheric Sounding (MARSIS), will begin collecting data, looking for water underground. It will be particularly exciting when MARSIS looks at the south pole because, once planetary scientists know how deep the ice reaches, they will be able to calculate exactly how much water there is. Knowing this is very important to understand how Mars evolved and if it ever harboured life.

83143

83144



HF02S

23073

Fotos von Überresten des Mars-„Beagles“?

Forscher der Europäischen Raumfahrtbehörde Esa haben auf einem Foto von „Beagle 2“ ein mysteriöses Objekt entdeckt, das für die Zerstörung des Mars-Roboters bei seiner Landung auf dem Roten Planeten im Dezember verantwortlich gewesen sein könnte. Dies teilten sie gestern in London mit. Das Foto zeigt einen noch nicht näher erläuterten Fleck. Auf anderen Bildern der Landezone sind vier helle Punkte zu sehen, bei denen es sich um die Überreste der ersten europäischen Marssonde handeln könnte

83145

Rechnungshof beklagt Marsmission

Der britische Rechnungshof hat den Verantwortlichen der gescheiterten Marsmission „Beagle 2“ vorgeworfen, die Risiken des Projekts heruntergespielt zu haben. Im ihrem Projektantrag hätten die Planer der Mission den Nutzen gegenüber den Risiken überbetont, hieß es gestern vom Rechnungshof. Großbritannien hat allein in den Bau der ferngesteuerten Sonde über 22 Millionen Pfund (rund 32 Millionen Euro) investiert.

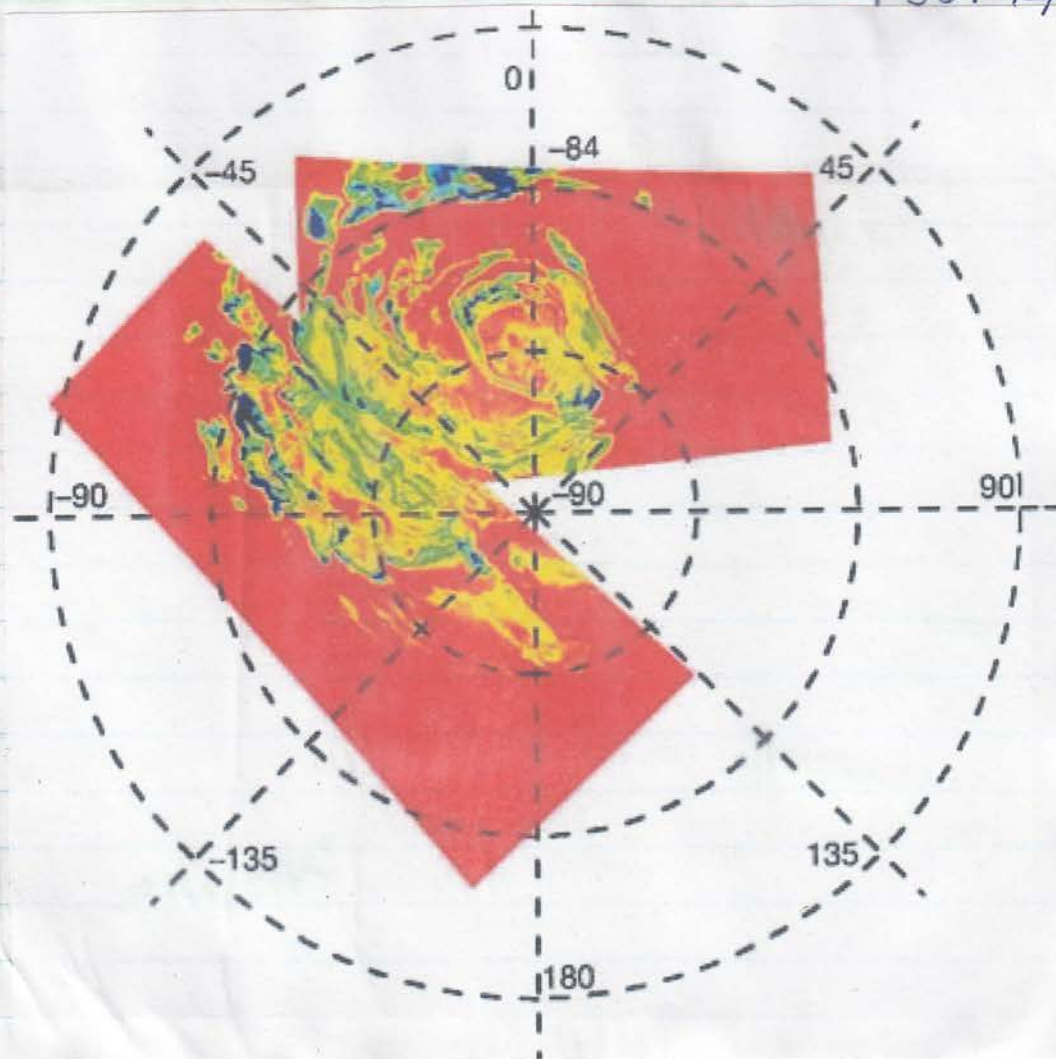
83146

17-03-2004

09-03-2004

Rheinische Post:

83147



Europese Beagle 2 laat niets van zich horen

Kwam de Beagle 2 te hard neer? Landde het misschien op een schuine kraterhelling en rolde het toestel naar beneden? Ligt het op zijn kop? Ontplooiden de zonnepanelen zich wel om de batterijen op te laden? Vragen, vragen en nog eens vragen, maar niemand heeft een antwoord hierop. Wat kan er mis gegaan zijn?

Na alle pogingen om ook maar het zwakste signaal als teken van leven op te kunnen vangen, leverden tot dusver niets op. Op 7 januari vloog de Mars Express het gunstigst over de landingsplek. Toen was het in staat het zwakste signaal nog op te kunnen vangen. Helaas, het bleef stil.

Het leek allemaal zo prachtig te verlopen nog vlak voor aankomst. Na 205 dagen onderweg geweest te zijn en ongeveer 400 miljoen kilometer afgelegd te hebben, bereikte de Beagle 2 de Rode Planeet. Zes dagen voor de landing op 25 december werd de lander van de orbiter Mars Express gescheiden. Die operatie verliep naar wens en de toestellen lagen op koers. Een camera aan boord liet een opname zien kort nadat beide toestellen gescheiden waren. Vlak voor de landing werd de Beagle 2 nog in zijn juiste baan gebracht om de landing in te kunnen zetten. Beschermd door een hitteschild dook het toestel de dunne Marsiaanse atmosfeer in. Een parachute zorgde voor de verdere afremming en airbags wisten een zacht neerkomen te realiseren. Dat scheen allemaal volgens plan verlopen te zijn. Het toestel was op 25 december te 5.52 uur geland. Toen braken drie uren van spannend afwachten aan. Het eerste radiocontact met de Beagle 2 zou via de Amerikaanse Mars Odyssey dan te horen zijn. Het bleef stil. In het vluchtleidingscentrum in Darmstadt kon men

zelfs het kleinste speldje horen vallen. De opgewonden blijdschap na de landing temperde. Nee, niemand wilde er aan denken dat er misschien toch iets..... Uitgesloten! Dan maar wachten tot een tweede gelegenheid zo'n achttien lange uren later. Maar ook toen bleef het stil. Er braken dagen aan om van alles te proberen om de Beagle 2 aan het praten te krijgen. De grote radiotelescoop van Jodrell Bank in Engeland werd erbij ingeschakeld. Muisstil bleef het. En toen dit nummer van ASTRUIM naar de drukker ging, begon iedereen al met de gedachte te leven dat de Beagle 2 mislukt was. Ontzettend jammer. Vooral omdat dit toestel de geavanceerdste was tot dusver naar Mars gestuurd. Nooit bevatte een Marssonde zoveel wetenschappelijke instrumenten.

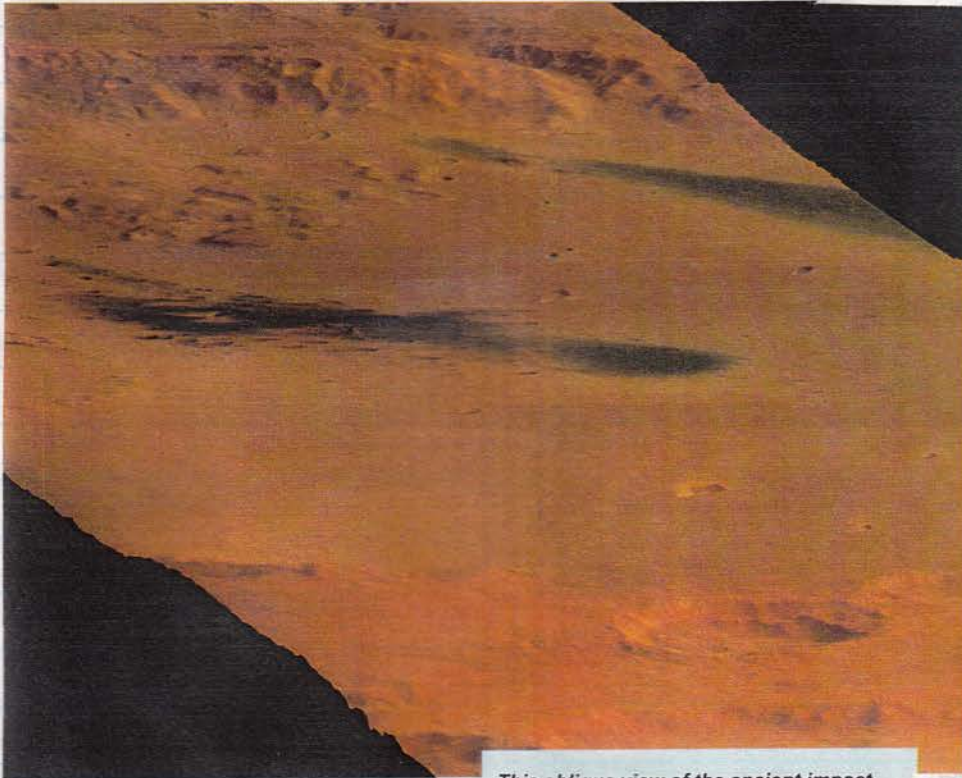
Is nu het hele Marsproject van ESA mislukt. *Geen sprake van!*

Op 4 januari zorgde de hoofdmotor aan de Mars Express dat tijdens een vijf minuten durende brandtijd, de baan om de planeet op 190.000 kilometer veranderde in 40.000 x 250 kilometer. Nog twee maal werden er wijzigingen in de omloopbaan aangebracht: in de nacht van 6 op 7 januari en in de nacht van 10 op 11 januari. De geplande baan van 11.000 x 300 was bereikt. Vanaf deze hoogte kan de orbiter aan zijn gedetailleerde studies van het oppervlak, ondergrondse structuren en de atmosfeer beginnen. Je zou kunnen zeggen van het gebied tussen de bovenste lagen van de atmosfeer tot enkele kilometers onder het oppervlak op zoek naar ijs of water. En wanneer die instrumenten voor de volle 100% het werk doen, dan zullen wetenschappers heel veel te weten komen van deze geheimzinnige planeet. Vanaf half januari

kunnen we de eerste 3D opnames al verwachten. Laten we vooral goed voor ogen houden dat instrumenten aan boord van de Mars Express de interessantste foto's en gegevens gaan leveren.

83148

Communications first over Mars



This oblique view of the ancient impact crater Gusev was taken by the Mars Express HRSC instrument in colour and 3D from orbit 24 on 16 January 2004. This crater with a diameter of 160 km probably hosted a lake, as inferred from the existence of an inflowing channel called Ma'adim Vallis. The Mars rover Spirit landed almost exactly in the middle of the shown image, at the geographic coordinates 14.5718°S and 175.4785°E. ESA/DLR/FU Berlin (G. Neukum)

83149

A pioneering demonstration of communications between NASA's Mars Exploration Rover Spirit and the European Space Agency (ESA) Mars Express orbiter in early February was successful. While Mars Express was flying over the area Spirit was examining, the orbiter transferred commands from Earth to the rover and relayed data from the robotic explorer back to Earth.

"This is the first time we have had an in-orbit communication between ESA and NASA spacecraft, and also the first working international communications network around another planet," said Rudolf Schmidt, ESA's project manager for Mars Express.

These two significant 'firsts' took place on 6 February as part of ESA and NASA's continuing efforts to cooperate in space and to enable plans to use joint communications assets to support future missions to the surface of Mars.

The commands for the rover were transferred from Spirit's operations team at JPL to ESA's European Space Operations Centre in Darmstadt, Germany, where they were translated into commands for Mars

Express.

The translated commands were transmitted to Mars Express, which used them to successfully command Spirit. Spirit used its ultra-high frequency antenna to transmit telemetry information to Mars Express.

The orbiter relayed the data back to JPL, via the European Space Operations Centre. "The communication sessions between Mars Express and Spirit were pristine. Not a single bit of data was missing or added, and there were no duplications," said JPL's Richard Horttor, project manager for NASA's role in Mars Express.

Beagle investigation

83150

An official investigation by the British Government and the European Space Agency has been launched into the loss of the UK's Beagle 2 lander on Christmas Day 2003.

It had been assumed that Beagle landed, so a series of attempts by Mars orbiters to detect signals was launched with no success.

Professor Colin Pillinger, the Open University's Beagle 2 creator, hopes that images taken by the orbiters may be able to spot Beagle 2 on the surface, or any of its artefacts, such as its parachute or landing bags.

The investigation will look at the development, integration and testing of the craft, the project's funding levels, resources and management.

Columbia memorial on Mars

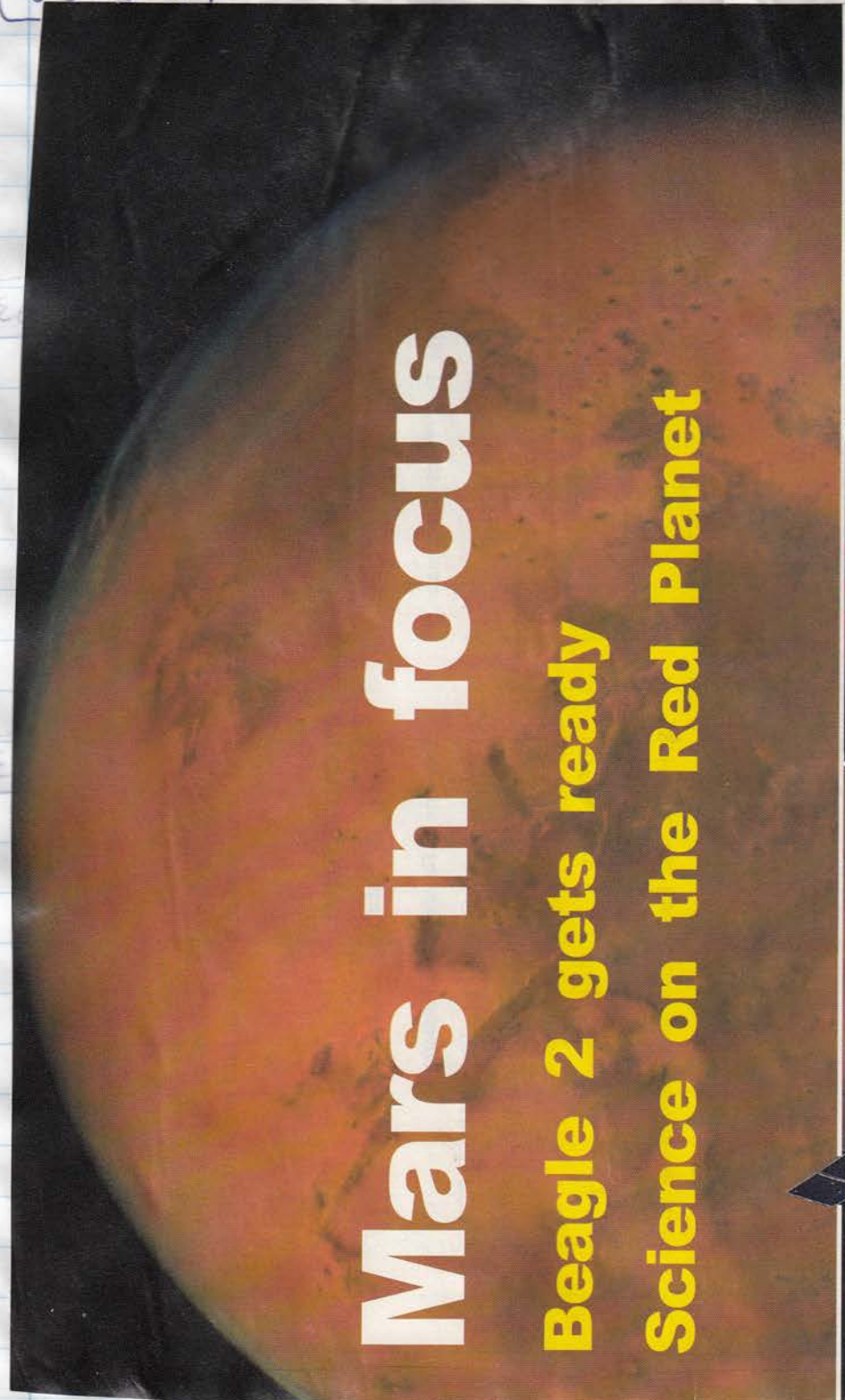
The area of flatland in the Gusev crater in which NASA's Mars Exploration Rover 1, Spirit landed on 4 January, has been named the Columbia Memorial Station in memory of the seven crew of STS-107 who perished during re-entry on 1 February 2003.

3F03S

23076

83152

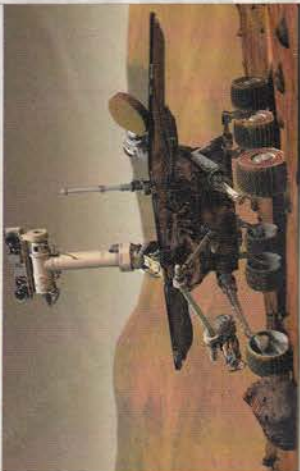
83151



Mars in focus

Beagle 2 gets ready

Science on the Red Planet



Marslander Beagle 2 verloren verklaard

PARIJS — De Europese ruimtevaartorganisatie ESA heeft gisteren de Marslander Beagle 2, na ruim anderhalve maand tevergeefs zoeken, officieel verloren verklaard. De ESA gaat ervan uit dat de Beagle bij de landing ernstig is beschadigd of in een krater is beland.

De Beagle landde op eerste kerstdag op de Rode Planeet, maar zond geen signaal uit naar de aarde of het moederschip Mars Express. Pogingen om via de Amerikaanse satelliet Mars Odyssey en radiotelescopen een teken van leven op te pikken, mislukten. Ook foto's van de vermoedelijke landingsplaats, gemaakt door het moederschip, lieten geen spoor zien van de Marslander.

Spits:
12-01-2001

F212

3128

8FO29

23077

Bush: extra geld voor reis naar Mars

83153

De Amerikaanse president George Bush heeft gisteren in een toespraak zijn plannen voor de ruimtevaart toegelicht. Bush wil tegen 2015 opnieuw Amerikanen op de maan, waar een permanente basis moet komen.

Volgend doel: mensen naar Mars brengen. Om de Amerikaanse kiezer niet te verontrusten, denkt president Bush daar de komende vijf jaar maar een miljard dollar extra per jaar voor nodig te hebben.

„In de afgelopen dertig jaar heeft geen mens nog een voet gezet op een andere planeet of zich verder in de ruimte gewaagd dat 621 kilometer, zowat de afstand tussen Washington D.C. en Boston. Het is tijd voor Amerika om de volgende stap te nemen”, zei Bush.

De spaceshuttle wordt binnen zes jaar uit de lucht gehaald en de Verenigde Staten trekken zich tegen 2010 terug uit het internationale ruimtestation (ISS). Dat levert jaarlijks zo'n vijf miljard dollar op. De NASA heeft nu een budget van zo'n vijftien miljard per jaar. Het vrijgekomen en extra geld moet de NASA investeren in het opzetten van peperdure langetermijnprojecten projecten als de bemande Marslanding. Na de door Bush becijferde vijf jaar komt het duurste deel van het

83154

programma. De berekening van de kosten daarvoor laat Bush aan zijn opvolgers over.

De Democratische senator en voormalige Shuttle-astronaut Bill Nelson, betwijfelde of het extra miljard per jaar voldoende is. „Daarmee geraak je niet op de maan tegen 2014”, zei Nelson. Maandag bleek uit een opiniepeiling dat iets meer dan de helft van de Amerikaanse bevolking het geld liever naar onderwijs en gezondheidszorg ziet gaan.

Veel wetenschappers vinden dat er beter in het gebruik van robots in de ruimte kan geïnvesteerd worden dan in astronauten. Bush was het daar niet mee eens. „De menselijke drang naar kennis kan zelfs niet door de meest levendige foto's of de nauwkeurigste berekeningen bevestigd worden. We moeten zelf kunnen onderzoeken en voelen”, aldus de president.

Bush' vader had tijdens zijn presidentschap ook al een plan om Amerikanen op Mars te zetten. Het Congres zag daar weinig in, vooral vanwege de astronomische kosten: aan het plan van George Bush sr. hing een prijskaartje van 400 tot 500 miljard dollar. De plannen van Bush jr. zijn ambitieuzer. In het plan van zijn vader was geen sprake van een permanente basis op de maan.

In 2008 sturen de Amerikanen robots naar de maan, onder

83156

meer om voorraden aan te leggen voor de astronauten die ergens tussen 2015 en 2020 vliegen om de basis aan te leggen. Een landing op Mars volgt op zijn vroegst tien jaar later. Om opnieuw naar de maan te vliegen moet de NASA een nieuw ruimtevaartuig bouwen. De basis op de maan is bedoeld als springplank voor verdere verkenning van de ruimte. Op de maan is helium-3 aanwezig, dat in theorie gebruikt kan worden als raketbrandstof. Ook is er vermoedelijk water. Daar kan onder meer zuurstof aan worden onttrokken.

Na de aankondiging van president Bush, hebben Rusland en China gisteren eveneens laten weten dergelijke ambitieuze ruimteplannen te overwegen.

„Voor het eind van het jaar willen we een federaal ruimtevaartprogramma tot 2015 ontwikkelen en het is mogelijk dat dergelijke projecten daarin staan”, zei Nicolaia Moisejev, de vice-directeur van de Russische Rosaviakosmos ruimtevaartorganisatie, tegen persbureau Itar-Tass.

In Peking maakte de Chinese Ruimtetwetenschap en Technologie Onderneming bekend dat het dit jaar tien satellieten gaat lanceren. Verder worden voorbereidingen getroffen voor een tweede bemande ruimtevlucht. In 2010 willen de Chinezen een onbemand voertuig op de maan laten landen.

83157

83158

DDL:
16-01-2004

23078

FFOES

Verdrehte Fruchtfliegen zurück aus dem All

Zoologie Jenaer Forscher studieren, wie sich Schwerelosigkeit auf Fliege und Mensch auswirkt

Sie lassen sich auf frischen Äpfeln nieder oder ertränken sich im Rotweinglas - Fruchtfliegen sind den Menschen lästig. Nicht so den Wissenschaftlern. Für sie zählt die „Drosophila melanogaster“ zu den bevorzugten Forschungsobjekten - und dieses schicken sie sogar ins All.

Biologen des Instituts für allgemeine Zoologie und Tierphysiologie der Universität Jena untersuchen derzeit Fruchtfliegen-Stämme, die die „Cervantes“-Mission zur Internationalen Raumstation ISS Ende Oktober begleitet hatten. Ziel der Weltraumfliegenstudie sei es, die Prozesse des Alterns in der Schwerelosigkeit aufzuklären, erläutert die Biologin Uta Kirschnick. Dazu waren kurz- und langlebige Fliegenstämme auf die Reise geschickt worden, deren Le-

bensdauer bei etwa drei beziehungsweise fünf Wochen liegt.

Auch filmten Forscher an Bord des Raumschiffs, wie sich die Insekten völlig schwerelos verhielten. Für diesen Teil der Forschungsaufgabe flog ein Stamm von Fliegen-Mutanten mit. Dabei handelt es sich um so genannte „verdrehte Fliegen“, deren Orientierungssinn durch genetische Eingriffe verändert wurde. „Normalerweise laufen die Fliegen in einem Röhrchen immer nach oben“, erklärt Kirschnick. Den Mutanten fehle diese Orientierung.

Wie sich der Trip in die Schwerelosigkeit auf Altern und Verhalten der Fliegen auswirkt, hoffen die Jenaer Forscher im Hirn der Tiere zu entdecken. „Insekten haben - anders als Säuger - sehr konstante Nervenmus-

ter“, erläutert der Neurobiologe Hans Agricola. Individuelle Unterschiede gebe es praktisch nicht. Daher seien Insekten sehr gut geeignet, um grundsätzliche Erkenntnisse über den Aufbau des zentralen Nervensystems und seine Entwicklung zu erhalten. Am Jenaer Institut wurde ein Verfahren entwickelt, mit dem alle Bestandteile einer Nervenzelle und Zellennmuster im Nervensystem von Insekten sichtbar gemacht werden können.

Freilich geht es den Biologen nicht um die Raumfahrteneignung der Fliege, sondern um den Menschen. „Die Gene der Fliege ähneln denen der Menschen“, erklärt Kirschnick. Erkenntnisse zu den Fliegen ließen deshalb eine Antwort auf die Frage zu, wie die Schwerelosigkeit sich auf das Gehirn des Menschen auswirkt.

Keine galaktischen Dimensionen

Die Dimensionen, in denen sich die Forscher bewegen, sind keineswegs galaktisch, sondern mikrokosmisch - das Gehirn einer Fruchtfliege hat von Auge zu Auge lediglich eine Länge von einem halben Millimeter, in Höhe

Rheinische Post:
27-12-2003.



23079

23128

Bericht uit de ruimte.

Nummer 48 - 15 februari 2004

Mensen in de ruimte.

Aan het begin van het nieuwe jaar werd het International Space Station bewoond door de Amerikaan Michael Foale en de Rus Aleksandr Kaleri, die samen Expeditie-8 vormen. Het ruimteschip Soyuz TMA-3 was gekoppeld aan de Pirs module, en de vrachtcapsule Progress M-48 zat vast aan de achterste koppelpoort van de Zvezda woonmodule. In de eerste week van januari bleek dat de luchtdruk in het station geleidelijk daalde, wat duidde dat er ergens in het complex een klein lek aanwezig was. Op 11 januari werd het lek eindelijk gelokaliseerd in een slang verbonden met het grote venster in het Destiny laboratorium. De slang wordt gebruikt om de lucht te ventileren tussen de verschillende glasbladen waaruit het venster is opgebouwd, om zo condensatie te voorkomen. Foale slaagde erin het lek te dichten, waarna het station weer op de normale luchtdruk werd gebracht. De Progress M-48 ontkoppelde op 28 januari om 08:36 uur. Twee omlopen later ontstak de Progress M-48 haar motoren en verbrandde korte tijd later in de atmosfeer boven de Grote Oceaan. Daags daarna werd de Progress M1-11 gelanceerd en op 31 januari om 13:15 uur koppelde deze aan de achterste koppelpoort van de Zvezda module. De Progress M1-11 bracht nieuwe voorraden naar het ruimtestation, twee nieuwe Russische Orlan-M ruimtepakken, rendez-vous apparatuur voor de in 2005 te lanceren Europese bevoorrader ATV. Aan boord bevond zich ook het experimentenpakket die de Nederlander Andre Kuipers zal gaan gebruiken in het kader van de DELTA-missie in april. Op 14 januari presenteerde de Amerikaanse president George W. Bush de toekomstvisie voor het Amerikaanse bemande ruimtevaartprogramma. Hoewel het plan weer een duidelijk doel aan de NASA activiteiten kan geven, lijkt het aan de financiële ondersteuning te mankeren, en zijn er ook geen definitieve data vastgesteld waarop de doelstellingen verwezenlijkt zou moeten zijn. Sommige analisten suggereren dan ook dat deze toekomstvisie eerder gezien moet worden in het kader van de verkiezingsstrijd van de volgende Amerikaanse president later dit jaar. Hieronder enkele details van het gepresenteerde plan (naar J. McDowell):

- Onbemande maansondes en landers vanaf 2008.
- Een nieuw te ontwikkelen Crew Exploration Vehicle (CEV) zal onbemand getest gaan worden vanaf 2008. De ontwikkeling van de CEV staat inmiddels bekend als Project Constellation.
- De assemblage van het internationale ruimtestation ISS wordt afgerond in 2010.
- Vervolgens zal de space shuttle in 2010 uit de actieve dienst genomen worden.
- De CEV zal vanaf 2014 bemande vluchten naar het ISS gaan uitvoeren. In de vier jaar tussen het uit de vaart nemen van de shuttle en de ingebruikname van CEV, zullen bemanningen van en naar het ISS getransporteerd worden door middels van niet-Amerikaanse ruimteschepen zoals de Russische Soyuz.
- CEV zal bemande maanmissies gaan uitvoeren ergens tussen 2015 en 2020.
- Er is geen Amerikaans budget voorzien voor het ISS programma na 2016.
- Bemande missies naar Mars en verder nadat de terugkeer van mensen naar de maan verwezenlijkt is.
- Internationale participatie is gewenst (doch niet nadrukkelijk).
- Het budget van NASA (jaarlijks 15 miljard dollar) wordt verhoogd met 1 miljard dollar per kalenderjaar. De rest van het benodigde geld zal verkregen moeten worden door het o.a. vroegtijdig beëindigen van de shuttle en ISS programma's.

Op 16 januari maakte NASA bekend dat de vierde en vijfde servicevlucht van de shuttle naar de Hubble ruimtetelescoop geannuleerd zijn. De reden hiervoor is dat na het ongeluk met de Columbia alle shuttlevluchten naar het ISS zullen gaan, zodat de bemanning een veilig heenkomen kunnen zoeken mocht de shuttle niet in staat zijn terug te keren naar de aarde. Men verwacht dat de ruimtetelescoop nog drie tot vier jaar zal kunnen blijven functioneren. Omstreeks 2011 zal de Hubble een ongecontroleerde terugkeer in de aardse dampkring maken en grotendeels opbranden.

(83161)

Space Shuttle
2005-01-15

23080

2F025

SPACE.COM : 24 FEBRUARI 2004

A FIRST : ISS SPACEWALK WILL LEAVE SPACE STATION UNATTENDED.

CAPE CANAVERAL - The two men aboard the international space station will venture outside on Thursday, leaving the orbiting complex unattended during a spacewalk for the first time ever. NASA gave its final approval Tuesday for the spacewalk and insisted that the safety precautions will be ample, even though no one will be inside the space station to serve as a watchman. Normally, two crew members go out at a time, employing the buddy system for safety reasons, while the third astronaut stays behind to watch over them and the spacecraft. But the station has had just a two-man crew since last spring to reduce the need for supplies while the shuttles are grounded because of the Columbia space shuttle disaster. NASA was initially skeptical of the Russian Space Agency's idea for an all-hands spacewalk and agreed to the 5 1/2-hour outing only after months of safety analyses. The Americans and Russians came up with 13 flight rules governing what to do if something breaks, the space station spins out of control, a fire erupts or some other emergency arises. During the spacewalk, astronaut Michael Foale and cosmonaut Alexander Kaleri will retrieve some science experiments and set up others. They will also check the exterior of the station for any signs of a blow from debris. Last November, the crewmen heard a strange metallic noise, possibly from a piece of space junk hitting something. The space station has been abandoned briefly a few times in the three years it has been occupied, to move the astronauts' escape craft from one docking port to another. Flight controllers kept close watch over the spacecraft, and nothing went wrong. But the station has never been left unattended while the crew was outside on a spacewalk. The Russians have left their space stations empty during spacewalks for decades. They had been pushing for this excursion since last summer because of contractual agreements with the European and Japanese space agencies, which own the experiments that need to be taken in and out. Flight controllers routinely monitor and even run the international space station's systems, so that was not the major concern for NASA. The chief worry was safety, and all NASA's concerns were answered to its satisfaction, said flight director Sally Davis. The crewmen overcame the final hurdle last week when they managed to squeeze into their docked Soyuz capsule while wearing bulky spacesuits. NASA wanted to prove that in an emergency, such as a fire or decompression, the spacewalkers could immediately get into their escape craft. Medical supplies will be left inside near the hatch in case one of the spacewalkers comes in hurt. After the Columbia disaster a year ago, NASA wanted to wait until shuttle flights resumed so a third crew member would be inside for any spacewalk. But managers changed their minds when it became apparent that shuttles were going to be grounded for much longer than anticipated. The station's next two-man crew expects to make two spacewalks, conducting far more critical work. Station operations manager Mike Suffredini said this week's spacewalk will be fairly routine and will help NASA identify any problems for the next time.

83162

FLORIDA TODAY : 24 FEBRUARI 2004

NASA CONFIDENT SPACEWALK SAFE / 2-MAN CREW WON'T OVERSEER.

CAPE CANAVERAL - U.S. managers of the International Space Station said Tuesday they have minimized the risk involved in the station's first spacewalk by a two-man crew. The station can support just two people while the space shuttles are grounded. No one will be inside to coordinate activities or monitor the station's systems when Mike Foale and Alexander Kaleri leave a Russian airlock on Thursday. The spacewalk was scheduled at the instigation of NASA's Russian counterparts, who want to retrieve and install Japanese and European experiments to satisfy contracts they made with those partners. U.S. officials said Tuesday they had overcome initial reluctance to conduct the spacewalk after months of discussions and planning. In addition, they said, the spacewalk will prove the next two-man crew can do two more spacewalks to prepare for the arrival of a European cargo ship next year. "We are mitigating more risks than we're taking by doing this EVA (extra-vehicular activity) now," said Mike Suffredini, ISS manager for integration and operations. The station is in a stable position and wouldn't move much even if controlling devices failed, he said. In addition, temperatures and radiation are expected to be favorable for a spacewalk now. U.S. and Russian managers set rules for ending Thursday's spacewalk in case there's a crisis on board, said Sally Davis, lead flight director for the spacewalk. "They were prepared," she said of meeting with the Russians. "They knew what they were doing for the EVA. They had timelines already assembled for us, and they were ready to go to work. In my opinion, in my experience, this was cooperation at the highest level I have seen." For instance, the managers agreed that even if there's a serious crisis on the station, such as a fire, the crew will finish its current task outside the station and move inside according to routine, a process that could take two hours. The biggest worry is the possibility of a failure of one of the four gyros that control the station's position, Davis said. One of the four isn't working, and worries about another have prompted managers to use Russian thrusters to keep the station stable. If thrusters have to be fired during the spacewalk, the astronauts must get to safety first. Some station segments and systems are being placed in safe configurations in case the station must be abandoned suddenly. Commander Foale will close the hatch on the U.S. segment this evening and camp out in the service module the night before the spacewalk. Kaleri was securing the Russian segment, as well. Both Foale and Kaleri have done spacewalks before. Russian crews have frequently performed spacewalks outside their stations with no one inside. Gennady Padalka, who will perform two such spacewalks while commanding the upcoming Expedition 9 mission, shrugged off any increased risks. "It's very boring to be inside the space station during the spacewalk," Padalka said. "It's such a long time." "I feel we can conduct this EVA safely," Foale said recently. "Our third person will actually be (mission controllers in) Houston and . . . Moscow, and they will be looking after our station, our home." The spacewalk is scheduled to last five and a half hours, with the hatch of the Pirs docking compartment opening about 4:15 p.m. EST Thursday. The men, wearing Russian spacesuits, will install an experiment that calculates radiation exposure to humans during spaceflight. They also will switch out a Japanese experiment that studies exposure to space and micro-meteor impacts, and they will work on an experiment that measures residue from thruster firings. In addition, Foale and Kaleri will remove reflectors that are under study as part of the navigation system for a European cargo ship expected to arrive at the station in spring 2005.

83163

83168

58085

23081

Giant Leap

Chinese want new heavy-lift Long March to fly in time for the Beijing Summer Olympics

MICHAEL A. TAVERNA/BREMEN, GERMANY

China is on track to loft by 2008 the first model of its next-generation launcher family—probably a heavy-lift version capable of carrying an orbital laboratory—officials said at the International Astronautical Federation Congress here last week, as they fleshed out details of the new line.

THE CHINESE have been working on the KT rocket family, which will be able to launch payloads of 25 metric tons into low-Earth orbit (LEO) and 14 metric tons into geostationary transfer orbit (GTO), since the beginning of the decade. It is aimed at replacing the country's present fleet of light and medium-lift boosters, whose upper GTO limit is 5.2 metric tons, and creating a heavy-lift capability comparable to the Delta IV, Atlas V and Ariane 5 and, most recently, Japan's enhanced H-IIA (*AW&ST* Sept. 29, p. 22; Nov. 12, 2001, p. 54).

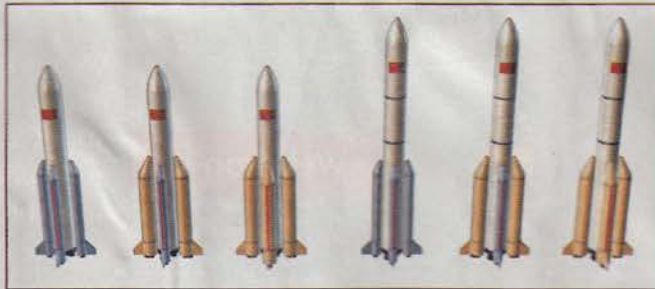
The KT line is also intended to boost flexibility—through a modular design based on three standard sizes similar to those employed for the U.S. EELV program—and improve reliability, while reducing fuel-related hazards and cutting costs.

Tangming Cheng, of the Beijing Institute of Aeronautical Systems Engineering, said the next-generation launcher family is expected to improve rocket reliability to 0.98 for unmanned missions and 0.99 for manned flights, compared with 0.91 for the existing model line. Engineers also forecast a 20-30% decrease in payload injection cost per kilogram, and a launch preparation time of less than 15 working days.

Officials declined to discuss the cost of the ambitious program, but acknowledged that a Chinese plan to orbit a 25-metric-ton space laboratory is a major driver, as are other planned projects such as the fledgling lunar program and the country's recent entry into the World Trade Organization (*AW&ST* Aug. 25, p. 30). They admitted the 2008 target date for the first flight is geared

to the Summer Olympic Games in Beijing, which would offer a high-profile opportunity to showcase the nation's new capability.

According to Wang Jianjie, assistant director for launch vehicles at China Aerospace Science and Technology Corp., which is responsible for developing the new launcher line, the two all-new powerplants to be used for main and booster stages have begun firing tests and are expected to be ready by late 2005 or early 2006. These are a 120-



New heavy- and medium-lift Long March models also will be available in smaller versions put together by modifying the number or module size of boosters or by eliminating the upper stage.

metric-ton-class liquid hydrogen/kerosene (LOX/KO) engine and a 50-metric-ton-class liquid hydrogen/liquid oxygen (LH/LOX) engine, designed to replace nitrogen tetroxide/UMDH that power the bulk of existing Chinese rockets.

The LOX/KO powerplant, based on research done in cooperation with Russian engine design bureaus, has a vacuum thrust rating of 1,340 kN. (301,232 lb.) and a specific impulse of 335 sec., and can swing in one direction. The LH/LOX engine, which derives from Chinese experience with cryogenic technology introduced in the third stage of the LM-3 series, generates 700 kN. of thrust with a specific impulse of 432 sec. and swings in two directions. The former is pressurized using turbopumps; the latter, via helium. Both engines are built by China's Academy of Aerospace Liquid Propulsion Technology, using only indigenous components, Wang said.

The upper stage, when used, will feature 8-metric-ton-thrust-class LH/LOX engines basically identical to the YF-75 engine used on the third stage of the LM-3B. The differences, Wang indicated, are mainly related to process changes introduced to increase reliability.

In contrast to the approach in Western countries, which focused initially on medium-lift versions, the first member of the new launcher family is expected to be the basic heavy-lift version, which will have a total mass of 175 metric tons and a 14-ton GTO rating. This two-stage rocket will utilize modules measuring 5 meters (16.5 ft.) in diameter for the main and upper stages and have 3.35-meter and 2.25-meter strap-on modules for the booster stage. It will carry two 50-ton LH/LOX main stage engines, six LOX/KO boosters in four pods and two 8-ton LH/LOX upper stage engines.

Paradoxically, he indicated, the second model to enter service will probably be the smallest—a single-stage light launcher using a 2.25-meter-dia. module and one LOX/KO engine that is to fly in 2008-09. The light launcher line will also include a two-stage version with a total mass of 69 metric tons, capable of lofting a

1.5-ton payload into LEO. The explanation for this strategy is doubtless the relatively weak competitiveness of the low end of the Chinese rocket family, which is dominated by older models. Another new light launcher is being developed by rival China Aerospace Science and Industrial Co.

MEDIUM-LIFT versions, weighing 147 metric tons and designed for a GTO capability of up to 6 tons, will be introduced only when existing models, including the LM-3 series, no longer meet market or government requirements. By way of indication, Wang said, there are currently no plans to move manned missions from the present Shenzhou launch vehicle, the LM-2F.

The three-stage basic medium-lift model will comprise 3.35-meter-dia. main and second stages, a 3-meter-dia. third stage and 2.25-meter strap-ons. The core stages will carry two LOX/KO engines and each strap-on, one powerplant of the same type. As with the heavy-lift version, the medium-lift model will be made available in smaller variants down to 1.5 tons (to GTO) by diminishing the number of strap-ons and dropping the upper stage.

83164

18085

23082

GROTE STAPPEN VOOR CHINA.

Als alles mee zit dan lanceert China in het jaar 2008 zijn nieuw model uit zijn "raket familie". De heavy-lift versie die onder andere een ruimtestation in een baan om de aarde kan brengen valt onder de Long March variant. Dit werd bekend gemaakt tijdens het internationale Astronautical Federation Congress in de eerste week van oktober.

De Chinezen zijn druk doende met het ontwikkelen van zijn raketten die de mogelijkheid hebben om vrachten in een lage baan om de aarde te brengen. De bedoeling is dat zij zeker 30 ton aankunnen. Voor de geostationaire baan is het 14 ton. Als deze ontwikkeling klaar is, dan vervangen ze de huidige vloot van raketten. Deze zogenaamde medium-lift raketten hebben nu een capaciteit van 5,2 ton. En dat is toch een stuk minder in vergelijken met de Delta 4, Atlas V, de Ariane

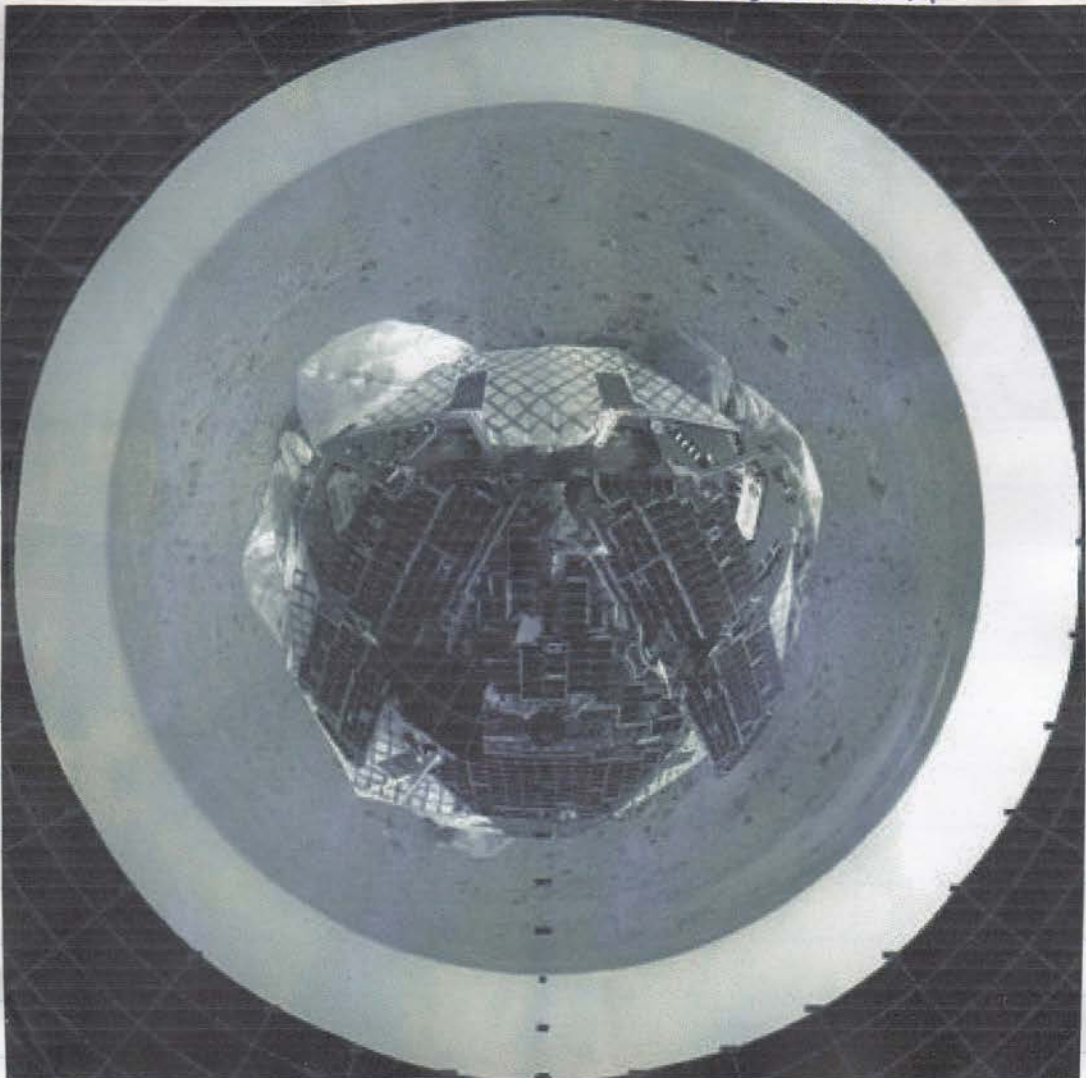
5 en de nieuwe versie van de Japanse H-IIA. De KT lijn komt er ook om het allemaal wat gemakkelijker te maken. Zo komt er een basis idee waarmee verschillende versies gemaakt kunnen worden. Vergelijk het maar met het Amerikaanse EELV. Atlas 5 en Delta 4 hebben ook verschillende configuraties. De streefdatum voor de eerste zogenaamde "maiden flight" is ergens in 2008. Deze moet samenvallen met de Olympische spelen in Beijing in dat jaar. Zo'n evenement als de spelen is natuurlijk een goede showcase voor het project.

Wang Jianjie, assistent directeur van het bedrijf China Aerospace Science and Technology, onder andere verantwoordelijk voor de ontwikkeling van de nieuwe raket gaf aan dat ze op het moment ook nieuwe faciliteiten aan het bouwen zijn. Deze zijn voor de testen met o.a. de motoren die op de planning staan voor 2005/2006. De tests bestaan uit verschillende soorten motoren die gebruikt worden om de diversiteit van het systeem uit te proberen.

83165

83167

83166



83168

83168

83168

UPOES

23083



83168

83169

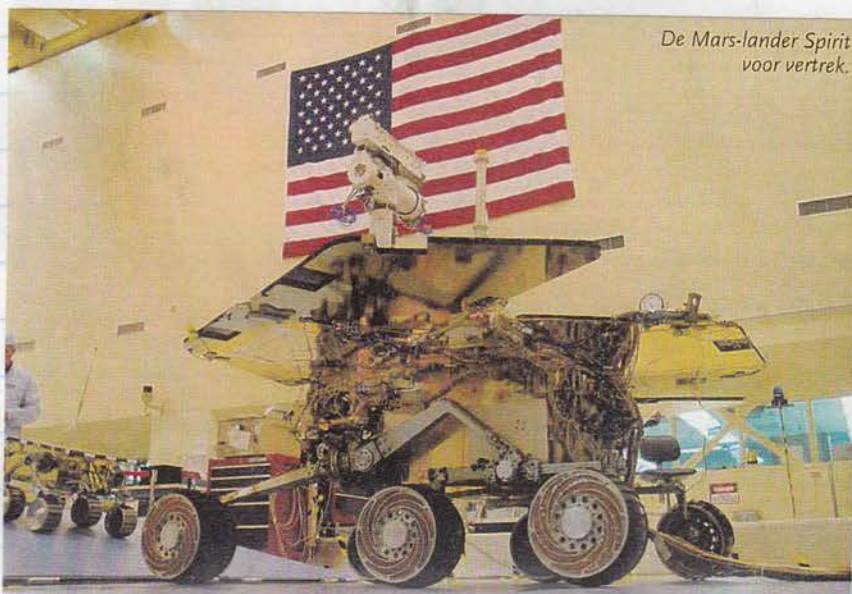


60



80

83170



De Mars-lander Spirit voor vertrek.

83171

53083

23084

REPORT : CHINA TO RECRUIT WOMEN FOR SPACE.

BEIJING - China will recruit women astronauts for future manned space missions as a result of pressure from a leading women's organization, the official Xinhua News Agency reported Sunday. A proposal by Gu Xiulian, president of the All-China Women's Federation, to allow women to fly on space missions has been approved by the central government, Xinhua reported. Last October, China launched its first manned space mission. Astronaut Yang Liwei became an instant national hero upon returning from his 21 hours in orbit aboard the Shenzhou 5. China's space craft designers will have to make minor changes to future space ships to accommodate women, the report said, quoting an unnamed official with the Beijing-based Space Medical Engineering Institute, which is responsible for training astronauts. No further details were provided. The report said hundreds of Chinese women pilots have joined the country's civil aviation and air force since 1951. Xinhua has reported that 14 astronauts are being trained for the nation's next mission, which could happen as early as the first half of next year. The United States and Russia are the only other countries that have sent manned spacecraft into orbit. China appears to be stepping up the pace and profile of its space missions. The government said in January it hoped to send 10 satellites into orbit this year while developing its first lunar probe. A space station is also planned.

83172

Warum Chinas Mauer gar nicht so groß wirkt

83173

PEKING. Pekings erster bemannter Raumflug hat für China verspätete Folgen. Kaum fünf Monate, nachdem Astronaut Yang Liwei im Oktober die Erde mit seinem Raumschiff (Shenzhou V) umkreiste, muss das Reich der Mitte seine Geschichte umschreiben. Zumindest die von der „Großen Mauer“, die so groß ist, dass alle sie auch vom Weltraum aus bewundern könne. Das verkünden bisher die Lesebibeln an den Grundschulen.

Nicht mehr lange. Das 6300 Kilometer lange Bollwerk sei vom All aus gar nicht zu sehen, beschwert sich der Volksabgeordnete Wang Xiang. Er stellte während der Parlamentstage den Antrag, alle Schulbücher für die sechste Klasse „schnellstens“ zu ändern. Diese würden wahrheitswidrig behaupten, dass Astronauten „mit bloßem Auge zwei Bauwerke auf unserer Erde erkennen, die Meerdämme Hollands und Chinas Große Mauer“. Wang Xiang ruft Yang Liwei als seinen Kronzeugen auf. 14 mal habe der Nationalheld die Erde umrundet und

Ausschau gehalten. „Unsere Erde ist wirklich wunderschön. Aber ich habe keine Mauer auf ihr gesehen“, habe er schließlich bekennen müssen.

Chinas erster Taikonaut konnte auch nichts sehen. Die zehn Meter breite, weitgehend nur als Ruine erhaltene Große Mauer lasse sich aus maximal bis 36 Kilometer Distanz gerade noch erkennen, musste sich der Abgeordnete belehren lassen. Aus 300 bis 400 Kilometern Höhe, in der Astronauten gemeinhin verkehren, könnten Bauwerke nur auffallen, wenn sie mindestens 500 Meter breit und ebenso lang wären. Die Schulämter reagierten schnell auf den Antrag, eine von 4113 Eingaben aus dem ansonsten machtlosen Parlament. Sie versprachen in allen Neuauflagen die Geschichte streichen zu lassen.

Für China heißt es, stückweise Abschied nehmen von einer hübschen Legende. 1909 hatte es in den USA sogar noch geheißen, die Mauer sei vom Mond aus zu sehen. Tatsächlich kann man dort zwar Grundstücke kaufen, aber nicht ein einziges Menschenhand erschaffenes Werk auf der Erde erkennen.

Rheinische Post:
13-03-2004

REPORT : CHINA TO LAUNCH MOON ROVER IN 2012.

BEIJING - China plans to launch its first moon rover in 2012 as part of its ambitious space exploration program, state media reported. The vehicle's main purpose would be to provide information on where to set up a base on the moon, the Beijing Youth Daily newspaper said Sunday, citing Ouyang Ziyuan, lead scientist of the country's lunar probe program. The rover would carry a camera, a telescope and seismological gear to register quake activity on the moon, the report said. The rover is part of the three-phase lunar probe program, also called "Change," after a fairy in Chinese folklore who flies to the moon. The first phase is under way, with Chinese scientists building a two-ton lunar probe that is to be launched by 2007 and orbit the moon for at least 12 months, state media has reported. It will take three-dimensional lunar images, measure the density of the moon's soil and explore its environment. The official Xinhua News Agency put the price tag of the first phase at 1.4 billion yuan (US\$170 million). The satellite launch is to be followed by a moon landing by an unmanned vehicle by 2010 and soil sample collection by 2020, Xinhua said. China's top space official has also said the country wants to land a human on the moon that same year. Since the success of its landmark manned space launch last October, China has raised the profile of its once-secret, military-linked space program and regularly releases information about plans for further exploration. It is now the third country in the world to successfully accomplish manned spaceflight.

83176

83175

SPACE.COM : 17 MAART 2004.

CHINA PREPARES FOR SECOND PILOTED SPACE MISSION.

China is moving forward on readying its second piloted space mission, targeted for liftoff in June or July of 2005. The Long March 2F booster that is to loft the Shenzhou 6 spaceship is now being built, and is slated to undergo extensive testing early next year. China's Xinhuanet news service reported earlier this week that Shenzhou 6 is likely to be heavier than the craft used last October to place Taikonaut Yang Liwei into Earth orbit. He circled the globe 14 times in the 21 hour-long mission. Yang's flight catapulting China into an elite group of nations capable of independent human spaceflight: Russia orbited its first cosmonaut in 1961, followed by the United States in 1962. Xinhuanet quoted Wang Yongzhi, noted as the chief designer of China's manned space program, as saying that the Shenzhou 6 would take two people into space for a flight lasting five to seven days. Now being trained in China is a cadre of 14 space pilots, from which two will be picked for that nation's second piloted mission. According to Xinhuanet, during the mission the crew will float into the spaceship's forward orbital module to conduct experiments. Chinese space authorities have repeatedly stated that early shakeout flights of Shenzhou vehicles will lead to space docking of hardware, as well as establishing a permanent laboratory in Earth orbit. Meanwhile, as China moves forward on its next human spaceflight, the Shenzhou 5 orbital module continues to whirl about Earth. It was left in space after Taikonaut Yang returned to Earth in his reentry capsule. The module, outfitted with its own solar power panels and rocket motors, has been maneuvered a number of times over the last several months. The orbiting capsule, stuffed with science gear and other equipment, has completed its work after 152 days, according to China Central Television this week. Phillip Clark, a British-based specialist in Soviet/Russian and China space prowess, said the Shenzhou 5's module will reenter to Earth in some 75 days, give or take a week or so. Clark said he was initially surprised at the long gap between the first and second piloted space jaunts. "But I think the current Chinese five-year plan simply calls for two manned missions, and maybe the first one came earlier than expected. The test program had fewer problems than expected," he told SPACE.com. Chinese space officials have stated that there will be no docking trials on next year's flight. But Clark senses that the Shenzhou 6 orbital module - left in space - could be used for a launch up using a Shenzhou 7 vehicle that could be launched late next year. "Shenzhou 7 could even see the first Chinese space walk, as well as being their first three manned flight," Clark said. On the other hand, he added, the Chinese have split the 14-man team now in training to seven teams of two men each. So perhaps they are planning two-man missions for the foreseeable future, he speculated. Looking deeper into the future, Clark said that China's new generation launch vehicle under development appears well-suited for hurling Taikonauts out of Earth orbit. That planned booster could launch a complete three-man Shenzhou craft on an around-the-Moon and Earth-return trajectory, "if the Chinese want to do this," Clark said.

83177

Handwritten notes: 809 21 2004, 18-08-0008

SPACE.COM : 26 MAART 2004.

CHINA MOVES UP MOON ORBITER LAUNCH DATE.

SHANGHAI - China has moved up the launch of a moon-orbiting satellite by one year to 2006, state media said Friday, adding momentum to the space program that got a massive boost from October's successful manned flight. The lunar mission, originally scheduled for 2007, will place a two-ton satellite into orbit around the moon for at least a year, the official Xinhua News Agency said Friday. China's lunar exploration program has shifted into high gear following last year's successful launch of the Shenzhou 5 spacecraft with astronaut Yang Liwei aboard. It made China the third country after the United States and Russia to put a man into space, providing massive prestige to the Communist regime and the military-linked space program. The lunar orbiter and its 280-pound payload will be based on China's existing Dongfanghong 3 satellite and other indigenous technology, Xinhua said. A Chinese Long March III A rocket will be used to launch the satellite, it said. Xinhua cited China National Space Administration Luan Enjie, the chief commander of the lunar satellite project, saying work had begun on the satellite, its launch vehicle and support systems. It said Luan delivered his comments Thursday at the first national work meeting on the project. The lunar program -- named Chang'e after a legendary Chinese goddess who flew to the moon -- aims to eventually place an unmanned vehicle on the moon by 2010. Plans also call for a vehicle to land by 2020 that would collect soil samples and conduct other tests, possibly in preparation for a manned moon base. Xinhua gave the budget for the initial phase of the program as \$170 million. It said the launch would take place from the Xichang Satellite Launch Center in the southwestern province of Sichuan. Along with the lunar mission, a second manned space flight -- this time carrying more than one astronaut -- is planned for next year. Longer-term plans call for a space station. The report adds to China's growing openness about its space program, whose plans, costs and launch dates were once closely guarded secrets.

83178

Handwritten number: 28095

Handwritten number: 23086

MALFUNCTIONING SPACESUIT CUTS SPACEWALK SHORT.

CAPE CANAVERAL - A riskier-than-usual spacewalk outside the international space station was cut short Thursday night because of a malfunction that left one of the two crewmen with a warm, damp suit. Russian cosmonaut Alexander Kaleri made it safely back inside despite the problem with his spacesuit. Kaleri and American astronaut Michael Foale had left the space station empty when they ventured out, the first time the 5-year-old outpost had ever been unattended during a spacewalk. It was necessitated by the grounding of NASA's shuttle fleet in the wake of the Columbia accident. Everything went well until three hours into the spacewalk, when Kaleri reported that the inside of his helmet was wet. Flight controllers immediately suspected a breakdown of the device that is supposed to regulate temperature and remove condensation. "It's strangely warm," Kaleri said. A few minutes later, he radioed: "It's amazing. I have rain inside the helmet. I have water on the visor." Russian space officials decided to end the spacewalk early and advised Kaleri not to exert himself. Foale continued working as Kaleri rested. The cosmonaut said he could see well through the visor, even though it had a water film. "I'm not moving too fast so I don't overheat," Kaleri said as he made his way to the hatch. Foale soon joined him in the air lock, and they closed the hatch. The crewmen managed to complete half their work -- primarily installing new scientific experiments outside -- before Kaleri's suit began malfunctioning. The spacewalk was supposed to go 5 1/2 hours; it lasted three hours and 55 minutes. Foale inspected Kaleri's spacesuit once they were back inside. The cosmonaut was glad to have the suit off. "I feel better now. I feel cooler," he said. The men quickly discovered that one of the tubes through which water flows to cool the suit, in the stomach area, was bent. Kaleri straightened the tube and water began flowing through it. He said he had no idea how the tube became bent. Two spare Russian spacesuits are aboard that Kaleri could use if he and Foale have to go out again. However, no more spacewalks are scheduled for their mission. Foale's Russian suit worked fine. Throughout the excursion, flight controllers in Houston and Moscow watched over all the systems orbiting 230 miles up and were prepared, after months of safety analyses, to call the veteran spacewalkers back in if a fire, decompression or some other emergency arose. What ended up happening -- a suit malfunction -- was not nearly as critical but still worrisome, especially with no one inside to help. Normally, a third crew member stays inside during a spacewalk to oversee the systems, watch over the two outside and help them once they re-enter. But the space station has had only a two-man crew since last spring to conserve supplies while the shuttle is grounded. With shuttle flights off until next spring, an initially uneasy NASA agreed with the Russian Space Agency that it could not keep waiting for a three-person crew in order to perform a spacewalk. For decades, the Russians left their Salyut and Mir space stations unattended during spacewalks. Before the spacesuit malfunction, Foale and Kaleri took out trays of scientific samples to replace ones that had been hanging outside for more than two years to gauge the effects of space debris and other cosmic wear and tear. They also put out a radiation-measuring doll. The space doll -- a "matryoshka," or traditional Russian nesting doll -- is actually a close-to-lifesize head and torso made of soft material to simulate human tissue, with embedded sensors to measure radiation exposure. Scientists want to know how much solar radiation a spacewalker receives, critical information as NASA strives to meet President Bush's goal of sending astronauts back to the moon and on to Mars. The spacewalkers also photographed the area where they heard a strange metallic noise last November, to see if space junk caused any damage. But they did not have time to replace a thruster contamination-measuring kit or relocate navigational reflectors for a new unmanned cargo ship due to arrive next year. Foale and Kaleri have been aboard the space station since October. They will be replaced in April by a two-man crew that expects to perform two spacewalks.

83179

83180

83181



28

88025

23087

FLORIDA TODAY : 26 FEBRUARI 2004.

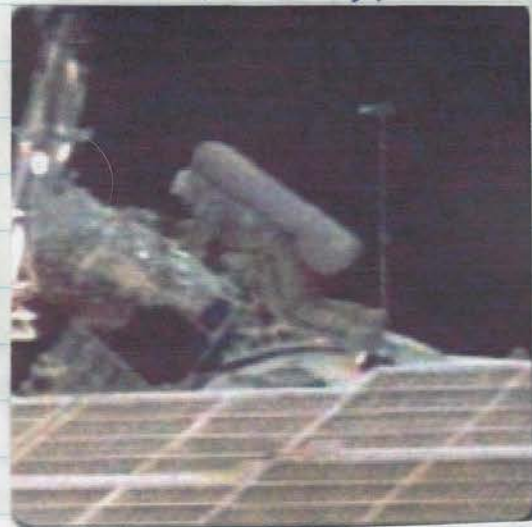
OVERHEATING SPACESUIT CUTS SHORT SPACEWALK.

Russian mission controllers ended Thursday's spacewalk at the International Space Station early after Alexander Kaleri's spacesuit began to overheat. The Russian spacesuit's sublimator malfunctioned, possibly because of a kink in a tube, about three hours into the spacewalk. The sublimator is designed to remove heat and humidity from the spacesuit as the cosmonaut does his work. "I can feel I am strangely warm," Kaleri told ground controllers after reporting that drops of water had formed in his helmet. "Please take care of yourself right now," worried Russian controllers replied as they discussed whether to call off the spacewalk. Kaleri and Commander Michael Foale completed about half the tasks they were supposed to finish on this spacewalk, the first from the International Space Station without anyone left inside to keep an eye on its systems. Among the tasks left undone was the removal of reflectors that are under study as part of the navigation system for a European cargo ship expected to arrive at the station in spring 2005. In addition, Foale and Kaleri didn't have time to replace samples in a Russian experiment that studies residue from station-thruster firings. They did, however, attend to a Japanese experiment that studies exposure of materials to space, and they installed a torso-shaped European experiment that estimates radiation exposure to humans. Russia wanted to accomplish both to satisfy contracts with those partners. The next space-station crew, which also consists of just two men, plans two spacewalks. Gennady Padalka and Mike Fincke likely will complete the tasks left unfinished during Thursday's 3-hour, 55-minute excursion, which began at 4:17 p.m. EST.

83183

83182

83184



FLORIDA TODAY : 27 FEBRUARI 2004.

SPACE STATION INSPECTIONS INADEQUATE, NASA REPORT SAYS.

83185

CAPE CANAVERAL - Inspections of the outside of the International Space Station are inadequate, according to a NASA safety report released Friday. Adding to the problem, an external inspection astronauts were to do during a spacewalk Thursday was among the tasks left unfinished when a malfunctioning Russian spacesuit cut the excursion short. Lax inspections, which have been done remotely with cameras mounted outside the orbiting lab, are among several deficiencies NASA outlined in a station safety review that was prompted by last year's shuttle Columbia disaster. NASA is beefing up the station inspections now and reported "exterior hardware is generally performing as expected and no significant anomalies have yet been revealed." The external inspections are not complete. Other problems cited in the report were inconsistent record-keeping and tracking of in-flight problems with station parts, a problem also present in the shuttle program before the Columbia accident. NASA acknowledged the need to improve its system for keeping drawings and photographs of ISS components for engineers to use in troubleshooting. The station program, like its shuttle counterpart, is reviewing every "waiver" or exemption from the original engineering requirements to make sure they are justified. Excessive waivers of such requirements was criticized by Columbia investigators. NASA is double-checking the rationale used to justify risks accepted before Columbia was lost. There were no examples of specific dangers, but NASA said its improvements will focus first on any issues that could destroy the \$100 billion lab or harm crewmembers on board. Meanwhile, NASA said a risky spacewalk Thursday proved a scaled-back, two-man crew could venture outside the station in an emergency. "We feel like it was a huge success," said Michael Suffredini, NASA's manager for station operations and integration. The station has been staffed with two, rather than three, crewmembers since the shuttle accident to conserve onboard supplies. After initial hesitation, NASA went along with a Russian proposal to try the first ISS spacewalk without a colleague inside to assist. A spacesuit glitch prompted U.S. astronaut Michael Foale and Russian cosmonaut Alexander Kaleri to come back inside early. Work left undone will be delayed until at least July. A new crew scheduled to arrive in April will do the work during spacewalks planned for July and September. Suffredini said engineers think a crimped cooling system water line caused a build-up of condensation in Kaleri's suit. The suit also began to overheat. So Russian controllers called the walk off. Foale and Kaleri finished about 75 percent of the planned work. Among the tasks not completed: relocation of navigation reflectors needed to dock new European cargo ships that will begin arriving next year, replacement of sensors to measure contamination on the station and the external damage inspections.

23088

F8025

Essen ins All bringen und Müll einsammeln

Raumfahrt II Mit einem Raumtransporter, in Bremen gebaut, trägt Europa zur Versorgung der ISS bei

Ein Raumtransporter aus Bremen soll Europas Wunderkind im Weltall werden. Das so genannte ATV (Automated Transfer Vehicle) kann allein fliegen, navigieren und in 400 Kilometer Höhe an die internationale Raumstation ISS andocken. Europas erster vollautomatischer Raumtransporter wurde bei EADS Space Transportation in der Hansestadt zusammengebaut. In diesen Tagen starten die entscheidenden Tests mit dem Prototyp „Jules Verne“.

„ATV ist das intelligenteste, was jemals in Europa gebaut worden ist

und fliegen wird“, sagt Integrationsleiter Hans-Wilhelm Usedom. Der unbemannte Transporter ist Europas Beitrag zur Versorgung der ISS. Das im Auftrag der Europäischen Weltraumorganisation Esa entwickelte Fahrzeug soll den Astronauten Wasser, Essen, Atemluft, Treibstoff und Arbeitsmaterial bringen. „Wie ein Lkw“, sagt Usedom. Zudem wird das 4,5 Meter breite und zehn Meter lange Gefährt den ISS-Müll einsammeln.

ATV wird mit einer Ariane in den Orbit geschossen. Für die Stromversorgung während der Flug- und An-

dockphase sorgen vier zehn Meter lange Sonnensegel. Der Transporter bleibt etwa ein halbes Jahr lang im All und ist der ISS solange wie ein Lager angeschlossen. Danach wird er kontrolliert verglühen.

Die wichtigsten Bausteine des Einweg-Transporters heißen Space Craft und Integrated Cargo Carrier (ICC). Der an eine riesige Waschmaschine-trommel erinnernde Cargo Carrier ist das Lager, es bietet Platz für gut zwei Tonnen Nutzlast. Mit seiner roten Nase dockt das Lager an die ISS an. In dem wie eine große silberne Dose

aussehenden Space Craft sitzen Antrieb und „Gehirn“. Letzteres besteht aus Computern, dem Navigationssystem GPS, einem Sonnensensor und dem „Star Trekker“. Im ATV-Hirn werden der Treibstofffluss geregelt, die Flugbahn berechnet und Sternbilder erstellt. „So sucht er sich seinen Weg zur Raumstation“, sagt Usedom. Und das geschieht voraussichtlich 2005. Dann startet der All-Lkw vom Weltraumbahnhof Kourou in Französisch-Guayana.

83186

83187

Extrem seltenes Himmelschauspiel

Der Himmel bietet uns bald ein sehr seltenes Schauspiel: Von April bis Mai sind zwei Kometen gleichzeitig mit bloßem Auge sichtbar. Auf ihrer Reise durch unser Sonnensystem kommen „C/2001 Q4 Neat“ und „C/2002 T7 Linear“ bis auf etwa 40 Millionen Kilometer an die Erde heran - weniger als ein Drittel des Abstands der Erde zur Sonne. Während im Schnitt alle zwei Jahre ein Komet mit bloßem Auge zu sehen ist, ist der Doppelauftritt zweier Kometen extrem selten, berichtet das Harvard-Smithsonian-Zentrum für Astrophysik in Cambridge (USA).

Rheinische Post:
28-02-2004

83188

Galaxie an Grenze von Raum und Zeit

Bei der Erforschung der Tiefen des Weltraums haben Forscher aus Frankreich und der Schweiz einen neuen Rekord aufgestellt: Mit Hilfe der Europäischen Südsternwarte in Chile entdeckten sie eine Galaxie in 13,23 Milliarden Lichtjahren Entfernung - so nah an den Grenzen von Raum und Zeit wie noch kein anderes zuvor gesehenes Himmelsobjekt.

Rheinische Post:
02-03-2004

83189

Rekord-Kohlenstoff in kosmischem Staub

US-Forscher haben in kosmischem Staub Kohlenstoffverbindungen entdeckt, die älter sind als unser Sonnensystem. Die Zusammensetzung der Atomkerne dieses interstellaren Kohlenstoffs weicht deutlich von der ab, wie sie auf der Erde oder in anderen Teilen des Sonnensystems vorkommt. Damit sind die organischen Verbindungen aus dem All älter als 4,5 Milliarden Jahre, schreibt ein Team von der Washington-Universität in St. Louis in „Science“.

Rheinische Post:
18-02-2004

Rheinische Post:
02-03-2004



Radiotelescoop bestaat hoofdzakelijk uit computers

De Lofar-antennes zijn verspreid over honderd veldjes. De ontvangen radio-signalen worden ter plekke gefilterd door een computer in de container.

Deze week tekenden IBM en Astron, de organisatie die de Lofar-radiotelescoop bouwt, een contract voor levering van een BlueGene/L-supercompu-

[83190] - Automatiserings Gids: 27-02-2003

23090

capaciteit van 34,4 teraflops, krijgt een plaats op het terrein van de Rijksuniversiteit Groningen. De nieuwe 'super' is zo'n vijftien keer sneller dan de nog maar pas geïnstalleerde supercomputer bij SARA in Amsterdam.

Lofar staat voor 'low frequency array', wat inhoudt dat de toekomstige telescoop radiostraling in lage frequentiegebieden moet kunnen opvangen. Het gaat om frequenties ter weerszijden van de FM-band, tussen 10 en 250 megahertz. Sterrenkundigen hopen met de observaties van de nieuwe telescoop meer te weten te komen over het ontstaan van het heelal.

De circa 25 duizend goedkope antennes (circa 100 euro per stuk) vormen samen een zogeheten Wide Area Sensor-netwerk. Ze komen te staan op een centrale locatie van 320 hectare in de gemeente Borger-Odoorn (Drenthe) en verder op honderd kleinere veldjes van 2 tot 4 hectare. Ze worden gespreid over een gebied van 350 vierkante kilometer dat ook delen van Friesland, Groningen, Overijssel, Gelderland en Duitsland beslaat. Bij elk antenneveld komt een decentrale computer te staan die een eerste bewerkingslag uitvoert. Een 10 gigabit Ethernet-glasvezelnetwerk, te bouwen door KPN en Lucent, verbindt alle locaties met de supercomputer in Groningen.

Marco de Vos, engineering ma-

In Drenthe verrijst binnen enkele jaren de grootste radiotelescoop ter wereld. Een netwerk van 25 duizend antennes vangt de zwakste signalen uit het heelal op. IBM's supercomputer BlueGene/L zal de enorme datastromen verwerken.

GEERT KELFKENS

nager van het Lofar-project: "Elke antenne genereert uit zijn analoge/digitaal-omzetters 2 gigabit gegevens per seconde. Dat is behoorlijk veel. De computers te veld bouwen we op uit generieke 'processing boards' die in ons eigen laboratorium zijn ontwikkeld. Die combineren een grote 'data troughput' met krachtige processing op basis van Field Programmable Gate Arrays (FPGA's). Deze combineren de signalen van alle antennes op één veldje, voeren een aantal eerste filteringslagen uit en stomen de gegevens klaar voor de supercomputer in Groningen."

De supercomputer is een geoptimaliseerde versie van de BlueGene/L die IBM eerder heeft geleverd aan John Post, senior consultant technologie van IBM Nederland: "De Lofar-computer wordt geoptimaliseerd voor het binnenhalen van enorme hoeveelheden gegevens. Een relatief groot deel van de processors is daarom bestemd voor de I/O (communicatie, red.) met het

antennennetwerk. Bijzonder is dat we samen met Astron in staat zijn geweest een soort buffer te creëren die gegevens 30 tot 60 seconden vasthoudt. Mocht er in die tussentijd iets bijzonders worden ontdekt, dan staat een speciaal programma stand-by om nadere analyses te doen. Bijvoorbeeld om te zoeken naar tekenen van leven of naar bijzondere gebeurtenissen, milieunen jaren geleden."

Het totale Lofar-project kost ongeveer 150 miljoen euro. Ruwweg de helft van dat bedrag is afkomstig van wetenschappelijke instituten en bedrijven. De Nederlandse overheid en de Europese Unie betalen de resterende 50 procent.

Het had weinig geschied of de Nederlandse overheid – die 52 miljoen euro meebetaalt – had het laten afweten. De subsidieaanvraag voor ICES/KIS-gelden was aanvankelijk als 'te sterrenkundig' terzijde geschoven. Vooral dankzij het ministerie van Onderwijs is de subsidie er eind november 2003 uiteindelijk toch gekomen.

Marcel Creemers, hoogleraar aan Nijenrode en de Vrije Universiteit, kan zich daar nog steeds kwaad over maken. "Het is een schande dat het Lofar-project destijds, vooral door toedoen van het Centraal Planbureau, uit de running is gehaald voor de ICES/KIS-gelden. Dat gebeurde omdat de maatschappelijke relevantie niet zou zijn aangetoond. Maar het ICT-concept dat achter het project zit, is revolutionair."

Met dat laatste doelt Creemers op de mogelijkheid enorme gegevensstromen continu te verwerken. "We krijgen een tijd waarin iedereen met RFID (radiofrequente identificatie, red.) aan de slag gaat. Het is natuurlijk prachtig om een project als Lofar te hebben dat voor de hele ICT en de hele retailsector en groothandel de kastanjes uit het vuur haalt."

Grote winkelketens als Albert Heijn zullen in de naaste toekomst al hun producten van minuscule chips voorzien die het mogelijk maken de artikelen door de hele logistieke keten te volgen. Creemers: "Die RFID-tags leveren terabits aan informatie op. Maar Albert Heijn heeft nog geen idee hoe het de software moet maken die de patronen in de RFID-data moet herkennen. Het ontwikkelen van die software zal een hoge vlucht nemen."

NEWFOUND GALAXY SHATTERS DISTANCE RECORD.

Astronomers say they've peered deeper into the cosmos than ever before, recording light that left a galaxy when the universe was just 3 percent its current age. The discovery represents an important and challenging leap in time and space beyond the previous record holder and points to more record-setters to come. The galaxy is 13.23 billion light-years away, seen when the universe was 470 million years old. Likening the universe to an 80-year-old human, the astronomers said the previous record holder would be a four-year-old child, while the newfound galaxy is just two-and-a-half. The galaxy is thought to be one of the first to form, in an era when a thick "fog" had begun to lift and end the so-called cosmic Dark Ages that followed on the heels of the theoretical Big Bang. It and others found in the same study will help theorists refine ideas about how galaxies initially developed. The near-infrared observation was made with the European Southern Observatory's Very Large Telescope in Chile. In a sort of Best Supporting Actor role, an intervening cluster of galaxies served as a giant, natural magnifying glass, making it possible to detect the more distant galaxy. "This discovery opens the way to future explorations of the first stars and galaxies in the early universe," said the study's co-leader Daniel Schaerer from the Geneva Observatory and University in Switzerland. Light from faraway objects is stretched during its travels across space. The wavelengths of visible light are gradually shifted from blue to red, toward invisible infrared light. Scientists measure this stretching with a scale they call redshift. Prior to today's announcement, the most distant galaxy – presented just two weeks ago – was estimated to be somewhere between redshift 6.6 and 7.0 and was said to be 13 billion light-years away. It had supplanted a redshift 6.4 galaxy that was announced in January 2003. The redshift scale is like a logarithmic one: The difference between redshift 1 and 2 is billions of years, but the difference between redshift 6 and 7 is only hundreds of millions of years. The most distant echoes of the cosmos come from redshift 1,000 or higher, radiation that's stretched into radio waves. The new No. 1 sits at redshift 10, according to Schaerer and his colleague Roser Pello from the Observatoire Midi-Pyrenees in France. Getting to redshift 10 and beyond, many scientists have thought, would be extremely challenging if not impractical until next-generation space telescopes are built. One scientist involved in finding the redshift 6.4 galaxy in January 2003 said last month that getting routinely beyond redshift 6.5 with current telescopes would be very difficult. Schaerer is more optimistic. "Though technically difficult there's no reason why one should not be able to find galaxies beyond redshift 7," he told SPACE.com. Here's why: The newfound galaxy is catalogued as Abell 1835 IR1916. The intervening galaxy cluster, whose gravity bends light from objects beyond, magnified the light of the Abell 1835 IR1916 somewhere between 25 and 100 times. There are other, similar natural lenses in space. Among the challenges astronomers face is sorting out what these magnified observations mean. After identifying several objects that appeared to be very far away, Schaerer and Pello examined visible-light images from the Canada-France-Hawaii Telescope (CFHT) and the Hubble Space Telescope. The galaxies don't show up in those images, suggested their light had all shifted out of the visible and into the infrared and helping the astronomers pin down their redshifts. In all, six previously unseen galaxies appear to sit more than 13 billion light-years distant. Schaerer hinted that the new record might not hold the top spot for long. "In principle one could be able to find galaxies up to redshift 16-18 from the ground," he said. "In practice this seems, however very difficult. I suspect that redshifts around 11-14 could be feasible, but very tough." For now, he said, "we'll start to observe more galaxies between redshift 7 and 10, to be able to study their properties and to understand in more detail how they form and evolve. We've just started to see the tip of the iceberg." Most of the most distant galaxies seen are known as a quasars, a class of very bright and compact objects thought to be powered by supermassive black holes. Abell 1835 IR1916 is probably not a quasar, but it is experiencing a bout of intense star formation, the astronomers said. Yet the overall mass of the stars is estimated to be 10,000 times less than the mass of our much more mature Milky Way Galaxy. Astronomers are not exactly sure how galaxies grew in the early years of the universe, but discoveries like this one should help them sort it all out. The leading theory holds that black holes and star formation go hand-in-hand, and that galaxy mergers played an especially important role early on in a universe that was smaller and far more crowded. The latest discovery supports this big-business model of galaxy growth by acquisition, the astronomers said.

83192

P180 tt-TV1 180 dl D2 mrt 10:16:52
wetenschap

NIEUW VERSTE EN OUDSTE STERRENSTELSEL

Fransen en Zwitserse geleerden hebben met de Europese Very Large Telescope een nieuw verste en dus oudste sterrenstelsel ontdekt.

Het sterrenstelsel Abell 1835 IR1916 staat 13,23 miljard lichtjaar van de aarde en is dus 13,23 miljard jaar oud. Dat is zo'n 470 miljoen jaar na de Big Bang, het ontstaan van het heelal.

Het vorige record was op 16 februari bekendgemaakt en dateerde van 750 miljoen jaar na de Big Bang. Met zoals die ontdekking werd ook dit sterrenstelsel ontdekt dankzij een zwaarte-kracht lens. Die bestaan uit andere sterrenstelsels die het licht van Abell 1835 IR1916 versterken.

Volgende Binnenland Economie Inhoud

83193

10025

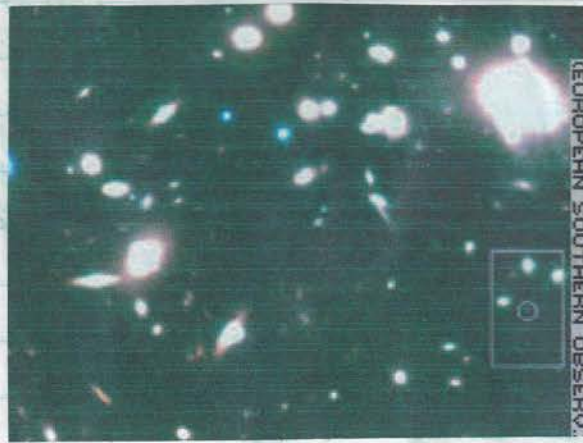
23092

CNN : 01 MAART 2004.

MOST DISTANT GALAXY DISCOVERED.

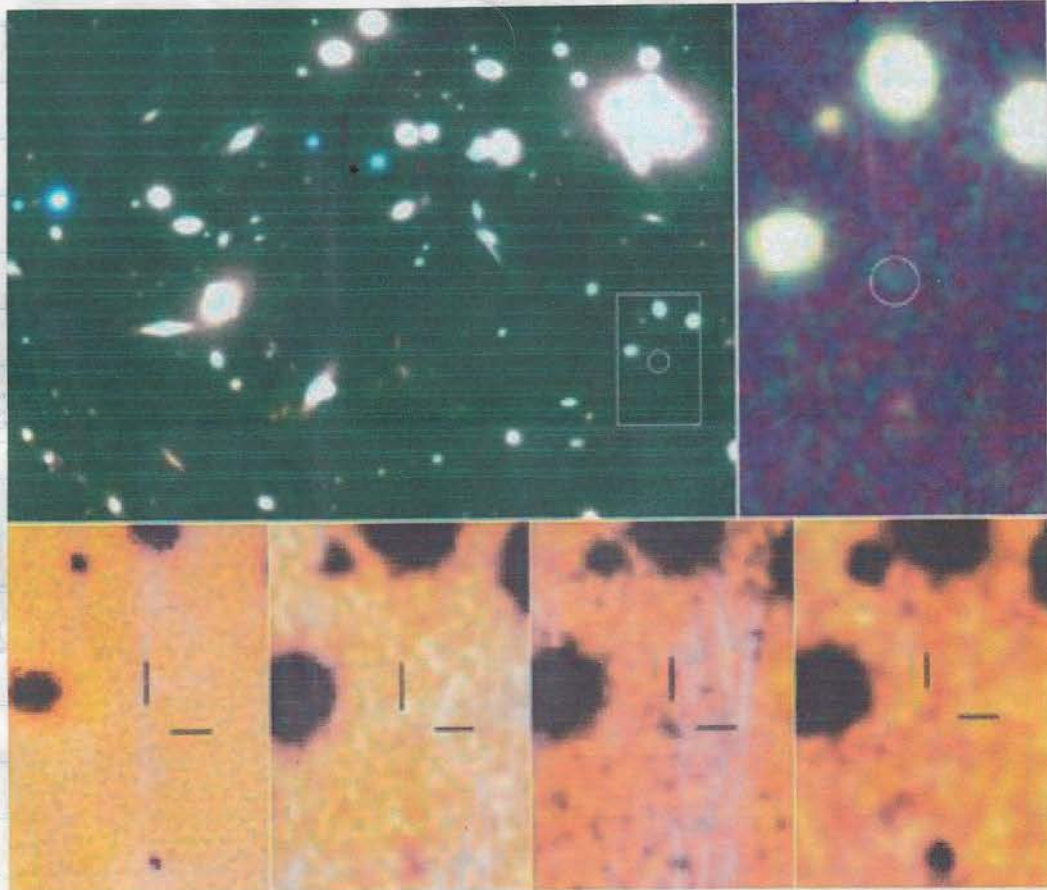
PARIS - Pushing back the boundaries of space observation, French and Swiss astronomers say they have detected the farthest galaxy ever seen. The galaxy, dubbed Abell 1835 IR1916, is 13.23 billion light-years from Earth, France's National Center for Scientific Research said Monday. That places it further away than another galaxy believed until now to be the farthest known object. That galaxy, far smaller than our own Milky Way, lies roughly 13 billion light-years away. Its discovery was announced in mid-February. Because its glimmer took so long to reach Earth, the new galaxy offers a look back in time to when the universe was just a baby. "It is as if we are seeing the childhood of the galaxy," said Roser Pello, a member of the team that found it. "It's a galaxy that is starting to form." The universe, thought to have begun with the Big Bang some 13.7 billion years ago, would have been a mere 470 million years old when the newly observed galaxy formed, the national research center said. "If we compare the age of the universe to that of a person aged 75, we are facing a baby aged two-and-a-half," the center said in a statement. The discovery was made using the European Southern Observatory's Very Large Telescope, with other images also coming from the Hubble Space Telescope and Canada-France-Hawaii Telescope, the center said.

83194



83195

83196



FE 18

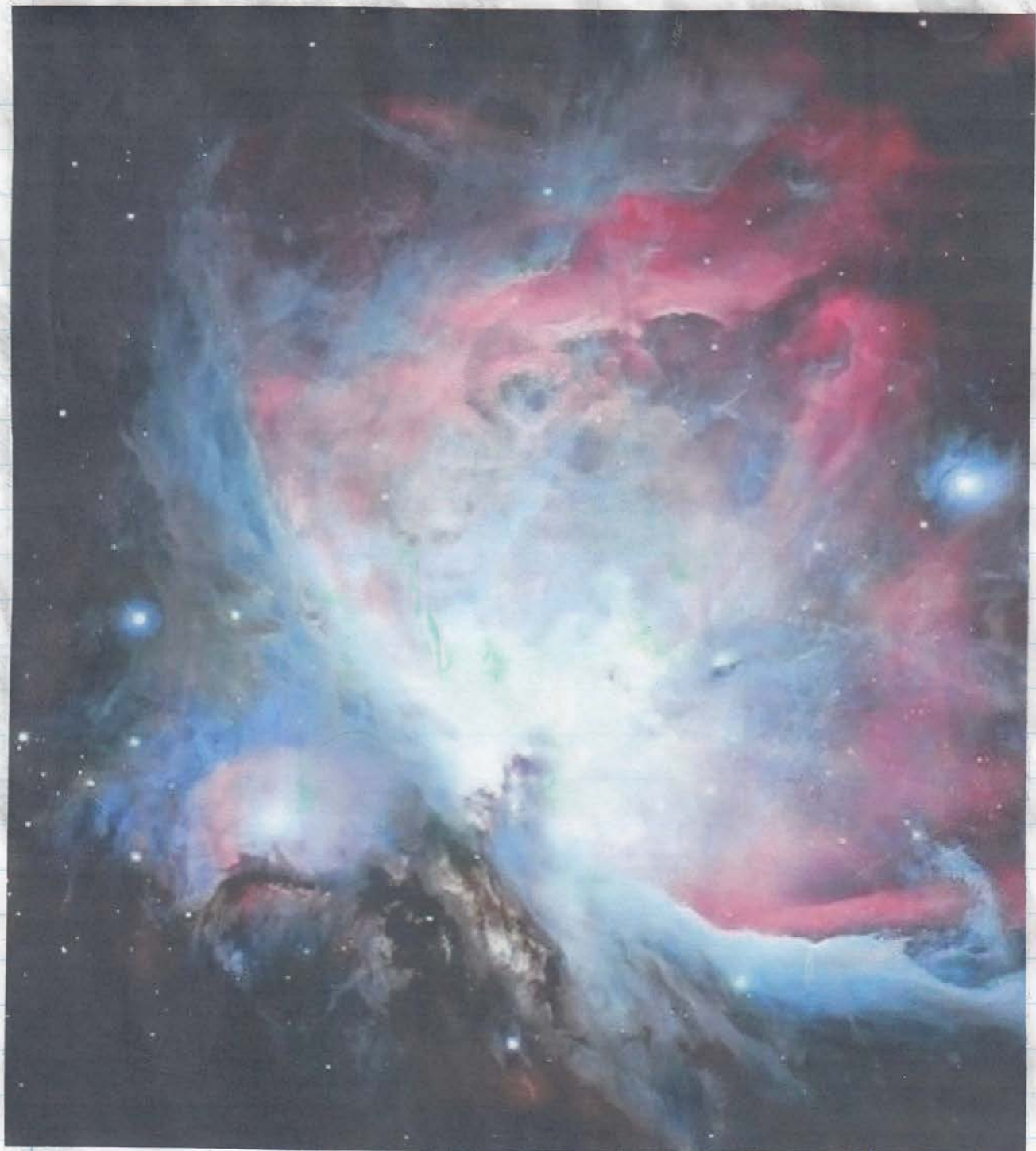
78

Abell 1835 IR1916 - the Farthest Galaxy - Seen in the Near-Infrared (VLT ANTU + ISAAC)



42083

23093



83197



83198

80025

23094

SPIRIT



ROAMING THE RED PLANET

JANUARY 2004

03 januari 2004



83199

23095

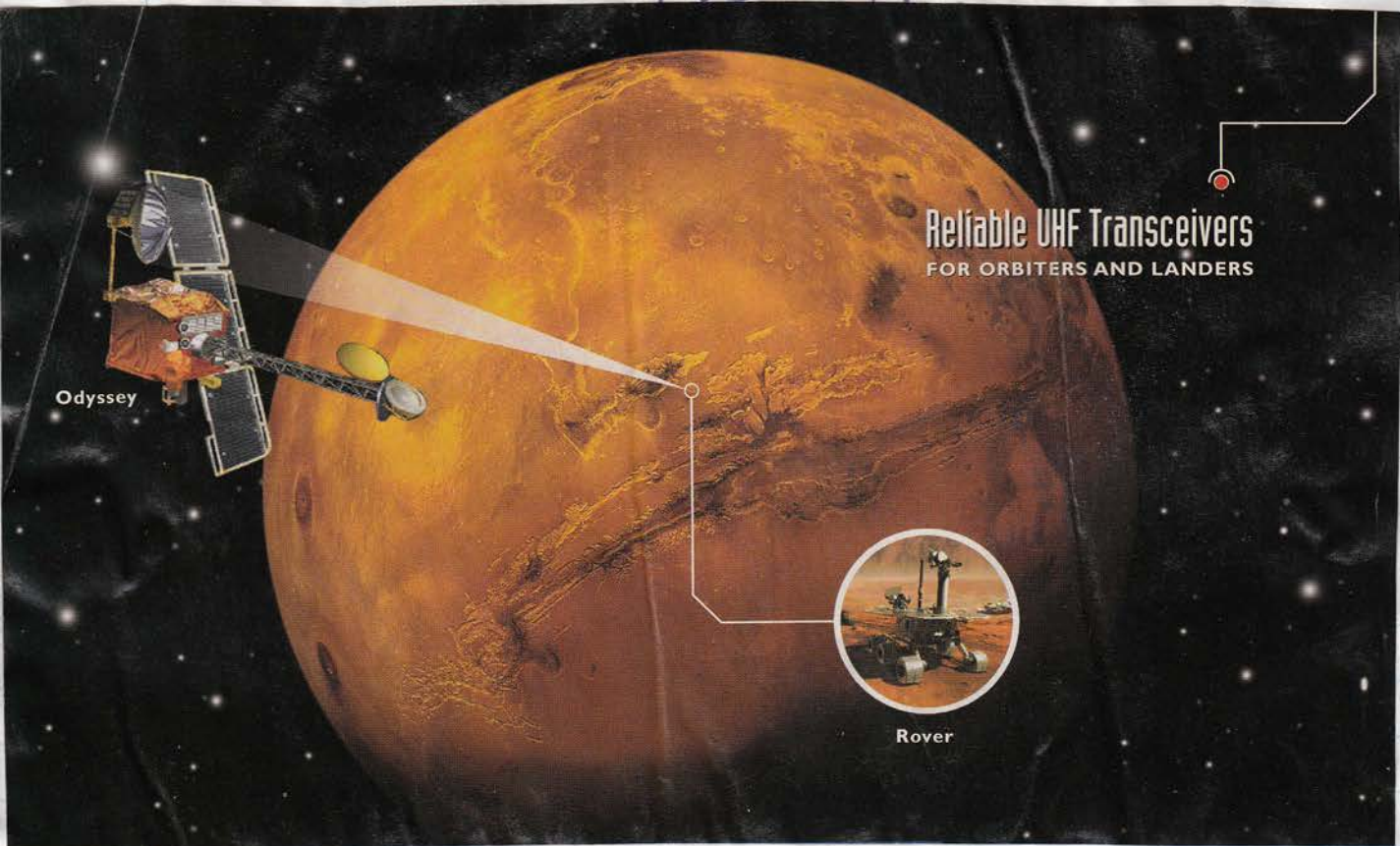
ASTRONOTES : 05 NOVEMBER 2003.

MARS ROVER SPIRIT INSTRUMENT WORKING FINE NOW.

PASADENA - A series of tests of one of the science instruments on NASA's Mars Exploration Rover Spirit has enabled engineers and scientists to identify how to work around an apparent problem detected in August. Tests now indicate that all of the science instruments on both Spirit and its twin, Opportunity, are in suitable condition to provide full capabilities for examining the sites on Mars where they are scheduled to land in January. Spirit's Mössbauer spectrometer, a tool for identifying the types of iron-bearing minerals in rocks and soil, returned data that did not fit expectations during its first in-flight checkup three months ago. A drive system that rapidly vibrates a gamma-ray source back and forth inside the instrument appeared to show partial restriction in its motion. "The drive system is adjustable. We can change its velocity. We can change its frequency," said Dr. Steve Squyres of Cornell University, Ithaca, N.Y., principal investigator for the rovers' science instruments. "We've found a set of parameters that will give us good Mössbauer science if the instrument behaves on Mars the way it is behaving now." A possible explanation for the instrument's behavior since launch is that intense vibration of the spacecraft during launch shook something inside the spectrometer slightly out of position. Spirit is on course to arrive at Mars' Gusev Crater at 11:35 p.m. EST on Jan. 3 (0435 GMT on Jan. 4). As of 8 a.m. EST (1300 GMT) today Spirit has traveled 228.3 million miles (367.4 million kilometers) since its launch on June 10 and will still have 74.3 million miles (119.6 million kilometers) to go before reaching Mars. Opportunity has traveled 184 million miles (296 million kilometers) since its launch on July 7 and will still have 99.2 million miles (160 million kilometers) to go to reach Mars.

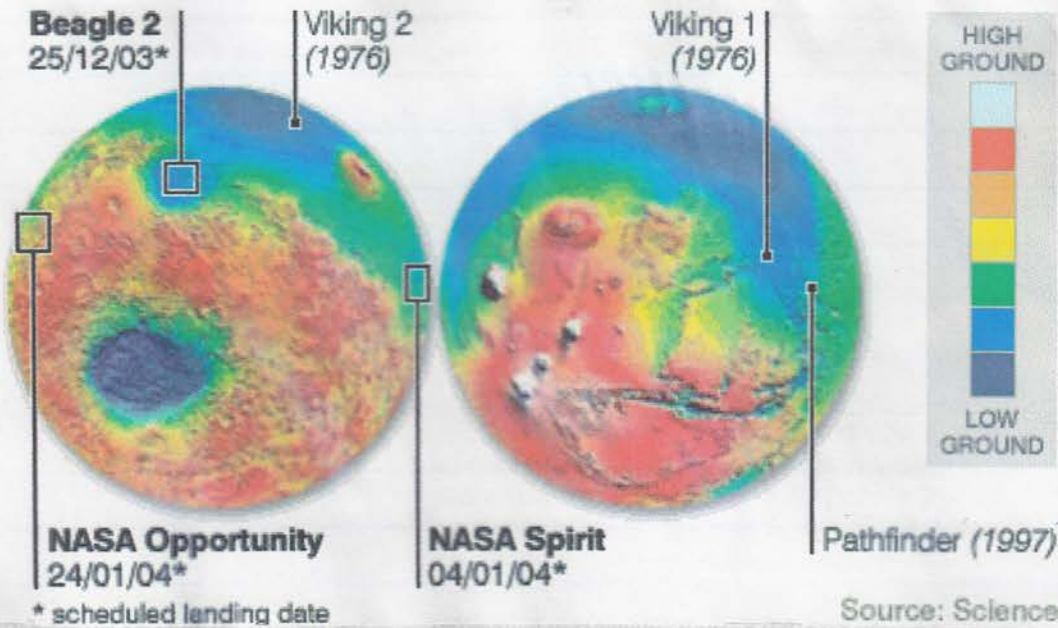
83200

83201



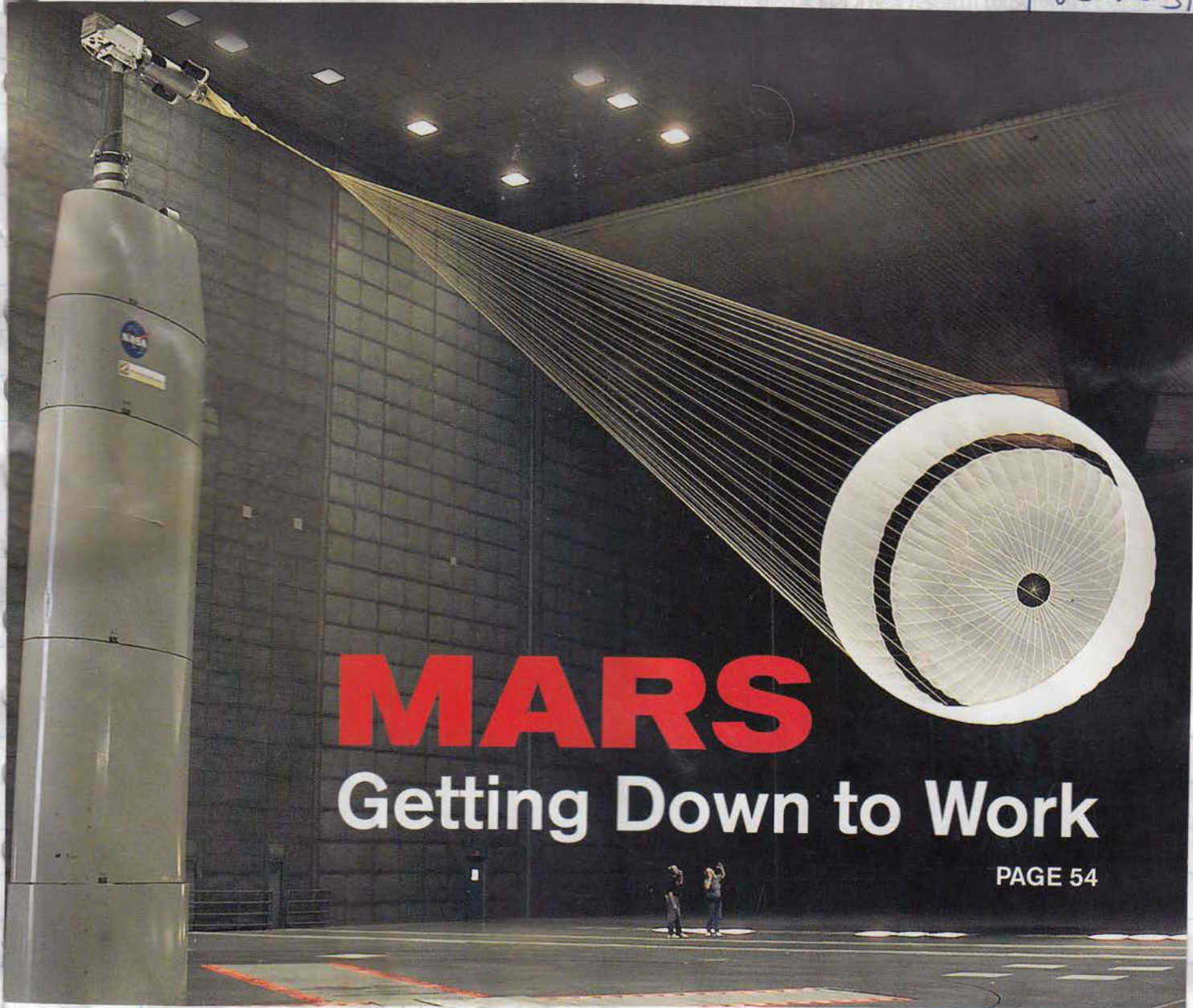
23096

MARS LANDINGS (1976-2004)



83202

83203



83203

080023

23097

TAKING MA

The Mars rover surface operations strategy will be coordinated in a military-like manner to trace the role of water at the landing sites

CRAIG COVAULT/CAPE CANAVERAL

The two NASA Mars Exploration Rovers poised to descend on supersonic parachutes like scientifically armed commandos will be operated by a Jet Propulsion Laboratory science and engineering battle staff on both tactical and strategic Martian surface operations.

As befitting the Roman god of war, Mars will be explored in a military-like manner by the MER Spirit and Opportunity rovers. They will first conduct a stationary but highly detailed reconnaissance of their landing zones before moving out to specific science targets chosen by their commanders on Earth more than 100 million mi. away.

Once on the move, the 400-lb. rovers will sometimes be ordered on specific point-to-point routes, while at other times they will be told to reach an objective, but navigate their own way to it with their hazard-avoidance software.

Depending upon what's found, they will shift to other objectives as their ground teams maintain a flexible but precisely timed planning and execution process. That day-to-day "tactical" process will be keyed to Martian sunrise and sunset for rover solar-array power.

Once commanded, the rovers operate autonomously. The surface operations strategy will be governed by the timing of X-band radio links direct to the vehicles or relayed via UHF to the Mars Odyssey and Global Surveyor (MGS) spacecraft orbiting overhead. Other factors include Earth rise and set over the landing site's horizon, when signals either can or cannot be received.

While tactical operations are underway, a formal strategic ops team will assess "the big picture" to begin to build science targets and roving plans to be im-

plemented in the days or weeks ahead during each vehicle's expected three-month lifetime.

U.S. rover operations will be preceded by the Dec. 25 landing of the British Beagle-2 spacecraft (see p. 57). The 73-lb. stationary Beagle, unlike the rovers, has instruments to detect the chemical signature of biological processes, following inconclusive 1976 Viking lander data. Beagle will be complementary to the MERs.

With mobility and detailed "Athena" instrument and imaging capabilities, the U.S. rovers will focus on whether water-related geologic and climatic processes could have made ancient Mars habitable for simple life. The MERs will be targeted to land about 3,300 mi. to ei-

Both MER sites show **signs of past water,** and Spirit's could have been a 3,000-ft.-deep lake

ther side of Beagle. MER high-resolution imaging and surface spectral data acquisition should begin as early as landing day, depending upon critical self-tests after descent and landing on a parachute (see cover), braking rockets and airbags (*AW&ST* May 26, p. 54).

Each 1,850-lb. lander/rover entry package will transmit X-band telemetry to Earth through the parachute descent. Telemetry during the airbag roll will be possible but questionable until after the four-sided platform stops and opens with the rover fixed atop the base petal. More detailed telemetry will be taped for replay by MGS, maneuvered to over-

fly each MER site during the landings.

The MER-A Spirit rover, launched June 10, is to touch down Jan. 3 at 8:35 p.m. PST (Earth receive time) in Gusev Crater, once an ancient lake. Gusev is in the "Martian tropics"—theoretically, in the past, one of the warmest and wettest places on the planet. It will be followed on Jan. 24 by the MER-B Opportunity rover, launched July 7 and planned for a 9:05 p.m. PST touchdown on the Meridiani Plane about 6,000 mi. west of Spirit. Data from Global Surveyor indicate a large presence of the mineral hematite at Meridiani. On Earth, this would be an indicator of combined water and geologic processes.

From a science planning and initial roving standpoint, "the several days from when we first land until the rover rolls off the lander is in many respects the most critical portion of each rover's surface mission," said Steve Squyres, Athena principal investigator from Cornell University. This "impact-to-egress" (ITE) period is a formal mission phase that could last for a little more than a week, depending on the pace of initial rover events.

In fact, the actual rover landings on Mars will not be completed until their rollofs from the lander base petal, said Mark Adler, overall MER deputy mission manager. He will share Spirit mission management duties with Jennifer Trosper.

MER operations present human-factors, as well as engineering and science, challenges. Large portions of the 250-member ground teams will change their work-cycles to correspond to Mars days (Sols), which are about 40 min. longer than an Earth day. That will alter their wake-up, work-shift and sleep times. And within that Sol time, the teams are also shifting to Mars local solar time (LST) based on sunrise and sunset at each landing site. They will not, however, be able to make a full circadian rhythm shift because they will still be exposed to Earthly sunrise and sunset time. Human fatigue experts from the

83204

23098

F00FS

RS

83205

NASA Ames Research Center and private companies are providing guidance on how to best adjust, however.

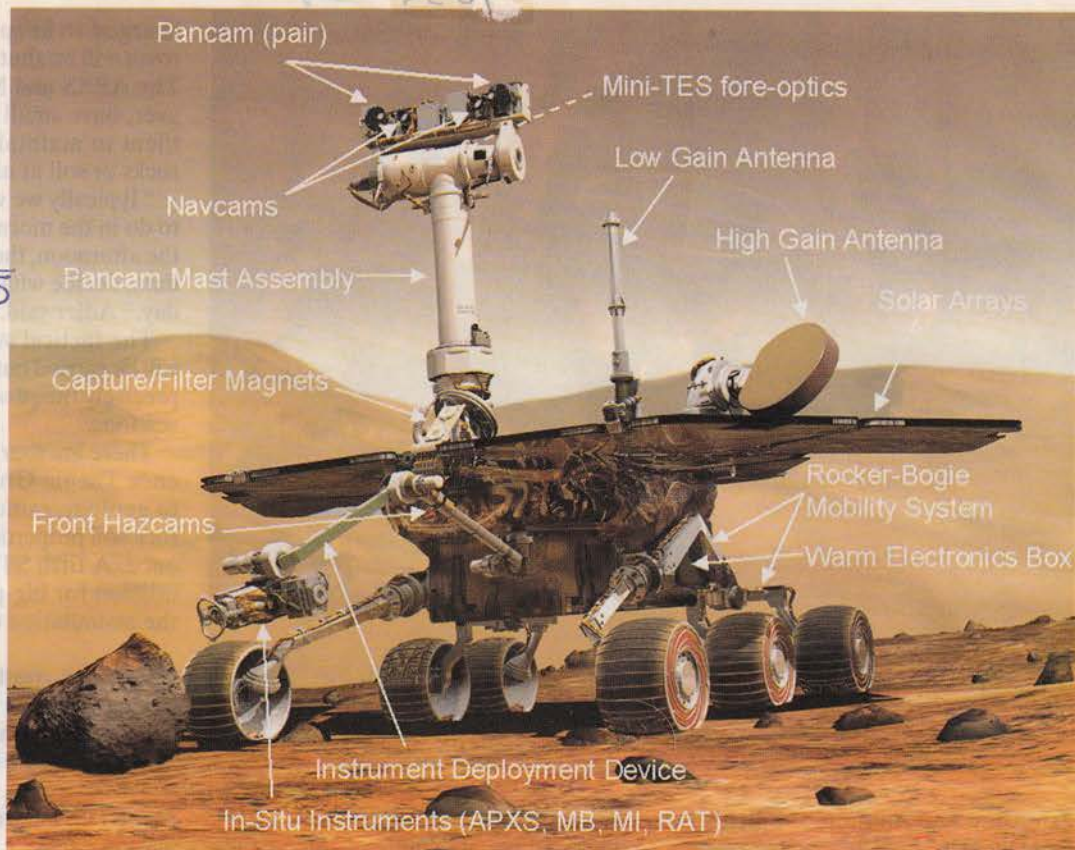
The shift to Sols and more specific LSTs will govern the precisely timed rover ops planning/commanding that the ground teams must do during their work shifts. Those factors will be further complicated when Opportunity lands on the opposite side of Mars from Spirit—

meaning each team's planning and commanding routines will be as much as 12 hr. out of phase with the other's.

Spirit will land just past 2 p.m. Mars LST, about 17.5 hr. ahead of Pacific time at JPL. To take maximum advantage of remaining sunlight, Spirit and (later MER-B) will use stored commands for all key tasks during its first Martian Sol. Airbag retraction and the lander petal opening should be completed within 90-100 min. of touchdown. Once exposed, the rover will immediately open its solar arrays. If critical health checks are passed, it will also deploy its Pancam (panoramic camera) mast extending 5 ft. above the Martian surface.

One group of immediate operations important for both science and rover navigation planning will be the start of highly detailed 360-deg. panoramas of the landing site from the mast. These will be done by three systems: the twin-lens high-resolution color stereo Pancam, the two wide-angle monochromatic Navcams (navigation cameras) and the Mini-TES (thermal emission spectrometer). Such imaging could begin about 2.5 hr. after landing.

The first panorama at each site "will be a spectacular product," Squyres said. The Pancams have 20/20 vision and will provide IMAX-quality imagery. The first pan will use a red filter on one lens and



alternating blue, green and infrared filters on the other, so the full color range of the landing site is captured.

The Mini-TES will also capture a 360-deg. panorama, providing the initial mineralogical data on the rocks and soil around the site. The Mini-TES is a remarkable instrument capable of differentiating individual rocks by their mineralogy and therefore as rover targets. The Mini-TES imagery will be overlaid immediately on the Pancam imagery. Mini-TES also will be pointed upward to obtain a temperature profile of the Martian atmosphere.

The wide-angle navigation cameras will provide an early panorama, too. The Pan and Mini-TES views, coupled with the Navcam panorama, will be the fundamental scientific and planning tools on which surface operations will be based.

Earth will set at the Spirit landing site about an hour after touchdown. Although a long-shot first attempt, Odyssey may be able to acquire UHF data from the lander at about 4:30 p.m. LST and retransmit it to Earth as early as about 2 a.m. local time Jan. 4 at JPL.

If the project is lucky, this could provide the first detailed information of rover status before it automatically shuts

Camera mast on each 400-lb. U.S. rover will extend 5 ft. above Martian surface. Arm carrying instruments can extend 3 ft. Surface operations strategy will be divided into tactical and strategic objectives.

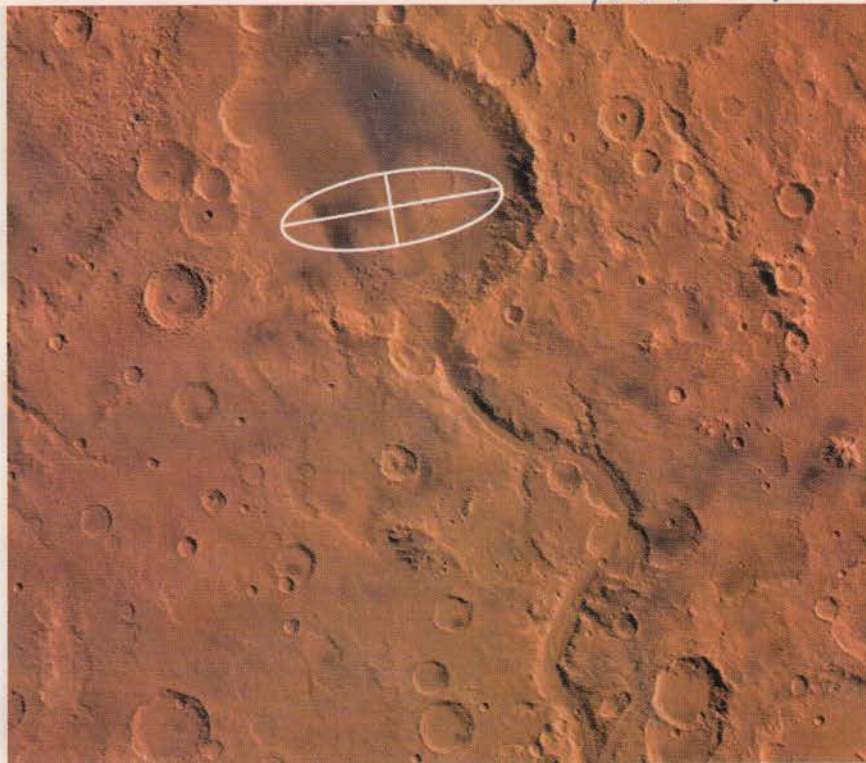
down for the day at Martian dusk 4 hr. after touchdown. But it's more likely initial imagery will not reach Earth until the first direct X-band contact the morning of Jan. 4 at JPL.

On Sol 2, the rover is programmed to awake early, ready to accept its first commands from Earth for multiple engineering tasks, including the start of extensive instrument checks. The high-gain antenna also will be deployed.

Although the schedule can be changed, Sol 3 is to be critical for roving operations, with the start of unfolding of the rover's suspension system, legs and wheels. Squyres calls this process "reverse origami," after the Japanese art of folding complex geometric shapes in paper. This will be done in connection with images sent by the rovers' two forward-facing and two aft Hazard Cameras. The Hazcams will be used later to help drive the rovers, but initially they will serve as key engineering verification tools.

One major event will be commanding the lift mechanism on the base petal to elevate the lander about 10 in. at its center. This must occur for deployment of the rover's suspension system and the

83209



charged to keep warm overnight, the rover will be shut down for the evening. The APXS and MB instruments, however, have small processors that allow them to maintain long data takes on rocks or soil at night.

"Typically we will tell the rover what to do in the morning, see how it does in the afternoon, then having received that data, decide what to have it do the next day," Adler said.

The tactical strategy on the surface will be carried out with an organized and precisely timed series of daily planning sessions.

There are four tactically oriented Science Theme Groups (STGs) assigned to geology, mineralogy/geochemistry, rock/soil properties and atmospheric science. A fifth STG has the "strategic" mission for big-picture planning from the assimilation of data from the other

Spirit target crosshairs lie in Gusev Crater landing ellipse at mouth of a large river channel. The 90-mi.-wide crater once could have been filled with water 3,000 ft. deep.

extension and rotation of Spirit's two front wheels.

Sol 4 is tentatively planned to be a heavy imagery downlink day, with images taken and transmitted interleaved between higher priority engineering data.

The panoramas will be done in eight 45-deg. segments to facilitate this interleaving for downlink, Squyres said. On Sols 5 and 6, the rear wheels are to be extended aft and into place. And tentatively about Sol 7, the umbilical between the base petal and lander is to be cut, followed by about a 4-in. "baby step" drive atop the base petal—the first rover motion, Adler said.

This would verify command and drive system health, and possibly also be used to reorient the rover slightly for the best drive-off angle, be it forward or reverse or angled slightly to one side depending upon what the imagery shows.

Normally, on about Sol 8, Spirit would be commanded to drive about 10 ft. off the lander petal, finally completing its "landing" on Mars and finishing the ITE phase. Its first drive will be targeted to the "safest patch of dirt we can find," Squyres said.

First checks of the 3-ft. Instrument Deployment Device (IDD) arm mechanics, its joints and motors, will be critical at this juncture, because arm motions cannot be tested while the rover is on the lander petal. 83210

Immediately after checkout, the arm will be lowered to the ground to acquire

initial spectroscopy of the Martian soil. This will be a baseline reading at the landing site using the arm's Alpha Particle X-ray Spectrometer (APXS) to determine the soil's elemental chemistry, and its Mossbauer Spectrometer (MB) to assess mineralogy.

The microscopic imager—another rover camera, but in effect a microscope—will also be used to observe soil structure. All three will play a much bigger role later inspecting specific rocks selected via Pancam and Mini-TES imaging. The same process will be repeated with the Opportunity rover.

Each rover will transmit data directly to Earth by X-band two or three times a day for 1-2 hr. at a time. The frequency, however, may be somewhat higher early in each mission, Adler said. Engineers want to conserve electrical power and also avoid overheating the rover, which the X-band system can do.

Most commands to the rovers will be sent direct from Earth via X-band while rover downlinks will be about evenly split between direct and the UHF orbiter relays. MGS will pass over each landing site at about 1:30 LST every morning and evening, and Odyssey at about 4:30 twice daily.

Being solar powered, the rover will "wake up" about 8:30 a.m. LST for commands and operation, take a short siesta around noon to cool down, and wake up again to continue operations until about 3 p.m. Then with its batteries

four STGs and related terrain and navigation issues. 83212

A typical day will begin with a Science Context Meeting directed by the strategic STG lead scientist with participation by the other STGs. This session will be driven daily by the desire to explore specific scientific hypotheses raised by team members. The pursuit of these theories will be based on data received so far, weighed against what's expected in the upcoming downlink—and what it might mean for uplink commanding.

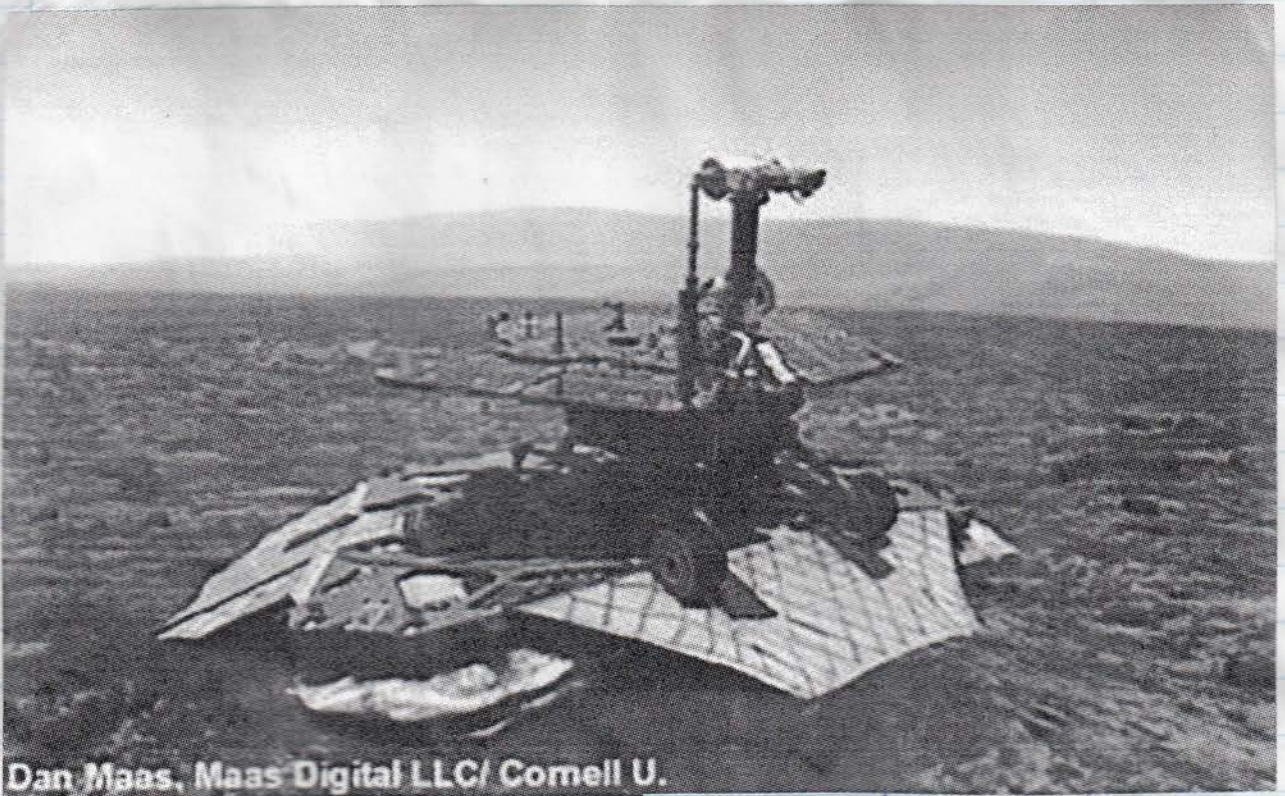
BASED ON DISCUSSIONS at the context meeting, STG members will receive instructions on what specifically to look for in the approaching downlink to support the various hypotheses discussed. And they need to be ready to report on the new data in about 3 hr.

The downlink of science data from the rover will then start. The information will first be managed by Payload Downlink Leads assigned to each instrument or imaging system. They first assess the system's health and data quality, then format the information for access by STG members. From this point on, the STGs have about 3.5 hr. to assess the data and determine what they want the rover to do on its next Sol, in light of what was just received.

Toward the end of this period, the chairman for the overriding Science Operations Working Group (SOWG) comes on shift to chair the first of the day's two additional, and most impor-

83211

23100

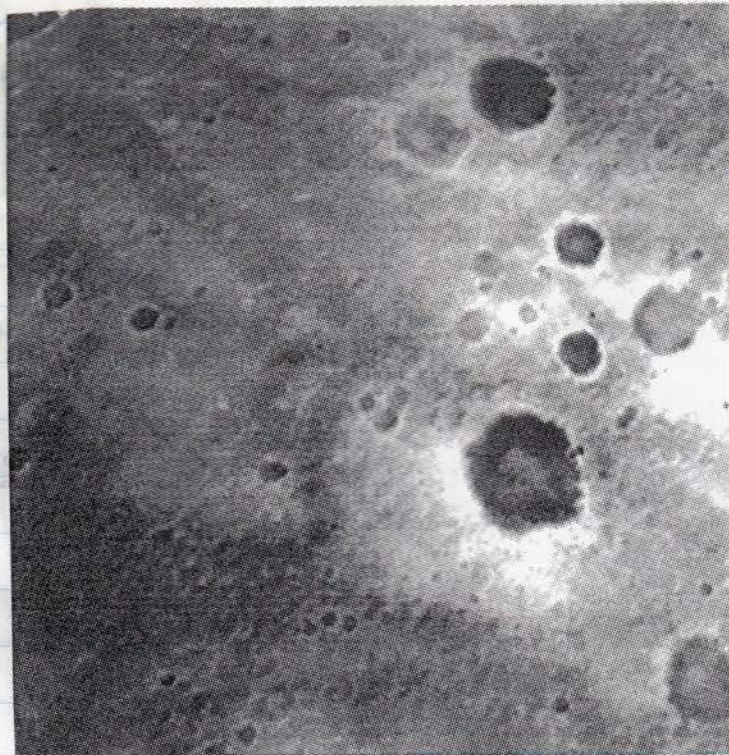


Dan Maas, Maas Digital LLC/ Cornell U.

Foto boven: tekening zoals de Spirit op zijn landingsplaat op planeet Mars stond.

83213

Foto onder: een camera aan boord van de lander maakte op 1400 meter hoogte deze opname van het landingsgebied



83214

101

tant, discussions—the Science Assessment Meeting. This is where the Payload Downlink Leads and tactical Science Theme Group review the latest science data and determine what near-term actions to take.

Discussions typically will involve, for example, whether to have the rover go to a particular rock for specific science objectives based on Pancam/Mini-TES data already received, weighed against what might be obtained with the arm-mounted instruments. And this in turn may frequently require using the Rock Abrasion Tool (RAT), which can grind open a patch up to 5 mm. (0.2 in.) deep and 45 mm. (1.8 in.) in diameter for the instrument to reach subsurface layers.

Differences of opinion will inevitably arise that the SOWG chair will have to help resolve. After the meeting, the STGs will have only 1 hr. to complete the (already well-practiced) instrument tasking sequence for their particular sensor.

That will bring the process to the formal SOWG meeting that will be held at 6 p.m. LST for each rover—essentially immediately after each is shut down for the night. This 90-120-min. session is designed to weigh the STG operational sequences against rover electrical and other competing resources. It's essentially a "bloodlet meeting" to choose between what could be done versus what actually will be done—and make that selection in time for key uplink command timing.

Immediately after the SOWG decides among the winners and losers, it will present the resulting integrated plan to another group called Payload Uplink Leads. They will take the science plans and run them through the uplink planning and validation process, with the objective of having them ready to transmit to each rover about 8 hr. later, when the vehicle wakes up on Mars to start a new day.

The appropriate engineering, software and uplink/downlink personnel are integrated throughout this process, to be repeated every day for each rover, to guide tactical operations on the surface. To facilitate commands, the planning process and command software has already been divided into four generic categories:

- Panoramas to guide the Pancams and Mini-TES imaging.
- Drive operations to traverse distances up to about 30 ft.
- Approach operations to move the rover to within the IDD arm's reach of target rocks.
- Target science operations that guide what to do with the various instruments once the rover arrives at a specific spot.

This includes what sequence the arm should rotate the RAT, APXS, MB or microscopic imager into place on the target. The tasking will again be keyed to support data on a particular hypothesis related to geology or water.

Each category of operation can take an entire Sol, depending on the science objective. The "driving" and "approach" operations are distinct in their own right. The fore and aft ground-level-hazard cameras and twin wide-angle mast-mounted navigation cameras are critical for both rover movement and hazard avoidance, and involve positioning the instruments within the arm's reach of targets.

WAYPOINT NAVIGATION in which controllers map out safe routes can be uplinked, as can longer traverses of about 30 ft. when the rover's automatic hazard-avoidance software is engaged.

Hazard avoidance, however, must be deactivated for approach operations because controllers do not want the rover to avoid a rock they want to sample. If something tantalizing emerges in the imagery as the rover moves, the science

team plans to command the vehicle to stop and sample a target of opportunity that may not have been apparent when planning to reach a more distant objective.

For these operations, precise but small positioning movements will be commanded until the arm's instruments are within reach of the rock or soil target.

The science and operations teams aren't going to be shy about driving to interesting targets, Squyres said. With a highly mobile rover, the immediate landing site is the only area within about a half-mile radius that the science team did not pick, based on science objectives. "It may not make a whole lot of sense for us to hang around where we landed for very long," he said. "We will sample at least one soil location and one rock there, but if it doesn't look very interesting, we might 'put the pedal down' and move elsewhere pretty fast." ©



Reserves: Yuri Onufriyev,
Daniel M. Tan

STS-114, September 2004
Bemanning: Eileen Collins,
James Kelly, Stephen K.
Robinson, Soichi Noguchi,
Andrew Thomas, Wendy D.
Lawrence, Charles Carmar

STS-124, November 2004

83215

83216

10185

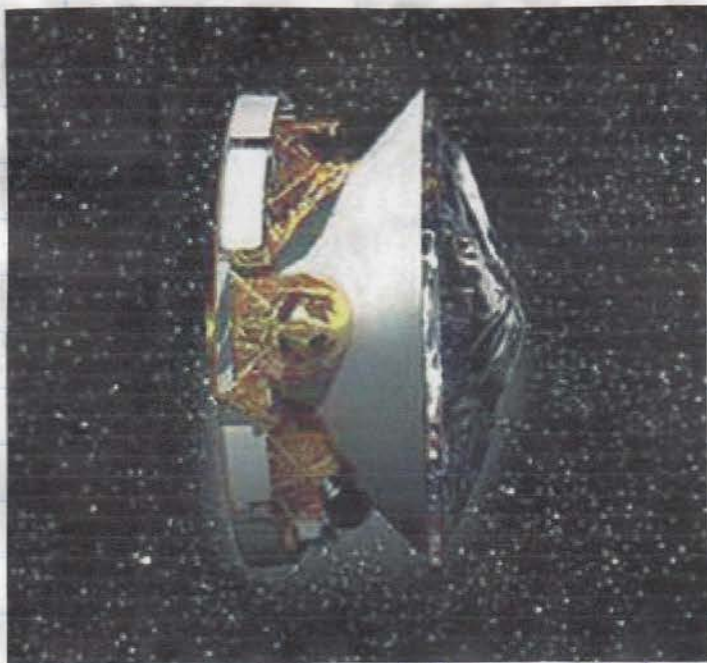
23102

SPACE.COM : 29 DECEMBER 2003.

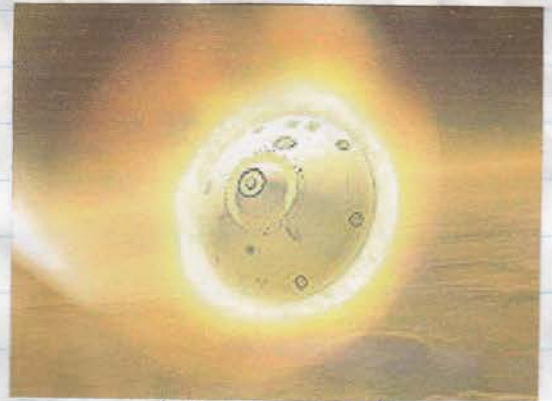
NASA ADJUSTS COURSE OF MARS-BOUND ROVER.

NASA said Monday it successfully adjusted the course of a rover that is scheduled to land on Mars this weekend as part of a mission to search for evidence of life on the Red Planet. Engineers altered the course by firing the thrusters of the Spirit spacecraft for 3.5 seconds Friday, shifting the scheduled landing spot by about 34 miles, mission manager Mark Adler said. It was the fourth and possibly last time the course has been adjusted for the six-wheeled robot. Such adjustments become necessary as the craft gets closer to its destination. Spirit is being sent to Gusev Crater, a depression the size of Connecticut that scientists believe once held a lake. It is set to land Saturday. Spirit is one half of a \$820 million double mission to Mars. Its identical twin, Opportunity, is scheduled to land Jan. 24. Both rovers were designed to prospect for minerals that could indicate whether the planet was once a wetter place hospitable to life.

83217



83218



83219

ORLANDO SENTINEL : 29 DECEMBER 2003.

NASA PINS HOPES ON MARS WITH SPIRIT.

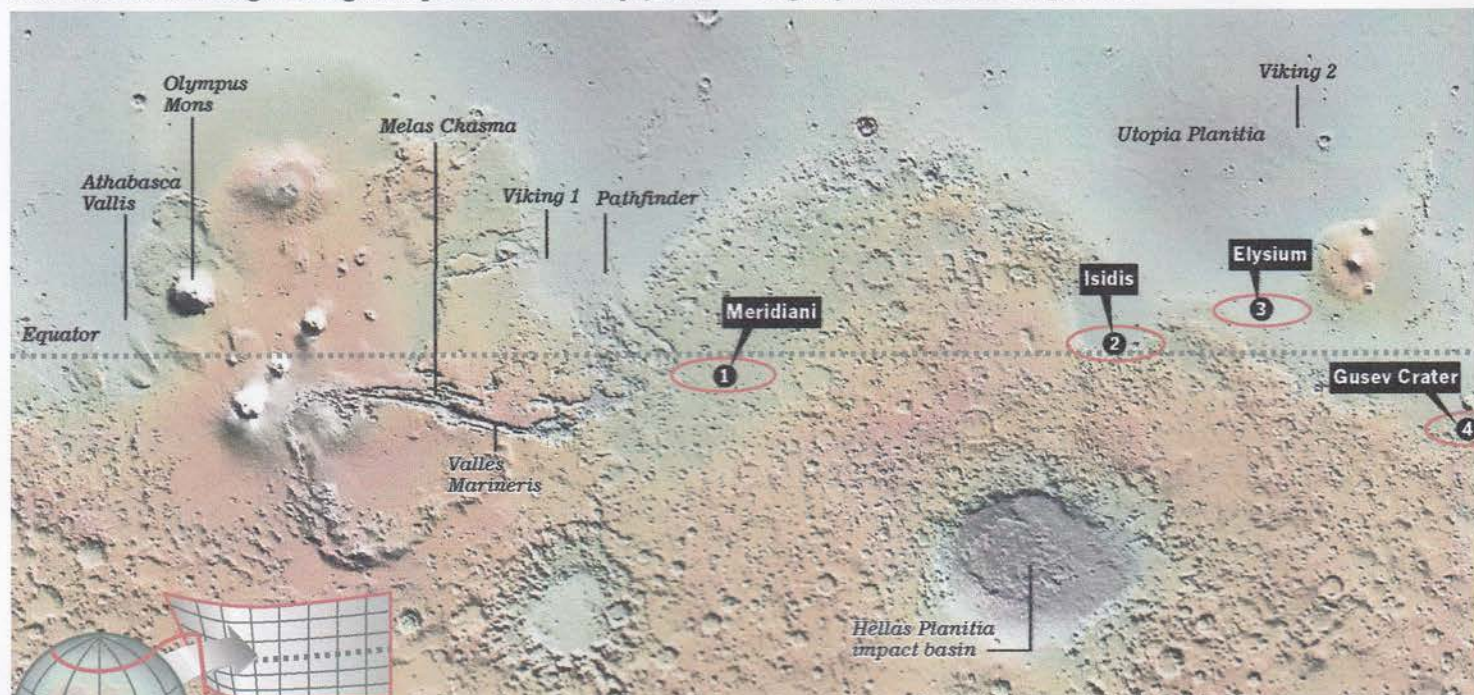
CAPE CANAVERAL - The first of two NASA robot geologists will make a death-defying plunge to the surface of Mars on Saturday to begin one of the most ambitious science missions ever attempted. Dubbed Spirit, the Mars Exploration Rover has traveled more than 300 million miles on a looping six-month journey since its launch from Cape Canaveral Air Force Station on June 10. But the final 21 minutes of that trip -- the time it takes to separate from a spacecraft above the Red Planet and land in Mars' Gusev Crater below -- likely will determine the mission's success or failure. To get there, Spirit will make a fiery 80-mile dive through Mars' atmosphere, drop from the height of a four-story building surrounded by air bags and bounce a mile or more through potentially lethal boulders and rocks. A wind gust at the wrong moment could spell doom. The possible rewards to scientists, however, are worth the risks. The goal is to learn from Martian geology whether water was on the planet's surface long enough to support past life. All the other ingredients are known to have been present. "If you look at the surface of Mars today, it is a desolate place," said Steve Squyres, a Cornell University professor and principal scientist for the mission. "It's cold. It's dry. It's barren. It's not an inviting environment for life. And yet we see these tantalizing clues: dry river beds and lake beds and the kinds of minerals that you see formed by liquid water." History indicates the odds are against Spirit and an identical sister rover named Opportunity, which launched July 7 and is scheduled to land on the other side of the planet shortly after midnight Jan. 25. Two-thirds of humankind's previous 32 missions to Mars since 1960 have ended in failure, prompting some to start referring to the Red Planet as the Death Planet. The harsh reality was driven home earlier this month. On Dec. 9, Japan abandoned plans to put its Nozomi probe in Martian orbit. The spacecraft, designed to study the planet's atmosphere and magnetic field, was off course and low on fuel. Last Wednesday, Europe's Mars Express probe successfully went into orbit around the planet after deploying a small lander named Beagle 2. The lander hasn't been heard from since. Mars Express, which will look for traces of water near the planet's surface, so far appears to be working fine. The National Aeronautics and Space Administration has defined minimum success for its \$800 million rover project as having at least one of the 384-pound robots land safely and carry out its 90-day mission. Besides being a scientific coup, success would provide a badly needed lift for a space agency still feeling the loss of shuttle Columbia on Feb. 1 and two earlier Mars probes in 1999. Even so, NASA officials insist there is no added pressure because of past failures. "Every time we launch something," said Ed Weiler, NASA's associate administrator for space science, "I'm concerned about it."

83220

Mars: Location, location, location

NASA scientists are searching for safe landing sites for two new Mars rovers. The rovers must land near the equator, where there is enough sunlight to power solar arrays, and

in spots that are not too windy, rocky or steep. The landers will bounce down in ellipses that are 50 miles by 12 miles, slightly smaller than Cape Cod.



Unwrapping Mars

This flat map (above) of the middle latitudes of Mars was generated by the Mars Orbiter Laser Altimeter aboard NASA's Mars Global Surveyor. The colorized map represents 27 million elevation measurements gathered in 1998 and 1999. Closeup-images of the landing sites are available online at marsoweb.nas.nasa.gov/dataViz/index.html.

1 Meridiani

Pros: Major hematite deposits imply water was once present. Flat with low winds.

Cons: None.

2 Isidis

Pros: Flat plain may contain interesting rocks that tumbled down from the mountains.

Cons: Volcanic plain of little geological interest and very windy.

3 Elysium

Pros: Extremely flat, and so calm it has become known as the "wind-safe" site.

Cons: With little variation, some call the area boring.

4 Gusev Crater

Pros: Layered rocks and possible stream channel indicate water may have been present.

Cons: Winds and turbulence may make landing hazardous.

Bouncing onto Mars

After a seven-month, 286-million-mile trip from Earth, the landers will smack onto the Martian surface in a ballistic landing in January 2004.

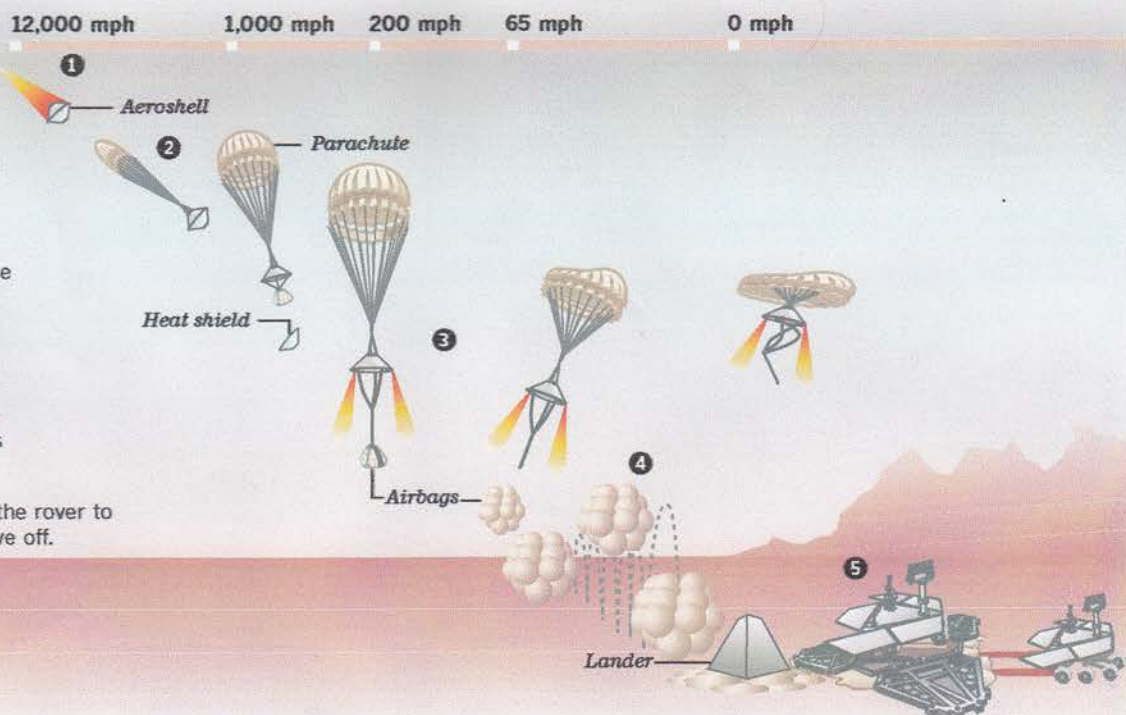
1 The rovers, speeding through space at 12,000 mph, hit the Martian atmosphere and, within a minute, slow to 1,000 mph.

2 Closer to the surface, a parachute slows each landing package to 200 mph.

3 After a radar measurement determines the ground is close enough, rockets fire at about 65 feet, slowing the craft to nearly zero.

4 Inflated airbags protect the landing package as it hits the surface and bounces, perhaps more than a dozen times.

5 The lander unfolds, allowing the rover to open its solar panels and drive off.



Source: NASA

LESLIE CARLSON Los Angeles Times

83221

23 104

BBC : 31 DECEMBER 2003

Q&A : WHAT CAN SPIRIT EXPECT?

The first US rover - called Spirit - is due to arrive at Mars at 0435 GMT on Sunday. The "robotic geologist" will be followed down in late January by its twin, Opportunity. Their mission is to examine their landing sites for past environmental conditions that may have been conducive to life. Dr Steve Squyres, of Cornell University, is principal investigator for the suite of science tools on each rover.

What is the mission status?

SS: We've just completed a final trajectory correction manoeuvre with Spirit - a little nudge of the spacecraft to put us on course to our final landing site in Gusev Crater. Both spacecraft are healthy and we're ready.

Does the silence from Beagle add to your nerves?

I wouldn't say that it adds to our nerves. We're certainly interested and concerned with Beagle. We've been staying in touch with our colleagues in the UK, wishing the best for them. Mars is a hard place to do business for anybody and it is going to be no exception for us. We'll see how all these missions come out. We're still rooting for Beagle 2 to call home.

Is there anything you can learn from the Beagle experience?

The two vehicles are very different and so I'm not sure there is much we can learn from their experience. It is hard to tell what has happened to Beagle and it will be until Colin Pillinger and his team hear from their spacecraft.

How do Spirit and Opportunity differ from the first Mars rover?

They are much larger and much more capable. The rover that flew to Mars in 1996-7 on the Mars Pathfinder mission was really just an engineering demonstration vehicle; it didn't have much of a science payload on it or the capability to go very far from its lander. It never got more than about 10 or 20 metres away from its lander. This time we are flying a much, much larger vehicle. It's more than 180 kg in weight. It's able to travel tens of metres in a day across the Martian surface and it carries an entire suite of scientific instruments with it. It's a real robotic explorer.

What are Spirit and Opportunity going to be looking for?

The purpose of the mission is to try to find out whether or not Mars was once the kind of place that could have supported life. Mars is a really cold, dry, miserable place today. It is not an environment at its surface that is very well suited to life. And yet when we look down from orbit with cameras and spectrometers we see tantalising clues that it used to be different. We see dried up river beds, we see dried up lake beds, we see the kinds of minerals that one might find in a hot-spring environment.

We're trying to go to two places where we think it might have been warmer and wetter and more Earth-like in the past and to try to read the geologic clues there and see if these really were places that would have been suitable for life.

And to look if there is still life there?

No. We're not actually looking specifically for life. What we are doing is looking for evidence that life could have been supported. This is not a life search or life detection mission.

Why do probes to Mars have such a high failure rate?

It's an incredibly long distance away. Landing in particular is very, very hard because you are going into a very poorly known environment. We don't yet have the technology to do a controlled landing at a pinpoint location on the Martian surface. So at the moment you just plummet towards the surface into what could be a rock field or some other type of terrain. You have got to design a vehicle that can withstand anything it might hit, any environment it might run in to. It's not surprising that there have been a significant number of failures.

What size area will you come down in?

In the case of our vehicles we will land in an area that is maybe 60 kilometres long and 10 or 15 km wide.

And there is no opportunity to look for Beagle 2?

No. We're going to two very different places. The landing sites we've picked are quite far from the Isidis Planitia site where Beagle landed.

Presumably you are still learning so whatever happens with Spirit you can still modify Opportunity to help it?

Yes. We hope so. If we saw some unexpected events during the final descent of Spirit towards the surface, we could do some last-minute reprogramming of some aspects of the way Opportunity would land.

83222

83223



TO THE MOON
THEN MARS

TENSE TIMES AS SPIRIT CLOSES IN ON MARS.

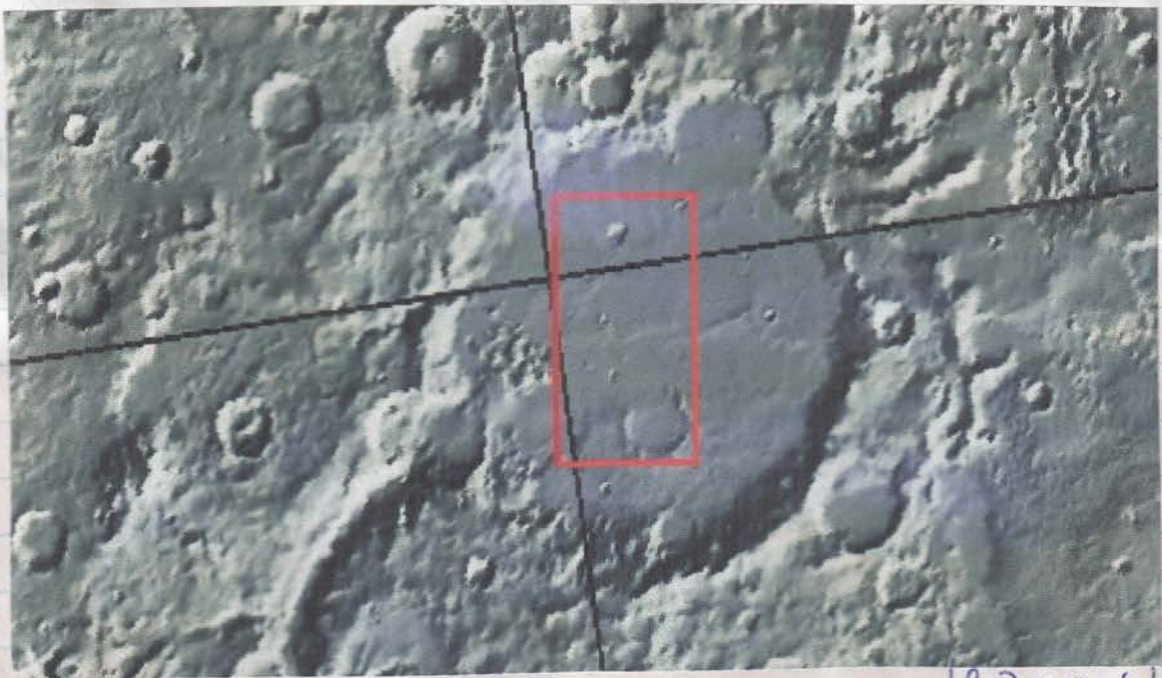
PASADENA - Hundreds of scientists and engineers are gathering here at the Jet Propulsion Laboratory (JPL) to take part in the touch down of Spirit -- the first of two look-alike mobile landers. The six-wheeled, golf-cart sized robot is to reach the surface of Mars on Saturday, January 3, at about 8:35 p.m., Pacific Standard Time. The spacecraft's trajectory is so precise that ground controllers opted not to perform a correction maneuver called TCM A5, and may forgo a final adjustment to Spirit's targeting into Gusev Crater. Spirit's twin, Opportunity, is also on course and will reach Mars three weeks later. Akin to making a "hole in one" after Spirit has flown over millions of miles, ground control team members at JPL want to make a bulls-eye landing within Gusev Crater, a 90-mile (145-kilometer) wide feature likely formed three to four billion years ago as a result of an impacting asteroid. Gusev is considered a dry and ancient lakebed, complete with a channel system that most probably carried liquid water, or water and ice, into the crater. The Gusev landscape has been eyed for years by Nathalie Cabrol, a planetary scientist at NASA's Ames Research Center. She was a key advocate for having a Mars Exploration Rover touch down at Gusev, and eagerly awaits the first "ground level" panorama from Spirit's camera. "Yes, this is getting very close now," Cabrol told SPACE.com. "At the present time... interestingly enough, I am not nervous at all. I guess, there is nothing we can do except pray!" "I find myself often thinking how big Mars should be by now in Spirit's 'eyes' and it is a wonderful thing to be thinking about," Cabrol said. "I would like to be there, and just see Gusev becoming bigger and bigger in the last moments before landing," she said. As Spirit dives through the Martian atmosphere, a complex set of actions must occur in rapid-fire order, such as: Unfurling a critical parachute, heatshield separation, radar scans of the approaching terrain, retro-rocket firings, and the inflation of a huge set of airbags to cushion the lander from repeat bounces before coming to full-stop on Mars. To a person standing on the surface of Mars, that aerial show would be an eye-catcher for sure. "I wish I could be sitting on Gusev floor and see Spirit landing, bouncing and finally come to rest on this place I have been thinking about so much in the past 13 years," Cabrol said. "With God's help, in few days from now, we will see the first images of Gusev and I feel extremely privileged. For a planetary geologist, and for the time being, this is as close as one can get to being in the field on Mars." As Spirit hurdles toward Gusev Crater, the spacecraft will initially communicate with Earth through a series of simple tones, letting controllers on Earth know the craft has completed various phases of its entry, descent, and landing. The Deep Space Network (DSN) antennas on Earth could hear from Spirit Saturday night, but may not receive the first signal from a healthy spacecraft until Sunday evening. Within the first 24 hours, Spirit will have several chances to communicate with Earth both directly to the DSN and through NASA's Mars Global Surveyor orbiter and NASA's Odyssey orbiter. Both orbiters are now circling Mars, collecting science about the planet. They will each fly over Spirit's landing site within Gusev Crater, throughout the mission. Meanwhile, the enigmatic world appears to have claimed yet another robotic explorer. Mum's the word from the British-built Beagle 2. It dropped onto Mars' surface more than a week ago. Repeated attempts to contact the lander have not been successful. Beagle 2 was targeted to land on Isidis Planitia, a large flat region that overlies the boundary between the ancient highlands and the northern plains. While the British stiff-upper-lip is clearly in full bloom, the chances that the impressive science package is alive and well seem to be fading away, day by day. If lost to Mars, the Beagle is one more piece of hardware heaped atop a growing planetary junkyard of earlier failed U.S. and Russian Mars missions that dot the planet. "Mars has been a most daunting destination. Some, including myself, call it the 'Death Planet,'" noted Edward Weiler, associate administrator for NASA's space science programs during a recent press briefing. "Just getting to Mars is hard... but landing is even more so," he added. NASA's Deep Space Network has contributed search time for the missing lander. But now the DSN is increasingly busier handling the links for both Spirit, as well as the NASA Stardust mission that is closing in on Comet Wild-2 for a January 2 flyby. The next opportunity for retrieval of a signal from Beagle 2 will be with the European Space Agency's (ESA) Mars Express in the New Year. ESA's Mars Express is the orbiter that deployed the Beagle 2 and is now circling the planet. ESA ground teams recently nudged the Mars Express from an equatorial orbit into a polar orbit around Mars. That change of orbit will allow increasingly closer looks at the Beagle 2 landing site. If Beagle 2 did successfully make it to the surface of the red planet intact, the reduced distance, the ideal angle of overflight and the pre-tested communications link between the "mother" craft and its "baby" Beagle 2 will increase the probability of catching signals from the lander.

83224

6 MINUTES TO DECIDE OUTCOME OF MISSION.

83225

PASADENA - NASA's Spirit rover has trekked more than 300 million miles through space en route to Mars. The trip took six months, but tonight it comes down to what the rover team is calling "six minutes of hell." Spirit, the first of two automated Mars buggies set to land on the red planet this month, makes its supersonic plunge to the surface late this evening. And NASA scientists and engineers admit the number of things that could go wrong is large. More often than not, the unmanned probes Earthlings have fired toward Mars landings do not make it -- at least not intact. The latest example came last month. Britain's Beagle 2 screamed through the atmosphere Christmas Eve. Its fate is still unknown because ground controllers can't pick up its signal, meaning it's lost somewhere on the surface. "Clearly, Mars is not a Sunday drive," said Firouz Naderi, manager of NASA's Mars Exploration program office. "It's quite an adventure every time you go." Nothing about tonight's entry and landing sounds like a leisure trip. The shell containing the rover will zip into the thin Martian atmosphere at about 12,000 mph. For the next four minutes, a heat shield shaped like a saucer sled will slow the lander down to about 960 mph. The building friction will increase the temperature outside to 2,600 degrees. A monstrous parachute will pop out two minutes before Spirit hits the ground, further slowing the ship. The top and bottom halves of the lander's shell will be cast aside and, six seconds and 49 feet above the surface, the airbags will inflate to protect the rover from its impact. The ship, looking like a cluster of giant beach balls, will bounce off the ground more than 40 feet and roll to a stop perhaps more than a half mile away from initial impact. It's during that six minutes that so many things can go wrong -- some of them under NASA's control, but many of them impossible to predict or prevent. If the parachute or airbags don't work, the ship will slam into the surface too fast and be smashed to bits. If anything is wrong with the navigation software, or some other problem such as a sudden burst of wind that causes the ship to land off course, it could end up in a hole. That's what the Europeans say might have happened to the Beagle 2 that is presumed lost on the Martian surface. The most feared bit of bad luck Spirit could encounter is a rock, especially a sharp one. If on any of the initial bounces, the rover's inflatable cocoon hits a pointy rock that pops the airbag, then the mission is almost certainly over. While scientists and engineers took great care to aim the rovers to a safe place, Earthlings' mapping of Mars is still too crude and knowledge of the atmosphere and weather so limited, that it is impossible to predict for certain that Spirit was aimed at a safe spot. "We know a lot more about Mars today than we've known in the past, but there is still a lot we don't know," said Tom Young, an outside consultant who looked over the rover technical plans before launch. "There are a lot of hazards." "You're somewhat at the mercy of the unknowns of Mars. They've taken all of that into consideration with the selection of the landing sites, to minimize that, but even the better of the landing sites has some hazards."



83226

P108 CNTEXT P108 Fri 02 Jan 23:25:10
NEWS
CNN NASA Mars rover set to land
After a journey of seven months and 303 million miles, a six-wheeled NASA rover will speed like a bullet Saturday night toward the surface of Mars and, if all goes as planned, stop with a bounce.
The plunge through the Martian atmosphere at 12,300 mph will mark the start of the riskiest portion of the voyage thus far.

83227

AP NEWS : 02 JANUARI 2004.

NEW NASA MARS ROVER TO TOUCHDOWN ON 03 JAN.

83228

PASADENA - After a journey of seven months and 303 million miles, a six-wheeled NASA rover will speed like a bullet Saturday night toward the surface of Mars and, if all goes as planned, stop with a bounce. The plunge through the Martian atmosphere at 12,300 mph will mark the start of the riskiest portion of the voyage thus far. As the unmanned spacecraft Spirit plummets to the rocky surface 80 miles below, it will rely on the precisely choreographed use of heatshields, parachutes and rockets to slow its descent. Just eight seconds before hitting the ground, the golf cart-size Spirit should inflate a set of airbags to cushion its impact. The entire harrowing trip down should take just six minutes. A single sharp boulder could doom the entire enterprise. "It's not the fall that kills you. It's what you hit at the end," said Pete Theisinger, project manager of the \$820 million project, which also includes a twin rover, Opportunity, set to arrive on Mars on January 24. The camera- and instrument-laden rovers are designed to spend 90 days analyzing Martian rocks and soil for clues that could reveal whether the Red Planet was ever a warmer, wetter place capable of sustaining life. If successful, the six-wheeled, 384-pound Spirit and its twin would become the fourth and fifth U.S. spacecraft to survive landing on Mars. If neither survives, they will join the wretched ranks of some 20 other spacecraft from various nations that failed to successfully reach the planet. The latest, apparently, were Japan's Nozomi satellite and Britain's Beagle 2 lander. Nozomi was unable to enter Mars orbit last month; Beagle 2 has been silent since it was to have landed on Christmas Day. "Some, including myself, call it the 'death planet,'" said Ed Weiler, NASA's associate administrator for space science. NASA hopes to learn almost immediately whether the twin rovers have landed safely. In 1999, NASA's last attempt at landing on Mars failed when a software glitch sent the Polar Lander crashing to the ground. Its descent took place in a communications blackout, and the lack of data later stymied the investigation into the failure. Spirit, in contrast, is designed to transmit a series of tones to Earth throughout its descent to signal engineers each time onboard computers order a critical action, such as the deployment of the parachute. Even if Spirit crashes, engineers on Earth will be able to reconstruct its last minutes. "Entering into Mars is always very tricky, as everyone knows, and we can fail. But we want to learn from those failures, so next time -- of course, we have another rover coming three weeks later, so we do have our own next time -- we can learn from the experience so we can correct any problems," said Polly Estabrook, who is in charge of telecommunications for the landing.

80185

23107

HOUSTON CHRONICLE : 02 JANUARI 2004.

MARS ROVER READIED FOR SATURDAY LANDING.

PASADENA - After a journey of seven months and 303 million miles, a six-wheeled NASA rover will speed like a bullet Saturday night toward the surface of Mars and, if all goes as planned, stop with a bounce. The plunge through the Martian atmosphere at 12,300 mph will mark the start of the riskiest portion of the voyage thus far. As the unmanned spacecraft Spirit plummets to the rocky surface 80 miles below, it will rely on the precisely choreographed use of heatshields, parachutes and rockets to slow its descent. Just eight seconds before hitting the ground, the golf cart-size Spirit should inflate a set of airbags to cushion its impact. The entire harrowing trip down should take just six minutes. A single sharp boulder could doom the entire enterprise. "It's not the fall that kills you. It's what you hit at the end," said Pete Theisinger, project manager of the \$820 million project, which also includes a twin rover, Opportunity, set to arrive on Mars on Jan. 24. The camera- and instrument-laden rovers are designed to spend 90 days analyzing Martian rocks and soil for clues that could reveal whether the Red Planet was ever a warmer, wetter place capable of sustaining life. If successful, the six-wheeled, 384-pound Spirit and its twin would become the fourth and fifth U.S. spacecraft to survive landing on Mars. If neither survives, they will join the wretched ranks of some 20 other spacecraft from various nations that failed to successfully reach the planet. The latest, apparently, were Japan's Nozomi satellite and Britain's Beagle 2 lander. Nozomi was unable to enter Mars orbit last month; Beagle 2 has been silent since it was to have landed on Christmas Day. "Some, including myself, call it the 'death planet,'" said Ed Weiler, NASA's associate administrator for space science. NASA hopes to learn almost immediately whether the twin rovers have landed safely. In 1999, NASA's last attempt at landing on Mars failed when a software glitch sent the Polar Lander crashing to the ground. Its descent took place in a communications blackout, and the lack of data later stymied the investigation into the failure. Spirit, in contrast, is designed to transmit a series of tones to Earth throughout its descent to signal engineers each time onboard computers order a critical action, such as the deployment of the parachute. Even if Spirit crashes, engineers on Earth will be able to reconstruct its last minutes. "Entering into Mars is always very tricky, as everyone knows, and we can fail. But we want to learn from those failures, so next time -- of course, we have another rover coming three weeks later, so we do have our own next time -- we can learn from the experience so we can correct any problems," said Polly Estabrook, who is in charge of telecommunications for the landing.

83229

83230





83231



83232

CNN : 04 JANUARI 2004.

NASA ROVER LANDS SAFELY ON RED PLANET.

83233

PASADENA - A NASA robotic explorer touched down on Mars, sending a signal home that it survived the risky descent through the Martian atmosphere and bouncing landing. The \$400 million rover Spirit, designed to conduct unprecedented geologic and photographic surveys on the Martian surface, transmitted a simple hello to Earth minutes after landing, which took place just after 11:30 p.m. ET Saturday. The golf cart-sized Spirit went through what NASA assistant administrator Ed Weiler characterized as "six minutes from hell" -- the time it took to enter the Martian atmosphere, descend and land in Gusev Crater. During the descent, Spirit deployed parachutes and fired retrorockets to decelerate. Seconds before impact, it inflated a protective cocoon of airbags. A series of bounces and rolls may have sent the robot up to four stories high and more than a mile from its landing spot, according to mission control scientists at NASA's Jet Propulsion Laboratory in Pasadena. "It sounds like a crazy way to land on Mars, but it's actually tried and tested," said Steven Squyres, a Cornell University geologist in charge of the scientific instruments on Spirit and its identical twin, Opportunity, which will complete the 300 million-mile trip to Mars in the next three weeks. Spirit launched June 10 and Opportunity took off July 7. The airbag bounce method worked well with Pathfinder, NASA's last success on Martian soil. The 1997 mission included a lander, which beamed back thousands of images, and Sojourner, a toy-sized test rover that scurried around the rocks and boulders littering the landing site. Packed with a slew of geology instruments and cameras, Spirit and Opportunity have much more mobility and capability than previous missions. Each of the nearly 400-pound machines is built to explore nearly as much territory in one day as Sojourner covered in three months, about 100 yards. Their eight cameras should provide stunning panoramas of the Martian surface, with resolutions so sharp they retain crisp detail when blown up to the size of a movie screen, according to NASA. And their microscopes, spectrometers and drills could unlock secrets from Mars billions of years ago. "It's a cold, dry miserable place today. But we have got these tantalizing clues that, in the past, it used to be warmer and wetter," said Squyres, who exudes a passion for planets like his one-time teacher at Cornell, the late astronomer Carl Sagan. "You can think of these vehicles as being robot field geologists. A field geologist is like a detective at the scene of a crime. They go to a place where something happened long ago and they try to read the clues," he told CNN. Spirit's landing generated enthusiastic cheers, hugs and applause at NASA's mission control. Team members had waited nervously for confirmation, knowing too well that Mars has often proven a deadly place to visit. Two-thirds of the more than 30 spacecraft that have attempted to reach or orbit Mars have met with disaster, including two NASA attempts in 1999. The most recent casualties include Japan's Nozomi, a satellite zapped by lethal solar radiation during its four-year odyssey to Mars. Mission engineers abandoned their attempts to steer the ailing craft as it neared the red planet last month. Another possible victim is the Beagle 2, an ambitious life-searching lander from Britain, which has remained silent since its presumed touchdown December 25.



83234

01185

23109

NASA wacht landing Mars-wagen af

PASADENA Morgenvroeg om 05.35 uur onze tijd zal de Spirit, de eerste van twee Amerikaanse robotwagens, neerkomen op Mars. Over drie weken zal de Opportunity op de andere kant van Mars landen. De wagens onderzoeken of er ooit leven mogelijk is geweest op de Rode Planeet.

De wagens zijn omhuld met luchtzakken en moeten door parachutes een deel van hun snelheid verliezen, voor ze op het oppervlak van Mars stuiteren. Het duurt enkele minuten voor ze stilliggen.

De missie is niet zonder risico, zoals bleek bij de landing van de Europese Beagle 2 op Mars. Daarvan is sinds de landing op 25 december niets vernomen.

volgende nieuws financieel sport

83235

83236



83237



83238



NASA rover lands safely on red planet

A NASA robotic explorer touched down on Mars, sending a signal home that it survived the risky descent through the Martian atmosphere and bounced to a halt.

The \$400 million rover Spirit, designed to conduct unprecedented geologic and photographic surveys on the Martian surface, transmitted a simple hello to Earth minutes after landing.

TELEGRAAF : 04 JANUARI 2004

AMERIKAANSE SONDE SPIRIT GELAND OP MARS.

WASHINGTON/PASADENA - De Amerikaanse sonde Spirit is zondagochtend (Nederlandse tijd) veilig geland op de planeet Mars. Na een reis van zeven maanden en een risicovolle landing kwam de robot neer in een grote krater op de rode planeet, zo maakte de Amerikaanse ruimtevaartorganisatie NASA bekend. Enkele uren later stuurde de Spirit zijn eerste foto's van de omgeving. Na de landing duurde het enige tijd voor de robot zijn eerste signaal doorzond. Toen echter duidelijk werd dat de Spirit veilig was geland, braken wetenschappers in het controlecentrum in Pasadena in luid gejuich uit. Ze spraken van een perfecte landing. NASA-directeur Sean O'Keefe noemde het "een grote nacht" voor NASA. "We zijn weer terug". De hoogste ruimtewetenschapper van NASA, Ed Weiler, beschreef de landing als "zes minuten hel". In die periode moest het ruimtevaartuig afremmen van 20.000 kilometer per uur tot nul. Wetenschappers weten dat een missie naar Mars een van de meest moeilijke dingen is die mensen tot nu toe hebben ondernomen. Circa tweederde van alle missies naar de buurplaneet van de aarde is mislukt. In 1999 faalden nog twee Amerikaanse Marsmissies. De Europese ruimtevaartorganisatie ESA wacht nog steeds vergeefs op een signaal van de Marslander Beagle 2, die met kerst neerging op de rode planeet. De Spirit is een vernieuwde versie van de Robot Sojourner die in 1997 als eerste over het oppervlak van Mars reed en spectaculaire foto's van de rode omgeving nam. Het voertuigje is ongeveer zo groot als een koelkast en weegt 180 kilo. Het kan dagelijks 40 meter afleggen en ondertussen foto's maken en stenen onderzoeken. Net als de Beagle gaat de Spirit, die over drie weken wordt gevolgd door de onderzoeksrobot Opportunity, op zoek naar sporen van water. Door de krater waarin het landde loopt een droge rivierbedding. Wetenschappers zijn ervan overtuigd dat er in de krater een meer moet zijn geweest en hopen zo meer te weten te komen over de aanwezigheid van water. "Wat we niet weten is hoe lang Mars water bevatte", aldus Weiler. "Als het er tientallen miljoenen jaren is geweest, is er een goede kans dat er zich leven in heeft ontwikkeld."

83239

SPACE.COM : 04 JANUARI 2004.

THAT'S THE SPIRIT!

MARS ROVER LANDS SAFELY ON MARS.

PASADENA - After some seven months of interplanetary travel, NASA's Mars rover, Spirit, has rolled to a full stop on the surface of the Red Planet. "Sit back and enjoy the landing," said one controller as Spirit slashed through Mars' atmosphere. Ground controllers received a series of tones that showed the entry, descent and landing went by the book. Bursts of applause broke out of mission control as the spacecraft began to feel the heat from atmospheric entry. Follow-on signals from Spirit told Earth operations that the parachute was fully deployed, with radar locking onto the Martian surface as the craft raced toward the surface. Signals received from Spirit indicated that the spacecraft was alive on the ground and bouncing, perhaps bouncing across the rocky terrain for several miles. After a lengthy wait for confirmation that Spirit had survived its plunge onto Mars came the word: "We got it" came the word from Spirit's mission control Center. "We have a very strong signal from the rover," said Robert Manning, Entry, Landing and Descent Manager. Initial word was that the Spirit had landed in the most favorable position for later unfolding of the Rover and its eventual first traverse onto the planet's surface. That lander position makes retracting the airbags, and the opening of lander pedals a fairly simple operation. Initial thoughts are that a first image from the rover may well be available later tonight. NASA's \$820 million dual Mars Exploration Rover project -- Spirit and still en route Opportunity -- are designed to build upon a legacy of earlier discoveries about Mars. The two specially-equipped robots were hurled toward Mars to gain new insights regarding the history of environments on the planet -- perhaps hospitable to life in the past or possibly today. Following touch down on Mars, each rover has been built to carry out three months of exploration at their respective landing spots. Both Spirit and Opportunity are geared to wheel across Mars, inspecting their surroundings with a stereo, color camera and with an infrared instrument that can classify rock types from a distance. Rocks that are deemed by scientists to be the most interesting can be subjected to a handful of tools attached to a rover's robotic arm. The second rover, Opportunity, is zeroing in on its attempted Mars landing on January 24 at approximately 9:05 pm Pacific Standard Time. This robot craft is heading for Meridiani Planum, a region on Mars that contains exposed deposits of a mineral -- gray hematite -- that usually forms under watery conditions. Scientists speculate that the hematite might have resulted from environmental conditions indicative of a past lake or active hot springs, perhaps hospitable to life. The iron oxide mineral could be the result, however, of hot lava -- a situation not conducive to supporting life. Two out of three missions to the red planet have failed. One reason there have been so many losses is that there have been so many attempts. "Mars is a favorite target," says Dr. Firouz Naderi, manager of the Mars Program Office at the Jet Propulsion Laboratory.

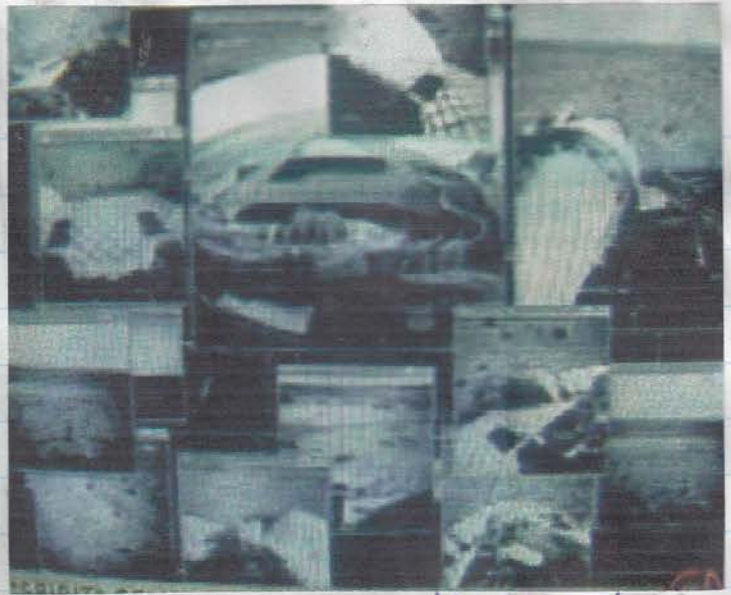
83240

83238

23111



83241



83242



83243



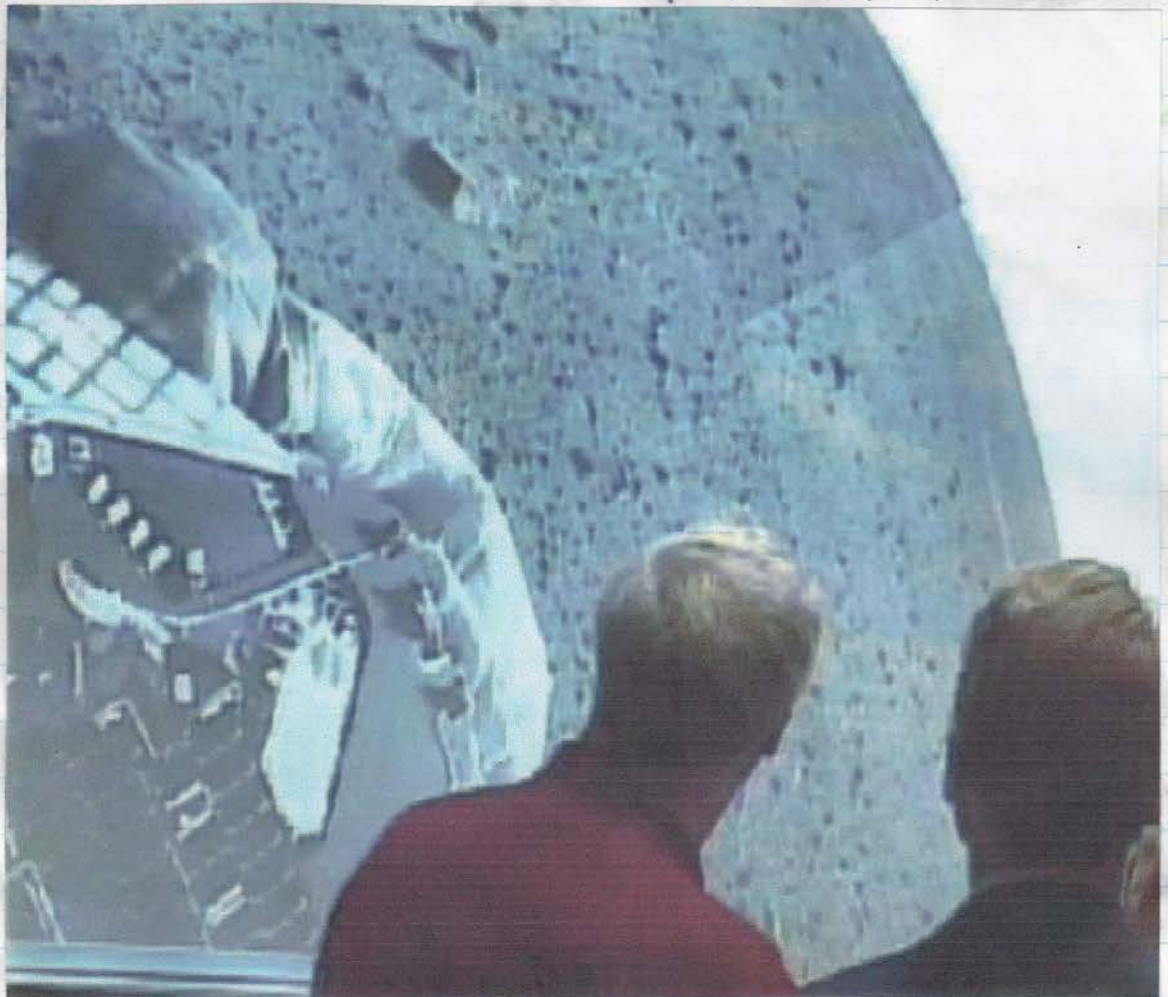
83244

23112



83245

83246



23113

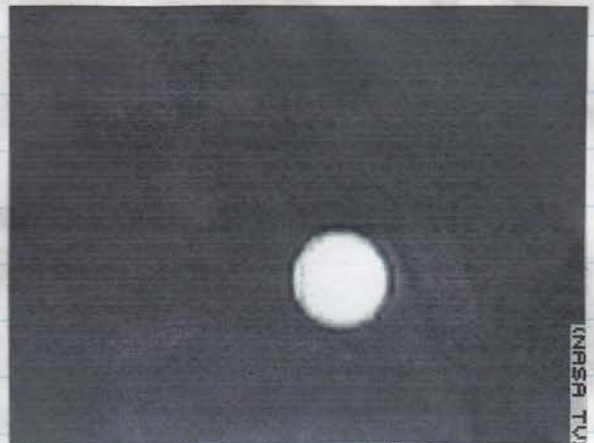
23113



183247



83248



83249

83250



23114

53115

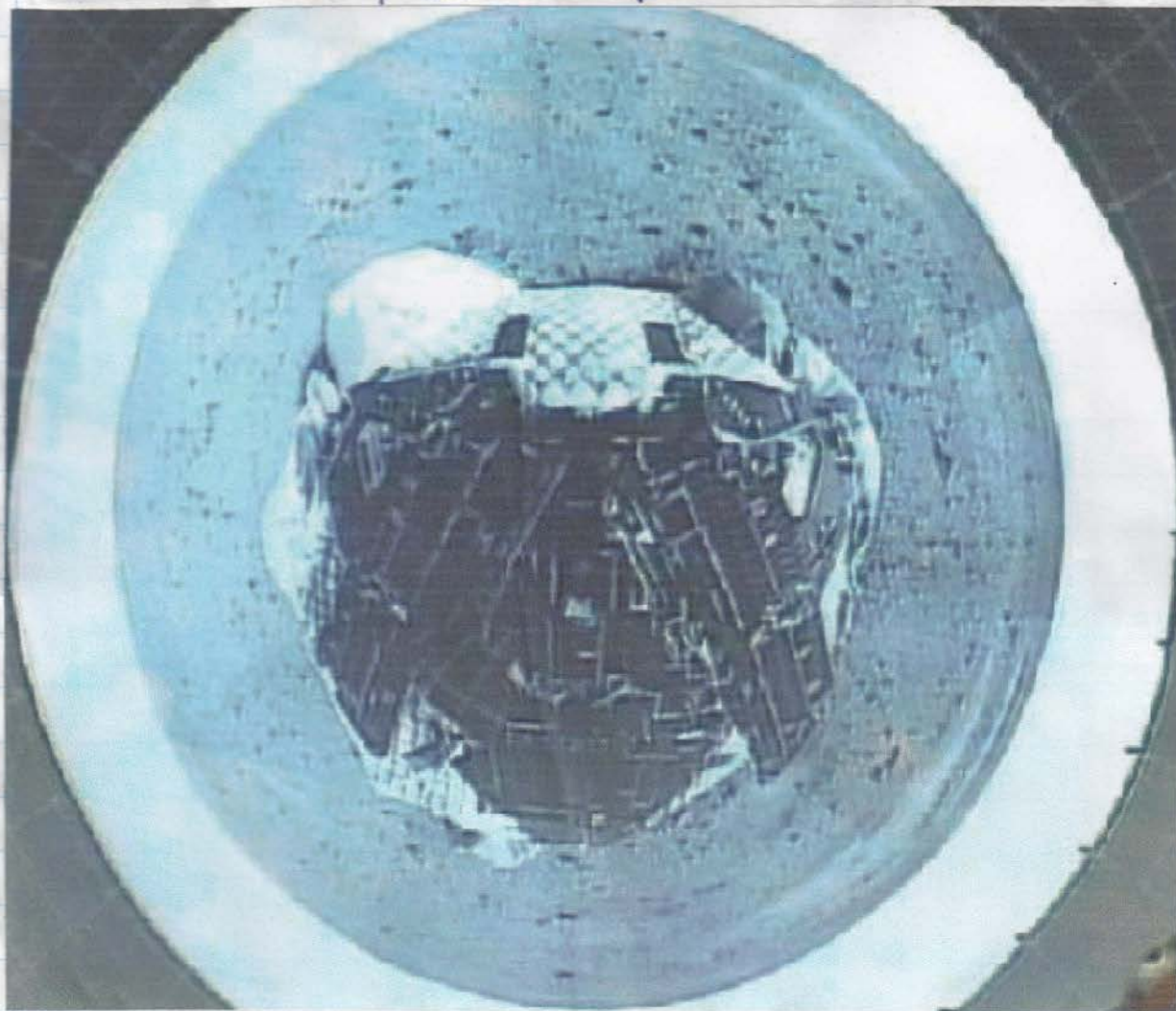
SPACE.COM : 04 JANUARI 2003

SPiRIT'S FIRST IMAGES OF THE RED PLANET.

PASADENA - "What a night," said Steve Squyres, Principal Investigator for Spirit from Cornell University. "Spirit has shown us her new home, Gusev Crater. It's a glorious place... a wonderful place from a science perspective," he said in a midnight press event at JPL. In taking a first look at images, Squyres said that Spirit's final resting spot shows it near distinctive patterns of impact craters. "It looks to be tailor made for our vehicle. We see rocks. We see enough rocks that we can do great science with them... not so many that they are going to get in our way," he said. "I'm looking forward to some good driving in the weeks and months ahead," Squyres said. The site is ideally suited for Spirit's suite of instruments, he said. First impressions of the landing site, Squyres said, are that Gusev, indeed, looks like a dry lakebed. He offered cautious optimism that the robot geologist may well find sediments. Sedimentary rocks would do a wonderful job of preserving the evidence of what the conditions were like in this area long ago, Squyres said. "Our robot detectives are itching to get to work and try and answer that question." Jennifer Trosper, Spirit Mission Manager for Surface Operations, said the state of the landed rover is excellent. "The solar arrays are out and the batteries are fully charged. We are ready to go," she said. Over the next days, scientists and engineers will begin charting the rover's maiden voyage of exploration across Mars. Also on tap is checking out the health of Spirit's array of instruments. The craft underwent multiple jolts during its airbag-protected landing. "It has been unreal," said Richard Cook, JPL Deputy Project Manager for the Mars Exploration Rover program. "We've got a really amazing machine on Mars." Waiting for the first picture from the surface of Gusev Crater was a particularly nervous and emotional time for Nathalie Cabrol, a planetary scientist with the SETI Institute and works at NASA Ames Research Center at Moffett Field, California. She has studied Gusev for years, making extensive use of orbital imagery and other scientific data about the locale. There is plenty of science to do," Cabrol told SPACE.com. "It's like corresponding with somebody for 15 years through mail, and having the chance to see them in person. You don't know what you are expecting. You have a mental picture... but this is beautiful." "To tell you the truth I've been speechless for most of the evening. Because me being speechless about Gusev... that should tell you something," Cabrol said.

83251

83252



DDT-02-01-2003

53112

23115

83253

Morgens auf'm Mars



Der Mars – unbekannte Weiten. Genauer gesagt der Kusev-Krater, dort späht die US-Sonde „Spirit“ ihre Umgebung aus. Was wenig aufregend aussieht, begeistert die Nasa-Techniker, sie haben die Fotos zur Panora-

ma-Aufnahme zusammengesetzt. Ein 3-D-Bild, ein Blick rund um den Besucher von der Erde. Sonnenaufgang. Mindestens fünf Tage verharbt der Roboter noch in seiner Position, dann startet die Fahrt auf dem Mars.

Spirit sollen keine Steine im Weg liegen, deshalb werten seine Betreuer jede Unebenheit aus – 1997 schaffte die Sonde „Sojourner“ nach 114 Richtungsänderungen 52 Meter.

Rheinische Post: 06-01-2004

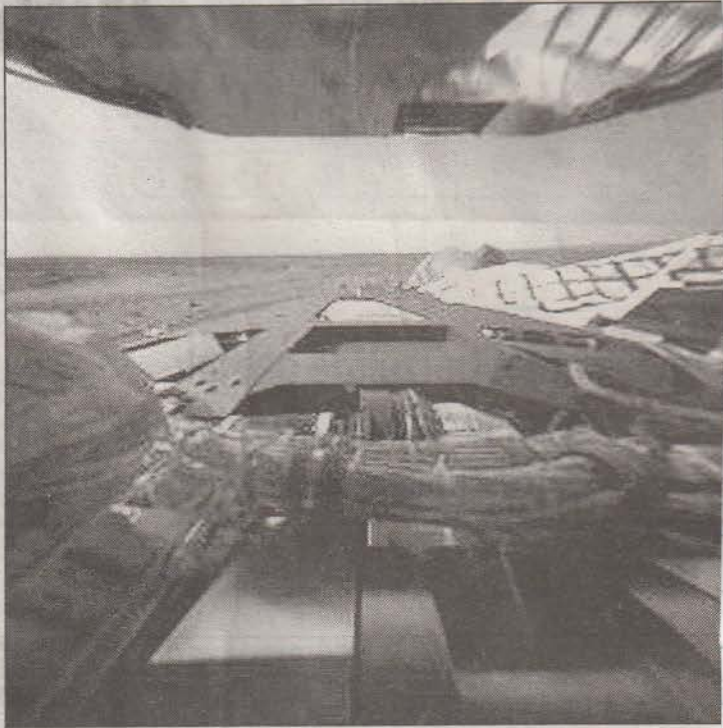
NASA krijgt foto's Marslander

PASADENA
AP

De Amerikaanse ruimtesonde Spirit is in de nacht van zaterdag op zondag geland op Mars. Al kort na de landing stuurde het vaartuig tot grote opluchting van de ruimtevaartdienst NASA de eerste foto's door. De Spirit gaat onderzoeken of er ooit leven mogelijk is geweest op Mars.

„Dit is een geweldige nacht voor de NASA“, jubelde de leider van de ruimtevaartdienst, Sean O'Keefe. „We zijn er weer!“ De NASA kan een succes goed gebruiken, bijna een jaar na het verongelukken van het ruimteveer Columbia. „De navigatie verliep perfect“, zei projectleider Louis D'Amario. „We hadden het niet beter kunnen doen.“ In het vluchtcentrum in Pasadena heerste een feeststemming.

Het 173 kilo wegende robotvaartuig landde in de Gusevkrater, een op het zuidelijk halfrond van Mars gelegen laagvlakte. De Spirit werd bij de landing beschermd en afgeremd door een hiteschild, een parachute en afremraketten. Acht seconden voor de landing bleven bovendien een aantal reuzenairbags zich op rond de Spirit, die na enkele malen stuiteren tot stilstand kwam. De eerste negen dagen blijft de Spirit op de plek waar hij is neergekomen. Daarna gaat hij op z'n zes wieltjes op verkenning uit. De eerste foto's laten de horizon van de planeet zien en delen van de Spirit zelf. Tot nu toe waren twee van de



Op een van de eerste foto's die de op Mars gelande sonde Spirit nam, zijn een deel van het voertuig en de horizon van de planeet te zien. foto AFP/NASA

drie Marslandingen mislukt. De laatste poging van de NASA, in 1999, liep op een groot fiasco uit. De Polar Lander stortte toen als gevolg van een softwarefout te pletter op het oppervlak van de planeet. Een recente poging van de Europese ruimtevaartdienst ESA om de Beagle 2 een zachte landing op Mars te laten maken, is vermoedelijk ook mislukt. Sinds het moment van de geplande landing, eind vorig jaar, zijn er geen signalen meer opgevangen van de sonde, al blijft de ESA wel proberen het contact te herstellen.

De missie van de Spirit en zijn tweelingsondeste Opportunity, die later deze maand op Mars moet landen, kost 820 miljoen euro. Beide Marslanders gaan negentig dagen lang het gesteente op de koude en droge planeet onderzoeken op sporen van een warmer en vochtiger verleden. De ruimtevaartdiensten profiteren met hun missies naar Mars van het feit dat de planeet in 60.000 jaar niet zo dicht bij de aarde heeft gestaan. De afstand bedraagt momenteel zo'n 170,5 miljoen kilometer.

83254

DDL: 05-01-2004

21185

23116

NASA-Roboter auf dem Mars gelandet

Der amerikanische Mars-Roboter "Spirit" hat am frühen Morgen sein Ziel erreicht und ist erfolgreich gelandet.

Im Kontrollzentrum der US-Raumfahrtbehörde NASA brach Jubel aus, als das Signal kam, dass der Roboter geschützt durch seine Prallsäcke im Krater Gusev aufgeschlagen ist. Anschließend hüpfte "Spirit" wie ein Ball auf dem Marsboden umher.

Die NASA hofft nun, dass sie wieder Kontakt herstellen kann, wenn "Spirit" zur Ruhe kommt. Dann wird der Roboter sich langsam entfalten und seine Kameras ausfahren. Auf dem Mars soll er nach Spuren von Leben suchen.

83255

Internetpagina's NASA erg in trek

83256

PASADENA - De Marsverkenner Spirit was zondag enkele uren na zijn geslaagde landing op de Rode Planeet al hard op weg de grootste trekker van bezoekers van de webpagina's van de NASA te worden.

De Amerikaanse ruimtedienst registreerde in het etmaal waarin de landing plaatshad meer dan 109 miljoen hits op zijn homepage en aanverwante pagina's. Dit aantal was binnen zeventien uur na de landing al meer dan verdubbeld.

Spits:
06-01-2004



83257

Geslaagde afdaling Marslander NASA

PASADENA De Amerikaanse robotwagen Spirit is vanochtend om 6.35 uur geland op Mars. Na een korte radiostilte vindt er nu communicatie tussen de robotwagen en de aarde plaats. Dat is gemeld door de ruimtevaartorganisatie NASA.

Het is de tweede keer in korte tijd dat er een ruimtevaaruig op de Rode Planeet landt. Rond de kerst kwam de Beagle 2 daar neer. De ruimtevaartorganisatie ESA wacht echter nog altijd op een signaal van de Europese marslander.

Het is de bedoeling dat over drie weken een andere Amerikaanse ruimtewagen, de Opportunity, ook op Mars landt. Er wordt onderzocht of leven ooit mogelijk was.

83258

81185

23117

BBC : 04 JANUARI 2004.

US MISSION TOUCHES DOWN ON MARS.

A US space probe has landed on Mars to seek signs that the planet was once capable of supporting life. The six-wheeled rover Spirit parachuted on to the planet's surface at about 0435 GMT on Sunday. The rover sent back a radio signal shortly after touchdown which confirmed that it had survived the plunge through the Martian atmosphere. The six-minute descent was the final and most daunting leg of the seven-month voyage from Earth. In the past, two out of three attempts to land spacecraft on the Red Planet have failed. The European Space Agency is still searching for the missing British-built Beagle 2. The probe was supposed to land on Mars on Christmas Day but has not yet sent back a signal to confirm it has arrived safely. Such are the risks of landing on Mars that Nasa had installed a system on the rover to send back information about the descent. The landing sequence took the spacecraft from 19,000 km/h (12,000 mph) to a complete stop in six minutes. A series of tones picked up by telescopes on Earth signalled that the vehicle's parachute and landing airbags had deployed properly. Mission controllers at Nasa's Jet Propulsion Laboratory (JPL) in Pasadena, California, smiled and cheered as the news came in. After a nervous wait of about 20 minutes they received a radio signal from the rover confirming it was functioning after bouncing to a halt. Nasa chief Sean O'Keefe congratulated mission officials while scientists jumped up-and-down in jubilation. "This is a big night for Nasa - we are back!" he said. "I'm very, very proud of this team and we're on Mars. It's an absolutely incredible accomplishment." Spirit is one of a pair of rovers that will seek evidence for water on Mars. Its twin, Opportunity, will touch down on the other side of Mars in late January. The £545m rovers will roam the planet and examine rocks in a three-month mission to map out the history of water on Mars. Mission scientist Dr Steve Squyers, from Cornell University in New York said Spirit and Opportunity will act as robotic field geologists. "They look around with a stereo, colour camera and with an infrared instrument that can classify rock types from a distance," he said. "They go to the rocks that seem most interesting. When they get to one, they reach out with a robotic arm that has a handful of tools, a microscope, two instruments for identifying what the rock is made of, and a grinder for getting to a fresh, unweathered surface inside the rock." Spirit will explore the Gusev Crater, just south of the Martian equator, which may once have held a lake. Nasa officials said on Saturday that the rover was on course to land within a target zone 62 kilometres long by 3 kilometres wide. "The navigation status is truly excellent," said Dr Lou D'Amario, the mission's navigation team chief. The first picture of the landing site could be available within 24 hours of landing. "We could get part of a panorama this evening. There's nothing better," said Matthew Golombek of JPL. Spirit will spend a week or more scanning its surroundings and carrying out engineering checks. Then it will roll off its lander and start exploring the surface of Mars.

83259

2102
NOOS-10-20

83260



F1185

23118



FLORIDA TODAY : 04 JANUARI 2004.

WE'RE ON MARS / NASA REJOICES IN ROVER'S LANDING.

PASADENA - Jubilant scientists greeted signals from the Spirit rover with cheers, claps and embraces Saturday night after the lander rolled to a stop on Mars. The signals indicated Spirit survived a fiery, bouncy landing on Mars, where it's designed to spend three months journeying from rock to rock in what might be an ancient lakebed. "We're all ecstatic, absolutely ecstatic," said Matt Golombek, Mars landing-site scientist. "We have . . . signs of bouncing on the surface," descent manager Rob Manning said shortly after touchdown, prompting a round of applause and cheers. Then the signal dropped out for several minutes as the airbag-protected craft continued its roll, prompting a quiet tension in the Jet Propulsion Laboratory control room. Soon, however, strong signals were received by tracking stations on Earth, confirming the rover's survival. "We've done the hardest part," Golombek said. "The hardest part is landing safely, and we now have confirmation we've landed safely." Tones from the lander indicated it landed base-petal down, the ideal configuration for it to unfold its petals and solar arrays so it can roll off the lander after several days of checkups. "The solar-array deployment is critical. Assuming that goes well . . . we'll deploy the pan-cam mast assembly and start taking pictures of our landing site," said Chris Jones, director of planetary flight projects. Just after 12:30 a.m. today, NASA Administrator Sean O'Keefe poured champagne for the giddy mission team. "We're on Mars," O'Keefe said. The Mars team at the Jet Propulsion Laboratory ate Milky Way bars for good luck and watched anxiously as the rover went through the steps leading up to the automated landing. "It was pretty funny when they said 'We're go for landing,' 'cause there wasn't anything else you could do," Golombek said. The first communication from the lander was just the first step after its plunge into the Martian afternoon. After it performs its first critical tasks, it will undergo several days of checkups before exploring the landscape for evidence water once existed there. Spirit's landing ellipse was just 2 miles by almost 40 miles -- about the distance between Cocoa and the Orlando airport. It was to bounce on its airbags over as much as a mile inside Mars' 100-mile-wide Gusev Crater, which may have once held a lake. The next rover, Opportunity, lands in three weeks on the other side of the planet.

83261

83263

83262



23119

Fantastische Bilder vom Mars

Das Trauma vom 1. Februar 2003, als die Raumfähre „Columbia“ mit sieben Astronauten an Bord verglühte, ist überwunden.

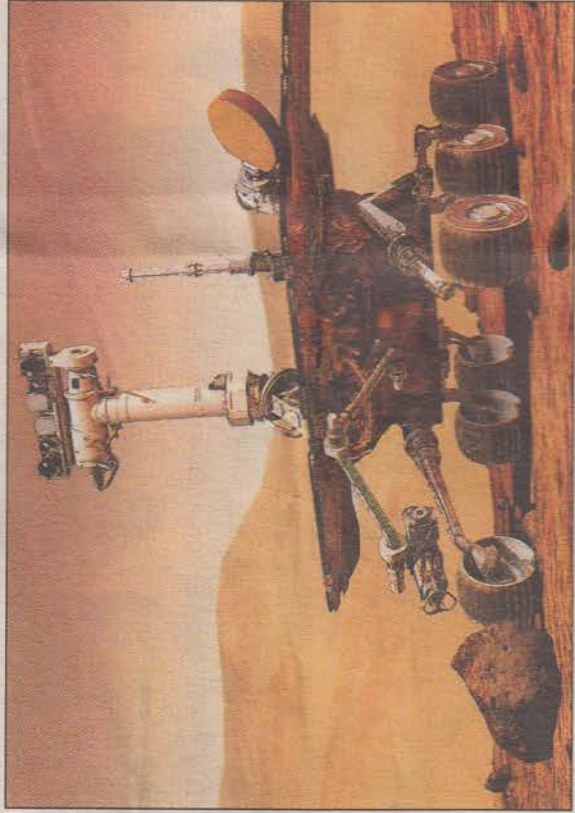
Die US-Raumfahrtbehörde NASA bejubelt die glückliche Landung ihrer Mars-Sonde „Spirit“.

PASADENA (ap). Im Wettbewerb der Mars-Forscher haben die Amerikaner die Nase vorn: Eineinhalb Wochen nach der Ankunft des bisher stumm gebliebenen Mars-Landergeräts „Beagle 2“ der europäischen Raumfahrtagentur ESA setzte in der Nacht zum Sonntag die NASA-Sonde „Spirit“ auf unserem Nachbarplaneten auf und sendete bereits mehr als 60 Fotos zur Erde.

„Die Bilder sind fantastisch“, freut sich der wissenschaftliche Projektleiter John Callas im kalifornischen Pasadena. Die Aufnahmen zeigen unter anderem den Marshorizont und Teile des Fahrzeugs. „Das ist eine großartige Nacht für die NASA – wir sind wieder da“, jubelte der Leiter der Raumfahrtbehörde, Sean O'Keefe, gestern mit Blick auf den Absturz der „Columbia“ am 1. Februar 2003, als alle sieben Astronauten an Bord ums Leben gekommen waren. „Das war eine perfekte Navigation“, freut sich auch Projektleiter Louis D'Amario. „Wir hätten es nicht besser machen können.“ Die Mitarbeiter der Bodenkontrolle in Pasadena brachen in Jubel aus und umarmten sich.

Landung im Gusev-Krater

Der 173 Kilogramm schwere Roboter landete weich im Gusev-Krater, einer in der Nähe vom Mars-Südpol gelegenen Vertiefung von der Größe Hessens. Gesichert und abgebremszt wurde die Landung mit einem Hitzeschild, einem Fallschirm und Bremsraketen. Acht Sekunden vor der Landung polsterten riesige Airbags das Aufsetzen ab. Die ersten neun Tage bleibt „Spirit“ an Ort und Stelle. Danach soll das Gefährt auf seinen sechs Rädern durch die Gegend rollen und Eindrücke sammeln. Kalt und tro-



Die Mars-Sonde „Spirit“ (oben dargestellt in einer Computer-Simulation) hat gestern bereits erste Bilder (Foto unten) zur Erde gesendet. Foto: ddp

cken ist die Oberfläche des Mars. „Spirit“ soll erkunden, ob es dort früher einmal Bedingungen gab, die Leben ermöglicht haben. Zuvor waren zwei von drei Marslanderversuchen gescheitert. Der letzte Anlauf der NASA schlug 1999 fehl, als der „Polar Lander“ wegen eines Softwarefehlers auf der Oberfläche des Mars zerschellte.

Das europäische Marslandergerät „Beagle 2“ wird in Pasadena inzwischen auch als offenkundig gescheitert betrachtet, weil seit dem Absetzen des Geräts vom Orbiter „Mars

Zu dem 820 Millionen Dollar teuren Projekt der NASA gehört auch die baugleiche Schwestersonde „Opportunity“, die am 24. Januar auf dem Mars landen soll. Dieser Rover soll ebenfalls 90 Tage im Mars-Gestein und in Bodenproben nach Hinweisen auf Wasser suchen. Mit den drei Landeprojekten wird der Umstand genutzt, dass der Mars seit 60 000 Jahren nie so nahe an der Erde war wie zuletzt. Die NASA will künftig etwa alle 26 Monate eine Sonde von der Erde zum Mars schicken – immer dann, wenn beide Planeten auf ihren Umlaufbahnen um die Sonne einander passieren.

„Das ist ein Juwel“

Neue Erkenntnisse über die Beschaffenheit der grundlegenden Bauteile des Sonnensystems erhoffen sich die Astronomen auch von der Sonde „Stardust“. Diese flog am Samstag durch die Gaswolke des Kometen Wild 2 und sammelte Staubpartikel ein. Dabei machte die Sonde auch 72 Fotos vom Kern des Kometen. „Wir haben erfolgreich Proben eines Kometen gesammelt und bringen sie jetzt nach Hause“, sagte der leitende Wissenschaftler der Mission, Don Brownlee. Vom ersten Foto, das auf der Erde eintraf, zeigte sich Brownlee begeistert. „Wir wussten sofort, das ist ein Juwel“, erklärte er.

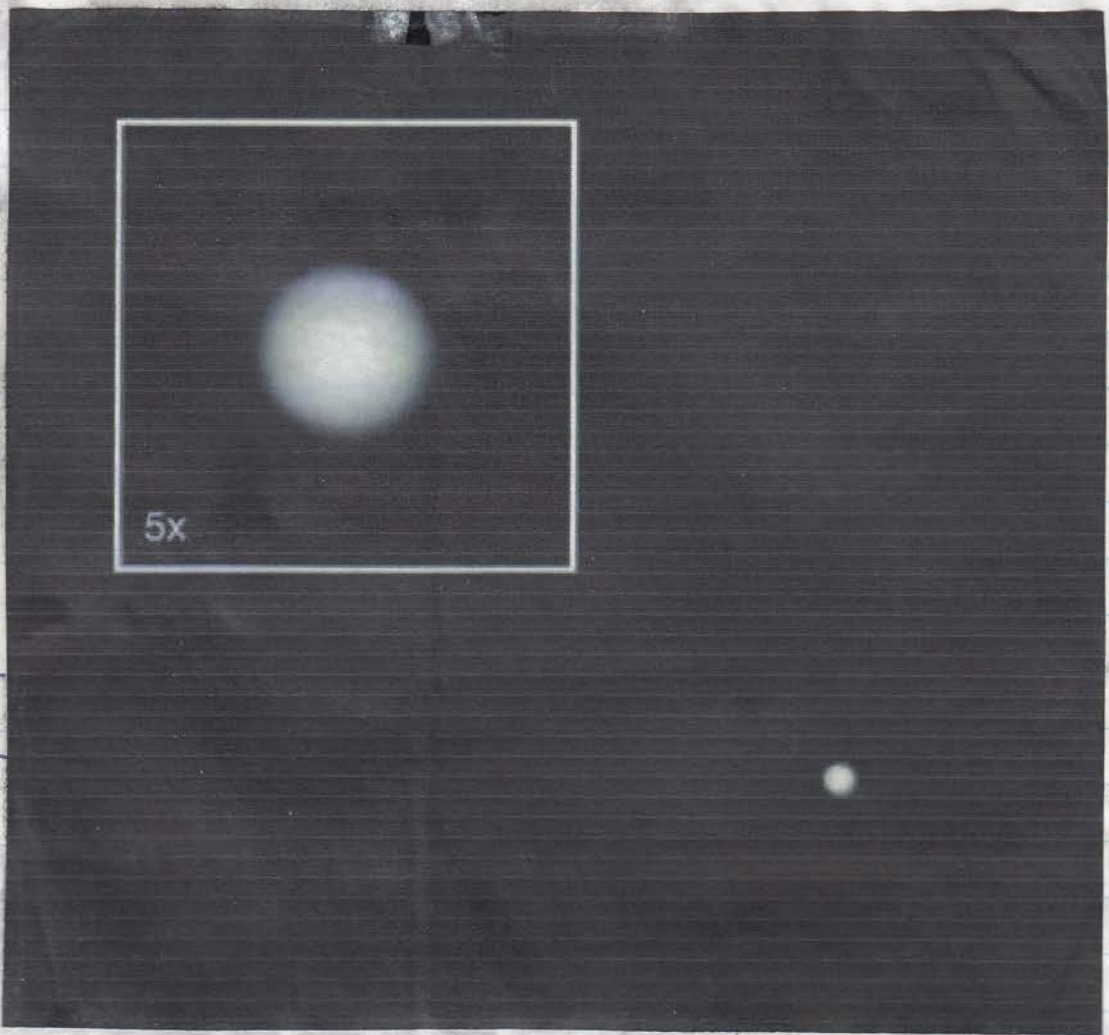
„Stardust“ soll im Januar 2006 wieder an der Erde vorbeifliegen und einen Behälter mit den gesammelten Staubproben über dem US-Staat Utah fallen lassen. Bei der Auswertung der Partikel soll die Hypothese überprüft werden, dass der Kometenstaub organische Moleküle enthalte, mit denen das Leben auf der Erde begann.



83264

Rheinische Post: 05-01-2004

83265



83266



83267

DE PLEK WAAR SPIRIT IS GELAND.

58155

23121

HOUSTON CHRONICLE : 04 JANUARI 2004.

SPIRIT ROVER LANDS ON MARS.

PASADENA - After a near seven-month journey from Earth, NASA's Spirit robotic rover bounded onto the rocky surface of Mars late Saturday, informing anxious space agency officials and scientists in early communications the spacecraft was down on target and preparing to widen the search for life on the Red Planet. The first signals confirming a successful descent reached the Jet Propulsion Laboratory, where NASA Administrator Sean O'Keefe and other top space agency officials were gathered for an all-night vigil, at 10:35 p.m., CST. It took the good news nearly 10 minutes to traverse the 106 million miles separating the Earth and Mars. "We see it; there it is," whooped one relieved member of the NASA flight control team. Slowed by parachute and its impact with the ground cushioned by two dozen inflatable air bags, the golf cart-sized spacecraft bounced into Gusev Crater, a 100-mile-wide bowl-shaped depression on the planet's southern equatorial belt. More than 3 billion years old and gouged from the terrain by an impact with a comet or an asteroid, the crater may once have been the site of a lake. If Spirit's studies of the basin's rock and soil mineralogy are confirmed, Mars may once have had a climate warm and wet enough for some form of life. With news the \$410 million mission was safely down, Spirit's flight control team embraced and cheered wildly. "It's a very exciting time," said Steve Squyres, the Cornell University astronomer who serves as the Spirit mission's chief scientist. "To have finally gotten to the planet is a wonderful feeling." A global network of radio telescopes along with a pair of NASA spacecraft already orbiting Mars were tuned to listen for a distinctive sequence of tones as well as more informative signals that would reveal success or failure. Experts were hopeful the earliest signals of the landing would be followed overnight by transmissions of post card images. "All of our team is anxiously anticipating what our new home on Mars looks like," said NASA's Jennifer Trosper, who leads the team of engineers that will take over supervision of Spirit's surface activities. Scientists plan to use the rover's high-powered cameras to carefully survey Spirit's surroundings in the coming days. Engineers will carefully activate the six-wheeled rover before commanding it to roll across the dusty alien landscape for the first time, a milestone that is probably at least eight to nine days away. Spirit is only the fourth spacecraft to safely reach the Martian surface in 13 attempts over three decades. Great Britain's diminutive Beagle 2 lander has not been heard from since its attempted landing late on Christmas Eve. On the eve of Spirit's arrival, the British team wished their American counterparts good fortune. Early this week, they plan a new round of attempts to make contact with Beagle 2 through the European Space Agency's recently arrived Mars Express orbiter. But the long silence could mean the English spacecraft has joined the long list of casualties. A twin NASA robotic rover, Opportunity, trails closely behind Spirit. Even subtle troubles successfully overcome by Spirit's flight control computer with the parachute and air bags dissent system could spell trouble for Opportunity, which is on course to reach Mars late on Jan. 24. In order to deal with the prospect, a team of NASA experts called the "reconstruction team" was poised to sift through Spirit's earliest communications with Earth for signs of potential trouble for the second mission. "One of NASA's prime goals is to search for life," said NASA's Ed Weiler, the agency's associate administrator for space science. "The (Spirit and Opportunity) missions are not searching for life per se, but they take a large step in that direction. This mission is not about geology. Its partially to show us whether life could have persisted on Mars because water persisted on the surface for long periods of time." Though Beagle 2's mission included efforts to look for chemical signatures of biological activity in the soil and air of Mars, NASA's strategy is to leave that to future missions after experts have identified the most promising landing sites to search for evidence of current or past biological activity and developed the technology required for pinpoint landings.

83268

ORLANDO SENTINEL : 04 JANUARI 2004.

SPIRIT FINALLY SITS ON MARS!

PASADENA - A NASA robot geologist named Spirit landed safely on Mars late Saturday to begin a landmark three-month mission that could reveal whether conditions favorable for life once existed there. To get there, the golf cart-sized rover survived what one official at the National Aeronautics and Space Administration dubbed "six minutes of hell" -- a fiery plunge through the planet's atmosphere, a parachute descent to 40 feet above the Martian surface, then a bouncing landing surrounded by two dozen impact-cushioning air bags. Two-thirds of humankind's previous missions to Mars had failed, and before landing, NASA officials were worried that an ill-timed gust of wind or a sharp rock could spell doom for Spirit as well. The tension heightened moments after Spirit's 11:35p.m. touchdown, when contact with the rover was lost. But after 15 or so minutes of gut-wrenching silence, cheering scientists at the Jet Propulsion Laboratory in Pasadena locked on signals from the probe at 11:52p.m., indicating Spirit was alive and well after landing in a crater just south of the Martian equator. "Finally!" an unidentified flight controller shouted as bedlam erupted in Mission Control. "We got it! Look at the data!" NASA Administrator Sean O'Keefe was among the celebrants. "This is a big night for NASA," he said before pouring champagne for program managers at a news conference. "We're back. I'm very, very proud of this team -- and we're on Mars." The successful landing wasn't the only good news: Initial indications were that Spirit had landed on its base, simplifying the process of lowering its air-bag-covered protective panels and beginning operations on the surface of Mars. Two hours after landing, Spirit already had begun taking panoramic photos of its landing site and transmitting them to Earth. The rover is scheduled to leave its base and begin roaming the Martian surface in a week or so after completing a series of engineering and science tasks. Spirit landed in the Gusev Crater, just south of the Martian equator. Scientists think an ancient asteroid or comet impact dug the depression, which appears to have once held a lake. Rocks and sediments deposited on the floor of the crater could contain evidence of whether liquid water persisted there. The other prerequisites for life as it exists on Earth already are known to be present on Mars. Scientists don't anticipate that Spirit will discover direct evidence of past Martian life. "There is nothing we expect to find that will be in any way a trace of life," said Steve Squyres, a Cornell University professor and principal researcher for the mission's science instruments. "This is not a fossil hunt. What we are really doing is trying to find the places where evidence of life might be preserved, so that when we can send much more sophisticated vehicles to return samples and bring them back to laboratories, we have the maximum chance of finding what we might be after." To do that, the six-wheeled Spirit rover will act as a field geologist, traveling up to 65 feet in a day to examine interesting-looking rocks seen in photos taken with onboard panoramic cameras. The 384-pound rover has navigation software and hazard-identification cameras that will allow it to autonomously make its way toward destinations identified by researchers on Earth. Spirit is equipped with an extendable arm that has spectrometers to determine the chemical composition of surface objects, a microscope and more. Data gleaned by those instruments could revolutionize knowledge of Mars. "With a vehicle like this, we are going to really be able to move around on the surface of another world in a significant way for the first time," Squyres said. "We can look off into the distance, see a hill, wonder what the view looks like from the top of that hill, then go there and find out... We can really explore in the sense that you and I would use that word."

83269

15185

23122

CNN: 05 JANUARI 2003

NEW ROVER SEES RED PLANET WITH 3D EYES.

PASADENA - On its first full day on Mars, a NASA craft beamed back a three-dimensional panorama of its new home, a tantalizing hint of the capacity of the most sophisticated eyes ever to scan the red planet surface. The \$400 million rover, expected to send back its first color postcards from Mars within a day, also comes equipped with an unprecedented array of scientific instruments, which could help determine whether the cold, desert world once was a warm, wet planet. Earlier Monday, the robotic explorer, named Spirit, locked in on Earth with its most powerful antenna for the first time, a crucial technical accomplishment that allows it to beam images and data directly home. After landing over the weekend, the machine had used the smallest of three antennae to relay brief messages via Martian satellites, but they can only be reached a few minutes a day, when the satellites zoom over the lander. Now the rover can hail the home planet, when it comes into view, without a middleman for hours at a stretch with its lollipop-like, high-gain antenna. "It gets you the critical information you need at the end of one Martian day and use it to plan the next day," planetary researcher Matt Golombek said. Golombek and others on the rover team have adopted a Mars schedule, coordinating their waking and sleeping patterns with Martian days, which are nearly 40 minutes longer than those on Earth. They have blacked out their windows to prevent sunlight from coming in. Some even sport watches that measure Mars time. "My cats are staying with my husband, so they get to stay on Earth time," quipped mission scientist Wendy Calvin. The rover, also trying to become accustomed to a strange new world, will need at least a week before it begins roaming around Gusev Crater, a nearly 100-milewide pockmark just south of the Martian equator. The golf cart-sized machine needs a chance to stretch, stand up and test its tools and wheels before NASA cuts its umbilical cord, a thick line that secures it to the landing platform, and turns it loose for its planned 90-day jaunt. "We have to cut that last cable. That's when the rover is really born," said Mark Adler, manager of the Spirit mission. In the meantime, mission engineers are poring over data to check Spirit's operational health. By all accounts, the robot ship made a nearly flawless landing late Saturday, far surpassing even the most optimistic predictions of precision to hit its landing target. But engineers were devoting much of Monday to checking one of two motors that moves the high-gain antenna. It proved slightly noisier than expected, but they consider the anomaly a minor one that won't affect the mission. Within hours of touchdown, Spirit beamed back black and white images from its new home, including a stunning panorama complete with a nearly setting sun and a possible cliff face along a depression or mini-crater inside Gusev crater. Dubbed "Sleepy Hollow," it may prove an irresistible draw for its Earth-bound drivers, should more data determine that it is within roaming range. But they maintain they will exercise restraint when selecting points of interest to visit, no matter how tantalizing. Steven Squyres, a Cornell University geologist in charge of the robot's instruments, speculated that the hollow contains fine-grained soil that could bog down Spirit's wheels. "I'm not sure that's not a rover trap," said Squyres, who will also manage the scientific payload on Spirit's identical twin, Opportunity, which will complete the seven-month, 300 million-mile trip to Mars in late January, landing on the opposite side of the planet. For the most part, the science team was ecstatic about the quality of the landing spot. There are plenty of rocks for interesting geologic fieldwork, but few or no boulders to block its path. And save for the "rover trap," most of the area appears swept clean of possibly troublesome dust. Spirit and Opportunity have considerably more mobility and capability than the most recent successful visitor to Mars. The 1997 NASA mission included the Pathfinder lander, which beamed back thousands of images, and Sojourner, a toy-sized test rover that scurried around the rocks and boulders littering the landing site. Each of the new rover, however, is built to explore nearly as much territory in several days as Sojourner covered in three months, about 100 yards. And each comes equipped with eight cameras that should provide stunning panoramas of the Martian surface, with resolutions so sharp they retain crisp detail when blown up to the size of a movie screen, according to NASA. Their microscopes, spectrometers and drills could unlock geologic secrets from billions of years ago, when scientists think the planet may have had conditions more suitable for life.

83270

83271

83272

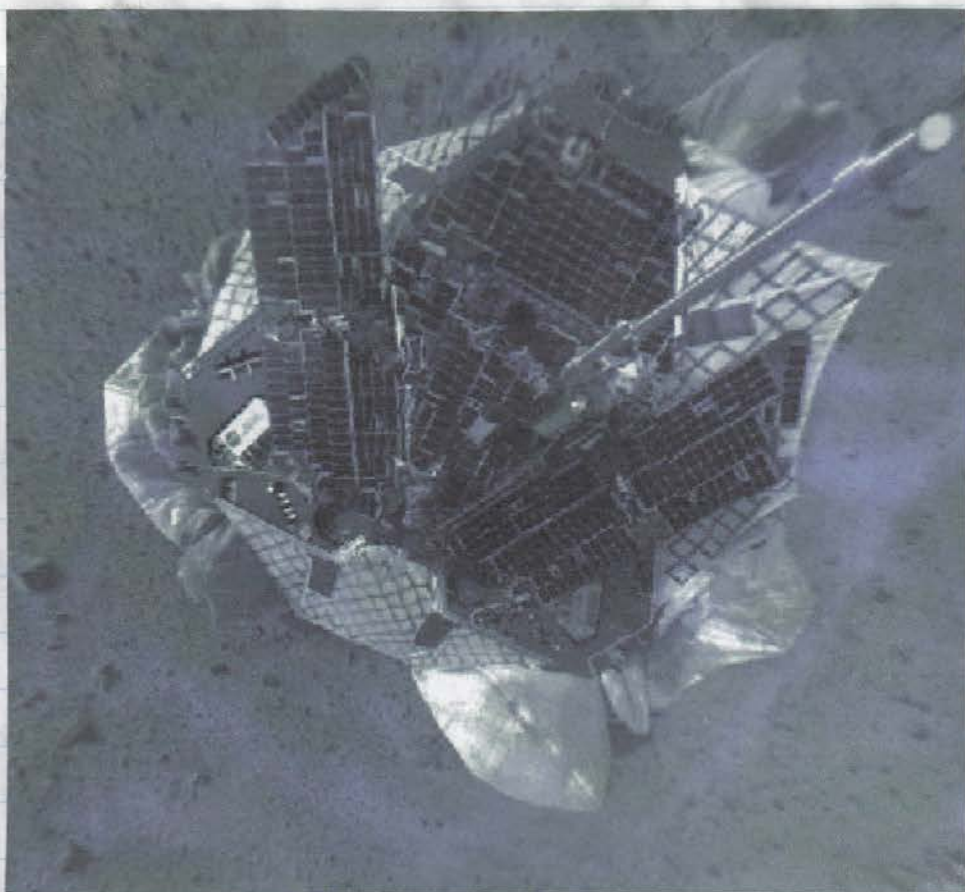


83273



5315H

23123



83274

83275

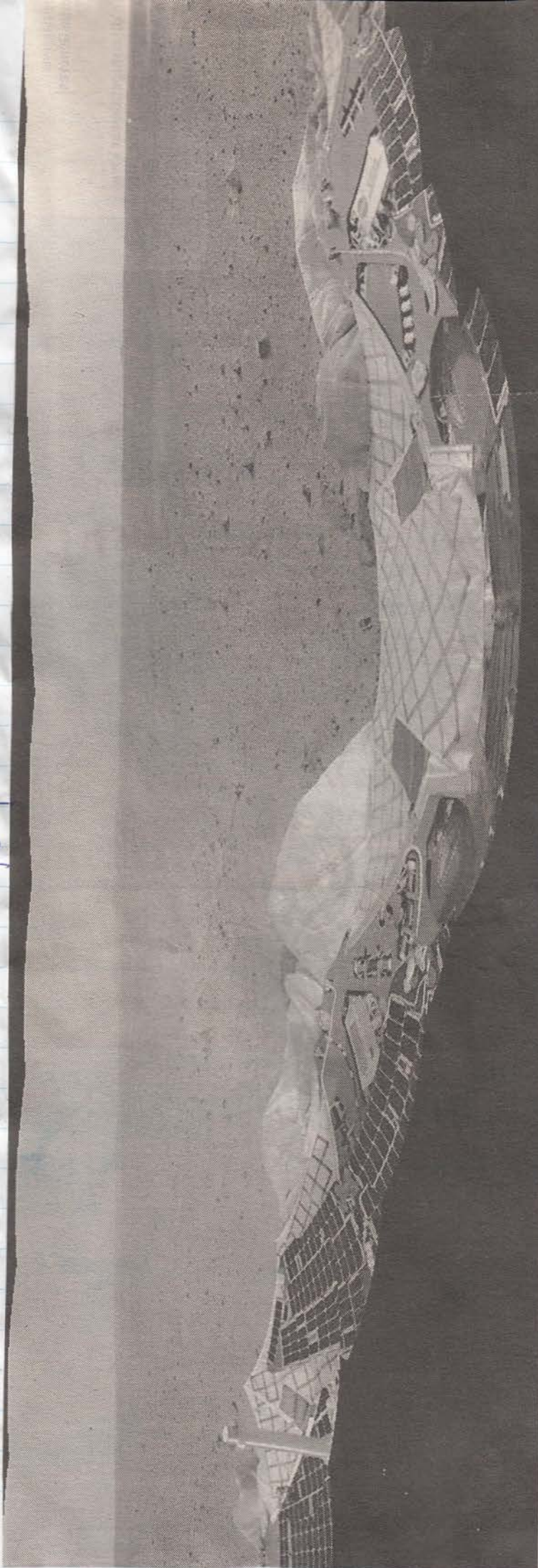


MARSA JUBA

85185

23124

83276



Beeld van Mars
Een panoramafoto van de planeet Mars. De plaat is gemaakt door de Amerikaanse ruimtesonde Spirit (waarvan een deel op de voorgrond is te zien), die

zondagochtend landde op de Rode Planeet. Na een reis van zeven maanden kwam de sonde neer in een grote krater, aldus de ruimtevaartorganisatie NASA. In de namiddag had de sonde al meer dan zestig foto's 'van uitstekende kwaliteit' naar de aarde gezonden, meldde NASA.

83578

838

Sonde Spirit zendt scherpe foto's van Marsoppervlak

Reuters, AP
PASADENA

De Amerikaanse ruimtesonde Spirit is in de nacht van zaterdag op zondag geland op Mars. Al kort na de landing stuurde het vaartuig tot grote opluchting van de ruimtevaartorganisatie NASA de eerste foto's door. De Spirit moet onderzoeken of er ooit leven mogelijk is geweest op de planeet.

83277

Dit is een geweldige nacht voor NASA', riep de leider van de ruimtevaartdienst, Sean O'Keefe, uit. 'We zijn er weer!' De veelgeplagde NASA kan een succes goed gebruiken, bijna een jaar na het verongelukken van het ruimteveer Columbia. 'De navigatie verliep perfect', zei projectleider Louis D'Amario. 'We hadden het niet beter kunnen doen.' In het vluchtcentrum in Pasadena (Californië) heerste een feeststemming.

Het 175 kilo wegende robotvoertuig landde in de Gusev-krater, een op het zuidelijk halfrond van Mars gelegen laagvlakte. De Spirit werd bij de landing beschermd en afgeremd door een parachute en remraketten. Acht seconden voor de landing bliezen

een aantal airbags zich op rond de Spirit, die na enkele malen stuiteren tot stilstand kwam.

De eerste negen dagen blijft de Spirit op de plek waar hij is neergekomen. Daarna gaat hij op z'n zes wieltes op verkenning uit. De eerste foto's laten de horizon van de planeet zien en delen van de Spirit zelf.

Tot nu toe waren twee van de drie Marslandingen mislukt. De laatste poging van de NASA, in 1999, liep op een fiasco uit. De Polar Lander stortte als gevolg van een softwarefout te pletter op het oppervlak van de planeet. Een recente poging van de Europese ruimtevaartorganisatie ESA om de Beagle 2 een zachte landing op Mars te laten maken, is vermoedelijk ook mislukt. Sinds het moment van de geplande landing, eind vorig jaar, zijn er geen signalen meer opgevangen van de sonde.

De missie van de Marslander en zijn tweelingsonde Opportunity, die later deze maand op Mars moet landen, kost 820 miljoen euro. Beide Marslanders gaan negentig dagen lang het gesteente op de koude en droge planeet onderzoeken op sporen van een warmer en vochtiger verleden.

83278

NRC Handelsblad:
05-01-2004

P107 107 RTL 4 zo 04 jan 08:58:54

rtl nieuws

83278

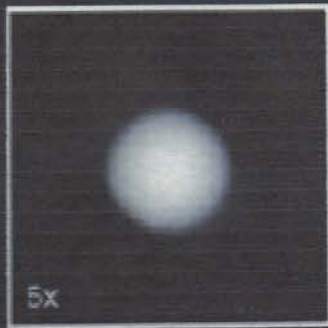
Amerikaanse Marsrobot veilig geland
De Amerikaanse Marssonde Spirit is geland op Mars en is nog heel. Dat heeft de ruimtevaartorganisatie NASA bekendgemaakt.

De robot zond na de landing, waarbij snelheden tot 20.000 kilometer per uur konden worden gehaald, een signaal uit dat betekent dat de apparatuur nog functioneert. De Spirit gaat op zoek naar sporen van water en leven op Mars.

De Europese Marslander Beagle 2, die op eerste kerstdag had moeten landen, heeft nog steeds geen signaal laten horen. Wetenschappers gaan ervan uit dat de sonde te pletter is geslagen.

23126

58152



Spirit finds the Sun from Mars

Pancam Solar Filter L8; Jan. 4, 2004
Mars Exploration Rover Mission

83279

CBS NEWS SPACE PLACE : 05 JANUARI 2004.

83280

SPIRIT'S HIGH-GAIN ANTENNA DUCCESSFULLY DEPLOYED.

In another major milestone, the Spirit Mars rover's high-gain antenna was successfully deployed Sunday night and aimed at Earth. A few minutes before 12:30 a.m. EST today, the first direct-to-Earth communications session over the high-data-rate antenna began, prompting a now-familiar round of cheers and applause in mission control at the Jet Propulsion Laboratory in Pasadena, Calif. The X-band antenna is critical for Spirit's mission. Flight controllers plan to beam commands directly to the high-gain antenna every morning to tell the rover what to do. Science data from the rover can be beamed back through the high-gain or through NASA's Mars Global Surveyor and Mars Odyssey orbiters. During the first communications session early today, engineers successfully established a two-way link, uplinking commands and downlinking science data, including more pictures that were stored in the rover's computer. A so-called "postcard" from Mars, a seven-frame color mosaic taken by Spirit's panoramic camera was expected to be downlinked later in the evening. If all goes well, the picture will be released during a news briefing at noon. In the meantime, more low-resolution black-and-white Navcam images were downlinked, a series of pictures that will be stitched together into a panorama to help engineers judge how Spirit's mostly collapsed landing airbags change shape as daily heating and cooling affects trapped gases. Engineers are trying to determine what, if anything, needs to be done to further retract sections of partially inflated airbags that might block one or more of Spirit's possible exit routes off the lander.

85185

23127

83281



P184 tt-TV1 184 zo 04 jan 09:09:12
ruimtevaart

RUIMTEJEEP SPIRIT IS MET SUCCES GELAND

De Amerikaanse ruimtejeep Spirit is zondagmorgen met succes geland op Mars. De Spirit is de eerste van twee identieke Marslanders van de Nasa, die deze maand op de rode planeet aankomen. In de eerste plaats moeten ze de bodem onderzoeken.

De Spirit zal nog negen dagen nodig hebben om uit zijn beschermde cocon te komen en aan zijn werk te beginnen.

De landing van de Spirit is het tweede succes voor de Nasa in twee dagen. Zaterdag slaagde een Amerikaanse ruimtesonde er voor het eerst in om stof van een komeet op te vangen. Van de Europese Beagle is ondertussen nog altijd niets vernomen.

Volgende Binnenland Economie Inhoud

83282

83283



FS 185

23128

SCIENTISTS EAGER TO EXAMINE GUSEV CRATER FOR WATER.

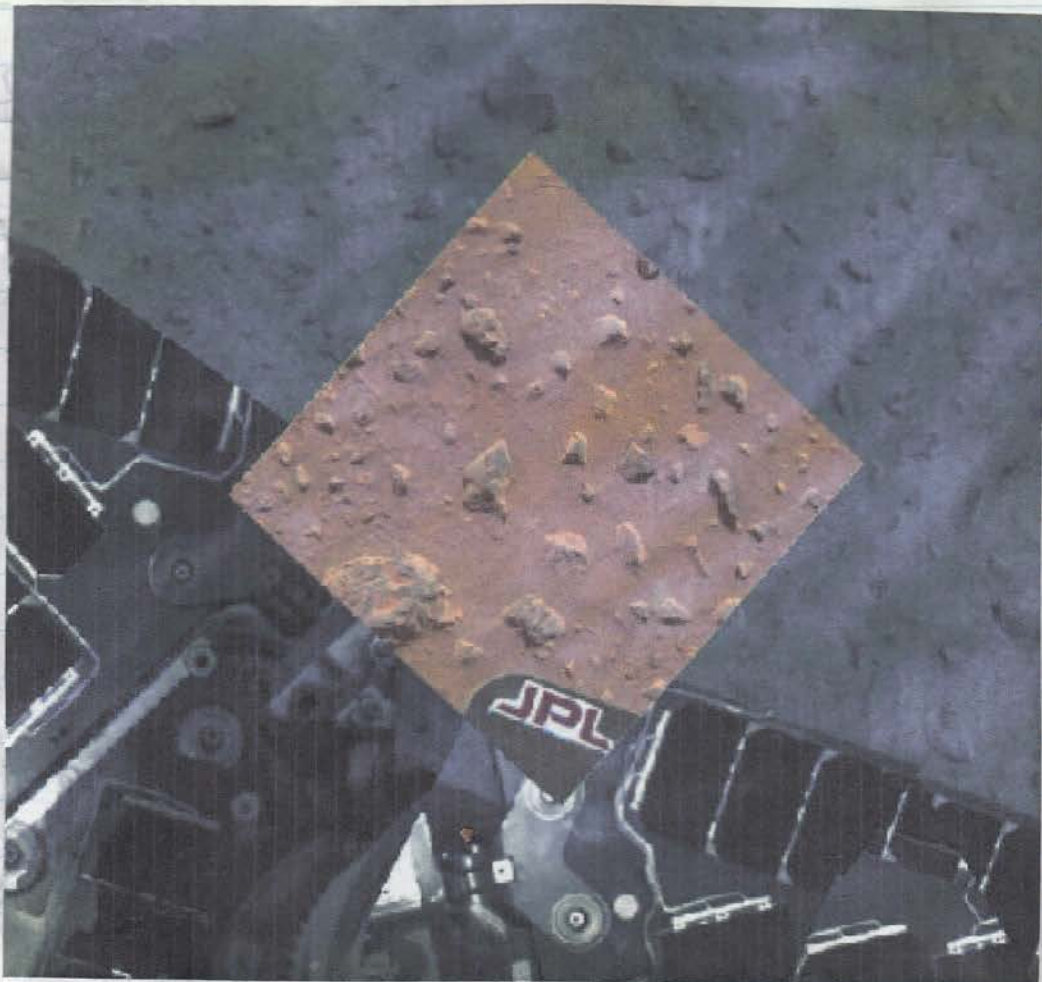
PASADENA - Scientists already are putting together a portrait of Spirit's new home in Mars' 100-mile-wide Gusev Crater. What they're finding is a site that, so far, fits their hypothesis: The crater, which strongly resembles an ancient lakebed, might have held water. "We couldn't have hoped for a better site," said Nathalie Cabrol, a planetary scientist at NASA Ames Research Center who was instrumental in getting Gusev on the rovers' itinerary. Cabrol said seeing the first picture of Gusev was like meeting someone she'd been corresponding with by mail for 15 years. "It got very emotional at that point," she said. She and other scientists are looking closely at the first pictures Spirit took. They already know a few things:

- Small, round depressions, possibly craters, are nearby.
- The landscape is criss-crossed by dust-devil tracks that, helpfully, have stripped dust away from the surface.
- The rocks are perfect for study and not big enough to stop the rover from driving through them.

"We have the rocks we wanted . . . right in front of us," Cabrol said, "and very tempting hills just far away enough, so that we know we can go there, because it's flat enough."

"I'm intrigued by how very flat it is," principal investigator Steve Squyres said. "That sort of looks like what you would expect a lake bed to look like. I'm intrigued by the rock distribution, the shortage of big boulders. . . . I'm intrigued by those holes in the ground and how they might provide us access to stuff underneath the surface." For now, the pictures raise more questions than they answer, Squyres said. The scientists will know a lot more when Spirit rolls off its lander and starts digging into the soil and rocks, probably in a week. Spirit landed about 6 miles away from the bull's-eye in its landing ellipse -- a shift that proved to be exactly the area where the science team wanted to go, Squyres said. The spacecraft shot three descent images on the way down. It quickly compared high-contrast elements in the images - in this case, a distinctive cluster of craters -- and fired small rockets to compensate for a drift caused by high winds. More helpful for the science team, the descent images, when compared with more expansive photos taken of the region by the orbiting Mars Global Surveyor, give them some geographical context for the landing site. For instance, the Surveyor image shows the area is streaked with dust-devil tracks. Dust devils on Mars strip away dust from the surface, leaving exposed areas that are more accessible to the rover. They also raise the intriguing possibility that Spirit might actually see afternoon dust devils as it drives around. "These things could do terrific atmospheric science as well," Squyres said of the rovers. "The dust devils have done us a favor by cleaning off our rocks for us, and I'd like to catch one in the act." One area where dust -- or at least a fine material -- seems evident is in the large depression front and left of the rover. The round hole seems to be filled with a soft material. "I don't know for sure it's not a rover trap," Squyres said. "And we're going to have to be a little bit cautious." The depression's lip suggests it might be an impact crater. Craters are appealing targets for the rovers, because when objects hit the surface, they kick up rocks. In effect, impacts do some of the digging, unearthing deeper, older material that could provide evidence of water. "It's the whole ball game in Gusev," Cabrol said, "because it's an old place, and it might be a lakebed . . . but the lakebed might be a hundred meters beneath our feet and covered by something else." Many of the rocks visible in the images could be material ejected from impacts, Cabrol and Squyres said. The landscape is very different from anything the Viking landers or the Pathfinder Sojourner saw, Cabrol said. "The distribution of rocks is very different from anything we've seen and, once again, is very consistent with a sedimentary basin," she said. "And the other thing that struck me is the sheer beauty of the place and the poetry of this place."

83284



83285

108

FEBS

531307

23129

NASA ROVER WAKES UP ON MARS.

PASADENA - The robotic explorer Spirit woke up to its first full day on Mars on Sunday, hours after making a perilous landing, sending postcards to Earth and taking a much deserved snooze. The \$400 million NASA craft, the first to land without disaster on the red planet since 1997, probably woke up around 5:30 p.m. ET Sunday. That was a few hours after Martian dawn, when the sun's rays juiced up its solar panels enough for it to wake itself up, according to the space agency. Just to make sure, mission controllers sent a transmission of the Beatles' tune "Good Morning, Good Morning" to perk up the rover, which probably will not speak for a few hours while it warms up, NASA said. The six-wheeled robot ship, crammed with high-tech cameras and geology instruments, is expected to begin roaming the surface in a week or so, after it has a chance to stretch, stand up and settle into its new environment. In the meantime, mission engineers pored over data Sunday to check Spirit's operational health. The rover by all accounts made a nearly flawless landing late Saturday, far surpassing even the most optimistic predictions of precision to hit its landing target in Gusev Crater. "Even some of the things that we were not sure about are working really well," said Brian Portock, a member of the navigation team at NASA's Jet Propulsion Laboratory in Pasadena. Earlier in the day, soon after confirmation of the late Saturday landing, NASA chief Sean O'Keefe poured champagne and toasted Spirit's handlers. "This is a big night for NASA. We're back," said O'Keefe, whose agency lost a Martian lander in 1999. Within hours of touchdown, Spirit beamed back images from its new home, stunning black and white snapshots that elicited excited shouts from mission controllers. Its mobile geologic studies are expected to last at least 90 days. It may send its first color images back Sunday night. The golf cart-size Spirit went through what NASA assistant administrator Ed Weiler characterized as "six minutes from hell" - the time it took to enter the Martian atmosphere, descend and land in Gusev Crater. During the descent, Spirit deployed parachutes and fired retrorockets to decelerate. Seconds before impact, it inflated a protective cocoon of airbags. Everything went as planned. "It went to perfection. I can't tell the difference between what was predicted and what actually happened," said Rob Manning, descent and landing manager at JPL. A series of bounces and rolls may have sent the robot up to four stories high and more than a mile from its landing spot, according to mission control scientists at JPL. The final stopping spot has elated mission researchers. "The rocks, to a great extent, look swept clean. It's a much cleaner surface than what we had a right to hope for," said Steven Squyres, a Cornell University geologist in charge of the scientific instruments on Spirit and its identical twin, Opportunity, which will complete the 300 million-mile trip to Mars in three weeks. "It's a very good surface for driving. It couldn't be better for what this vehicle is designed for," he said. Spirit launched June 10 and Opportunity took off July 7. Spirit and Opportunity have much more mobility and capability than the most recent successful visitor to Mars. The 1997 Pathfinder mission included a lander, which beamed back thousands of images, and Sojourner, a toy-sized test rover that scurried around the rocks and boulders littering the landing site. Each of the new rover twins, however, is built to explore nearly as much territory in one day as Sojourner covered in three months, about 100 yards. And each comes equipped with eight cameras that should provide stunning panoramas of the Martian surface, with resolutions so sharp they retain crisp detail when blown up to the size of a movie screen, according to NASA. Their microscopes, spectrometers and drills could unlock geologic secrets from billions of years ago, when scientists think the cold and dry planet may have been warm and wet enough to host life.

83286

FIRST COLOR IMAGES FROM THE MARS ROVER SPIRIT.

PASADENA - Scientists are having a "field day" on Mars, ogling a staggering new view of the Red Planet revealed through the camera eyes of NASA's Spirit rover. Sitting on its landing perch within Gusev Crater, Spirit used its Panoramic Camera to reveal the martian landscape to be a colorful, dazzling locale ripe for exploration. "It's spectacular," said Dr. Jim Bell, lead scientist for the camera. "But to really do it justice, you have to zoom in and explore all the incredible detail." The initial view, a mosaic of 12 separate pictures, released was taken from the front of the rover, said Bell. At 12 million pixels, the image and the rest that followed, are the highest resolution pictures ever obtained from Mars. It is a 45-degree field of view of the terrain in Gusev Crater. The color vista shows the surface to be a geological paradise, rich in rock and soil variations. Image details of the robot's neighborhood are of far greater clarity than photos taken previously by the Viking and Mars Pathfinder cameras. Scientists were elated at the quality of Spirit's camera-clicking job. The imagery was shown today at an early morning press briefing held here at the Jet Propulsion Laboratory (JPL). Early black and white pictures whetted the appetite of scientists, but the new sweeping color panorama will help chart exactly where the six-wheeled robot should first be sent. Prior to the press conference announcing the new images, the team received a telephone call from President George W. Bush congratulating them for their accomplishment. Yesterday into early morning, color views that were stored onboard the rover in its memory started to reach the gathered science and engineering teams here at JPL. That highly-prized imagery has come courtesy of Spirit's Panoramic Camera - also called the "PanCam" for short. This photographic hardware tops a tall mast built into the Spirit Rover. On this rotating and swiveling mast, two high-resolution color stereo cameras complement the rover's navigation cameras, as well as a Mini-Thermal Emission Spectrometer, or "Mini-TES". When Spirit begins wheeling about Mars, the camera system will be some 5 feet (1.5 meters) above the ground - providing a view similar to what a space-suited human might see standing on Mars. As expected, the rust color of the martian surface is apparent. Scientists are particularly keen to study in greater detail what has been called "Sleepy Hollow," a shallow depression in the Mars ground near NASA's Spirit rover. That feature may become an early destination when the rover drives off its lander platform in a week or so. More imagery and engineering data will continue to be fed to Earth in the days, weeks, and months to come. Engineers have now successfully tested "robot speak" through multiple communications links - relayed through both NASA's Mars Global Surveyor and Mars Odyssey, but also directly between Earth and Spirit. Traveling at the speed-of-light, the image and data transmissions take about 10 minutes to careen through the intervening space between Mars and Earth. Not only is that a good idea, "it's the law," said Steve Squyres, principal investigator for Spirit's science package from Cornell University.

83287



183288



83289

53135

23131

CNN : 06 JANUARI 2004

ROVER YIELDS HIGHEST RESOLUTION PIC EVER TAKEN OF MARS.

PASADENA - NASA unveiled a breathtaking color snapshot Tuesday of the surface of Mars shot by its Spirit rover using a camera with the robotic equivalent of 20/20 vision. The new color image is the sharpest photograph ever taken on the surface of Mars. NASA scientists called the picture a "postcard," sent across 169 million kilometers (105 million miles) of space to Earth from its Spirit rover. The image is actually a mosaic of 12 separate pictures shot by Spirit's high-resolution panoramic camera, or Pancam. It covers a 45-degree field of view of the terrain in Gusev Crater, where Spirit landed late Saturday. "Trenching into this stuff will be an absolute blast," Steven Squyres, the mission's main scientist, said while describing the image of smooth and angular rocks and soil near the rover landing site. The image is a taste of bigger and better pictures to come. The postcard makes up just one-eighth of a sweeping color panorama Spirit continues to shoot. It should be transmitted to Earth over the next week. After a flawless landing on the Red Planet, the rover has snapped images of a barren, rock-strewn landscape scientists hope will yield clues to whether Mars was once hospitable to life. NASA on Monday released a 3-D, black-and-white picture that provided a 360-degree look at the desolate, wind-swept plains of Mars' surface. "I feel like I'm at a bad, '50s B-movie," mission manager Matt Wallace after reporters were issued 3-D glasses to take in the image at NASA's Jet Propulsion Laboratory. Guided by the high-resolution image, NASA scientists selected the first target on Mars they want Spirit to explore: a dusty depression nicknamed "Sleepy Hollow" that lies about 12 meters (40 feet) from where the rover landed. They believe the nine-meter (30-foot) -diameter depression is a dust-filled impact crater, one of dozens that pock an otherwise flat landscape. "It's a window" to Mars' ancient past, said Squyres. The golf cart-size Spirit alighted on Mars in what scientists believe was a near-perfect landing with giant airbags as cushions. It marked NASA's first visit to the planet's surface since Pathfinder in 1997. The \$820 million unmanned project also includes a twin rover, Opportunity, set to land on the opposite side of Mars on January 24. Other missions to Mars have ended in spectacular failure, with some spacecraft crashing or blowing to pieces. Just one in three past attempts to land on the planet has succeeded. British scientists said Sunday they would keep trying to contact their probe, the Beagle 2, which was supposed to land on Mars on Christmas. The 3-D images also show a cluster of hills on the horizon, thought to be less than three kilometers (two miles) away. Over the next three months, Spirit will look for geologic evidence that Mars was once warmer, wetter and perhaps more conducive to life. Scientists continued to perform health checks on the rover. A science instrument to analyze minerals in rocks and soil had malfunctioned on the way to Mars but was found to be in perfect working order. There were a few minor concerns: The current in one of two motors that drive the rover's high-gain antenna was spiking intermittently, and dustier-than-expected conditions meant Spirit's solar panels were generating just 83 percent of the expected amount of power. Neither condition threatened the overall mission, NASA said. Scientists determined that two objects believed to be rocks partially blocking the ramp Spirit will use to roll down to the surface are actually bits of air bag. NASA planned to retract the air bags to clear the way.

83290

83291



NASA/JPL

23132

FLORIDA TODAY : 03 JANUARI 2004.

GLITCHES WILL DELAY ROVER'S TREK.

PASADENA - The Mars rover will wait a couple of extra days to roll off its lander while the mission team works through airbag and antenna glitches. Further tests on the high-gain antenna showed no more current spikes like one that occurred when it was deployed, mission manager Arthur Amador said Wednesday at NASA's Jet Propulsion Laboratory. "Everything came back clean as a whistle," he said. Meanwhile, engineers were slowly retracting airbags still sticking out from under the lander, said Art Thompson, the tactical uplink lead for the mission. They hope Spirit can roll straight off the front of the lander, though probably not until next Wednesday or later. "We really want nothing more than to get this puppy off the lander," Thompson said. The scientists are echoing that thought as they see more high-resolution photos taken by Spirit, the first of two rovers to land on Mars. Scientists' potential targets for Spirit will multiply when it completes its full-circle, high-resolution photo of the landing site in Gusev Crater, which could have been an ancient lake. "It's a pretty complex site," said Ray Arvidson, a geologist and deputy principal investigator for the mission. "It's not a simple lakebed." He proposed an ancient lakebed may have been covered with lava, cratered by impacts from space that threw out rocks, then at least partially covered with dust. Arvidson also suggested a patch of soil "crumpled" when the spacecraft's airbags dragged across it probably isn't that exotic and might be explained by similar processes on Earth. "We need our engineer buddies to get us off this lander and onto the surface," Arvidson said. At least we're on Mars. If anything brings that fact home, it's the new three-dimensional picture unveiled Wednesday, taken by Spirit's high-resolution, two-eyed panoramic camera. "We are getting these slow glimpses of the world around us at very high resolution," pan-cam chief Jim Bell said. Gazing at the Martian surface through goofy 3-D glasses, journalists and scientists at the Jet Propulsion Laboratory saw a highly detailed landscape that was almost palpable. It featured an undulating surface littered with rocks, stretching out to a horizon complete with hazy, distant hills. The 3-D images were greeted with a "Whoa!" from the mission team, Bell said.

83292

83293



23133

SPACE SHUTTLE COLUMBIA AND CREW MEMORIALIZED ON MARS.

NASA announced today that a plaque commemorating the Space Shuttle Columbia and her crew is attached to the back of the Mars rover Spirit's high-gain antenna. The Columbia was lost on re-entry into the Earth's atmosphere on Feb. 1, 2003. Spirit successfully landed on Mars Jan. 3. It will spend the next three months exploring the barren landscape to determine if Mars was ever watery and suitable to sustain life. "During this time of great joy for NASA, the Mars Exploration Rover team and the entire NASA family paused to remember our lost colleagues from the Columbia mission. To venture into space, into the unknown, is a calling heard by the bravest, most dedicated individuals," NASA Administrator Sean O'Keefe said in a written statement. O'Keefe also announced plans to name the landing site of the Mars Spirit rover in honor of the Columbia crew. The area in the vast flatland of the Gusev Crater where Spirit landed this weekend will be called the Columbia Memorial Station. The disc-shaped plaque was fitted to Spirit's antenna a few months before the craft was readied for booster liftoff from Cape Canaveral, Florida in June of last year. Spirit's twin, Opportunity, will reach Mars on Jan. 25 to begin a similar examination of a site on the opposite side of the planet. Since its historic landing, Spirit has been sending extraordinary images of its new surroundings on the red planet over the past few days. Among them, an image of the memorial plaque. NASA continues to target the period of Sept. 12 to Oct. 4 -- give or take a few days -- as to when the shuttle fleet returns to flight status and a mission to the International Space Station will be flown.

83294



83295

83296



33133

23134

NASA PRESS RELEASE: 06 JANUARI 2004

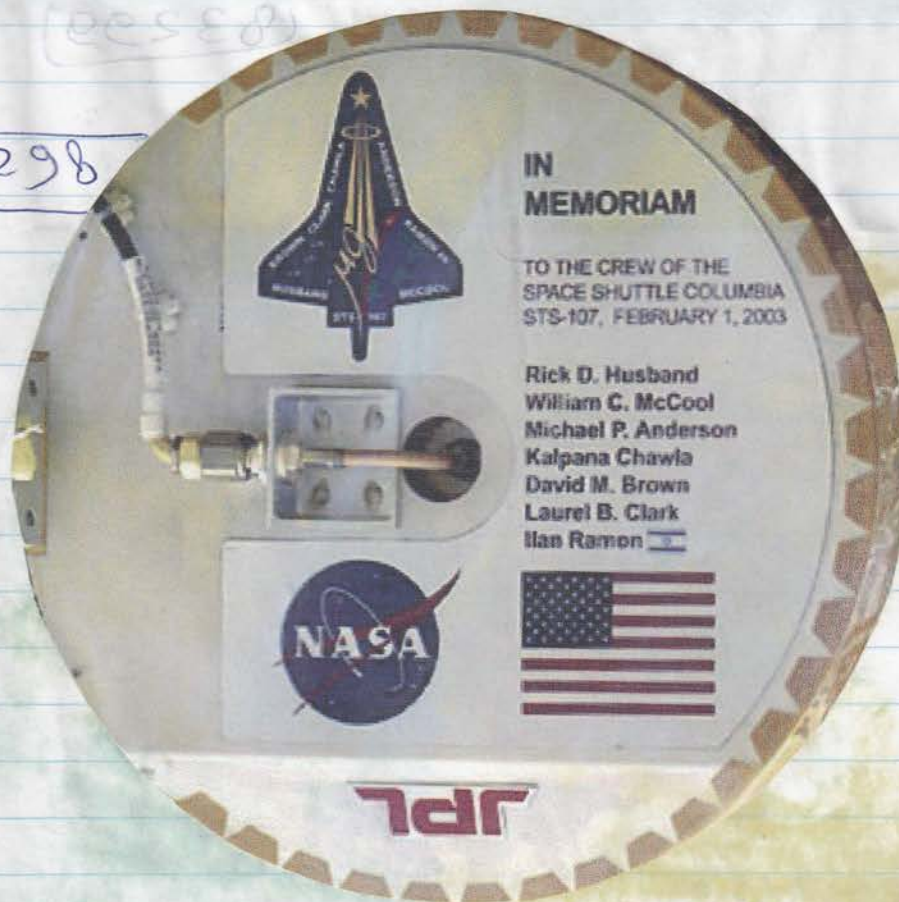
SPACE SHUTTLE COLUMBIA CREW MEMORIALIZED ON MARS.

NASA Administrator Sean O'Keefe today announced plans to name the landing site of the Mars Spirit Rover in honor of the astronauts who died in the tragic accident of the Space Shuttle Columbia in February. The area in the vast flatland of the Gusev Crater where Spirit landed this weekend will be called the Columbia Memorial Station. Since its historic landing, Spirit has been sending extraordinary images of its new surroundings on the red planet over the past few days. Among them, an image of a memorial plaque placed on the spacecraft to Columbia's astronauts and the STS-107 mission. The plaque is mounted on the back of Spirit's high-gain antenna, a disc-shaped tool used for communicating directly with Earth. The plaque is aluminum and approximately six inches in diameter. The memorial plaque was attached March 28, 2003, at the Payload Hazardous Servicing Facility at NASA's Kennedy Space Center, Fla. Chris Voorhees and Peter Illsley, Mars Exploration Rover engineers at NASA's Jet Propulsion Laboratory, Pasadena, Calif., designed the plaque. "During this time of great joy for NASA, the Mars Exploration Rover team and the entire NASA family paused to remember our lost colleagues from the Columbia mission. To venture into space, into the unknown, is a calling heard by the bravest, most dedicated individuals," said NASA Administrator Sean O'Keefe. "As team members gazed at Mars through Spirit's eyes, the Columbia memorial appeared in images returned to Earth, a fitting tribute to their own spirit and dedication. Spirit carries the dream of exploration the brave astronauts of Columbia held in their hearts." Spirit successfully landed on Mars Jan. 3. It will spend the next three months exploring the barren landscape to determine if Mars was ever watery and suitable to sustain life. Spirit's twin, Opportunity, will reach Mars on Jan. 25 to begin a similar examination of a site on the opposite side of the planet.

83297

(eess8)

83298



53136

23135

PHOTOS REVEAL STUNNING MARTIAN FEATURES / LANDING SITE NAMED IN HONOR OF COLUMBIA 7.

PASADENA - The highest-quality picture ever taken of the Martian surface reveals ruddy rocks sandblasted by the dusts of time and "alien textures" that are baffling scientists at NASA's Jet Propulsion Laboratory. The photo is just the first of many expected high-resolution color pictures taken by the Mars rover Spirit's panoramic camera. "This is it," said Jim Bell, who's in charge of the panoramic camera. One of its two eyes shot the view in front of the rover in about 20 minutes. "This is the day we've been waiting for." As it released the rover's first color picture Tuesday, NASA also named the landing site Columbia Memorial Station to honor the fallen shuttle crew. One of the most intriguing features of the pan-cam picture is next to Spirit's lander, where the lander's airbags dragged across the soil. The surface almost looks crumpled or folded, what camera chief Bell calls an alien texture and principal investigator Steve Squyres calls "bizarre." "This stuff is very cohesive," Squyres said. "It breaks away in pieces. And it's not like anything that I have ever seen before. It's very weird-looking stuff." The view extends to the distant horizon, where a hazy mesa-like feature tantalizes scientists. It's at least 12 miles away and unreachable, they think, since the rover travels just tens of yards a day. The rocks' distribution is quite different from what other Mars landers have seen, Squyres said. Some rocks have debris tails behind them, indicative of strong winds. There are small rocks and big ones. "I saw one out there that looked to me like it was close to the size of a Volkswagen," he said. Some rocks in the image, which reveals its true detail and beauty in close-up views of its individual features, show signs of years of weathering by Mars' potent dust storms. Their smooth surface could save the rover some time. It has a Rock Abrasion Tool designed to drill into rocks so the other instruments can study the pristine layer underneath the surface. "It looks to me like the windblown stuff that's been whacking up against these rocks for millions of years has acted like mother nature's Rock Abrasion Tool," Squyres said. There's still no way to determine the rocks' composition. Once the rover scans the rocks with an instrument that can see infrared radiation, scientists will get their first clues. Then they can drive closer to get intimate looks at the rocks, which may reveal evidence that water once existed in the landing site, Gusev Crater. The second rover, which lands in less than three weeks, also will look for signs of water on the other side of the planet. Spirit isn't expected to drive off its lander until early next week. Housekeeping and troubleshooting activities are continuing. The team planned to exercise the high-gain antenna to learn more about a current spike seen briefly when the antenna was elevated. It's also giving Spirit an afternoon siesta and reducing its communication sessions, because the rover is running a little hot. The temperatures should normalize when it rolls onto the cooler surface, mission manager Jennifer Trosper said. Spirit's ability to send information was aided when the data transmission rate was increased on Mars Odyssey, she said. It's one of two satellites that deliver data from Spirit to Earth, supplementing the rover's direct-to-Earth communications. The team also was giving orders to Spirit to further retract an airbag that is sticking out from under the lander. Pulling it back will give the rover a clear path to roll down to the surface. Also Tuesday, President Bush telephoned the Jet Propulsion Laboratory team and NASA Administrator Sean O'Keefe to offer congratulations. During the talk with the team at JPL, mission managers invited the president to visit the California center and "drive" the rover. White House spokesman Taylor Gross said the president did not take JPL up on its offer -- yet. "The president shares in the excitement of all Americans as we see the dramatic images from Spirit's new home and we know it is only a glimpse of the things to come as Spirit begins its historic trek." Gross said.

83299

83300

83588



83301



Spirit doet werk perfect

• De Amerikaanse ruimtesonde Spirit nam deze indrukwekkende foto van de Rode Planeet. Jennifer Trosper, mission manager voor oppervlakteonderzoek

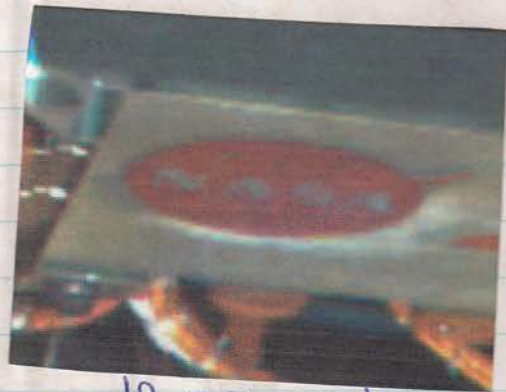


van de Marsverkenner, bekijkt in een laboratorium in het Californische Pasadena stereo-opnamen die de onderzoeksrobot gisteren maakte.

De Spirit is een vernieuwde versie van de robot Sojourner, die zeven jaar geleden als eerste over Mars reed. Het voertuigje, deels op de voorgrond te zien, is ongeveer zo groot als een koelkast en weegt 180 kilo.

Telegraaf: 06-01-2004.

83302



83303

83304



83305

23137

53138



FLORIDA TODAY : 07 JANUARI 2004.

83305

PHOTOS REVEAL STUNNING MARTIAN FEATURES.

PASADENA - The highest-quality picture ever taken of the Martian surface reveals ruddy rocks sandblasted by the dusts of time and "alien textures" that are baffling scientists at NASA's Jet Propulsion Laboratory. The photo is just the first of many expected high-resolution color pictures taken by the Mars rover Spirit's panoramic camera. "This is it," said Jim Bell, who's in charge of the panoramic camera. One of its two eyes shot the view in front of the rover in about 20 minutes. "This is the day we've been waiting for." As it released the rover's first color picture Tuesday, NASA also named the landing site Columbia Memorial Station to honor the fallen shuttle crew. One of the most intriguing features of the pan-cam picture is next to Spirit's lander, where the lander's airbags dragged across the soil. The surface almost looks crumpled or folded, what camera chief Bell calls an alien texture and principal investigator Steve Squyres calls "bizarre." "This stuff is very cohesive," Squyres said. "It breaks away in pieces. And it's not like anything that I have ever seen before. It's very weird-looking stuff." The view extends to the distant horizon, where a hazy mesa-like feature tantalizes scientists. It's at least 12 miles away and unreachable, they think, since the rover travels just tens of yards a day. The rocks' distribution is quite different from what other Mars landers have seen, Squyres said. Some rocks have debris tails behind them, indicative of strong winds. There are small rocks and big ones. "I saw one out there that looked to me like it was close to the size of a Volkswagen," he said. Some rocks in the image, which reveals its true detail and beauty in close-up views of its individual features, show signs of years of weathering by Mars' potent dust storms. Their smooth surface could save the rover some time. It has a Rock Abrasion Tool designed to drill into rocks so the other instruments can study the pristine layer underneath the surface. "It looks to me like the windblown stuff that's been whacking up against these rocks for millions of years has acted like mother nature's Rock Abrasion Tool," Squyres said. There's still no way to determine the rocks' composition. Once the rover scans the rocks with an instrument that can see infrared radiation, scientists will get their first clues. Then they can drive closer to get intimate looks at the rocks, which may reveal evidence that water once existed in the landing site, Gusev Crater. The second rover, which lands in less than three weeks, also will look for signs of water on the other side of the planet. Spirit isn't expected to drive off its lander until early next week. Housekeeping and troubleshooting activities are continuing. The team planned to exercise the high-gain antenna to learn more about a current spike seen briefly when the antenna was elevated. It's also giving Spirit an afternoon siesta and reducing its communication sessions, because the rover is running a little hot. The temperatures should normalize when it rolls onto the cooler surface, mission manager Jennifer Truesper said. Spirit's ability to send information was aided when the data transmission rate was increased on Mars Odyssey, she said. It's one of two satellites that deliver data from Spirit to Earth, supplementing the rover's direct-to-Earth communications. The team also was giving orders to Spirit to further retract an airbag that is sticking out from under the lander. Pulling it back will give the rover a clear path to roll down to the surface. Also Tuesday, President Bush telephoned the Jet Propulsion Laboratory team and NASA Administrator Sean O'Keefe to offer congratulations. During the talk with the team at JPL, mission managers invited the president to visit the California center and "drive" the rover. White House spokesman Taylor Gross said the president did not take JPL up on its offer -- yet. "The president shares in the excitement of all Americans as we see the dramatic images from Spirit's new home and we know it is only a glimpse of the things to come as Spirit begins its historic trek," Gross said.

83306



83308

83307

5137

23138



Eerste kleurenfoto Mars door Spirit

PASADENA, 7 JAN. De Amerikaanse robotverkener Spirit heeft gisteren voor het eerst een kleurenfoto van Mars gestuurd naar NASA's Jet Propulsion Laboratory in Pasadena, vanwaaruit de robot wordt be-

stuurd. Nooit eerder werd een foto met zo'n hoge resolutie vanaf een planeet naar de aarde gezonden. De Spirit is de eerste van twee verkenners die de NASA naar Mars stuurt.

83309

NRC Handelsblad:
07-01-2004

23139

Deutsche Wertarbeit auf dem Mars

83310

DÜSSELDORF. Es gibt sie also doch, die deutsche Spitzentechnologie. Nachdem das Land der Dichter und Denker bei der Autobahn-Maut technisch bisher kläglich gescheitert ist, nachdem der Transrapid in China statt bei uns zum Einsatz gekommen ist und die europäische Mars-Sonde „Beagle 2“ verschollen scheint, rettet nun ausgerechnet die amerikanische Mars-Erkundungsmission den Ruf der deutschen Wissenschaft: An Bord des NASA-Rovers „Spirit“ befinden sich nämlich mit dem Mößbauer-Spektrometer MIMOS II und dem Röntgen-Spektrometer APXS zwei handgroße, sensationell hochsensible Instrumente aus deutschen Laboren,

entwickelt und gebaut von den Forschern am Max-Planck-Institut und der Mainzer Johannes-Gutenberg-Universität. Sie sollen als Schnüffler fungieren, also Steine und Boden an der Oberfläche des Roten Planeten analysieren. „Wissenschaftlich betrachtet, senden sie dabei radioaktive Strahlung aus, die von der untersuchten Probe zurückgestreut werden“, erklärt Lutz Richter, der als Mitarbeiter am Deutschen Zentrum für Luft- und Raumfahrt an der Auswertung des Projekts beteiligt ist. „Mit Halbleiterdetektoren können dann chemische Elemente identifiziert werden.“

Etwas Vergleichbares haben die Amerikaner offenbar nicht zu bieten. „In der Öffentlichkeit ist das zwar

nicht so bekannt“, sagt Lutz Richter, „aber in der Planetenforschung gehören die Deutschen international zur Spitzenklasse“. Das zeigt auch die Besetzung des Gremiums, das die Expedition der NASA auf dem Mars wissenschaftlich begleitet: Zehn der fünfzig Forscher kommen aus der Bundesrepublik.

Vorerst müssen sich die deutschen Wissenschaftler allerdings mit Erfolgsmeldungen gedulden: Denn die Bewährungsprobe steht ihren High-Tech-Schnüfflern noch bevor. Bevor sie zum Einsatz kommen, muss der amerikanische Rover sicher die Landeplatte verlassen haben. „Vor nächster Woche werden wir wohl nicht mit der Arbeit anfangen“, sagt Lutz Richter. Danach geht es jedoch schnell. Morgens senden die Wissenschaftler erste Aufträge an den Rover, wenige Stunden später liefert er die gewünschten Daten. Richtig spannend wird es dann bei der Auswertung. Heute ist die Marsoberfläche knochentrocken.

Die Wissenschaftler hoffen dennoch, Belege dafür zu finden, dass es vor Millionen von Jahren Wasser auf dem Mars gegeben hat – „die geologische Struktur an den Landeplätzen legt das nahe“, sagt Richter. Doch sicher ist nichts.

Nicht mal Spirit. Denn der soll gestern leichte Probleme beim Übertragen von Fotos gehabt haben – deutsche Bauteile haben daran aber dem Vernehmen nach keine Schuld.

83311

Rheinische Post:

08-01-2004

SPACE.COM : 07 JANUARI 2004.

MARS ROVER'S TREK DELAYED DUE TO AIRBAG INTERFERENCE.

83312

PASADENA, Calif. — NASA's Spirit rover mission on Mars faces a little robotic cosmetic surgery today, a "lift and tuck" of a balky airbag that might impede the robot from rolling onto the surface of Gusev Crater. Engineers here at the Jet Propulsion Laboratory (JPL) are anxious to get the golf cart-sized rover off its landing platform. That event is now expected to take place in about a week, according to Art Thompson, Tactical Uplink Lead for the Mars Exploration (MER) Rover project. A step toward readying the six-wheeled robot — standing it up atop the lander platform — was put off from yesterday. Other priorities took precedence: Dealing with a high-gain antenna that appeared to have a slight mobility problem and checking out the health of a key science instrument, the Mini-Thermal Emission Spectrometer (Mini-TESS). Both are in excellent working order. "We want to get this puppy off the lander," said Thompson today during a morning press briefing. "Right now we're a lander-centric mission." "Our whole world is the lander we are sitting on," Thompson noted. Engineers for Spirit are dealing with a nagging airbag issue. One of the protective, balloon-like bags that cushioned the lander as it bounced across the martian surface might snag the solar arrays of Spirit as its egresses onto Mars. Spirit specialists plan an airbag adjustment today — a lifting of a lander petal, then tucking in the slightly-inflated airbag under the platform. "We're not stuck... but that's our first plan," Thompson said. "We're being cautious about this." If still a worry, engineers have other pathways to drive Spirit off its lander. Another slice of Mars was unveiled today, taken by Spirit's powerful Panoramic Camera (Pan Cam). Scientists are ecstatic about what they see. Gazing off into the distance, the Pan Cam has imaged a set of hills on the horizon, a little over a mile (2-kilometers) away. That's driving distance for Spirit, said Jim Bell, Payload Element Lead for the Pan Cam from Cornell University. As each day of images reaches scientists, where to drive Spirit becomes more a heated debate. "We'll keep our minds open," Bell said, about where to steer Spirit for the best science. "We're ready to go," said Ray Arvidson, Deputy Principal Investigator from Washington University in St. Louis, Missouri. "We need our engineer buddies to get us off this lander and onto the surface." Arvidson said that Gusev Crater remains an enigma. The scene that scientists see at Gusev "is familiar... but a little bit alien," Arvidson said, compared to earlier Viking and Mars Pathfinder landing sites. He described it as a classic "desert pavement," but determining the layering of dust, rock, lakebed materials, and lava at the landing site is work still to do. "It's a pretty complex site. It's not a simple lakebed," Arvidson said. While the dock is ticking in getting Spirit off its stationary pedestal, another countdown is on — the arrival of Opportunity. It is screaming toward Mars, and headed for a landing site on the other side of the planet from Gusev Crater. Opportunity is now set for touchdown on January 24 at about 9:05 p.m. Pacific Standard Time. "Mars has dealt us a complicated hand," said Joy Crisp, Project Scientist for the MER mission here at JPL. Airborne particles kicked up by a raging, but now diminishing dust storm on Mars, has dealt spacecraft engineers some issues. Spirit's entry, descent, and landing showed that the upper-atmosphere and high-altitude winds of Mars can be troublesome. Engineers are now debating such items as angle of entry, parachute deployment times, and other variables for Opportunity's plunge toward the red planet, Crisp told SPACE.com. Opportunity is targeted to land at Meridiani Planum, a region containing exposed deposits of a mineral — hematite — that usually forms under watery conditions. NASA's Mars Global Surveyor (MGS) is profiling the atmosphere over the Meridiani Planum landing zone. MGS is one of three orbiters — two U.S. and the newly arrived European Space Agency's Mars Express — now circling the red planet. MGS atmospheric data is being pipelined into decision-making and debate this week about Opportunity's upcoming dive to Mars. Density and temperature structure of the atmosphere has been made all the more complex by the recent dust storm, Joy said. "As this point, I'm absolutely ecstatic about the performance of Spirit," said David Lavery, NASA's Program Executive for Solar System Exploration, charged with full-time responsibility for working the Mars Exploration Rover project. "The anticipation of what's to come is the only thing gnawing at me a little bit. I'm excited about getting six wheels dirty and that's what I'm after," Lavery said. Missions of the past, Lavery said, Viking, the Mars Pathfinder/Sojourner, and now the dual robots — Spirit and Opportunity — each has created a foundation for things to come. "A 100 years from now, I think the most thrilling thing will be people standing on Mars who can go to these sites and look at them as truly historical sites of interest... the stepping stones for the exploration of Mars," Lavery told SPACE.com.

Pos

23140

SPACE.COM : 09 JANUARI 2004.

SPIRIT LANDING DATA EVALUATED FOR OPPORTUNITY.

PASADENA - Teams of engineers are reconstructing the entry, descent, and landing of Spirit on Mars, piecing together how well the spacecraft behaved as it plummeted through the martian atmosphere onto the surface of the red planet. Early assessments suggest that Spirit plowed through strong gusts of winds, so much so, that special onboard gear was triggered to assure the spacecraft safely survived the ordeal. Despite the harrowing plunge through turbulent air, Spirit's airbag touchdown was less severe than that experienced by the Mars Pathfinder/Sojourner rover in 1997. That mission also made use of an airbag landing system. Secure in its cocoon of airbags, Spirit's first impact shot it up into the air some 26 feet (8 meters), followed by some two dozen bounces and skips before coming to rest on the martian surface. Here at the Jet Propulsion Laboratory (JPL), a major reconstruction effort is underway to stitch together engineering data about Spirit's successful touchdown. Lessons learned are being filtered into decisions regarding the upcoming landing attempt by Spirit's twin craft, Opportunity. Opportunity is now speeding toward Mars, headed for a January 24 touchdown at roughly 9:05 p.m. Pacific Standard Time. "We are going to do a full-up reconstruction," said Pete Theisinger, Project Manager for the Mars Exploration Rover (MER) project. A team of engineers, as well as independent reviewers are part of the effort. Putting aside years of testing pre-launch, the only real "end-to-end" appraisal of the technology came during Spirit's actual entry, descent, and landing on Mars. "We will be basically comparing our expectations for what we thought might happen...and all these observables to what really happened," Theisinger told SPACE.com. Now being assessed are computer software changes that alter parachute deployment time and other parameters to maximize Opportunity's chances of success. But there is also trepidation of altering too many things that could snowball into a bad day. The Mars Exploration Rover (MER) design has new tools, absent on the Mars Pathfinder/Sojourner that landed on the red planet in 1997. Adding this equipment was hotly debated in engineering circles as to its need. The hardware was specially designed to avoid excessive horizontal speed caused by strong winds as the spacecraft raced toward ground impact. Innovations carried by Spirit and Opportunity include a set of three small transverse rockets mounted on the spacecraft's backshell that can be fired in any combination. Doing so reduces horizontal velocity or counteracts effects of side-to-side swinging of the landing system as it nears Mars' surface. Also carried for the first time was the Descent Imager Motion Estimation System (DIMES) - a downward-looking camera mounted on the lander. Once onboard radar senses the surface, this camera dutifully takes three pictures of the ground about four seconds apart. It then rapidly analyzes them to estimate the spacecraft's horizontal velocity. Looks at Spirit data has confirmed that DIMES worked like a champ, triggering rockets to dampen wind effects that were unexpectedly strong. A point of discussion is whether or not Spirit survived thanks to use of the DIMES/rocket activation or despite the system. "There is an entire story just on the reconstruction alone...a lot of fascinating stuff," said Gentry Lee, Chief Engineer for the Mars program at JPL. Meetings about the entry, descent, and landing data are held every day for hours, with engineers and managers arguing about what the data means. "There are some unexplained occurrences. We're trying to extract the information and see how it applies to Opportunity," Lee told SPACE.com. "We have loads of quality data. This is a job of analyzing and synthesizing an enormous amount of data in a very short period of time," Lee said.

83313

FLORIDA TODAY : 09 JANUARI 2004.

ROVER PREPARES TO ROLL OFF LANDER.

PASADENA - The Mars rover Spirit has acquired its full "mission success panorama," but only part of the large color image has reached the ground so far. The photo will be downloaded to Earth in pieces over the next few days. In the meantime, the mission team at the Jet Propulsion Laboratory on Thursday released another high-resolution color picture that looks north, out the rear of the lander, toward what the scientists call Sleepy Hollow. "You'll be able to keep zooming and zooming in on it," panoramic camera chief Jim Bell said. It shows more rocks, dune-like features and what may be marks caused by the spacecraft's airbags as it bounced and rolled to a stop. In the photo, the horizon is at a tilt because the lander is tilted, after its unsuccessful attempt to lift one corner and tuck in a puffed-up airbag protruding from under its base. Now, the team hopes to retract the last airbags so it can roll off the front of the lander. If the latest attempts at pulling them in does not work, it can roll off one of the sides of the lander, mission manager Matt Wallace said. More maneuvers with the petals of the lander, which unfolded after landing to reveal the rover, could lead to a further delay in Spirit's rolloff, he said. Rolloff is tentatively scheduled for Wednesday. "Our focus here is on making sure we do the right thing," Wallace said. While the scientists say they are "patient but eager" to roll off and start exploring, "the engineering corollary to that was 'brave but not stupid,'" he said. The six-wheeled NASA rover is beginning its work to stand up, unfurl its front wheels, settle to the deck of the lander and deploy the rear wheels. That process takes a few days. The goal of Spirit and its twin rover, Opportunity, which lands in more than two weeks, is to examine rocks on Mars for evidence they formed in the presence of water. If so, Mars might have sustained life when it was a wetter place.

83314

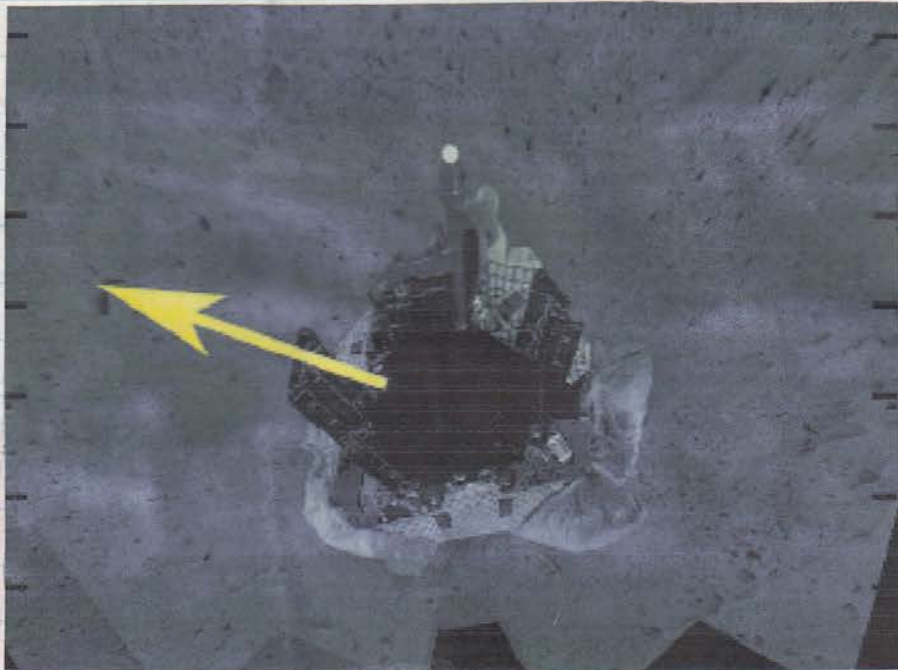
23141

AP NEWS : 09 JANUARI 2004.

NEW EXIT ROUTE PLANNED FOR SPIRIT ROVER.

PASADENA - The Spirit rover's path to the surface of Mars remains blocked by airbags and it will have to turn and use a secondary ramp, but while still parked it has revealed the presence of minerals that may have formed in a lake believed to have once filled the landing site, NASA said Friday. The first indications of the geologic makeup of Spirit's surroundings could support theories that liquid water persisted on the surface of the planet during its ancient past, providing an environment conducive to life. Scientists stressed that finding the minerals, called carbonates, does not immediately prove the lake theory. Instead, the carbonate dust could have formed through interactions with the tiny amounts of water vapor found in the martian atmosphere. Scientists continue to debate the various working hypotheses. "We've got a bunch of ideas and we don't know which one is right yet," said Steven Squyres, of Cornell University, and the mission's main scientist. Another NASA spacecraft previously has spotted carbonates from orbit as well. Spirit remained parked on its lander, nearly a week after safely arriving on Mars. Engineers said the six-wheeled robot won't roll off the lander and onto Mars until late Jan. 15 or early Jan. 16 at the earliest. A last-ditch effort failed to draw in two sections of the air bags that cushioned Spirit's landing. The sections of tough fabric still block the safest path the rover could follow to the surface. Engineers will now command Spirit to turn in place 120 degrees to its right and roll off a secondary, unobstructed ramp, said Matt Wallace, mission manager. While immobile, Spirit has continued to carry out science work, including snapping a sweeping panorama of its surroundings with its color camera. NASA has received 73 percent of that 360-degree view as the rest trickles in, said Albert Haldemann, deputy project scientist. Spirit also has begun measuring the temperature and makeup of the rocks and soil around it with its mini-thermal emission spectrometer. The instrument sees infrared radiation - heat - emitted by objects, including rocks and soil. It can measure that radiation in 167 different "colors," information that scientists use to deduce the mineralogical composition of what Spirit sees. Determining what the rocks and soil are made of opens up the martian geological history book they contain, and allows scientists to begin in earnest the job of picking targets they want Spirit to examine up close, once it rolls off its lander. On Friday, scientists displayed the first of that data, showing off psychedelically colored views of the surface of Mars. The rover also completed the first step in standing up to its full height, unfolding its two front wheels and locking them into place. The \$820 million Mars Exploration Rover project includes a second, identical rover named Opportunity, which is expected to land on the Red Planet on Jan. 24. NASA sent the two robotic geologists to prospect for evidence that Mars may have been a wet world conducive to life in its ancient past.

183315



83316

SPIRIT

83317

SPACE.COM : 10 JANUARI 2004.

SPIRIT READY TO HIT THE ROAD.

PASADENA - The Spirit rover has finished its final unfolding on the surface of Mars, with engineers here at the Jet Propulsion Laboratory (JPL) now targeting a late Tuesday night roll off of the robot onto the surface of Mars. "All six wheels are in final position and ready to drive...so it's a very big day for the Spirit Rover," said Jennifer Trosper, JPL Mission Manager for the Mars Exploration Rover mission during a Saturday morning press briefing. In a multi-phased bit of "robotic origami" -- the ancient art of paper folding -- Spirit has turned itself from a lander into a rover, said Chris Voorhees, Mechanical Systems Engineer at JPL. Voorhees said the Spirit rover is now standing atop the lander platform, supporting itself. "She's asleep right now...and resting on all sixes," he said. Set-me-free agenda There are still some tense moments yet to come. The rover is still attached to the lander. Tomorrow the middle wheels of the rover are to be unlocked and ready to roll -- the second to last release item on a set-me-free agenda for the robot. Also on tap is first-time movement of Spirit's instrument deployment arm. The following day the final cable will be cut that attaches the rover to the lander. Engineers here are simulating the roll off of the lander. Spirit will also be repositioned atop the lander deck, in a set of moves that align the rover to the expected egress direction. Make-or-break days ahead The upcoming two days are make-or-break for final release of Spirit. "Because of all the pyrotechnic firings and cable cutters that have happened so well already, we're not concerned," Trosper told SPACE.com. "So far they've all worked like a champ." Given the unlocking of the mid-wheels tomorrow, there is one remaining action item. A rear cable attached to the back of the rover must be severed. "And that's it. Then we're loose...ready to roll," Trosper said. Mark Lemmon, science team member for the Mars rovers at Texas A&M University, has begun analyzing the pervasive atmospheric dust at Gusev Crater. Dust falling on the Spirit's solar panels is being carefully watched, he said. Falling particles of dust covering the robot's solar cells cuts decreases the amount of energy they produce. So far, power levels for the rover are well within margin. Like a foggy day here on Earth, there are good days and bad for clear air on Mars. "We hope and expect it'll clear out a little bit as time goes by," Lemmon explained. Lemmon is on the lookout for dust devils -- swirls of dust that are known to crisscross Gusev Crater. None have been caught in action as yet. Matt Golombek said he was quite pleased that early geological interpretations of the Gusev Crater site where Spirit now rests proved correct. He said the key three words for any touchdown spot of Mars is "safety, safety, safety." It doesn't matter how good you think the science is going to be where you land if you don't land safely," Golombek added. Golombek is particularly hopeful that the rover can make a long-distance traverse to several nearby hills. "Many of us would be very excited about giving it a try," he said, but a "spirited debate" is underway about such a plan. The geologic bonanza that awaits there would be highly prized by Spirit scientists. Now speeding toward the red planet is Opportunity, the second robot in NASA's two-part Mars Exploration Rover effort. It will land at Meridiani Planum, halfway around the planet from where Spirit is exploring. Golombek said that forecasts about Gusev's terrain bode well in figuring out what awaits Opportunity at Meridiani Planum. "We predicted that this site...will look completely different from any of the four landing sites that we have landed on," Golombek noted. That targeted zone is expected to contain very little dust, and also be a grayish, rolling terrain, he said. We'll see if those predictions are right," Golombek said.

83318

FLORIDA TODAY : 10 JANUARI 2004.

83319

MARS ROVER READY TO ROLL MID-WEEK.

PASADENA - The Spirit rover may roll off its lander earlier than expected, because the mission team can make faster decisions thanks to extra information coming down from Mars. The team at NASA's Jet Propulsion Laboratory is hoping to move the rover onto the Martian surface late Tuesday night or early Wednesday. In addition to using direct-to-Earth communications, the team has been able to get an extra data dump from the orbiting Mars Odyssey to speed up its decisions, mission manager Jennifer Trosper said Saturday. "We did that today and got an unbelievable amount of activity done today," she said. When the rover bounced to a stop, airbags cushioned it. Then the lander's petals unfolded, revealing the rover inside. Now the rover has unfolded its front and rear wheels, lowered itself and was about to deploy its middle wheels. "Spirit has performed a reverse robotic origami," mechanical systems engineer Chris Voorhees said. The team was poised to cut the last cable connecting Spirit to its lander. "As soon as we cut the final cable, the lander becomes space debris," Trosper said. Because the airbags protruding from the front of the lander were too puffy, the rover will make a hard right turn Monday night to prepare it for rolloff. When it rolls, it will travel about 2 feet down a metal-framed fabric ramp, until all six wheels are on the Martian surface. It will drop about half the height of its nearly 10-inch-tall wheels. "This is not a height that really concerns us," Trosper said. Then it will stop and check out its instrumented arm. It is expected to look at soil and a rock, if one is at hand. Its initial tryout could take a few days.

HH185

23143

ANALYSIS : ROVER BOUNCED 24 TIMES.

PASADENA - That's the way the Mars rover bounces. Early analysis of Spirit's landing reveals it bounced 24 times on its airbags and rolled to a stop on its side, not its base petal as first thought, descent manager Rob Manning said. Its tilt was one reason there was an uncomfortable silence from the rover after it stopped on the surface. First it tried to send a signal from its low-gain antenna, which was pointed away from Earth. Then it sent a signal out the base petal, and that's what made the team rejoice. "Those were the strong tones that we heard after we landed," Manning said. Analysis of the landing in Gusev Crater will help the Jet Propulsion Laboratory team manage the entry of twin rover Opportunity in two weeks, when it lands on the other side of the planet at Meridiani Planum. "The biggest surprise was just how unusual the atmosphere was at Gusev," Manning said. Dust high in the atmosphere, transported there from a dust storm on the other side of the planet, made the lower part of the atmosphere cold and the upper part warm and less dense. That's the worst combination, Manning said. If the atmosphere is less dense higher up, it may not be as effective at slowing down the lander between its entry into the atmosphere and the opening of its parachute. Meanwhile, the atmosphere was so dense near the surface, it slowed the lander's descent more than expected. "It doesn't do you much good if it's down near the ground," Manning said. "You want it a little higher up, please!" Mission managers feared the same kind of warm, less-dense air that was over Gusev would affect Meridiani Planum, Manning said, "because they had a dust storm too, an even worse dust storm." To let Opportunity use more of the atmosphere, "we came very close to making an unscheduled trajectory correction maneuver this Saturday in order to shallow the entry flight angle," he said. But the team deduced that the upper atmosphere would be dense enough for the heat shield and parachute to work as expected. The temperature data Spirit gathered during its descent matches up well with the predictions of the rover team, project scientist Jay Crisp said. On Earth, profiles of the atmosphere are taken frequently with weather balloons. But on Mars, only successful landers have gathered such data as they hurtled through the atmosphere. "This is our fourth time that we've ever taken such measurements," Crisp said. That information is supplemented by readings taken by spacecraft orbiting Mars. Because predictions for the Gusev Crater landing were so accurate, Crisp said, "that gives us confidence that we can use the same model for predicting what the atmosphere will be like at Meridiani, for the next rover's landing." NASA's \$820 million rovers have an elaborate entry, descent and landing system, and it worked very well, Manning said. For one thing, it compensated for strong cross-winds. The lander takes three quick pictures on the way down and compares high-contrast features, such as craters, to determine its windblown drift across the planet's surface. Strong winds also can jerk the spacecraft around. A small rocket fired to compensate for the horizontal movement and may have prevented disaster, Manning said. "The little rocket saved the day," he said. Analysis of the descent also showed that when the lander lowered itself from the aerodynamic backshell on its bridle, the process took longer than expected. The team is still trying to understand why. After it was lowered, the lander opened its airbags, fired retro-rockets and cut the bridle about 8 yards above the ground. It bounced 24 times, Manning said, but the distances between bounces still weren't known. It bounced and rolled for about a minute, and the team briefly saw a signal from the lander. The roll took less time than expected - and then came the silence. Once the rover rolled to a stop, "it was flipped up on edge," he said, and the base petal antenna was pointing toward Earth. "The beach ball is still inflated. It's tilted off to one side." It wasn't tilted much, so the rover's software concluded it landed base-petal down. That was what it told Earth through the tones it transmitted. It wasn't long before the lander was, indeed, resting on its base petal. As the rover deflated and retracted its airbags, "it just casually rolls onto its base petal," Manning said. "It all worked out, and there we go," he said.

83320

83321

Backshell

Parachute

Heatshield Impact Location

○ First Bounce

DIMES "First Bounce" Estimate

○ Second Bounce

○ Third Bounce

○ Fourth Bounce

Other Bounces

Lander/Rover

○ Surface Feature Localization

58185

23144

SPACE.COM : 11 JANUARI 2004.

SPIRIT READY TO GET DOWN DIRTY ON MARS.

PASADENA - Engineers here at the Jet Propulsion Laboratory (JPL) are one cable cut away from having a free range Mars rover on their hands. But cautious technicians now project a day adjustment in the Spirit robot's egress onto Gusev Crater terrain, moving it to late Wednesday evening, overnight into Thursday morning. In a final step, Rover engineering teams have readied Spirit's set of middle wheels — there are six in all — that will enable the mechanical wonder to first roll across the deck of the lander upon which it is perched, and then exit onto Mars' surface. In another important milestone, the robot's arm was released, and then stowed in "drive position." The extra day sitting on the lander platform will give Spirit scientists more opportunity to carry out scans of the surrounding landscape. "So we are now fully stood up and all of our six wheels are deployed in a normal configuration," said Arthur Amador, a mission manager for Spirit operations on Mars, at an early morning JPL press briefing. Spirit's status in terms of power and communications capability remains top-notch. Amador detailed the rover's still-to-come set of turns on the landing deck. Over the next couple of days, Spirit is to make a three-part turn that equals some 120 degrees in relationship to the orientation the robot now rests. Each of the trio of turns is to be imaged to assure that all has worked as intended. Yesterday, technicians in a special JPL facility simulated the turning of Spirit in preparation for the real thing on Mars. This dress rehearsal helps determine the correct software and command uploads required for the robot to rotate itself on faraway Mars. John Callas, JPL Science Manager for the Mars Exploration Rover mission, said the extra day that Spirit will now spend on the lander allows for "unplanned science". Callas said the Mini-Thermal Emission Spectrometer (Mini-TES) sitting high on the Rover's mast will take detailed "stares" at three individual targets. One of those targets is "Sleepy Hollow" - an interesting feature filled with loose material. In addition, Callas said, the rover's Panoramic Camera will take images that can be co-registered with the Mini-TES. Still being assembled is a 360-degree, full-color panorama of the rock strewn, wind swept, dusty and sand covered landscape where Spirit rests. That is expected to be released shortly. "This rover is a very visually-rich mission," Callas explained. When the rover begins its reconnoitering at Gusev Crater, Callas said, scientists will have to analyze data very rapidly, making quick judgments and decisions about what they see in that information. To run the rover each day costs roughly \$4 million. So gathering and then transmitting data gleaned must be executed on a tight schedule. Once Spirit is physically down and dirty on Mars, science instruments mounted on the robot's arm will be lowered onto the surface. These rover measurements, likely including both soil and rock, are to be carried out over the first day or two. A major milestone is set for Monday night. That event is the cable cutting of an umbilical attaching Spirit to its lander platform. Spirit receives power and communications through that umbilical. Once cut, the robot can begin making its moves, taking an off ramp to Mars. "We expect a clean cut," Amador explained. Once Spirit's umbilical is severed, the lander becomes space debris on Mars — it is no longer functional. The umbilical cut "is a critical event," Amador told SPACE.com. That cable is fairly thick containing numbers of wires. Redundant cable cutters are now ready to do the task. Once cut, that umbilical springs back, snaking its way back underneath the lander, he said. Monday night, the commands to cut the umbilical will be sent up to Spirit by ground controllers. "We're almost there," Amador said.

83323

BBC : 10 JANUARI 2004.

MARS ROVER GETS READY TO ROLL.

The Spirit Mars rover has completed manoeuvres which should allow it to explore the planet surface within days. Twelve pyrotechnic devices were fired successfully, moving the craft onto its six wheels, Nasa scientists said. Concerns remain that an airbag used to protect the rover during landing could hamper its route to the surface. So mission controllers now plan to rotate Spirit 120 degrees before rolling it along what they hope will be a clear path on Wednesday. Untolding Spirit's wheels and getting it to "stand up" was the latest success for the US space agency Nasa's mission to Mars. Chris Voorhees, an engineer in charge of the process, said it was "intense" to witness the procedure which was met by cheers at mission control in Pasadena where the team played Bob Marley's "Get Up, Stand Up" reggae. He said it was "one of the most complicated deployments that has ever been done on a robotic spacecraft". "We have left Spirit in a very comfortable position. She is asleep right now, comfortable on all six wheels." But further checks on the position of the airbags which cushioned the rover as it landed confirmed fears that one might impede the exit of the surface explorer. Mission manager Jennifer Trasper told reporters that the raised airbag could have touched, and possibly damaged, one of Spirit's vital solar panels. After running through other strategies at Nasa's Jet Propulsion Laboratory, it has been decided to try to rotate the vehicle. Now pointing south, the goal is for Spirit to be turned and then roll off the landing craft towards the north-west as it begins to explore the Gusev Crater, she said. Nasa team members had wanted to drive the rover off the front ramp as planned originally but that idea has now been abandoned. The rotation is now scheduled for late Monday California time and the drive onto the surface of Mars has been brought forward again to late Tuesday (Wednesday GMT). Even in its parked position, the Spirit has already been able to provide a great deal of data to scientists on Earth, Ms Trasper said. Among its transmissions have been stunning colour images of the Red Planet, allowing scientists a detailed look at the landing site. A full 360-degree panoramic view is expected to be generated in the next few days.

83323

024185

23145

LORIDA TODAY : 13 JANUARI 2004.

PANORAMIC IMAGE GUIDES MARS TEAM.

PASADENA - The first full-circle panorama taken by the Spirit Mars rover is putting the team at the Jet Propulsion Laboratory in its place. "It begins to help us develop a sense of direction," said Michael Malin of Malin Space Science Systems. A medium-resolution image was released Monday because the highest-resolution picture is so huge, it was taking a long time to process. "That one is just dragging our computers to their knees," said Jim Bell, who's in charge of the panoramic camera that took the image. "It's going so slowly. It's so many bits to deal with." Because the file will be so big, probably the only way most members of the public will get to see the full image is through a future IMAX movie, he said. One is in the works that will feature the Mars images. "If you had a modem, it would take a year to download the whole thing," Bell said. In the old days, Malin said, scientists would put a panorama inside a sphere and then stick their head in it to experience the 360-degree view. He'd like to do the same with Spirit's panorama. "It gives you a very, very intense sense of being there," he said. The \$820 million twin rovers, Spirit and the soon-to-land Opportunity, won't have the luxury of taking many panoramas. This one was taken in pieces over three days and assembled into one picture. "This is a really remarkable piece of photography," Malin said. The benefit to such a high-resolution image is that scientists can zoom in to shards of rock a millimeter wide, Bell said. Even the medium-size picture -- which stretched across a back wall in an auditorium at NASA's Jet Propulsion Laboratory -- offers staggering detail. For one thing, bounce marks made by the lander's airbags show up clearly as dark spots. The spots stretch back into Sleepy Hollow, the possible impact crater nearby. The closest bounce mark has fine ridges in it. "We showed these to the engineers, and they went, 'Oh, yeah, those are airbag ridges!'" Bell said. "They'd seen them a thousand times. They knew exactly what they were." The high-quality images taken by the color pan-cam -- which can take stereo images with two lenses -- allow the team to reconstruct parts of the surface in three dimensions. Rover drivers use such 3-D renderings, but so do scientists. They looked closely at a patch of soil scraped by the lander's airbags that was called "alien" at first. The soil, which they call "magic carpet," moves in a fluid way but probably isn't sticky, scientist John Grotzinger said. Though the soil may have looked like mud in the early, low-resolution pictures, in these, "you can clearly see in there it does not have the mechanical behavior of a mud," he said. The 3-D image shows one dragged rock that is "very spectacular," Grotzinger said. "It's like a bow wave of dirt as the rock moves toward the lander." "Very, very fine-grained materials behave in unusual ways," Malin said, noting the crisp footprints the Apollo astronauts left on the moon. Spirit will get its first crack at nearby soil and rocks after it rolls off its lander, probably early Thursday morning. Overnight, the mission team was cutting the last cable connecting the rover to the lander. Spirit was to complete part of the right-hand turn that will put it in position to drive off the northwest side of the lander.

83324

SPACE.COM : 13 JANUARI 2004.

NASA PICKS 2 LOCATIONS TO EXPLORE ON MARS FOR SPIRIT.

PASADENA - NASA said today it has picked two locations on Mars for its Spirit rover to visit: a nearby crater and, later, a distant cluster of hills the explorer will reach -- or die trying. "We know where we are now and we also know where we're going," Steven Squyres, the mission's main scientist, said during a news conference at NASA's Jet Propulsion Laboratory. Spirit remained on track to roll onto the Martian soil late Wednesday or early Thursday. The rover cut the last cable attaching it to its lander and began a three-part turn to line it up with the exit ramp it should use to reach the ground, flight director Chris Lewicki said. The rover also rolled for the first time, moving backward on the lander about 10 inches, he said. "Spirit is a rover," Lewicki said of the robot, which had been largely immobile on the landing vehicle since landing Jan. 3. Pinpointing the rover's location, members of the mission determined Spirit landed about 990 feet to the southeast of where it first bounced down, swaddled in air bags, on Mars, said Tim Parker, the landing site mapping scientist. Revised data suggest it bounced 28 times before coming to a rest about 825 feet to the southwest of a low-slung crater, said Rob Manning, manager of the entry, descent and landing portion of the mission. Once off the ramp, Spirit will park for a day or two to give scientists a chance to study the chemistry and mineralogy of the area before it roams any farther. One of the first things Spirit will do is extend its robotic arm to touch and capture soil samples. It also will make measurements of any rock that happen to be in range. The first target after that is the crater, a destination it will take days if not weeks to reach. NASA plans to then send the rover to the southeast of the crater, toward a cluster of hills nearly two miles away. The distance is about five times Spirit's maximum driving range, meaning the rover could die on the way unless it far outlives its expected 90-day lifetime. "We are going to head for those hills," Squyres said, adding later, "We are going to get as close to them as we can." NASA on Monday released the first 360-degree, color panorama of the terrain around Spirit. A team of scientists and engineers assembled the sweeping panorama from 225 separate images. "The whole panorama is there before us. It's a great opening for the next stage in our mission, which is getting off the lander and out into this field," said Michael Malin of Malin Space Science Systems, a member of the mission science team. Spirit still needs to turn 70 more degrees to its right, in two steps, before it can roll off its now inert lander. "The analogy being we're about to kick the baby bird from the nest," said Kevin Burke, lead mechanical engineer for the roll-off process. The new panorama shows a landscape that is pancake flat in some directions and rolling in others. The topography appears dominated by mounds of material cast off when asteroids or comets pummeled the martian surface in the distant past, punching out craters. Spirit is working in chilly temperatures that, at their highest, would be familiar to anyone shivering through the cold snap that hit the United States in recent weeks. The daytime high is a relatively balmy 15 degrees Fahrenheit, project scientist Joy Crisp said. "I checked, this corresponds to Minneapolis' low tonight," Crisp told reporters Monday. The martian nighttime low is minus 100 Fahrenheit, or about the coldest it gets at the South Pole, Crisp added. The \$820 million Mars Exploration Rover project includes a second, identical rover named Opportunity that is scheduled to land on the opposite side of the Red Planet on Jan. 24.

83325

24185

23146

HOUSTON CHRONICLE : 14 JANUARI 2004.

SPIRIT GETS READY FOR MARATHON TREK.

PASADENA - NASA prepared the Mars Spirit rover for a marathon rather than a sprint on Tuesday, selecting a distant hill for the robotic geologist's ultimate destination. The low-slung hill is almost two miles east of Spirit's landing site, nearly five times the distance the six-wheeled rover was originally expected to traverse. But eager to get the most from the \$410 million mission, Spirit's science team has decided to head for the one- to two-mile-long, 300-foot range with an intermediate stop at a 60- to 90-foot-deep crater. By characterizing the soils and rocks of the crater and hills, scientists believe they have the best chance of determining whether Spirit's largely flat and rocky landing site is an ancient Martian lake bed. Standing 5 feet, 2 inches, Spirit is equipped with eagle-eyed stereo cameras that will witness the journey from an almost human perspective and frequently transmit images from its travelogue back to Earth. "That is our long-range plan, and I think it is very rich in scientific potential," said Steve Squyres, the Cornell University astronomer who leads Spirit's science team. "It also offers a shared adventure that I think is unprecedented in our history." Spirit has been perched atop the lander about 16 inches above the landscape since its Jan. 3 descent onto Gusev Crater. Once on the terrain, Spirit will spend several days analyzing the mineralogy and chemical makeup of the surrounding soil and rocks. Then it will steer toward a secondary crater inside Gusev about 800 feet to the northeast. As it closes in on the crater, Spirit will use the instruments fixed to the end of its robot arm to analyze the rocks and dirt to determine what kind of material, lake sediments or volcanic lava, resides below the floor of Gusev. Then it will attempt to scale a crater lip of about 15 feet to peer in. "Once we have done that, we will have seen as deep into Mars as we can ever hope to see on this mission," said Squyres. Then Spirit will steer toward the hill for similar studies. If Gusev was an ancient crater lake, the hilltop might have towered above the waves. Eventually, though, the surroundings would have been eroded away by flowing water or winds as some sort of unexplained but major change in climate turned Mars dry and cold. "It's a very beautiful piece of scenery, one we will get to know very well in the weeks ahead," said Squyres of Spirit's ultimate destination. "It's going to be an adventure, and I don't know how it will turn out."

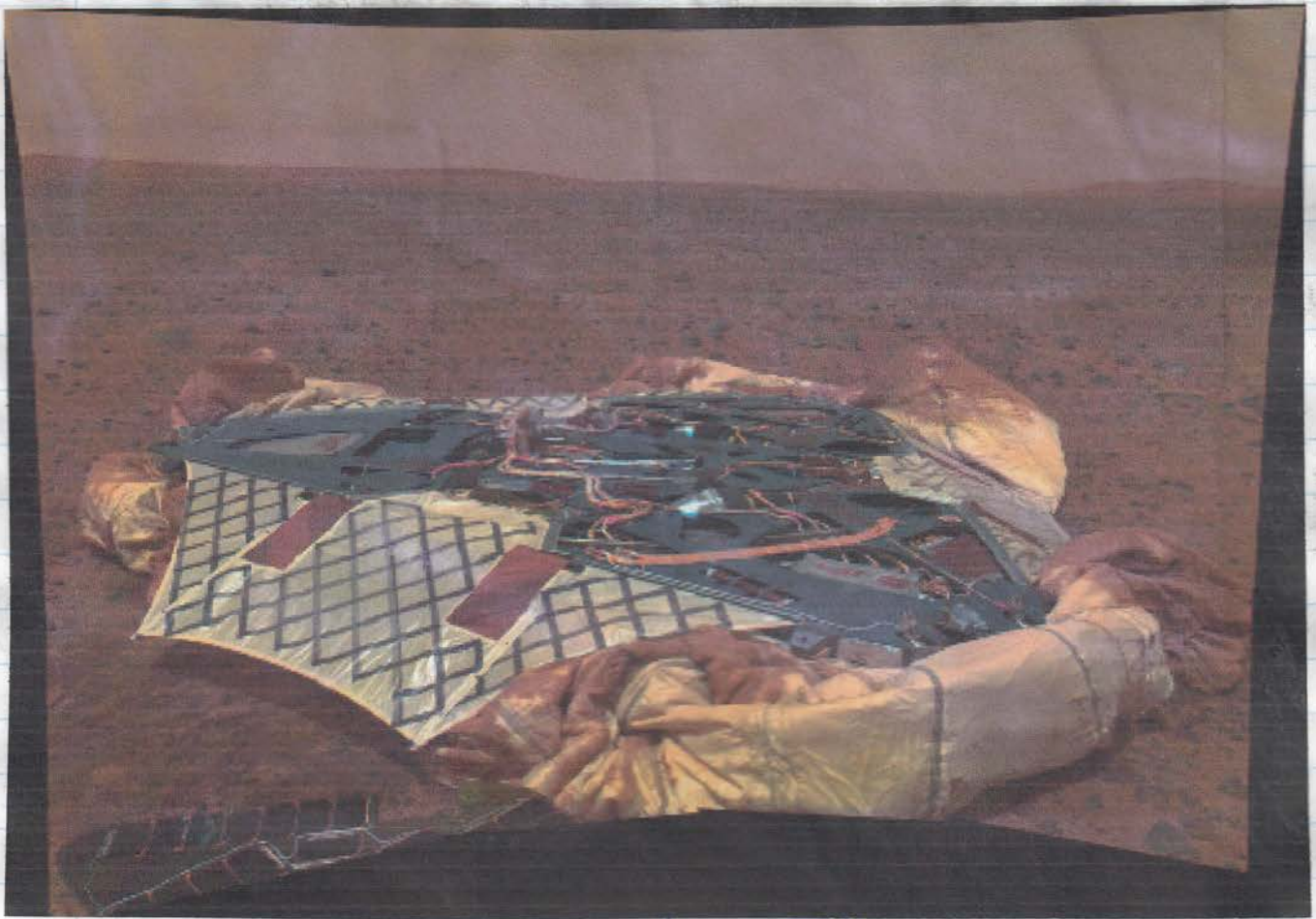
83326

83327



84185

23147



83328

FLORIDA TODAY : 15 JANUARI 2004.

ROVER SPIRIT MAKES ITS FIRST TRACKS ON MARS.

83329

PASADENA - The first of twin Mars rovers made wheel tracks in Gusev Crater this morning, confirmed by signals and pictures sent to Earth from the red planet. "That's the image we were waiting for," landing manager Rob Manning said when he saw the photo of the rover's tracks from the lander. "We are now on Mars. Our wheels are finally dirty." Members of the exhausted Jet Propulsion Laboratory team crammed into a press briefing afterward, when mission managers, some near tears, talked at length about all the work it took to get to this point. "Your efforts are historical," Jennifer Trospen said as she poured champagne for the panel. "Thank you very much." Joel Trajewski, the engineer in charge of getting the rover ready to move, said it didn't really feel as if Spirit landed until today. The rover has been sitting on the open petals of its airbag-cushioned lander since it bounced to a stop Jan. 3. "We have been approximately 40 centimeters above the surface of Mars," he said, "not quite there, but almost." Now Spirit will check out the instruments on its robot arm and begin probing Mars' dirt and rocks. It may be a few days before it drives again. The NASA rovers' mission is to look for evidence that water once flowed on Mars by examining the rocks for telltale minerals. Gusev Crater may have been an ancient lake. Earlier in the evening, the team played a wake-up call, more for its own benefit than Spirit's. It was Steppenwolf's "Born To Be Wild." Controllers issued the "go" command for rolloff at 12:21 a.m. PST (3:31 a.m. EST), then listened to the theme from "Rawhide," with its "rollin', rollin', rollin'" lyrics. They had to wait more than an hour to get data from the orbiting Mars Odyssey to confirm that Spirit made it off the lander. "This is a night that's extraordinarily rich in significance for all of us," principal investigator Steve Squyres told the mission team just before it heard that Spirit had completed its 10-foot roll. The first signal was heard just before 2 a.m. PST (5 a.m. EST). Then the engineers got a thumbnail image - a tiny picture from the rear of the rover, showing the lander in the background - that they greeted with whoops and applause. More photos quickly came back, including a vivid black-and-white image of the rover tracks. Project manager Pete Theisinger donned a T-shirt that said "My other car ... is on Mars!" When rover Opportunity lands, he said, he would add more words to the back: "My third car is, too." The mission controllers had a couple of special visitors on a busy day. One was Vice President Dick Cheney, who praised the Mars team and reinforced President Bush's announcement of a new plan for space exploration on Wednesday. Overnight, it was Sofi Collis, the Arizona fourth-grader who won the contest to name the two rovers. Dressed in a blue astronaut jumpsuit, she looked closely at rocks decorating a Mars landscape by a large model rover in the von Karman Auditorium. She likes to study rocks and hunts for them in her back yard, she said. "I look for crystals and stuff," Sofi said. Spirit's twin, Opportunity, lands on the other side of Mars in a little more than a week. The rovers launched separately from Cape Canaveral last summer. The mission cost \$820 million.

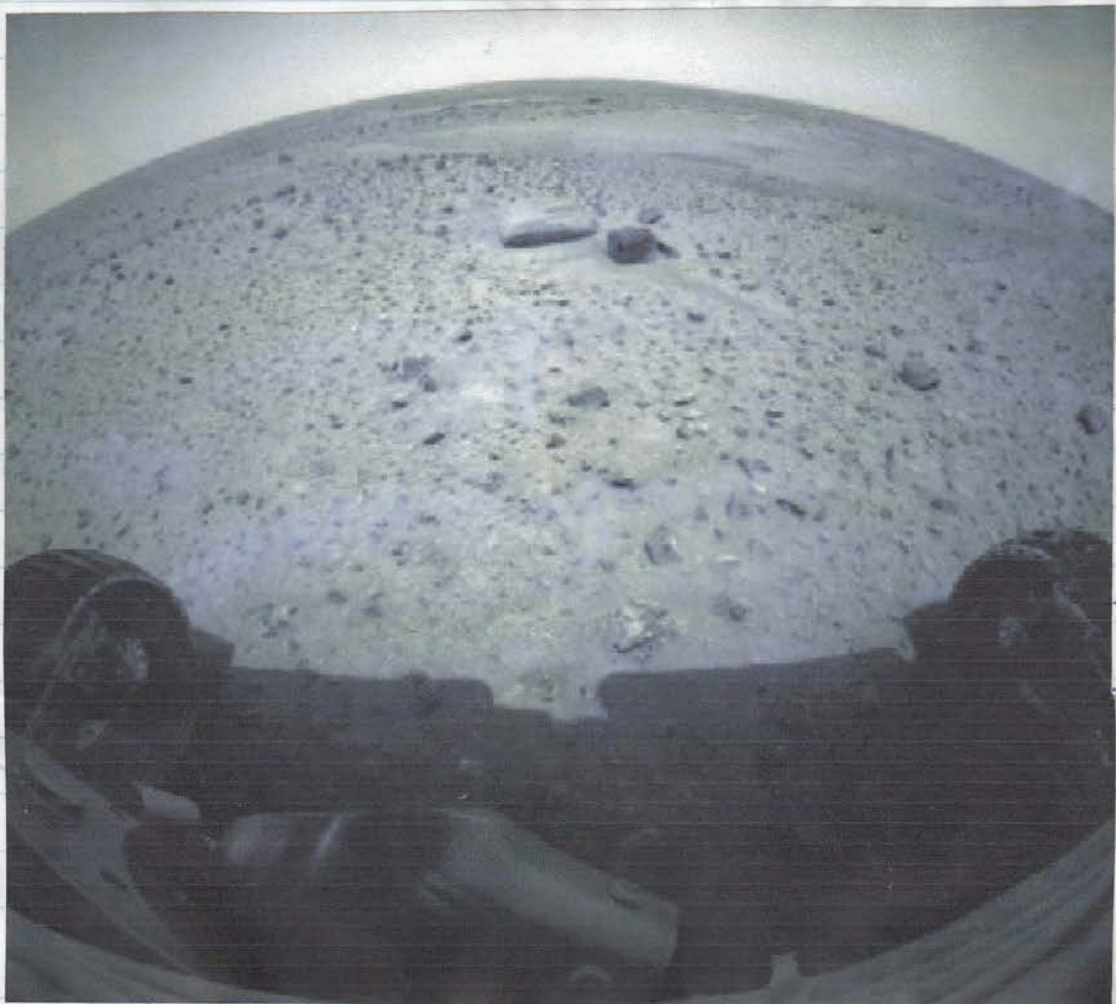
FN 185

23148

SIX WHEELS ON MARS!

83330

PASADENA - NASA's Spirit Mars rover has wheeled itself onto martian landscape, leaving its stationary lander that served as the robot's home base for 12 days on the red planet. Spirit was awoken today from its robotic slumber to the tune, "Born to be Wild" by the rock group Steppenwolf. The Mars Exploration Rover was commanded by the click of a mouse button to exit down a lander petal at 12:21:30 a.m. Pacific Standard Time (PST). It was ordered to head in a north-northwest direction. The six-wheeled robot is now resting in the stark, rock strewn and geologically rich landscape that is Gusev Crater. "Data is streaming in," said Rob Manning, Entry, Descent and Landing Development Manager for the rover effort. "It looks like the egress went very well." Controllers called it the most significant 10 feet (3 meter) drive in history. The drive took 78 seconds, ending with the back of the rover about 2.6 feet (80 centimeters) from the foot of the egress ramp. The first image relayed from the rover on Mars, snapped from the backend of the robot, showed the left-behind lander hardware -- now a useless piece of space junk. "We're on Mars. Spirit has finally landed," Manning said. One of robot's first tasks is to slew its panoramic camera and locate the Sun. Spirit uses that data to compute where to point its main antenna at Earth. Months of scientific sleuthing by Spirit is dedicated to study martian rock and soil to ascertain whether the past environment in Gusev Crater was ever watery, enough so to have been an abode for life. The entire Mars rover team of scientists and engineers cheered their own success -- an over three-year-long effort that resulted in today's striking achievement. "Spirit is now ready to start its mission of exploration and discovery. We have six wheels in the dirt," said Charles Elachi, JPL Director. "Mars is now our sandbox... and we are ready to play and learn," Elachi said during a press briefing shortly after the golf cart-sized rover parked itself on Mars' surface. Peter Theisinger, JPL's Mars Exploration Rover project manager, proudly wore a gift T-shirt, adorned with a picture of Spirit with the words: "My other car is on Mars!" "Mars is open to the public," said Kevin Burke, Lead Mechanical Engineer for Egress. The main scientific goal for Spirit is to determine whether Gusev Crater ever contained a lake. Color views taken by Spirit, as well as infrared scans of the terrain, have not definitively revealed the true character of the landing site. For the last few days, engineers had pivoted Spirit atop its lander platform on Mars for tonight's exit ramp victory. Once science gear onboard Spirit studies easily accessible rock and dirt in the general neighborhood for the next several days, mission controllers have already readied the rover's travel plans. Rover team members are slated to head for a crater that is about 270 yards (250 meters) northeast of the lander. Scientists are eager to drive up to the rim of the crater. Along the way, the terrain around the hole is expected to be peppered with rocks tossed up during the crater's formation. Spirit will study these ejected rocks as they offer a window into the subsurface of Mars. Scientists are eager to then send the rover toward a range of hills about 2 miles (3 kilometers) away for a look at rocks that sit higher than the landing neighborhood's surface. However, that distance is some five times as far as NASA's mission-success criteria for how far either rover would drive. The long-distance trek will depend on the overall health of Spirit, and uploading of special software that enables the robot to wheel itself across the landscape in "pedal to the metal" fashion. When Spirit began to roll across Mars, images revealed that the rover's wheels were being caked with surface material. "It looks like it's sticking to the wheels and lifting up. There are some very, very interesting soil mechanics going on here. We're going to have a very interesting time studying it," Steve Squyres, Principal Investigator from Cornell University for the Mars Exploration Rover project. "It doesn't look like anything I've seen before," he told SPACE.com. It won't be long before Spirit has company. Spirit's twin, the Opportunity rover is zeroing in on Mars, arriving on January 24 at 9:05 p.m., PST. It will land on the opposite side of the planet from where Spirit is roving -- Meridiani Planum, an area rich in gray hematite. Hematite here on Earth typically forms in association with liquid water, although it can also be formed as a result of volcanism. Buoyed by the successful deployment of Spirit into Gusev Crater today, Theisinger congratulated the entire Mars Exploration Rover team for their collective triumph. "Now we've got to do all this again in nine days," Theisinger said.



83331

23149

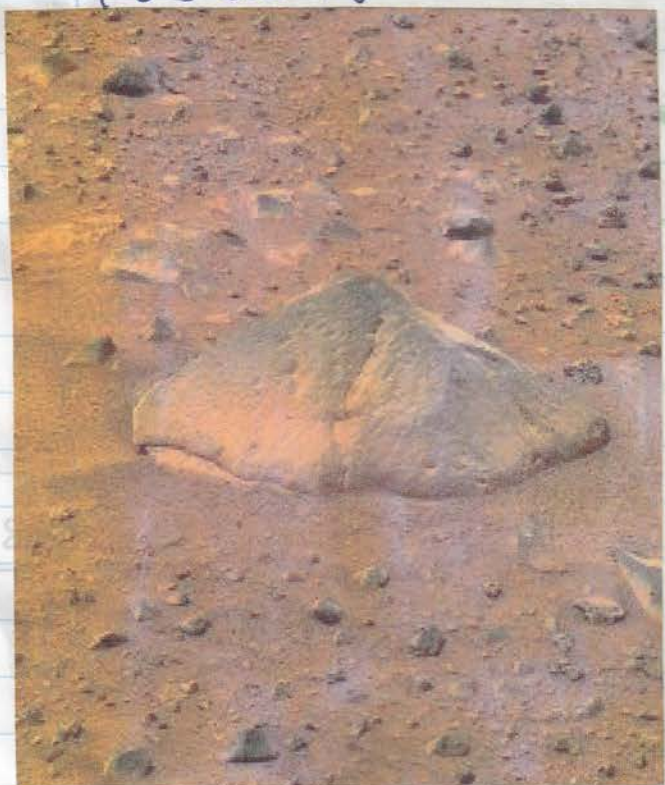
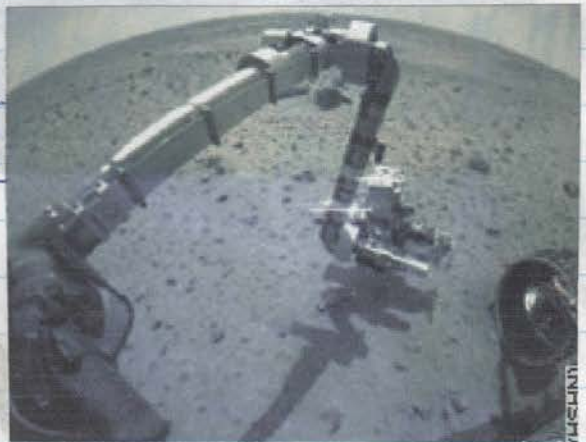
NASA ROVER ROLLS ONTO MARS.

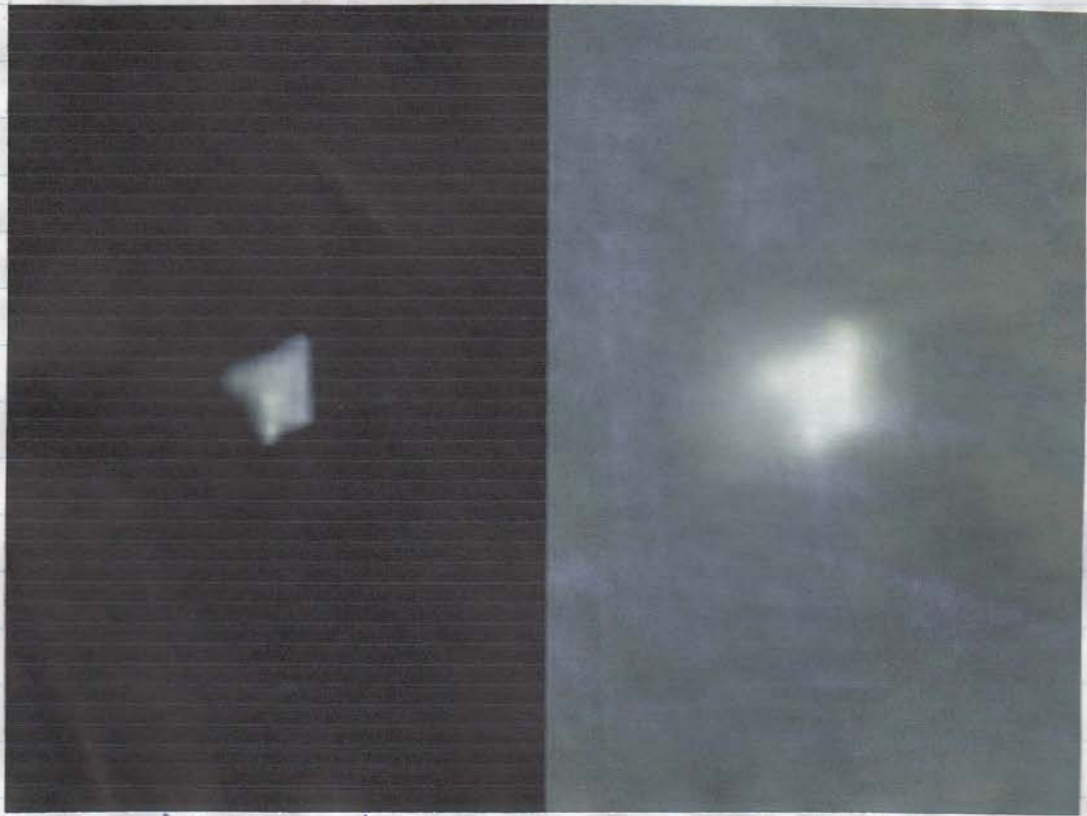
The Spirit rover has successfully rolled onto the surface of Mars for the first time since NASA's unmanned robot bounced down on the red planet nearly two weeks ago. Pictures confirming the "egress" came back to NASA's Jet Propulsion Laboratory in Pasadena, California, at about 5 a.m. ET (1000 GMT) Thursday. Engineers cheered loudly and celebrated the landing by playing the hip-hop tune, "Who Let the Dogs Out?" Mission controllers had sent the rover commands to move three meters down a ramp from its lander and onto the Martian soil. "We have six wheels in the dirt," Charles Elachi, director of the Pasadena, California-based JPL, told reporters. "Mars now is our sandbox and we are ready to play and learn." Mission managers had planned to roll the rover off the front ramp of the lander, but had to change that plan after an airbag failed to retract properly. They had trained for that contingency, however, and were prepared to turn the rover on the deck of the lander and roll it off via the rear ramp. "What we are going to do as soon as we egress off the lander, the next thing we're planning on doing is deploying the robotic arm," said Mission Manager Jennifer Trosper. "The first day we'll kind of hover over soil and take some microscopic images, and the second day we'll actually deploy the instruments on the soil, and then we'll swap instruments, and then we'll stow and get ready to drive." Project scientists have likened Spirit to a robotic geologist. The rover's mission is to study rocks and soil in an effort to determine whether the cold, desert world once was a warm, wet planet. Spirit will first analyze rocks and soil near the lander, eventually making its way toward a large crater about 100 meters (300 feet) away. After exploring that area, the rover will literally "head for the hills," making its way toward an area called the "East Hill Complex." "I cannot tell you that we are going to reach those hills," Principal Investigator Steve Squyres said Tuesday. "This vehicle was designed, our requirement for how far we should be able to traverse over the course of the mission, was 600 meters. These hills are five times that far away. OK, so don't sit here and think, 'Oh, we're going to go to the hills.' We're going to go 'toward' the hills." Steve Squyres will also manage the scientific payload on Spirit's identical twin, Opportunity. Opportunity is scheduled to complete the 300 million-mile trip to Mars next weekend. It will land on the opposite side of the planet from Spirit's landing site inside the Gusev Crater, a pockmark almost 170 kilometers (100 miles) wide just south of the Martian equator. Spirit and Opportunity have considerably more mobility and capability than the most recent successful visitor to Mars. The 1997 NASA mission included the Pathfinder lander, which beamed back thousands of images, and Sojourner, a toy-sized test rover that scurried around the rocks and boulders littering the landing site. Each of the new rovers, however, is built to explore nearly as much territory in several days as Sojourner covered in three months, about 100 meters. Each comes equipped with eight cameras that should provide stunning panoramas of the Martian surface, with resolutions so sharp they retain crisp detail when blown up to the size of a movie screen, according to NASA. Their microscopes, spectrometers and drills could unlock geologic secrets from billions of years ago, when scientists think the planet may have had conditions more suitable for life.

83332

83333

83334





83335

83336

83337

Sonde daalt af naar Marsoppervlak

PASADENA — De Amerikaanse sonde Spirit is gisterochtend aan zijn eerste expeditie op de planeet Mars begonnen. De ruimtesonde landde tien dagen geleden op de Rode Planeet en gaat onder meer zoeken naar sporen van water.

Na een tocht van de afrit van het landingsplatform raakte de robot het oppervlak van Mars. De zes wielen van de Spirit rolden drie meter over de planeet voor de sonde tot stilstand kwam om zijn antennes in positie te brengen. Kort na 11.00 uur zond de sonde de eerste opnamen van zijn eigen lege platform en de eerste sporen die hij met zijn wielen op het Marsoppervlak had gemaakt.

De NASA laat de sonde twee tot drie dagen op deze plek staan. In die periode moet de robot de bodem testen en voorbe-

reidingen treffen voor verdere expedities. In het vluchtleidingscentrum in Pasadena is er dan tijd om met de robotarm van de Spirit te oefenen en de instrumenten te controleren.

Voor ten minste de komende 78 dagen onderzoekt de sonde zijn omgeving in de Gusev-Krater. Wetenschappers zijn ervan overtuigd dat er in deze krater eens een meer moet zijn geweest.

Met spanning wacht de NASA ook op het moment dat morgen de Europese sonde Mars Express op 300 kilometer hoogte over de Spirit vliegt. De Spirit 'kijkt' dan naar boven en de Mars Express 'kijkt' dan naar beneden. Deze waarneming zal de onderzoekers veel gegevens verschaffen over de dynamiek van de atmosfeer ter plaatse, aldus een verklaring van NASA.

(ANP/DPA/RTR)

Robot rijdt op Mars

PASADENA
AP

De Amerikaanse Marssonde Spirit is gisteren het oppervlak van de rode planeet op gereeden. De robot landde bijna twee weken geleden. De drie meter die hij moest afleggen van zijn landingsvaartuig naar de grond waren de riskantste fase uit de Mars-missie, die drie maanden gaat duren.

De wetenschappers in het controlecentrum van de NASA reageerden uitgelaten op het succes. „Mars is vanaf nu onze zandbak”, zei missieleider

Charles Elachi. „We kunnen nu spelen en leren.” De Spirit landde op 3 januari en had al eerder uit het vaartuig moeten komen, maar de airbags die voor een veilige landing hebben gezorgd lagen in de weg.

De Spirit maakt op Mars foto's en doet bodemonderzoek. De NASA hoopt bewijs te kunnen vinden dat Mars ooit 'natter' was en dat er een omgeving heeft bestaan waarin leven mogelijk was. Op 24 januari moet Spirits tweelingbroertje Opportunity landen, die aan de andere kant van Mars hetzelfde onderzoek gaat doen.

DDL: 16-01-2004

Spits: 16-01-2004

23151

83338



Spirited Exploration

The Mars rover Spirit is returning tantalizing data about the history of potentially life-giving water at its landing site

CRAIG COVAULT/PASADENA, CALIF.

A long-held U.S. space program dream is moving toward reality this week with mobile science operations on Mars by a highly capable rover to search for life clues, while also scouting what eventually could be a manned landing site under new long-term U.S. space goals.

The Spirit rover in the Gusev Crater 100 million mi. from Earth is discovering increased evidence, like carbonates, of potential life-sustaining water.

Jet Propulsion Laboratory controllers were set to command Spirit to drive nine

ft. off the right side of its lander early Jan. 15 at 3 cm./sec. to begin a multi-month search for Martian rock and soil "with a story to tell" about the area as a potential habitat for life.

The JPL-commanded Spirit's stand up and reconfiguration of its six-wheel rocker-bogie-linkage-suspension system followed by a planned drive off the

High resolution imagery of the 300-ft. Eastern Hills shows rover's second planned destination about a mile from landing site. The hills could've been islands in ancient lake Gusev.

lander is "one of the most complex sequences of robotic operations ever done on a spacecraft," said Chris Voorhees, JPL mechanical systems engineer (see following story).

Using precise Spirit imaging and other positioning data, along with overhead reconnaissance by the Mars Odyssey and Mars Global Surveyor (MGS) spacecraft, JPL has mapped out the first overland exploration of Mars, said Steve Squyres, the rover mission principal investigator from Cornell University.

Spirit is first being sent about 800 ft



83339

No

12185

23153

northeast to a 600-ft.-wide, 60-90-ft.-deep crater. En route there, it will sample the crater's ejecta blanket for rock blasted from deep underground for a "bottoms up" analysis of suspected lakebed deposits at Gusev. Barely visible to Spir-

and overall trafficability of the site gives hope Spirit can reach the hills and the rockfalls below them. Up to 5-6 months of surface life are now being predicted by JPL beyond the three-month specification.

U.S. this week, Spirit faces the daily grind of waking up and setting out in frigid temperatures. Nights in Gusev Crater are dropping to minus 100F but at midday warming to 15F.

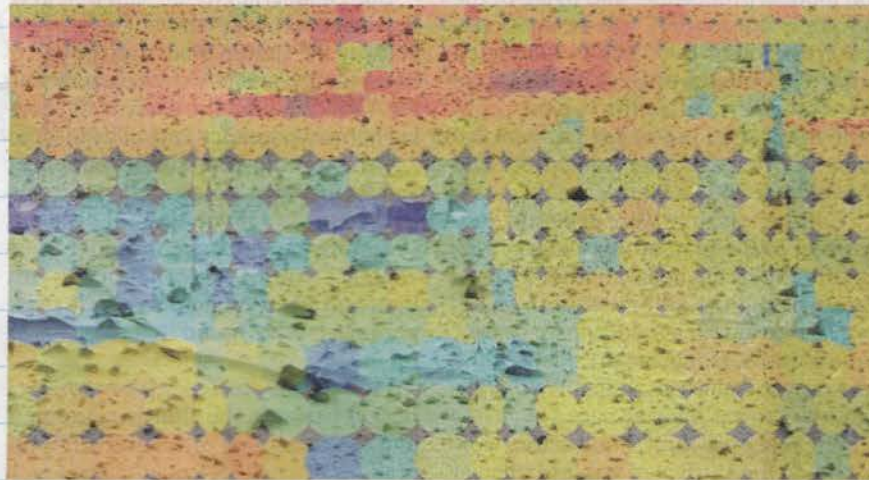
Meanwhile, back in space, things are heating up on the Opportunity rover, which is set for touchdown about 9:05 p.m. PST, Jan. 24, at the Meridiani landing site 6,000 mi. west of Spirit on the other side of Mars.

Mission planners expect Meridiani, with its water-related gray hematite surface, to look alien even to Mars, with a dark gray rolling plain void of dust, said Matt Golombek, JPL science team manager. With the rover drive-off delayed 2-3 days, JPL science teams were getting such good data from the stationary position they decided to shift early from a pre-set strategy to the more highly coordinated "tactical" process, said John Callas, JPL's overall science manager.

This involves structured meetings and decision points between the four science theme groups and an overriding Science Operations Working Group (SOWG). The objective is to review science data from the previous day's downlink within a daily 17-hr. period, formulate hypotheses for the next day's investigations, then turn those into commands for the following day's operations on Mars. "It is a really complex and arduous process," Callas said.

The primary objectives of the various science groups going into the start of roving operations involve:

- Geology and long-term planning groups: "They have both been very much focused on coming up with a strategy on what are the first few rocks that we go visit," Squyres said.



it's cameras at ground level, the nearby crater was located by MGS overhead reconnaissance.

"It is an extremely attractive target that will provide a window into the subsurface of Mars," Squyres said. "As we go further and further into the ejecta blanket, we will see stuff excavated from 30-60 ft. below the surface."

Large, perhaps insurmountable, rocks surround the 15-ft. sloping rim of the crater, but the overhead imagery also shows what could be "a door," an area free of large debris for a view into the crater on the side facing Spirit's approach path. The crater now is viewed as a much better target than the Sleepy Hollow small crater that first drew in-

Rover Mini-TES infrared spectrometer image overlaid on surface targets shows red (warmer) powdery material rover will avoid and blue (cooler) rocks rover aims to sample.

But even if Spirit can't get the full distance, every foot closer will give the Mini-TES infrared spectrometer and Pancam high resolution imaging systems evidence about whether the hills were perhaps islands in a once 3,000-ft.-deep lake at the site.

Along the way, Spirit will try to discover why some rocks at Gusev appear blue and why some of the soil at the site rolls up like mud, a feature the science team has dubbed "The Magic Carpet."

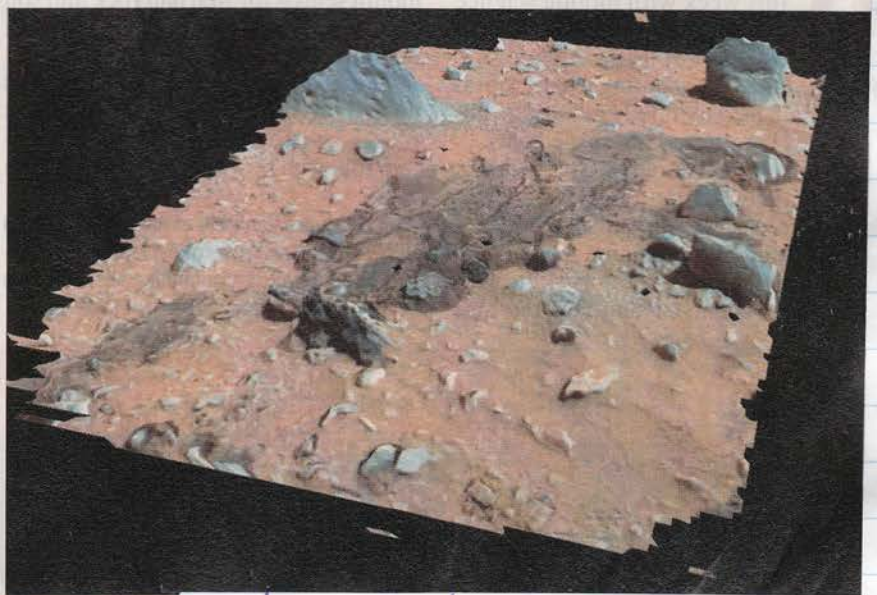
Like millions of people across the

"Magic Carpet" soil feature that curled as if it were mud when rubbed by airbag is shown in 3D. Chemical or electrostatic properties, or salt brine, are postulated as the cause.

terest (*AW&ST* Jan. 12, pp. 26-28).

After several weeks working around the crater, Spirit will begin a 1-2-mi. traverse east toward 300-ft.-high hills where the spectra and mineralogy of the rock will give the science team a "top down" view of Gusev's geology, which at the hills could be 3 billion years old, said David J. Des Marais, an Ames senior research scientist with the mission.

This should provide additional evidence as to whether or not the site was a life-sustaining lake. Spirit's design was for only about 2,000 ft. of travel and the hills are five times that distance away. The performance of the rover so far



83340

5812M

First Baby Steps

Good thermal and power performance raise prospect that Spirit could last for a year, instead of 90 days

MICHAEL A. DORNHEIM/PASADENA, CALIF.

The Mars Exploration Rover Spirit made its first moves last week and was set to roll off the lander deck and onto Martian soil for the first time on Jan. 15.

Rover health remained excellent, and officials at NASA's Jet Propulsion Laboratory (JPL) here believe warmer-than-expected temperatures mean that operations could last much longer than the 90-Martian-day (90 Sol; 92 Earth days) primary mission.

An initial long-term exploration plan has been set, first going to a crater 260 meters (850 ft.) away, and then toward hills an ambitious 3 km. (1.9 mi.) toward the horizon, stopping at interesting objects along the way.

The panoramic camera achieved formal mission success around Jan. 12 when final octants of a full 360-deg. image in stereo and color at high resolution were

transmitted to Earth. The miniature thermal emission spectrometer also achieved mission success with a full panorama. These achievements were aided by continuing high-rate communications with Earth.

CONTROLLERS DECIDED on Jan. 9 to abandon the primary forward route off the lander deck because an incompletely retracted airbag might snag the left solar wing (*AW&ST* Jan. 12, p. 24). Instead, they chose the egress ramp in the 4 o'clock direction. To realign the rover on the lander deck, they toed in the forward and aft drive wheels to turn it on its own axis 115 deg. to the right in a series of three moves.

The first move took place on Jan. 12. After cutting the cable from the rover to the lander—permanently disabling the lander's petal deflection and airbag retraction mechanisms—the rover

moved back 10 in. and a 45-deg. right turn was made. This allowed pictures to be taken of parts of the lander deck that had not been seen before, to ensure they were clear. Maneuvering room is tight, and controllers were worried about hangups on lander parts or debris. The moves were rehearsed with lander and rover engineering models at JPL.

On Jan. 13 two more moves were made, to 95 deg. and the final 115 deg. More checks were made between the moves. All appeared to go well. Late last week in the first few hours of Jan. 15 here, the rover was scheduled to roll 10 ft. off the deck and onto the Martian soil. That date would be three days behind the original schedule, with the delay caused by trying to retract the offending airbag. It is the 12th Sol of the mission.

Given the difficulty with airbags obstructing the primary egress path on

AVIATION WEEK & SPACE TECHNOLOGY/JANUARY 19, 2004

83341
This will entail using the arm for about three days of soil and rock tests near the lander immediately after drive-off to calibrate the arm-mounted instruments and obtain basic starting data on the surface.

The geology at the Spirit site is totally different with much greater diversity than that seen at the two 1976 Viking landing sites and at the 1997 Pathfinder site. And the rover is returning six times more science data per day compared with Pathfinder.

Geologists believe they see at least two types of rocks at the site, including those with a bluish tint. There are also fractured rocks that could be evidence of freeze/thaw cycles involving water, said Mike Malin, a science team member who has also led key MGS operations.

A vital early science operation was the completion of the 360-deg. "big panorama" involving 75 frames each of red-, green- and blue-filtered imagery. "It is a truly remarkable photograph," Malin said. It has been overlaid with Mini-TES infrared data. The image data were calibrated at Cornell, then transmitted back to Pasadena where the JPL Multimission Imaging Processing Laboratory assembled it. "The panorama is

83342
"Spirit is returning six times more science data per day than Pathfinder"

a great opening to the next stage of our mission as we start moving out into this field," Malin said.

● Rock and soil physical properties group: "They are very excited to obtain images of wheel tracks that will give data on soil compressibility," Squyres said. An early objective will be to do a "scratch and turn" to scuff up the surface. The microscopic imager will also be used to look at the Magic Carpet material which could be caused by electrostatic charges in the soil, or the more exciting prospect of chemical precipitate between minerals touching on the surface, said John Grotzinger from MIT.

● Atmospheric science group: "The atmospheric science team has been very much focused on analysis of the first Mini-TES infrared spectrometer observations looking upward through the at-

mosphere. We have some lovely temperature profiles through the lower Martian atmosphere," Squyres said.

● Mineralogy and geochemistry group: They are eagerly awaiting the first data from the Alpha Particle X-ray Spectrometer and Mossbauer spectrometer mineralogy and composition instruments mounted on the arm.

"They continue to pour over Mini-TES data to pick drive directions that will maximize our ability to learn about the mineralogy and the rocks," Squyres said.

The initial Mini-TES data show that fine-grain materials are comparatively warm and more coarse-grain material cooler at the site. In addition to mineralogy science, the infrared imagery will be used to help the rover stay out of fine-grained material where it could get stuck.

The initial Mini-TES temperature and spectral signatures also showed the presence of carbonate material on the surface, a possible key indicator of water processes.

That early carbonate findings alone will be a key area of investigation through the next several weeks because of its implications for potential life-giving water at the Gusev site. ●

23154

Spirit, also known as MER-A, changes are planned for MER-B "Opportunity," set for a Jan. 24 landing. The airbag retraction winches can turn a maximum of 40 revolutions, each one pulling in about 6.5 in. of retraction cord. More retraction gets the airbags out of the way, but puts them under the lander and raises the deck height for rover rolloff. The automatic retraction sequence on

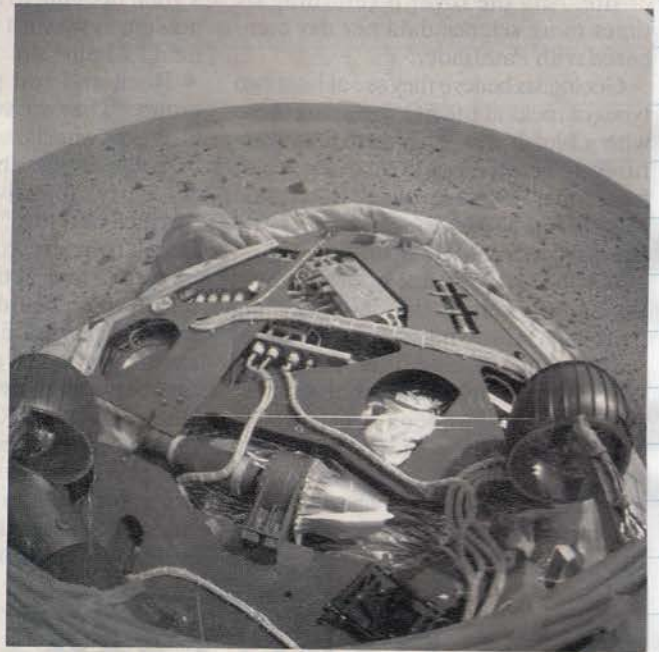
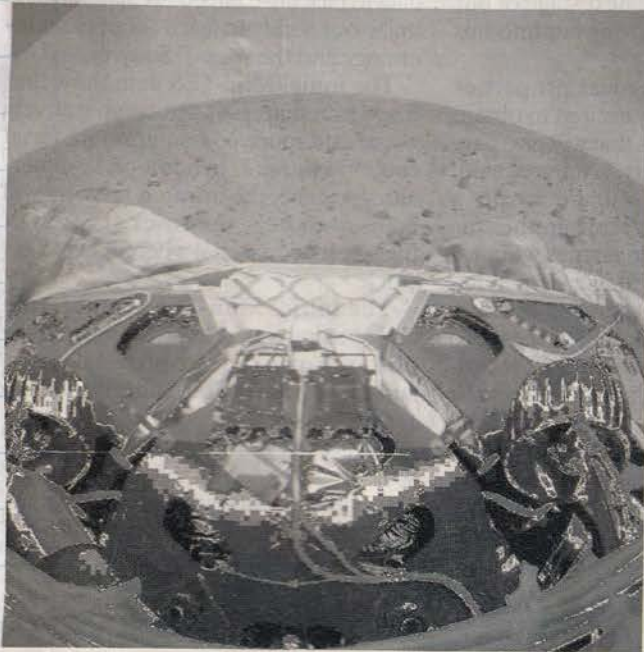
bauer spectrometer will be placed on the soil to take measurements. Their observations take 10-12 hr. each for accurate data.

Initially the rover will be kept at least 1.5 ft. away from the lander. Controllers may try to get pictures of the airbags to see why they didn't retract more. They may also send the rover to curious nearby marks in the soil made by the airbags.

After measuring rock and soil targets

come comfortable with automatic navigation and hazard avoidance. This system will run in the background and transmit its strategy maps to Earth for scrutiny by navigators.

Under manual control, the rover can move no more than 15 meters at a time, because that is the maximum distance at which the navigation stereo cameras can safely detect hazards. The first



Spirit reeled the base petal airbag in by 30 turns, and the side petal airbags by 37 turns, as a tradeoff between bag obstruction and deck height. The base petal winch was commanded to turn another 7-9 turns over the first week but the airbag moved less than expected, perhaps due to broken cords.

The deck height in the forward direction is 32 cm. (12.6 in.) above ground, and the edge of that fabric egress ramp is 7-8 cm. high. In the actual rolloff direction the deck height is 42 cm. and the egress ramp is 10 cm. above ground, said Jennifer Trospen, the surface development manager.

Opportunity will add more base petal retraction to the automatic sequence, probably another five turns, she said.

Egress will be followed by three days of testing and using the instrument deployment device (IDD) arm and its four instruments. It will be unstowed and hover over the ground. On the first day, the rock abrasion tool will be positioned where it can be seen with a camera and tested, and the microscopic imager will hover over the soil but avoid contact with dust. During the next two days, the alpha particle X-ray spectrometer and Moss-

Rover Spirit's first move on Mars is captured by front hazard camera. Frame at left shows Spirit at its original heading after moving back 10 in. and toeing-in the front wheels for a turn-in-place maneuver. Frame at right is after turning 45 deg. to right. Shiny object at lower center is actuator for lander petal. Airbag is visible at petal fringe.

of opportunity after rolloff, the plan is to drive northeast about 260 meters for observations near the 3-5-meter-high rim of a 200-meter-dia. crater, and then head southeast toward hills that are about 3 km. away and about 100 meters high.

The rover can move at 3 cm./sec. top speed, or 100 meters/hr. Automatic hazard avoidance may slow this by half, and power and temperatures can be limiting. Trospen said the rover is designed to move 20-40 meters/day. She thinks Spirit could be at the crater by Sol 30-35, which would be 17-25 meters/day if the drive were to start at Sol 20. The design range of the rover is 600 meters but with the good power situation "those hills don't look impossible," said Peter C. Theisinger, MER project manager.

Rover waypoints will at first be determined manually until controllers be-

moves will be under 10 meters for safety, then 15 meters, then several drives per day with rapid decision cycles enabled by the frequent communications opportunities. If automatic navigation is activated, it should give the longest drives with the least oversight.

Position on the surface has been resolved with UHF Doppler measurements by the Mars Global Surveyor (MGS) and Mars Odyssey satellites to ± 30 meters in latitude and ± 0.5 meter in longitude. The position is 14.5718 deg. S. Lat. and 175.4785 deg. E. Long. The resolution is more accurate than the positions of features on maps, which can be off by 300-400 meters, said navigation team member Joseph R. Guinn. Optical techniques are being examined for better map registration, he said.

There are signs that the rover could last much longer than expected. It was designed to survive 90 Sols, eventually to die of cold as Martian winter arrives, but updated thermal models are offering hope that it could remain active through the coldest day of winter, then regain strength as spring and summer return. This is offset by dust buildup reducing solar array output.

83343

0218

23155

"The mission lifetime is much longer than predicted," Trosper said. Based on power and temperature limits, she said lifetime now appears three times longer, or about 270 Sols, which is the number of cycles in the qualification tests. And the bottom of winter arrives sooner than that, in about 240 Sols. It is now in the latter half of southern summer.

Last week the solar arrays were generating about 900 watt-hr. of energy per day and the rover was using 700-750 watt-hr., providing good margin, said Arthur Amador, the Sol 9 mission manager. If the rover doesn't die from low power by 270 Sols, it's not clear what might cause failure. "That design spadework has not been done yet," Theisinger said.

A long life is by no means proven. The thermal model was updated with the rover on the lander, but engineers are not sure whether the changes stem from the hardware, or from the site temperature being warmer—there are no direct measurements of ground or air temperature. Sitting over terrain should make it 9F cooler, but that is not certain. Scientists believe the current location is one of the cooler spots in the roving area.

At the moment, the minimum daily air temperature near the ground, based on a physics model and not direct observation, is -75C at 6 a.m. Mars local time (MLT). At Sol 100 of the mission this is predicted to drop to -86C. The daily maximums are around 2 p.m. MLT and are estimated at -10C and -30C for Sol 1 and 100, respectively.

If electronics do get too cold during winter and the rover expires, it could revive when the seasons get warmer. "We sure will listen for it," Trosper said.

The MER team is working arduous shifts that get 40 min. later every day to remain in sync with Mars sunlight. To reduce exhaustion, after MER-B lands on Jan. 24 and proves its health, especially regarding communications, a team will start devising how to get most people back to normal days by the end of the primary mission on Sol 90, Trosper

said. The ability to have frequent communications is key to getting new instructions to the rovers as soon as possible, yet work normal hours.

So far, the Spirit experience has been excellent—it has been typically conducting three UHF sessions per day as well as three direct-to-Earth high-gain antenna sessions. The three UHF sessions involve one with MGS in the Mar-

km. was warmer and less dense than predicted, but this was partly compensated by a denser lower atmosphere. There was less braking in the upper atmosphere, then either a gust or a pocket of dense air created more dynamic pressure, which delayed deployment of the parachute to 24,500 ft. at 920 mph., versus a nominal altitude of about 30,000 ft., said Robert Manning, the EDL development manager.

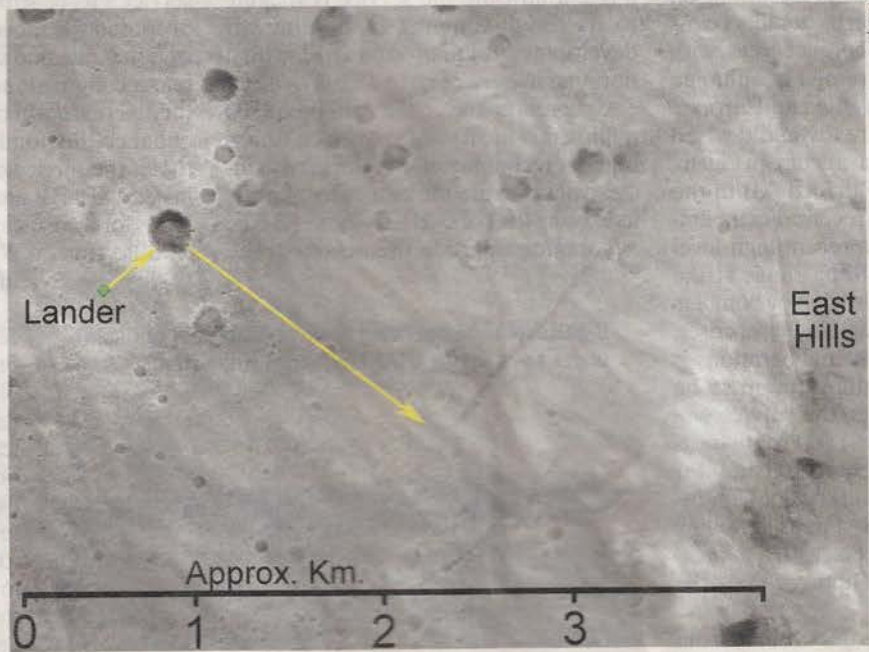
The parachute descent rate was slower than expected at 152 mph., perhaps due to updrafts or a high-density air pocket, he said. At 342 ft. above the ground, braking rockets on the backshell fired, reducing downward velocity to 8 fps. when the lander was cut free of its bridle 28 ft. above ground. The desired is 0 fps. Manning noted the bridle-cut altitude was only 1.5 airbag diameters; the nominal is 40 ft.

The lower altitude and 8 fps. sink was likely due to a low-altitude gust and the lander swinging the backshell attitude to off-vertical. Uncorrected, this would have added 10 meters/sec. to the touchdown drift when the braking rockets fired, but an attitude adjustment rocket fired to correct backshell angle, resulting in actual touchdown drift of 10 meters/sec.

Manning thinks when the rockets fired there still was residual lateral velocity from entry—the parachute didn't have enough time to stabilize to vertical flight owing to the thin atmosphere. Also, he was surprised at the wind dynamics.

The touchdown was 7-9 km. down-range of the target point, which can be largely ascribed to the weaker upper atmosphere deceleration and the several-second late parachute opening. The airbags bounced 28 times over about 1 min. with little rolling. The lander is located 250-300 meters from first impact.

Engineers might deploy Opportunity's parachute a little earlier depending upon atmospheric temperature observations by MGS. A previous idea to change entry angle to cater for a warmer atmosphere has become unnecessary. ☐



The plan is to drive 260 meters from the lander to a nearby crater, then head for hills 3 km. away. Overall site is in Gusev Crater.

tian morning and two with Mars Odyssey. An afternoon MGS session is available but usually skipped to avoid overheating the UHF transmitter.

THESE SESSIONS return 200-250 megabits per day of engineering and science data. This unexpectedly large amount is on the verge of overwhelming both the science and engineering teams—science from the volume of data, and engineering from the frequency at which it arrives. "It's hard to keep up with," Trosper said. Mars Pathfinder in 1997 had no UHF communications and only 1-2 direct-to-Earth sessions per day, she said.

The high-gain direct-to-Earth antenna is continuing to move without any recurrence of the high current spikes seen in the elevation motor the first time it was used on Sol 2. The stow position has been modified so if a motor froze it would be usable as the Earth drifted across for 0.5-1 hr. per day.

Reconstruction of Spirit's entry, descent and landing (EDL) is largely complete. The upper atmosphere above 20

828 (83344)

58122

23156

SPACE.COM: 20 JANUARI 2004

SPIRIT PREPARES FOR SEVERAL DAYS WORTH OF OBSERVATION ON MARS.

PASADENA - It's a sharply angled rock that sits on the surface of Mars. Scientists have dubbed it "Adirondack." The Spirit rover is expected to reach out with its arm later today and examine the football-size rock with its microscopic imager and two spectrometers, which can detail the minerals and elements that make up the rock. Spirit should then drill into the rock, perhaps as early as Wednesday, to reveal its interior. Scientists believe the rock is made of a volcanic material called basalt. "You can think of it as a time capsule that contains a history of its formation," said Dave Des Marais, of NASA's Ames Research Center and a member of the mission science team. NASA scientists also are expected to present results today of the Spirit rover's first down-and-dirty analysis of the soil beneath its six wheels from where it sits. Once done with Adirondack, the rover should trundle off again to examine a second patch of fine-grained soil no more than a yard away, Des Marais said. As engineers work to break in Spirit, the rover's range is limited to about a yard a day, mission members said. Eventually, it could travel dozens of yards a day. Spirit's twin, Opportunity, remains on track to land Saturday on Mars. NASA is targeting Opportunity to land in Meridiani Planum, which lies halfway around the planet from Spirit's Jan. 3 landing site in Gusev Crater. "Everything is looking good for the upcoming landing," Adler said. NASA dispatched the two robots to prospect for geologic evidence that Mars once was a warmer, wetter world capable of supporting life. Over the weekend, Spirit took a spin on Mars that doubled the distance on the odometer of the six-wheeled robot. The nearly 10-foot drive took the rover 30 minutes, including repeated pauses to snap pictures along its way. The drive was the first forward movement of the rover since it rolled off its lander and onto the martian surface. "We went for a little Sunday drive," mission manager Mark Adler told a Monday news conference at NASA's Jet Propulsion Laboratory.

833 45

SPACE.COM: 21 JANUARI 2004

"SERIOUS ANOMALY" SILENCES MARS SPIRIT ROVER.

PASADENA - Mars Rover officials at NASA's Jet Propulsion Laboratory announced Thursday that "a serious anomaly" occurred onboard the robot Spirit Wednesday, stopping the transmission of direct data for almost 24 hours. Peter Theisinger, Mars Exploration Rover project manager, began Thursday's press conference by telling reporters that they had not received contact from Spirit, either through relays from the orbiting Mars Global Surveyor or Mars Odyssey spacecraft. However, Jennifer Truesper, mission manager of surface operations, interrupted the press briefing to announce that a signal had been received from the rover via its direct link to Earth. That said, no direct data had yet to be received from the robotic geologist. Theisinger explained that the situation remains serious and that "no one single fault... that we can conceive of" can explain this anomaly. This morning's beep from Spirit was welcomed news. That beep confirms that the robot had received a transmission from Earth. Still, it has not returned any data since early Wednesday. Flight-team engineers for NASA's Mars Exploration Rover Project are working to diagnose the cause of communications difficulties. Spirit appears to be in what's known as "fault mode," said Theisinger, given that the robot has beeped back to ground controllers. That is good news for perplexed engineers. "So at least some element of Spirit's software that is necessary to process that command and take action... took action," Theisinger said. However, the robot is not transmitting significant data - enough information for troubleshooting - that the engineers can use to fully determine what has happened. Communication chain Spirit can communicate with Earth directly via an onboard "X-band system," or it can beam signals up to either of NASA's two orbiting spacecraft using a UHF antenna. There are four chances each day to reach the orbiters. NASA receives signals from spacecraft through its Deep Space Network (DSN) of tracking stations in Australia, Spain and California. Direct Mars-to-Earth communications are reserved for critical Spirit mission data, such as rover health and engineering. It takes about 10 minutes for a radio message, moving at the speed of light, to travel between planets. Signals transmitted to the orbiters can be delayed as little as 90 minutes to as long as 24 hours because of the way each orbiter works and communicates with Earth. There are several upcoming communication periods with Spirit via the two NASA Mars orbiting spacecraft now circling the red planet. Anxious engineers here hope to re-establish solid data contact with Spirit. Today, a Mars Global Surveyor relay session with Spirit is at 10:10 p.m. (EST). A follow-on Odyssey relay that session with the rover will take place overnight at 1:35 a.m. EST. On Friday, a wake-up call to Spirit is scheduled to be beamed from Earth at 6:00 a.m. EST. Getting tones from Spirit means a number of important things on the rover are in working order. Spirit is in what engineers call "power positive mode" and is maintaining proper temperatures in the frigid air of Mars. It continues to generate power from the Sun with its solar panels, said deputy project manager Richard Cook. The command from Earth requested Spirit to react if it did hear a signal. That response came in the form of a beep, lasting for five minutes. It heard the command and acted upon it. The rover was operating in the day when the problem cropped up. Engineers always worry about the issue of "thermal cycling" - hardware that must survive repeated day-to-night temperature swings. Theisinger told SPACE.com that this concern can't be discounted. "Yes something could break... something could fail." But the likelihood of that being the problem is now low on the list of probabilities, he said. A communiqué released late afternoon Wednesday from JPL indicated an unresolved issue with the status of the rover. According to the statement, ground controllers were able to send commands to Spirit early Wednesday and received a simple signal acknowledging that the rover heard them. However, ground controllers here did not receive expected scientific and engineering data from Spirit during scheduled communication passes during the rest of that Martian day. Officials said weather problems Wednesday at the Australian Deep Space Network receiver, which disrupted communications, were not related to Spirit's current quietude. Spirit had been gradually moving away from its landing pad, in the Gusev crater near the Martian equator. It has already sent back dozens of photographs and had begun exploring the soil of the red planet and digging into a rock named Adirondack. Spirit's twin, called Opportunity, is on target for landing on the opposite side of Mars Saturday night. The combined mission, designed to examine Martian geology and also determine if Mars once had large bodies of standing water, carries an \$820 million price tag. "I've never been on a flight project that didn't have one of these. Every single one that I've been involved in has had an event like this, or worse than this," said Steve Squyres, principal investigator for the overall Mars Exploration Rover (MER) program. Squyres works at Cornell University, which is collaborating with NASA on the project. Even highly successful spacecraft missions, like Voyager and Magellan, have had technical woes that were eventually sorted out, Squyres said. "The vehicle is up there. It is talking to us. It's definitely responding to things that we do. So a lot of stuff is working right on this spacecraft," Squyres told SPACE.com. "I've got a huge amount of confidence in this team. This vehicle is very, very good at keeping itself alive." Squyres said that his expectation is that the Spirit team will pull through this and have a long and successful mission. "But I might not sleep as well for the next few nights as I would have otherwise," he said.

833 46

833 45

231 57

HET WEER OP MARS

name twintig graden, maar omdat de dunne Mars-atmosfeer nauwelijks warmte vast kan houden, zakt de temperatuur na zonsopgang tot ver onder het vriespunt. Aan de polen kan het kwik zelfs tot min 130 dalen. Een ander verschil met de aarde is de ijle atmosfeer. Als de Marsplannen van president Bush doorgaan, moeten toe-

komstige astronauten zeker drukpakken en zuurstof meenemen, want de luchtdruk op Mars is minder dan een procent van die bij ons. De dunne Marslucht bevat duizend keer minder vocht dan de aardse atmosfeer. Toch is de dampkring volledig met waterdamp verzadigd, want bij de heersende luchtdruk en temperatuur kan er niet meer vocht bij. Gevolg

is dat er, net als op aarde, door condensatie van waterdamp wolken kunnen ontstaan. Vooral boven de poolkappen handhaaft zich vaak maandenlang een hardnekkig wolkendek. Verder moeten Marskarretjes zoals de Amerikaanse Spirit beducht zijn op gladheid en mist. Door de sterke afkoeling 's nachts slaat het vocht in de

atmosfeer soms als rijp neer op de bodem. Als het ijslaagje vervolgens door de opkomende zon verdamt, vormt zich in de lager gelegen gebieden gemakkelijk ochtendmist. De paraplu hoeft niet mee naar Mars. Wolken worden nooit dik genoeg om het te laten regenen of sneeuwen en bovendien kan vanwege de lage temperatuur en luchtdruk water hier niet in vloeibare vorm bestaan. Temperatuurverschillen tussen de evenaren en de hogere breedtegraden veroorzaken luchtstromingen en lagedrukgebieden. Meestal staat er een zwak briesje, maar er komen ook windhozen op Mars voor. Soms zwelt de wind zelfs aan tot orkaankracht. Grote hoeveelheden stof worden dan vanaf de grond de atmosfeer ingeblazen. Soms breidt de storm zich over de hele planeet uit en gaat het oppervlak achter een dikke stofsluier schuil. Ook als de storm na enige tijd gaat liggen, blijven de roestkleurige stoffeeltjes nog lange tijd in de atmosfeer rondzweven. Marswandelaars zullen met heimwee terugdenken aan de blauwe lucht bij ons, want het stof kleurt hun hemel roodbruin.



Op Mars regent het nooit, maar het kan er wel bewolkt, mistig, glad en zeer winderig zijn. De gemiddelde temperatuur is min 55 graden.

„Aanhoudend droog en zonnig met temperaturen uiteenlopend van min 18 graden Celsius in de middag tot min 83 graden 's nachts. De wind is zwak en draait in de loop van de dag naar noordelijke richtingen.” Aldus het weerbericht van een willekeurige plek op Mars. Wat heeft de rode planeet nog meer aan weer te bieden?

De motor van het weer is de zon. Haar warmte drijft de weermachine aan, maar zonder dampkring begin je niks. Kijk maar naar de atmosfeerloze maan. Nooit een wolkje aan de hemel, geen windvlaag of regenbui die het stoffige oppervlak beroeren.

Mars heeft daarentegen wel een atmosfeer. Wolken, wind en zelfs seizoenen komen op de rode planeet voor, maar er zijn ook verschillen tussen het aardse weer en dat van onze buurplaneet. Allereerst staat Mars anderhalf keer verder weg van de zon dan de aarde, zodat onze kosmische buur minder zonnewarmte ontvangt. Met een gemiddelde temperatuur van 55 graden onder nul verkeert Mars in een permanente ijs tijd. Alleen aan de evenaar bereikt de thermometer 's middags een aange-

DDL: 20-01-2004.

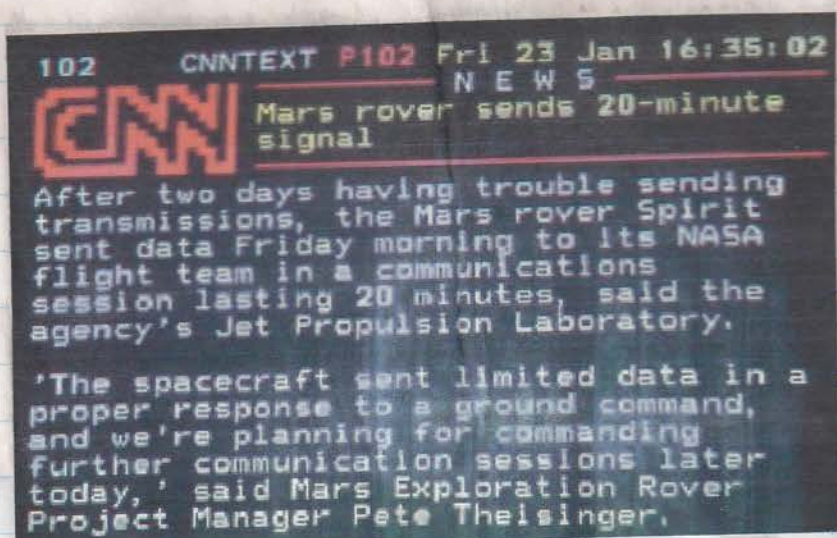
23158

5312F

SPIRIT TEAM WORKING ON COMMUNICATION GLITCH.

PASADENA - A communiqué released late afternoon Wednesday from the Jet Propulsion Laboratory (JPL) has indicated an unresolved issue with the status of the Spirit Mars rover. According to a JPL statement, ground controllers were able to send commands to the Mars Exploration Rover Spirit early Wednesday and received a simple signal acknowledging that the rover heard them. However, ground controllers here did not receive expected scientific and engineering data from Spirit during scheduled communication passes during the rest of that martian day. Project managers have not yet determined the cause, but similar events occurred several times during the Mars Pathfinder mission, stated a JPL press release. The team is examining a number of different scenarios, some of which would be resolved when the rover wakes up after powering down at the end of the martian day (around midday Pacific time Wednesday). The next chance to hear from the vehicle is when the rover may attempt to communicate with NASA's Mars Global Surveyor orbiter at about 8:30 p.m. Pacific time tonight. A second communication opportunity may occur about two hours later during a relay pass via the Mars Odyssey orbiter, another NASA spacecraft now circling Mars. If necessary, the flight team will take additional recovery steps early Thursday morning -- the morning of the 19th day on Mars that Spirit has been operating. -- when the rover wakes up and can communicate directly with Earth through its high gain antenna. Earlier today, Spirit ground controllers had reported that an uplink of commands from JPL's Deep Space Network station in Canberra, Australia had been thwarted due to heavy thunderstorms at that antenna site. That communication session included commands to Spirit to begin using for the first time its Rock Abrasion Tool, a grinder to begin work on a select rock within reach of the robot in Gusev Crater.

83348



83349

CNN : 23 JANUARI 2004.

NASA FIGHTS TO REVIVE SPIRIT ON MARS.

Attempting to diagnose a nearly mute and temporarily delirious spacecraft more than 100 million miles away, NASA mission controllers said Friday that they suspect a hardware problem on the six-wheeled Mars rover may have caused a severe malfunction. The craft, Spirit, has sent back little more than beeps and sporadic data bursts since Wednesday, forcing NASA engineers to scramble for answers at an inopportune time: an identical robot ship is poised to land on the other side of Mars on Saturday night or Sunday morning. Cautioning that they will need more time to understand what went wrong, project engineers said they have determined that Spirit has rebooted or tried to reboot itself more than 60 times a day since the failure. The preliminary health checkup includes both bad news and good news for the \$400 million mission, designed to search for evidence of water on the red planet in the ancient past. First the bad. "We will not be restoring functionality to Spirit for some time, for days or weeks, even in the best of circumstances," Pete Thiesinger, Mars rover project manager, told reporters at NASA's Jet Propulsion Laboratory in Pasadena, California. Now the good. NASA engineers think they can maintain the spacecraft's current health for some time, communicating simple commands and receiving simple replies, but nothing comparable to the flood of geological and photographic data from the first 18 days of the mission in Gusev Crater, a roughly 100-mile-wide pockmark thought to have once been filled with water. "I expect we will get functionality back from this rover," Thiesinger added. The chances that it will be perfect again are not good. But the chances that will not regain functionality are low, too, he said. The culprit remains a mystery, but engineers have pinpointed the time when the glitch began. Spirit was using an onboard motor to move its thermal spectrometer for a test when the motor unexpectedly conked out. After that, its messages to Earth became sporadic, feeble and in some cases garbled. More detective work determined that its processor repeatedly wakes up, attempts to load software data, finds a problem and then presses its own reset button. JPL engineers have coaxed Spirit back into regular and coherent contact with Earth, albeit in very simple conversations. They think one possible cause is that a hardware system has broken and affected the software somehow. "We're a long, long way from being done here, but we have serious problems and our ability to work around them is unknown," Thiesinger said. If performing long-distance therapy on Spirit were not enough, NASA must guide an identical twin rover to a landing in Meridiani Planum, a high-elevation plain loaded with a mineral that often forms in the presence of water. The Martian atmosphere is much thinner there than it is where Spirit landed, and a recent dust storm in the region thinned it even further. The conditions mean that Opportunity's parachute will have a harder time slowing the craft as it prepares to land. To compensate, the craft will deploy its parachute much sooner before touchdown, which is scheduled for 12:05 a.m. ET. "This will be challenging because it's the highest-altitude landing that NASA has ever attempted," said Wayne Lee, the engineer in charge of Opportunity's entry, descent and landing.

83350

23159

MARS MYSTERIES RIDE ON ROVERS.

SPIRIT'S TROUBLE PUT PRESSURE ON OPPORTUNITY FOR WATER CLUES.

PASADENA - NASA's next rover is due to land on Mars early Sunday, but its twin remains in critical condition on the planet's surface, raising the stakes for the upcoming touchdown. Cocooned in protective airbags, the Mars Opportunity spacecraft is scheduled to bounce onto a flat basin near the planet's equator at 12:05 a.m. EST Sunday, capping a six-month journey from Cape Canaveral. But fieldwork being done by the Spirit rover, which landed on the opposite side of Mars on Jan. 3, has been halted indefinitely while engineers try to sort out why it stopped operating properly earlier this week. "We've got a long way to go here with the patient in intensive care," NASA project manager Peter Theisinger said Friday. "We do have serious problems, and our ability to eventually work around them is essentially unknown."

The six-wheeled Spirit rover began acting erratically Wednesday when engineers started running a motor drive to point its infrared spectrometer at targets within Gusev Crater, a rock-strewn region the size of Connecticut. Sensing some sort of onboard problem, the rover's computer stopped executing commands. Then it began trying to reboot itself over and over again -- about 60 times over the course of two days. Theisinger likened the rover's behavior to trying to restart a desktop computer on Earth. "For you at home, this is just like pushing the reset button. This is in fact very close to pulling a wall socket out," he said. But the rover's attempts to fix itself so far have been unsuccessful, leading engineers to believe that the craft might be experiencing both hardware and software problems. The whole ordeal is perplexing engineers. The rover early Friday responded to commands from Earth for the first time in two days, but sent back only a limited amount of engineering data. That, however, was considered progress since Spirit was beaming back only extraneous radio noise and simple beeps that told ground controllers it still was alive. Despite its semi-comatose state, the rover's power and thermal control systems -- which are crucial to surviving the hostile Martian environment -- appear to be working properly. So in hospital terms, the craft is in critical but stable condition, giving engineers time to sort out the problems. Still, the rover's condition likely will remain the same "for many days, perhaps a couple of weeks, even under the best circumstances," Theisinger said. That means Spirit isn't likely to be beaming back scientific data, or photos of Mars, anytime soon. And the craft may never regain full function. "The chances that it will be perfect again, I would think, are not good. The chances that it will not work at all, I think, are also low. I think we're somewhere in that broad middle," Theisinger said. "We're slogging through this one day at a time, and we'll see where we end up," he added. "We certainly have not shot the last arrow in our quiver by quite a stretch of the imagination."

Spirit and its twin represent a combined investment of \$820 million. The former landed in Gusev Crater, an expanse not unlike dry lakebeds in California's Mojave Desert. NASA's Opportunity rover is headed for Meridiani Planum, a seemingly less intriguing plain on the other side of the planet. One of the flattest and smoothest regions on Mars, Meridiani was chosen in part because it provides Opportunity with an above-average chance for a safe landing. Scientists are enthralled with the site because it appears to harbor abundant stores of gray hematite, a mineral that typically forms on Earth near or within bodies of water. "And life as we know it requires liquid water," said NASA project scientist Joy Crisp. "So we want to go to Meridiani (and) study the rocks to determine whether liquid water was around in the past when these rocks formed, and whether that past environment was favorable for life."

NASA's Mars Global Surveyor, an orbiter circling 260 miles above the planet, first detected the presence of hematite at Meridiani -- and thus the potential for finding evidence of water on Mars -- just two years ago. "This was a major discovery," said Roy Arvidson, a deputy principal investigator from Washington University in St. Louis, Mo. "It kind of called to us to go to it." Data sent back from the NASA orbiter shows what appears to be a patch of hematite the size of Oklahoma. The Opportunity rover is targeted at an ellipse within that patch, which is about 45 miles long. Scientists think the presence of hematite indicates that the site once might have been the bottom of an ancient ocean. Or the hematite could have evolved in a vast pile of volcanic rubble, in which case, Meridiani might yield evidence of hot springs -- either past or present -- beneath the planet's surface. "At this point we don't know," Arvidson said. What is certain is this: The Meridiani site is expected to be strikingly unlike those visited by NASA's Viking, Pathfinder and Spirit landers -- almost alien in comparison. "We're all over the table on what this is going to like," Arvidson said. The topography still will be red -- due to the widespread presence of iron oxide in Martian terrain -- but it likely will be darker than previously seen landscapes. Look for Opportunity to beam back photos of windswept dunes and perhaps even a fine surface layer that sparkles like earthly hematite, which is mined for use in jewelry. Said Arvidson: "Expect the unexpected." The ongoing troubles with NASA's Spirit rover, meanwhile, ratchet up the import of the Opportunity landing. But the agency's criteria for mission success remain the same: At least one rover operating on the surface of Mars for three months. And project officials insist the level of strain remains the same. "Truly every mission is critical to us because we've invested a lot," said Crisp. "So that pressure can't really go up much more than it already is."

83351

83352



83353

Robot Spirit heeft pech onderweg op Mars

WASHINGTON - De Amerikaanse robot Spirit op Mars heeft pech gekregen. De robot heeft als gevolg van het euvel al 24 uur geen bruikbare signalen meer naar de aarde gestuurd, zo heeft het Amerikaanse lucht- en ruimtevaartagentschap NASA donderdag in Washington laten weten. Wat er kapot ging, is mede door het uitvallen van het contact nog niet duidelijk.

Volkskrant:
23-01-
2004

23160

105

105 RTL 4 vr 23 jan 16:29:05

Kort nieuws Buitenland

* De NASA heeft weer contact met de Amerikaanse ruimtesonde Spirit. De robot kreeg donderdag pech en kon geen bruikbare signalen meer sturen. Het euvel lijkt nu te zijn verholpen.

83354

Spirit

Washington - De Amerikaanse sonde Spirit op Mars heeft pech gekregen. De robot stuurt als gevolg van het euvel geen signalen meer naar de aarde, zo heeft het Amerikaanse luchtvaartagentschap NASA gisteren laten weten. Wat er precies kapot is gegaan, is mede door het uitvallen van het contact nog niet duidelijk. Het mankement is mogelijk ernstig, volgens de NASA. De Spirit arriveerde zondag 4 januari op de rode planeet.

83355

83356

NOS-TT 130 vr 23 jan 16:30:36
2/2**Kort buitenlands nieuws**

PASADENA De NASA heeft gedurende tien minuten weer contact gehad met de robot Spirit op Mars. In de afgelopen 2 dagen was er geen contact geweest. Onduidelijk is wat het probleem is geweest.

DDL: 23-01-2004.

SPACE.COM : 23 JANUARI 2004.

SPIRIT ROVER REMAINS IN CRITICAL CONDITION.

83357

PASADENA - Engineers here at the Jet Propulsion Laboratory (JPL) face a confusing high-tech detective story, trying to piece together fragments of data as to what has crippled the Spirit Mars Exploration Rover. NASA officials said in a statement this morning they had received a signal at the agency's Deep Space Network antenna complex near Madrid, Spain at 7:34 a.m. ET. Spirit communicated for 10 minutes initially and then later for 20 minutes more, for a total of a half-hour of data transmission. The transmissions arrived during 90-minute window of opportunity as the rover entered the martian morning. That's the good news. It means the robotic field geologist is keeping itself healthy enough to transmit information. But in a fit of robotic outrage, Spirit is rebooting itself over and over again, dozens and dozens of times in a futile attempt to restore itself to normalcy. One thing is obvious. The rover has seen better days, and may not be on active science duty for an extended period of time. "We do have a serious problem" in our ability to eventually work around issues, said Peter Theisinger, JPL Project manager for the Mars Exploration Rover program. "The chances that it'll be perfect again are not good," he said at an early morning press briefing here at JPL. Spirit's flight software is not behaving normally, Theisinger explained. The rover has been rebooting itself since Wednesday. Its onboard processor wakes up, loads flight software, then uncovers a condition that, in turn, causes the rover's brain to reset itself after a period of time. It then repeats that cycle. "Whatever causes the reset is not always perceived to be the same," Theisinger added, making the root cause of the problem all the more elusive. There are indications that Spirit is restless, Theisinger reported, not going to sleep at night. Theisinger said engineering and software teams do not know what started the chain of events that have upset Spirit operations. "I think, personally, that it's a sequence of events and we don't know, therefore, the consequences. I think it's difficult at this very preliminary stage to assume that we did not have some type of hardware event that caused this to start." To what extent operators can beam up a software patch to ignore that hardware issue - if that turns out to be the trouble spot -- is not know. "We've got a long way to go here with the patient," Theisinger said. Theisinger told SPACE.com that the problem now being wrestled with appears to be relegated solely to Spirit and not be a problem lurking within the look-alike Opportunity rover set to land Saturday night, around 9:05 p.m. Pacific Standard Time. One technical tidbit surfaced today about what was taking place onboard Spirit before it began to throw its temper tantrum. Engineers were testing a motor in Spirit's Mini-Thermal Emission Spectrometer (Mini-TES). The motor drives the elevation mirror within the Panoramic Mast Assembly -- a long tube-shaped structure at the front of the rover. Experiments were being done on Mars to compare temperature ranges and electrical currents needed to drive the mirror motor with those measured pre-launch in a vacuum chamber here at JPL. These tests were in process when Spirit seems to have started to experience problems. A special anomaly team at JPL has been formed, tasked to troubleshoot a myriad of possible scenarios that led to Spirit's bewildering condition. "I expect for this to go on in this mode for several days, talking to the spacecraft, gathering more data, winnowing out theories, and testing those theories," Theisinger explained. "I think we should expect that we will not be restoring functionality to Spirit for a significant period of time," he added, lasting "many days, perhaps a couple of weeks, even in the best of circumstances." "We're logging through this one day at a time," Theisinger concluded.

23161

Spirit Itches To Move

Rover landing goes well—but rolloff is delayed by bulky airbags—and its lessons are being applied to following ‘Opportunity’

MICHAEL A. DORNHEIM/PASADENA, CALIF.

Mars Exploration Rover “Spirit” has had a remarkably good week, but engineers at the Jet Propulsion Laboratory here are already using Spirit data to improve the chances of the other rover, “Opportunity,” slated to land on the opposite side of the planet on Jan. 24. These activities are part of a formal entry, descent and landing reconstruction team that started work immediately after Spirit’s Jan. 3 landing.

Program officials were going to decide late last week whether to add an unplanned trajectory correction maneuver (TCM) on Jan. 10 to alter Opportunity’s approach path. This and other tactics based on Spirit data and analysis are being considered because of a December Martian dust storm that has changed the atmosphere from the predicted assumptions. One day before Spirit’s landing, commands were sent to deploy its parachute 4 sec. earlier because of the same dust storm.

Spirit, also called MER-A, appears in overall excellent health and should drive off the lander platform this week. Science instruments indicate they are in good shape. The electronics are running warmer than expected, which can result in longer idle “siesta” periods in the middle of the day to prevent overheating, but the problem does not appear serious. It might even extend rover life, which is limited by cold temperatures as the Mars season turns to fall.

The main hangup late last week was getting the landing airbags away from the rover path off the lander. The desired path is to drive off forward, but the airbag on the left side might snag the solar array wing. The airbags are automatically partially retracted by tendon cables after they are deflated, and can be further retracted by command.

But several retraction attempts last week produced only marginal results, and engineers were wondering if some tendons might have broken. They are also looking at turning the rover on the

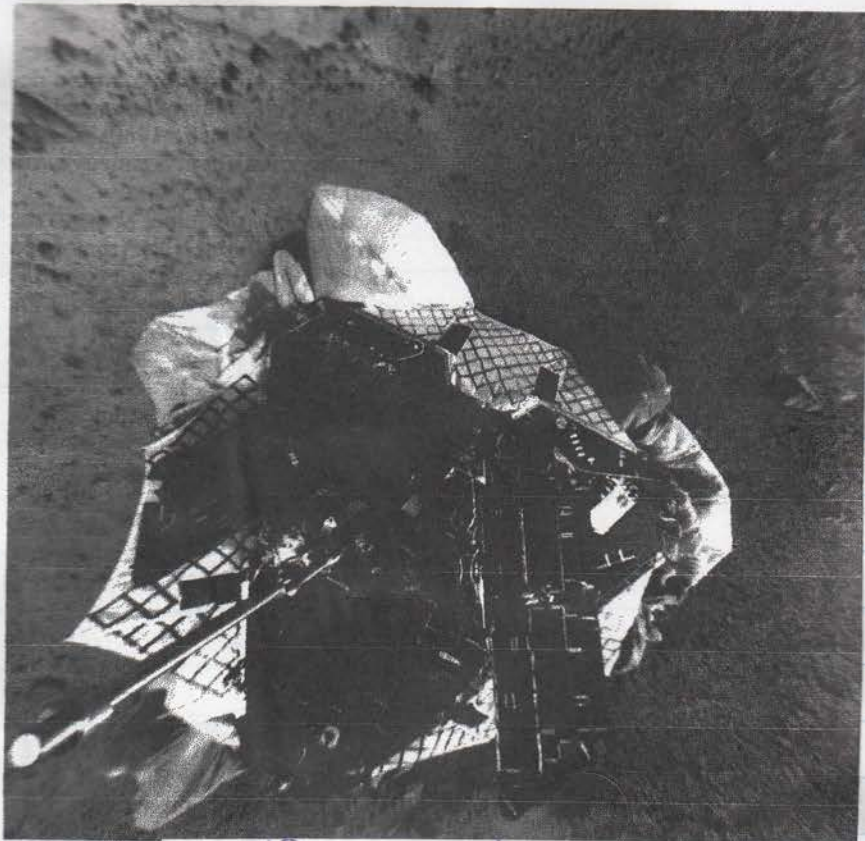
pad to exit in a different direction, such as 120 deg. to the right, but prefer the forward direction. Turning on the pad could cause its own snags. Another retraction attempt combined with lifting the lander petal 20 deg. was to be made Jan. 9. Engineers are simulating the problem at JPL with a full-size airbag and lander. The reconstruction team is studying whether it should change the automatic retraction scheme for Opportunity (MER-B).

Officials plan to start the process of jacking up the rover onto its own legs on Jan. 11, and think it might roll off on

Jan. 14, which is three days later than the ideal schedule. The biggest nearby rocks are about 20 cm. (8 in.), which the rover can drive over. “We’ll be able to drive a lot faster than anticipated,” said Jennifer Trosper, the surface development manager.

A last-minute discovery of a potential flaw in the entry, descent and landing (EDL) software resulted in changes being transmitted to Spirit about 5 hr. before landing. There was not enough time to test the software thoroughly before it was uploaded in mid-December, and testing will continue through the Opportu-

Novel top view of lander was created from a navigation camera panorama. The central mast supporting Navcam was removed from the picture, and the pole at lower left is the direct-to-Earth low-gain X-band antenna. Checkerboard areas are flexible egress ramps, with three triangular lander petals between them. Rover nose is aimed at 1 o’clock, but a drive in that direction could snag the left solar wing on the white airbag protruding from the ramp. Rover might also turn on the lander and exit in the 5 o’clock direction.



83358

23162

83359

83360

83381

nity landing. One JPL manager said it needed about five months more scrutiny when it was uploaded, mainly to check robustness of off-nominal paths. The MER program was reasonably well-funded, but the time available for development was less than half the historical norm for success, according to one study (*AW&ST* May 26, 2003, p. 56).

Ongoing tests revealed on Dec. 29 a hardware design flaw where computer resets and other events could interfere with pyro enabling. The last-minute change enabled pyrotechnic devices immediately, exposing the craft to an extra 40 min. of possible inadvertent firing. Several all-night sessions of testing and analysis took place before deciding to make the change.

The end of the approach to Mars started with TCM-A4 on Dec. 26. A minuscule firing changed velocity by 1 in./sec. and that was the last TCM. Two subsequent ones were scheduled but not needed.

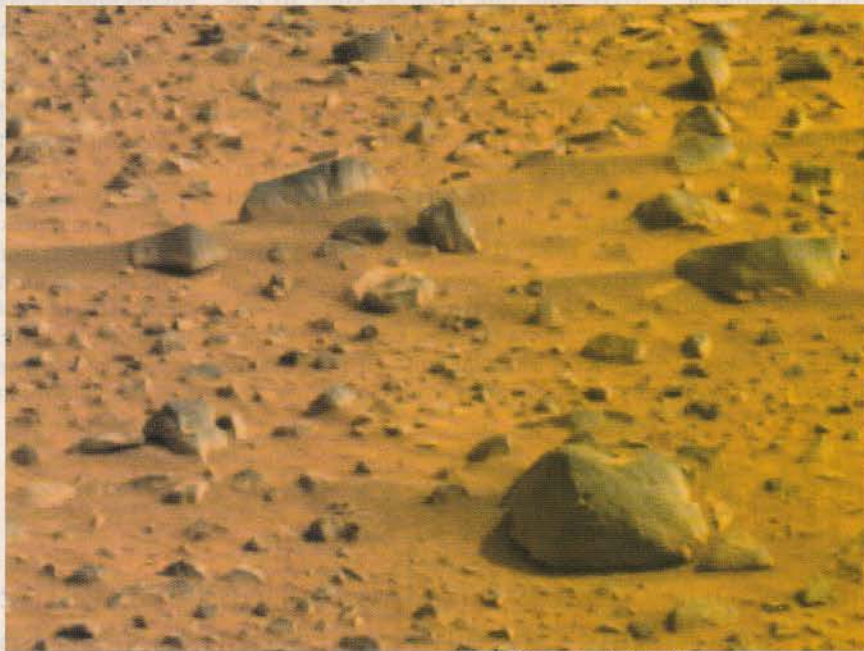
The lander's location appears to be about 7-9 km. (4.4-5.6 mi.) downrange from the target point in Gusev Crater. This may have been caused by a gust or high density pocket that delayed parachute deployment, said Robert Manning, the EDL development manager. The 90% probability error ellipse was about 60 X 3 km. so navigation proved to be superb. The MER mission is one of the first to use the "delta differential one-way ranging" technique, which gives precise lateral position in the sky. Traditional methods mainly measure range from Earth.

Around 7 p.m. PST on Jan. 3 the spinning spacecraft turned 20 deg. to point its heat shield at Mars. At 7:48 p.m. the craft vented Freon from its cruise heat rejection system that cools the rover electronics nestled deep inside the entry capsule. Times given are when signals were received on the Earth; the actual event occurred 9.5 min. earlier. The venting caused a wobble a little different than expected that was eliminated by thrusters over about 20 min. At this

point, telemetry showed the airbag gas generator temperature was rising more than expected from its heater and could reach its limit of about 32F, but the real limit turned out to be 68F and this proved not to be a problem.

Telemetry was now transmitting easy-

Closeup of landing site rocks demonstrates high-resolution capability of Cornell/JPL Panoramic Camera.



83362

to-receive X-band tones indicating the progress of EDL events. At 8:14 p.m. the entry capsule jettisoned the disc-like cruise stage and the signal was lost for 2 sec. as expected but quickly reacquired with a healthy tone.

At 8:29 p.m. the atmospheric entry phase started with the spacecraft at 73 mi. altitude and 12,192 mph. Two minutes later the tone changed, indicating that deceleration was being measured. Within a minute the tones changed several times, indicating increasing deceleration, and a peak of about 6.2g was reached. The heat shield reached about 1,600C (2,912F). At 8:33 p.m. a new tone confirmed that the parachute had deployed, but a few seconds later than expected. The nominal deployment altitude is 25,000 ft.

The heat shield was dropped at 8:34 p.m., according to the tone. After that, the lander descended on a 65-ft. bridle from the backshell and began a second transmission at UHF frequency with 8 kilobits/sec. telemetry to the Mars Global Surveyor (MGS) satellite passing overhead.

The radar altimeter started searching

for the ground, the airbags inflated, the Descent Image Motion Estimation Subsystem (Dimes) started taking pictures to calculate wind drift, and at the appropriate time three braking rockets on the backshell fired while parachute-descending at 240 fps., to slow the descent to zero at 40 ft. above the ground. There the bridle was chopped and the airbag-covered lander bounced for about a minute across the Martian terrain.

At the same time the braking rockets were fired, one of three smaller solid rockets fired to adjust the backshell attitude. That vectored braking thrust to reduce lateral velocity caused by winds and by swinging on the bridle. This is the Transverse Impulse Rocket Subsystem (TIRS). The lander was swinging about +/- 15 deg. under the backshell. Had TIRS not operated, the touchdown drift would have been about 22 meters/sec. (50 mph.), but TIRS reduced this to 10 meters/sec., Manning said.

Touchdown was at 8:35 p.m. There were signs of bouncing on the surface in the X-band signal and the control room erupted in cheers. But the signal became intermittent and disappeared at 8:36 p.m. Minutes passed as receivers searched for the tone. "It was nerve-wracking," Manning said.

At 8:44 p.m. Michael Malin of MGS reported that the satellite had received more than 240 kilobytes of UHF data—so much data that most of it must have come from the surface. But from the anxious looks on controllers' faces it appeared no one heard him. Malin made more increasingly positive reports over the next several minutes that also seemed to fall on deaf ears. As testimony to the strength of the UHF signal, the 150-ft. dish at Stanford University reported at 8:50 p.m. that it received the signal for up to 12 min.—well after landing. Still no reaction.

Finally, at 8:51 p.m. the Deep Space Network (DSN) reported a very strong X-band signal and the control room erupted in jubilation once again. "I had

23163

83363
 put on my magnifying glasses to look for the signal among the noise at the bottom of the display, and didn't notice that the signal had returned so strongly that it was at the top of the screen," Manning said. The signal came back on strongly when it switched to the bottom lander petal antenna, which apparently was pointed at the setting Earth. And at 8:54 p.m. DSN detected a tone saying the airbags were still inflated and the base petal was down—the ideal attitude.

Airbag retraction started at 8:56 p.m. and ran to about 9:30 p.m. After that, the lander petals opened and the rover solar arrays unfolded. Around 11:11 p.m. controllers received confirmation that critical deployments—through the solar arrays—had been completed. Spirit it reported it had no faults. "I've never seen that before," Trosper said.

Things were going very well. At 11:30 p.m. the Mars Odyssey satellite started sending 24 megabits of data it had received from Spirit's UHF transmitter—50% more than expected. This includ-

83364
 ed the first pictures as well as engineering data. The UHF link was also used in the other direction, to send commands to Spirit via Odyssey on the first day. The camera mast had deployed, Pancam pictures were taken, and the lander was only tilted two deg. Solar array output was 83% of predicted, due to dust obscuring the atmosphere.

Subsequent communications sessions have gone well, and by increasing the UHF data rate from 32 kbps. to 128 kbps. they can now pass more than 50 megabits per session. This provided data sooner than expected. "On the third day I'm getting data I didn't expect to see for three weeks," Manning said.

But the most critical electronics temperature is in the UHF transmitter and that has cut into its usage. When the rover rolls off the lander it should run 9F cooler, and a longer-term solution is being devised, Trosper said.

"We had a big scare coming in on approach," Manning said. "It was sneaky, a dust storm away from Gusev."

83365
 The team didn't think much of it, but infrared measurements from Mars Global Surveyor showed upper atmospheric temperatures were high along the entry path because the distant dust storm was having a global effect. That meant less density, and calculations showed that the critical time from parachute deployment to firing of the landing retrorockets had dropped about 20%, from 110 sec. to 90 sec. Important events must be completed in this period, such as calculation of drift from descent imagery, and engineers like to have 100 sec. "It looked tight in the worst-case conditions," Manning said.

Margin was gained by deploying the parachute 3-4 sec. earlier at a higher airspeed, based on sensing deceleration. The dynamic pressure for deployment was increased from 700 to 725 Pascals, or, in airplane terms, from 65.7 kt. equivalent airspeed to 66.9 KEAS. Data show this switch was useful—in fact the chute opened later anyway, making the change that much more important.

A Spirited Dialogue

As Bush administration debates which direction to send the space program, rover managers debate which direction to send Spirit

CRAIG COVAULT/PASADENA, CALIF.

83366
 The electrifying success of the Spirit Mars rover landing and Stardust comet intercept will form a powerful backdrop to the White House new space goal initiative.

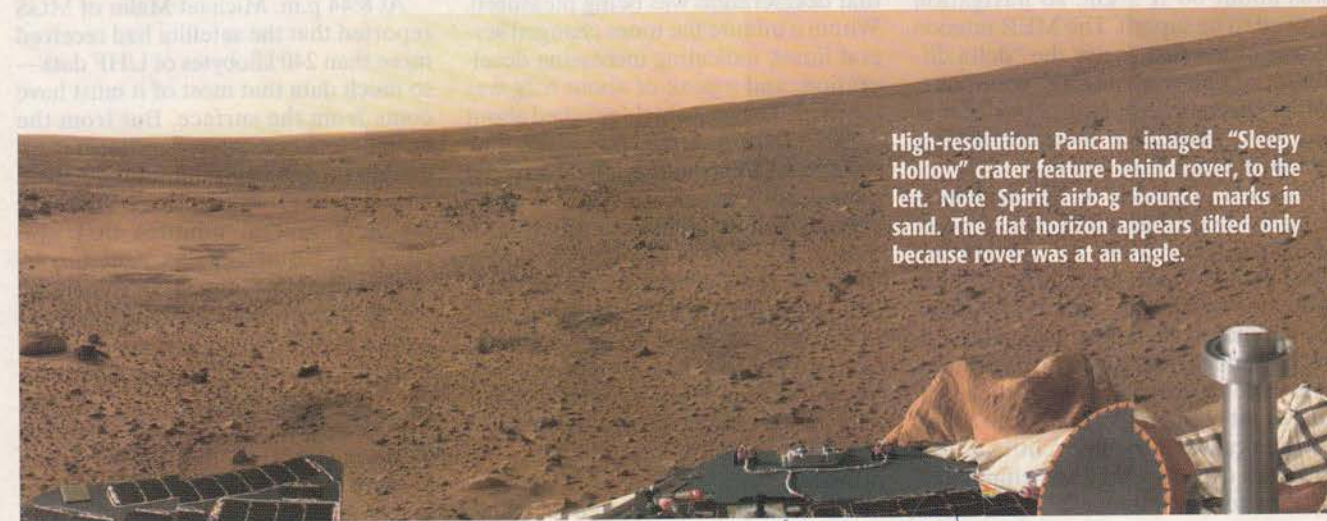
While Stardust is beginning a two-year trip back to Earth carrying 4-billion-year-old comet material, on Mars, Spirit's

cameras are returning superb imagery from the surface of that planet.

The rover's six-instrument Athena science package has been fully checked and robotic systems are getting a final shake-down before Spirit "completes its landing on Mars" and rolls off its descent system. That move, now set for late this

week, depends upon which direction it rolls off, pending resolution of an airbag interference issue on the forward, preferred ramp. There are, however, several off-ramp options.

In the meantime, the rover's mast-mounted Cornell University/Jet Propulsion Laboratory Panoramic Camera sys-



High-resolution Pancam imaged "Sleepy Hollow" crater feature behind rover, to the left. Note Spirit airbag bounce marks in sand. The flat horizon appears tilted only because rover was at an angle.

tem and Mini-TES thermal emission infrared spectrometer have been intensively characterizing the landing site for science and drive-route planning.

The location in the 93-mi.-wide Gusev Crater has been named "Columbia Memorial Station" in honor of the shuttle crew lost Feb. 1, 2003.

The rich scientific potential of the site has aroused vigorous debate among the rover science team about the type of landform they are actually on.

SPIRIT IS WITHIN 6 MI. of its original target. And, fortuitously, was blown by 40-mph. crosswinds during parachute descent into an even more favorable dust-free area devoid of large rock roving hazards, said Steve Squyres, overall rover science principal investigator (PI) from Cornell. Squyres said the site looks dramatically different from either the Viking 1, 2 or Pathfinder landing sites.

Although imagery from orbit showed this should be a lakebed with geologic evidence of potential life-giving water, "We are debating intensely what type of landform we are actually on," said Ray Arvidson, the project's deputy PI from St. Louis-based Washington University.

"It's all being debated," he said. "We have an excellent science team but, 'it's like herding cats'; they are all trained to be totally independent and vocal."

The rover landed pointing south, by luck, toward large tantalizing hills only a mile or so away, where the geology might indicate water-erosion features.

But Pancam imagery looking north 180 deg. shows what seems to be a small nearby impact crater that could have excavated potential sedimentary rock—another indication of past water.

The spot has been dubbed "Sleepy Hollow" because the area appears hollowed out and the 125-member science team is going without sleep.

Intensive mineral and composition science operations near the lander platform will be the first order of business after roll-off. But then some members of the team want the rover to "head for the hills" straight ahead, while others want it to back off the lander or make a U-turn and return to Sleepy Hollow.

The Spirit rover and the Bush administration both face the same major question—"which direction do we go?"

With about 1.5 billion internet hits on Mars rover web sites since the Jan. 3 landing, the public has clearly begun rooting for Mars and its potential to jump-start interest in math and science.

That has not been lost on Bush who last week phoned the Mars Exploration Rover (MER) science and control teams here telling them the Rover operations on Mars mark an "inspirational moment, especially for the next generation of explorers—the young students in schools today."

Goals that could reinvigorate the U.S. space infrastructure are important to watch for in the new Bush strategy. And again ironically, a totally new infra-



The low-resolution hazard camera, near aft wheels, imaged a scene framed by rover solar array on top, and lander platform and wiring at bottom.

structure is already taking shape—but on Mars—where the Mars Surveyor and Odyssey orbiters are relaying data between Earth and Spirit. "We have now accomplished a communications satellite system on another planet," said Ed Weiler, NASA associate administrator for space science.

At the same time U.S. operations are underway, potent new science instruments are being activated above the planet on board Mars Express, Europe's first Mars orbiter (see p. 28).

Hope for locating the British Beagle lander that was carried on Mars Express continues to fade with each gigabyte of new information from the four spacecraft that are working at Mars. But the new U.S. Mars program faces its own second

trial-by-fire Jan. 24 when Spirit's twin rover, Opportunity, will arrive on the opposite side of the planet from Spirit.

The missions are not about rocks, they are about the potential for life on another planet, Weiler said.

The objective for both rovers is the same: to trace the persistence of water billions of years ago at each area in order to evaluate Martian habitability for ancient life forms. But the reasons for using two sites are totally different.

The choice of the second rover's Meridiani site is based on chemistry. Mars Global Surveyor data shows the strong presence of gray hematite, a mineral on Earth closely associated with water processes.

Spirit's Gusev Crater landing site is based on the shape of geologic landforms. Specifically, imagery from orbit that indicates a large river flowed into and filled the crater with water, possibly 3,000-ft. deep, and perhaps more than once.

But what looked like a lakebed in the initial low-resolution navigation camera images, is shown to be otherwise in the 64-times-higher-resolution Pancam imagery.

"A lakebed is typically flat with fine-grained sediments. But that is not what we are seeing here," Arvidson said.

"We are looking at a surface that is rock-strewn, a surface that has a number of secondary craters and excavated rocks."

"It is not a primary depositional surface [such as] in the dry lakebeds between Los Angeles to Las Vegas," he said.

"If there are lakebed sediments, they have been chewed up and the rocks brought in either from the bottom, or laterally, from some set of different processes. One hypothesis is that a large volcano to the north filled the crater with ash after or during its water epic. Another is that liquid or icy carbon dioxide could have played a sculpting role.

"OUR JOB WILL BE to use the rover's integrated science payload to find the evidence, among everything else, that there have been lake environments here in the past," he said. "I suspect we will find it [confirmation of water's role], but it will take a while."

"And I personally think the rover's microscopic imager will be critically important because it might be the very fine-grained textures, combined with the mineralogy and chemistry that say some-

83372) thing about the various origins of the material," Arvidson said.

Before the rover moves an inch, basic science characterization of the surrounding terrain for a mile or two in every direction remains a priority. The

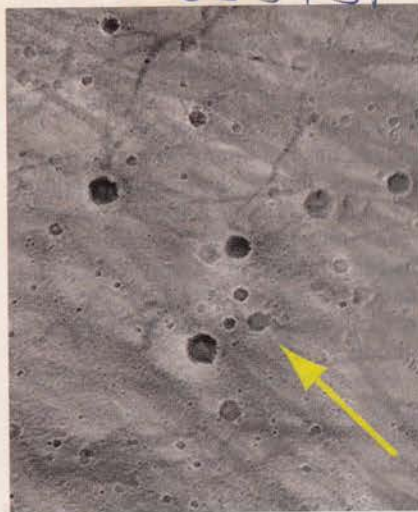
Spirit landing site (arrow) in this Mars Global Surveyor image shows small craters amid streaks on the surface caused by dust devils.

downlink of high-resolution stereo Pancam and Mini-TES infrared imagery 360 deg. around the rover was to be completed early this week.

When the first images of the large hills arrived there was a wave of "whoaaaa" across the team members in the JPL Mission Support Area where the flight is being controlled. "That is the fun of exploration and discovery," said James Bell, lead Cornell manager for Pancam development and operations.

The Pancam 360-deg. panorama carries a huge amount of data, especially useful for zooming in on individual features. The Pancam has 20/20 vision. Its images could be—and will be—blown up to IMAX size without losing detail.

The images were being taken and transmitted by the rover in "octants,"



each covering 45 deg. of the scene around Spirit. Each frame contains 1 million pixels. The full panorama contains 75 frames with about 50 megabytes of data. A single UHF downlink pass through Odyssey can move nearly 50 megabits of data, basically an octant, so downlink of the imagery was going well. The Mini-TES infrared system involves equal amounts of data.

The infrared mineralogy data was being overlaid on top of Pancam data last week. Computer graphics were also be-

ing used to visualize terrain around the lander from different aspects.

All of this will go into the initial roving plots for use after the rover takes initial data around the landing site to determine the homogeneity or heterogeneity of basic rocks and soils.

The initial deployment tests of the rover's 3-ft. Instrument Deployment Device arm, equipped with sensors and a rock abrasion tool to bore into rocks, was another key milestone set by early this week.

MANY ROCKS AT THE SITE show sandblast-type weathering and are absent of the "rind" on rocks seen at the Viking and Pathfinder sites. Although yet to be determined, this could mean less need of the abrasion tool to reach pristine mineralogy, thus saving time on the surface.

With few large rocks posing hazards, managers were confident Spirit would be going farther over the next three months than the original plan to travel perhaps only 600 meters during the entire mission, stopping often for science data.

By early spring, if the vehicle's basic science mission is complete, managers will be more inclined to choose a direction and go as far as they can for as long as they can, for perhaps more than three months, to explore whatever is beyond the next horizon.

Still Astray

As hope fades for recovering Beagle 2 lander, European mission team turns to orbiter

MICHAEL A. TAVERNA/PARIS and DOUGLAS BARRIE/LONDON

83375) **E**ngineers have not given up hope of establishing a communications link with Europe's Beagle 2 lander, but are already shifting most of their attention to the accompanying Mars Express orbiter, which was inserted into Martian orbit last Dec. 19 without a hitch.

Using NASA's Mars Odyssey and radio telescopes on Earth, mission controllers had tried to pick up a signal from Beagle 2 following touchdown on the Martian surface on Dec. 25 (AW&ST Jan. 5, p. 22). They had placed considerable hope in a new attempt on Jan. 7 using Mars Express, whose communications system, unlike that on Odyssey, underwent end-to-end tests with Beagle 2.

But this attempt, performed after a series of orbit-lowering and inclination-trim maneuvers on Jan. 4-6 that brought the orbiter to within 315 km. of the lander's planned landing site in the Isidis Planitia basin, also came up short.

Renewed overflights of the Beagle 2 landing site by Mars Express were planned for Jan. 8-10 and Jan. 12, the day considered the most propitious. Further attempts will be made if needed, said the European Space Agency's science director, David Southwood. "[Jan. 7] was the first good opportu-

nity, but there will be others. It'll be quite a few more weeks before we cease trying." However, he acknowledged that "the odds took a dive" after Jan. 7.

If, as seems increasingly likely, this proves unsuccessful, then scientists may face having to wait until perhaps early February to see if Beagle 2 uses its last back-up mode, auto-transmit, to determine if the lander has actually survived atmospheric entry and descent. Were nothing to be heard within 5-10 days, the assumption would be that Beagle has been lost.

While emphasis will now shift to mission science using orbiter instruments, in parallel, the Mars Express team will continue to analyze data and attempt to come up with additional recovery modes to find Beagle 2 if those already programmed prove inadequate, Southwood said.

In the absence of telemetry that could determine what happened, it is impossible to say to what extent the lander has survived reentry and retains a sufficient battery charge. Although Beagle 2 is too small to be seen, mission controllers hope to locate its airbags or parachutes using the orbiter's high-resolution stereo camera, which is scheduled to send first images this week.

23166

thing about the various origins of the material," Arvidson said.

Before the rover moves an inch, basic science characterization of the surrounding terrain for a mile or two in every direction remains a priority. The

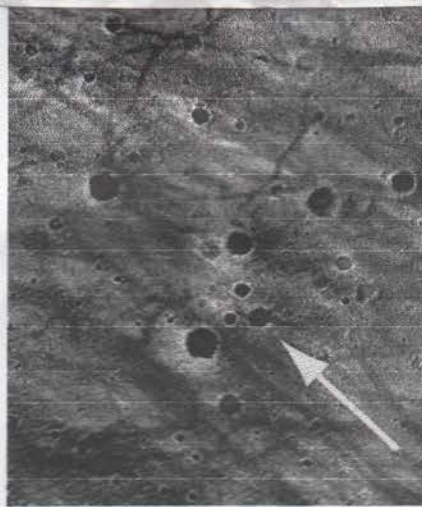
Spirit landing site (arrow) in this Mars Global Surveyor image shows small craters amid streaks on the surface caused by dust devils.

downlink of high-resolution stereo Pancam and Mini-TES infrared imagery 360 deg. around the rover was to be completed early this week.

When the first images of the large hills arrived there was a wave of "whoaaaa" across the team members in the JPL Mission Support Area where the flight is being controlled. "That is the fun of exploration and discovery," said James Bell, lead Cornell manager for Pancam development and operations.

The Pancam 360-deg. panorama carries a huge amount of data, especially useful for zooming in on individual features. The Pancam has 20/20 vision. Its images could be—and will be—blown up to IMAX size without losing detail.

The images were being taken and transmitted by the rover in "octants,"



each covering 45 deg. of the scene around Spirit. Each frame contains 1 million pixels. The full panorama contains 75 frames with about 50 megabytes of data. A single UHF downlink pass through Odyssey can move nearly 50 megabits of data, basically an octant, so downlink of the imagery was going well. The Mini-TES infrared system involves equal amounts of data.

The infrared mineralogy data was being overlaid on top of Pancam data last week. Computer graphics were also be-

ing used to visualize terrain around the lander from different aspects.

All of this will go into the initial roving plots for use after the rover takes initial data around the landing site to determine the homogeneity or heterogeneity of basic rocks and soils.

The initial deployment tests of the rover's 3-ft. Instrument Deployment Device arm, equipped with sensors and a rock abrasion tool to bore into rocks, was another key milestone set by early this week.

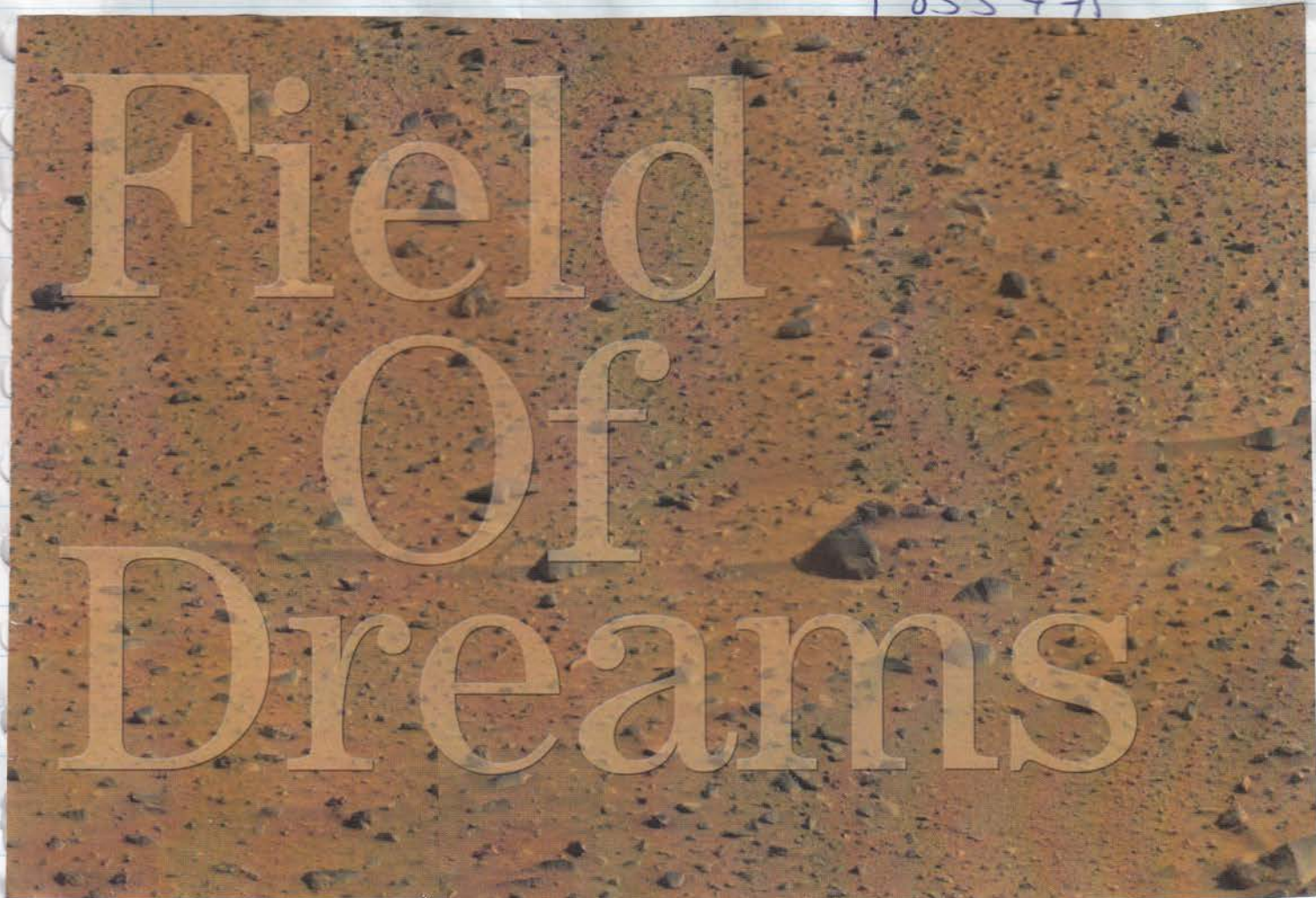
MANY ROCKS AT THE SITE show sandblast-type weathering and are absent of the "rind" on rocks seen at the Viking and Pathfinder sites. Although yet to be determined, this could mean less need of the abrasion tool to reach pristine mineralogy, thus saving time on the surface.

With few large rocks posing hazards, managers were confident Spirit would be going farther over the next three months than the original plan to travel perhaps only 600 meters during the entire mission, stopping often for science data.

By early spring, if the vehicle's basic science mission is complete, managers will be more inclined to choose a direction and go as far as they can for as long as they can, for perhaps more than three months, to explore whatever is beyond the next horizon.

83376

83377



83375

23167

SPiRIT ROVER SENDING DATA AGAIN, STATUS UNCLEAR.

NASA's Spirit rover communicated with ground controllers early this morning, sending back some data and giving hope that normal operations might resume. The rover had gone mostly silent Wednesday, returning only beeps to acknowledge it was alive. For unknown reasons, Spirit could not transmit data. NASA officials said in a statement this morning they had received a signal at the agency's Deep Space Network antenna complex near Madrid, Spain at 7:34 a.m. ET. Spirit communicated for 10 minutes initially and then later for 20 minutes more, for a total of a half-hour of data transmission. The transmissions arrived during 90-minute window of opportunity after the rover woke in the Martian morning. Data was transmitted at a rate of either 10 bits per second or 120 -- two separate NASA statements give differing numbers. Officials did not indicate whether the rate was normal or how optimistic they are based on the transmissions. "The spacecraft sent limited data in a proper response to a ground command, and we're planning for commanding further communication sessions later today," said Mars Exploration Rover Project Manager Pete Theisinger at NASA's Jet Propulsion Laboratory, Pasadena, Calif. Engineers worked late into Thursday night trying unsuccessfully to establish normal communications with Spirit. Efforts to relay signals using NASA's Mars Global Surveyor (MGS) at 10:10 p.m. ET resulted in no data being sent back. Spirit did send a radio signal via MGS, but that transmission did not carry any data. After a signal had been sent to the rover Thursday morning, Spirit replied with a simple tone but would not send data. Officials yesterday expressed serious concern for the health of the rover but remained optimistic. If the problem involved hardware, they said, the situation would be grave. A software problem, they said, might be fixable -- fresh commands and even new software patches can be possibly uploaded to Spirit if it is in listening mode. Indications Thursday were that the craft's batteries were in good shape, that its temperature was being properly maintained, and that it was indeed listening. Scientists said Spirit's flight software or computer memory might have become corrupted. Either glitch could leave the robot's power supply healthy and allow adequate time for recovering control of the rover. No single explanation considered so far fits all of the events observed, Theisinger said. Engineers tried to replicate the situation in a test facility at JPL, and the testbed rover did not have any trouble communicating. "We have a very serious situation," Theisinger said late Thursday. Spirit landed on Jan. 3 and is slated to scour the Gusev crater, near Mars' equator, for three months. Its twin, Opportunity, is due to land Saturday. The combined mission cost is \$820 million. Earlier Thursday, JPL Director, Charles Elachi, advised that everyone "stay calm, thoughtful and careful" and avoid making hasty decisions. "Sometimes you can do more harm than good by reacting too quickly," Elachi said. Spirit can communicate with Earth directly via an onboard "X-band system," or it can beam signals up to either of NASA's two orbiting spacecraft using a UHF antenna. There are four chances each day to reach the orbiters. NASA receives signals from spacecraft through its Deep Space Network (DSN) of tracking stations in Australia, Spain and California. Direct Mars-to-Earth communications are reserved for critical Spirit mission data, such as rover health and engineering. It takes about 10 minutes for a radio message, moving at the speed of light, to travel between planets. Signals transmitted to NASA's two Mars orbiters -- MGS and Mars Odyssey -- can be delayed as little as 90 minutes to as long as 24 hours because of the way each orbiter works and communicates with Earth.

83378

83379

P551 551 ARD-Text 25.01.04 08:55:33

Wissenschaft

NASA gewinnt "Spirit"-Kontrolle zurück

Kurz vor der erfolgreichen Landung des US-Marsroboters "Opportunity" haben NASA-Ingenieure die Kontrolle über den angeschlagenen Zwillingsroboter "Spirit" wieder erlangt.

Wie die NASA mitteilte, gelang es, den Grund für die technischen Probleme von "Spirit" zu diagnostizieren. Ursache für die Funktionsstörungen waren vermutlich die Speicherchips des Roboters. Er habe nun seine Neustart-Versuche beendet und sei in den energiesparenden Ruhe-Modus übergewechselt.

In spätestens drei Wochen sei "Spirit" wieder einsatzfähig, so die NASA.

531 << Fax-Abruf >> 108 >> 552

F21ES

23168

SPACEFLIGHT NOW : 25 JANUARI 2004.

BOGGED DOWN SOFTWARE COULD EXPLAIN SPIRIT'S AILMENT.

The group working to unravel the glitch with Spirit and return the rover to action has narrowed the possible cause of its trouble to three potentials, officials said Sunday afternoon. "Spirit is still serious but we are moving toward guarded condition now," rover project manager Pete Theisinger said. "I think we got a patient well on the way to recovery." The rover experienced a problem last Wednesday, disrupting communications with Earth and halting all science activities. The breakdown happened while Spirit was performing a calibration of motors on the Mini-TES instrument. "The leading theory is that the file management software module in the software has gone to some condition that it could not cope with -- that it was not robust enough for the operations we were engaged in when we had the flaw on Wednesday," Theisinger said. On Saturday, engineers began focusing on the rover's flash memory and the way the software communicates with the computer memory. To get the rover operating, it was told to avoid using the flash memory for now. On Sunday, the team was able to reset Spirit's computer to the non-flash utilization mode, Theisinger said. Also Sunday, the ongoing diagnostics determined the flash memory hardware aboard the rover to be healthy. "There are two other theories that are not as well in competition but cannot be discounted, and they are being worked by anomaly subteams," Theisinger added. "One is there was some kind of error or hardware issue on the motor control board. That's the circuit board with the electronics that control the motors. That's being examined." "Also...there was a solar event Wednesday and the timing of that is being looked at with respect to correlation to the onset of our problems. The flash memories are sensitive to high-energy ions and neutrons when they are being read from and written to, and we were certainly engaged in a lot of that activity that day." Theisinger remains hopeful that Spirit will resume its exploration adventure of Gusev Crater by mid-February. "I think we've got a patient well on the way to recovery, and I think we have a very good chance now we will have a very good rover when we are done getting this thing back up. Although, once again, it will take some time to make sure that we have completely characterized the problem and that we are able to check out all of the functionality on the vehicle. "You can't take anything for granted here. So I don't expect to be driving for a couple of weeks, maybe three."

83380

83381



23169

RECONSTRUCTING SPIRIT'S HOPEFUL ROAD TO RECOVERY.

NASA's Mars Exploration Rover Spirit appeared to be teetering on the brink of failure last week when ground controllers lost contact with the craft sitting in Gusev Crater, its arm extended to a rock as the scientific adventure was beginning. Now, engineers are cautiously hopeful that Spirit will soon be restored to full working order. "Spirit is doing better. It is kind of like we a patient in re-hab here, and we are nursing her back to health," Jennifer Trosper, rover mission manager, said Monday. "You have to keep in mind that the problem we've had actually is associated with our ability to collect and maintain recorded data (on the rover). So the flash memory where we store this data that would tell us what had happened over the past days actually is part of the problem we are seeing. So we don't have a lot of information," she told reporters at the daily spacecraft status briefing. It is believed the problem lies with the rover's flash memory and the software management system. Flash memory is used in electronics, such as digital cameras, because it retains stored information even when the power is turned off. The rover also has random access memory, which doesn't keep stored data when the rover goes to sleep each night. Some triggering event, not yet pinpointed, caused the rover's computer brain to begin a continuous series of resets until engineers on Earth were able to regain control of the craft. "Let me go back to Sol 18 and tell you a little bit about what we think happened -- to try and reconstruct it. As we get more data, I guarantee you that some of these things will change, but let me tell you what we think today," Trosper said, launching into a detailed explanation that begins last Wednesday. "Sol 18 we had some weather problems at the (Earth communications) station, and about 10 minutes early for the morning antenna pass we lost the signal. It wasn't clear whether that was the result of a spacecraft problem or a station problem. "We've done some tracking of that, it's still not completely clear, but it's entirely possible that was a spacecraft problem at that time. We believe that was possibly a reset on the spacecraft that would've caused our signal to be lost when...the software would reset and come up and power off all of the loads and put itself into a safe state. "Due to the reset, we have actually confirmed that the morning activities that we were trying to do that morning did not complete. So if you recall, we were moving the IDD (science arm), getting ready to (use the Rock Abrasion Tool). The IDD, the arm, position is actually in the same position it was on Sol 18 before we attempted to do that move. "Some time the morning, early afternoon of Sol 18 (Wednesday) we encountered the problem. That problem, initially, was most likely a reset. We don't understand exactly where that reset came from but we have some ideas. It caused us to get into this belief that the flash system was corrupted in a way that we got into continuous reset loops. "Then in the afternoon, we actually sent a command sequence to the vehicle with a little bleep in it to tell us that the sequence got there. We sent that sequence and got the bleep with no problems. "Twenty minutes after that we expected to see a session from the vehicle on the high-gain antenna communicating with us. We had been on the high-gain antenna since Sol 2. We didn't see that communications session. That, in addition to the 10 minute drop out early in the morning, that was one of the early indications that there was something wrong. "In the afternoon Odyssey pass we did not see any data from the vehicle. The early Sol 19 (Thursday) morning MGS (Mars Global Surveyor) pass, we only saw two minutes of data from vehicle and it wasn't really data from the vehicle -- it was 'the UHF radio was on and nobody was home' kind of data. And then the morning Odyssey pass we received no data. "On Sol 20 (Friday) in the morning we attempted to command the rover at the nominal uplink rate where it should be if everything is fine, and we received no data. We have pre-loaded communications windows when the rover should attempt to communicate with us and those windows did not execute on the morning of Sol 20. "One of the things that the vehicle will do if it encounters a system-level fault is change the rate at it will accept commands, and that is for the vehicle's protection as well as for our knowledge. And so in the afternoon we sent a command at a different rate for the vehicle to send us a beep, and we actually got that beep back. The rate we sent it at was a rate that the software would have autonomously put us in if it had some sort of system-level fault. So we knew at that point that there were about four scenarios that would put us at that rate and we started to go down that path of those four scenarios. "Then we didn't receive data in the overnight UHF passes that night. "On Sol 21 (Saturday) we were actually trying to establish the same commandability we had the previous day -- we now knew that there was a system-level fault, we didn't know if it was a power issue, if it was a thermal issue, if it was an X-band communications issue. So we sent, essentially, the same command to get a beep on the morning of Sol 21 and we didn't get the beep. "Then, as we were getting ready to send the next beep command, the vehicle decided to communicate with us in one of its nominal communications windows at which point we got a little bit of data that had very little information in it. In fact, originally we started to decode it and it was from the year 2053 and we thought 'this is not good!' Eventually we found out the data was corrupted, and we were all cheering at that point because there weren't a lot of scenarios that would put us in 2053 on Mars. "That signal actually dropped out nine minutes or 10 minutes after we got it. And that was at 10 bits per second, so there was very little data and the data we got was corrupted. "We sent another command to the spacecraft to give us a 30-minute communications session at 120 bits per second. And that command was received and we got the signal on the ground -- we got one frame of data, which told us that it was sending us data. Then it stopped. And that session then ended about 10 minutes early. "We tried the same thing again and we modified some of the parameters in the command to try and get a different set of data and that different set of data actually gave us a very limited state of the current state of the vehicle -- some channelized telemetry. It told us how many flight software resets happened over the course of those two nights and that's where the big 77 numbers came from, and we realized we had a reset problem, that certain tasks were failing and it was keeping us from doing the communications that we intended to do. "As a result of that knowledge, we also realized the vehicle may not have shut down because the reset could be associated with the shutdown of the vehicle. So we attempted to shut the vehicle down, and then we send a beep after shutdown to make sure it has shut down. [The rover would not reply with a beep if it was asleep.] "It's sort of like feast or famine -- we didn't hear from it for a day-and-a-half and then we shut it down and we send a beep and we get the beep, then we shut it down again and send a beep and we get the beep, and then we shut it down again and send a beep and we get the beep. The vehicle was clearly not able to shut itself down and the reset was causing a problem with the shutdown. "We knew that the power system was struggling, the battery wasn't charged as much as we expected it to be or wanted it to be. So we deleted our overnight UHF passes in case the vehicle decided to do them -- or attempted to. In the same way the reset cycle had caused those commands not to get in and so we got the first Odyssey UHF pass when we had hoped not to hear from the vehicle because we did want it to be asleep and charge the batteries. "We asked Odyssey and MGS to turn off their radio beacons so (Spirit) didn't use that energy during the night to transmit because we were getting close to entering our low-power mode. Low-power mode is the mode that will save the vehicle, take the batteries off-line and sit there, basically, and bask in the sun until the voltage gets high enough for the vehicle to wake up. "So we woke up the morning of Sol 21 (Saturday) on solar array wake up and saw that we had indeed entered low-power mode and the fault protection had worked exactly as designed. In the low-power mode we don't get our morning communications session until about 11 a.m. because that is when the sun is nice and high, the Earth is nice and high (in the sky) and you can get good data rates and transmit. "And in that we realized that we had this reset problem. Based on just kind of the hunch of our lead software architect, he believed that the problem was probably associated with the mounting of flash and initialization. There is a hardware command that we can send that bypasses the software where we can actually tell the hardware to not allow us to mount flash on initialization. When we the next day actually sent the command to do that, software initialized normally and was behaving like the software that we had always known. It was a fantastic moment. "Once we got into the mode where we could command the vehicle to get into a software state that we understood, then we were able to collect data. That is the path that we are on right now. "Right now, our most likely candidate for the issue has been narrowed down a little bit. It is really an issue with the file system in flash. Essentially, the amount of space required in RAM to manage all of the files we have in flash is apparently more than we initially anticipated. "We have been collecting data and collecting data thanks to (the science team) and we have lots and lots of files on the spacecraft. That's good -- we intended to have lots and lots of files on the spacecraft. This is a new problem that we encountered based on having many files. "We are currently in a much more specific debugging activity. Today (Monday), we started to dump out some of flash. We are actually loading a script that we get kind of the task trace on the software and identify exactly where the problem was in the code so we can make sure that our hunch is correct. "Tomorrow, we are might try to access flash and do a little bit of a health check on it. The next day we might try to delete some files to see if our hunch is correct that it's really due to the number of files that we are trying to manage on the flash file system. "And in parallel we are trying to work a less likely scenario that something happened with the high-gain antenna and the motor control board when we were doing this engineering check-out of the Mini-TES elevation actuator (Wednesday morning). We are still working that as well to make sure that we can get back on the high-gain antenna in a very cautious way. "In summary, I would like to say that -- as it has always been -- it's humbling to work with a team of such excellent people. I just want to tell you the folks who are working on the details of this problem are the best of the best in the world that we have. Everyday when I come into work, their innovation, their persistence, their talent and their hard work has almost overwhelmed me and certainly humbles me. But that is what has got us where today and that's what is going to get us to having a healthy rover on the surface shortly." But is still isn't assured that the rover will recover 100 percent, Trosper cautioned.

(833 8 2)

23170

Rover Crunch Time

Controllers lose contact with Spirit rover. Landing of Opportunity adds to stress.

MICHAEL A. DORNHEIM/PASADENA, CALIF.

The Mars Exploration Rover Spirit suffered its first major setback last week when it lost all communications with Earth for half a day, and reappeared with a signal indicating it was in a fault mode. Engineers were particularly anxious because the observed behavior did not quickly fit a simple pattern.

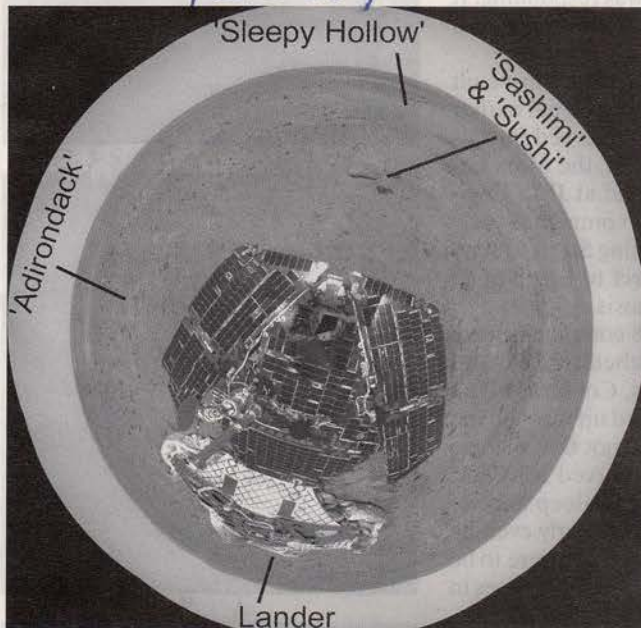
The problem couldn't have come at a worse time—three days before Spirit's twin spacecraft Opportunity was to land on the opposite side of Mars. Mars Exploration Rover (MER) staff at NASA's Jet Propulsion Laboratory (JPL) were already stretched thin to handle the landing along with benign surface operation of Spirit. Now Spirit may need critical life support to keep it alive while the complex landing and egress must also be attended to. Managers faced triage-type decisions late last week in assigning personnel to the two crucial tasks.

Before Spirit (also known as MER-A) dropped off the air, the plan was to put it in a three-day stand-down mode starting Jan. 24 to free up people to work on the Opportunity (MER-B) landing the same day. Engineers were trying to decipher late last week whether MER-A needed immediate days of critical attention to prevent fatal events such as its batteries dying, or whether it was healthy enough to have an intense diagnosis put off for a few days.

Given experience with the Mars Pathfinder rover in 1997, officials expected to lose about one day out of three due to some sort of glitch, said Jennifer Trospen, the MER surface development manager. They were excited that MER-A had gone for 17 Martian days ("Sols") without a major problem. A Sol is 34 min. 35 sec. longer than an Earth day.

On Sol 17 the rover was taking measurements at a rock called "Adirondack," and left the Mossbauer spectrometer (MB) on the rock for an overnight observation. The rover computer itself went to sleep for the night while the MB electronics collected data, which is standard practice.

On Sol 18 (Jan. 21-22) the rover woke up around the usual 8:45 a.m. Mars Local Time (MLT), transmitted apparent-



Polar view above is centered on Spirit rover, which has just rolled off the lander. Ahead are features of early interest, but scientists decided to go to "Adirondack" rock instead. Frames at right show start of driving sequence to Adirondack from Hazcam view.

ly healthy spacecraft status back to Earth and awaited the day's instructions. They were transmitted from the Deep Space Network antenna in Canberra, Australia, around 9 a.m. MLT but the rover responded that the files had not been correctly received and they were not being executed, said Richard Cook, the MER deputy project manager. The first impression was that thunderstorms and perhaps a mispointing antenna at Canberra had weakened the uplink.

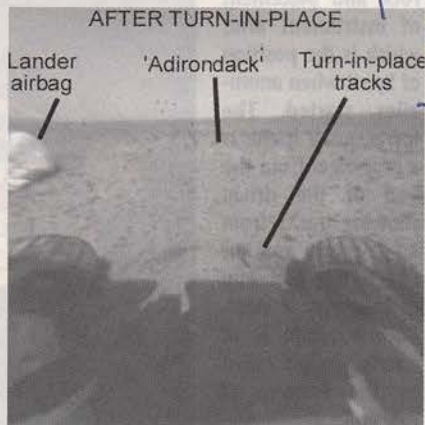
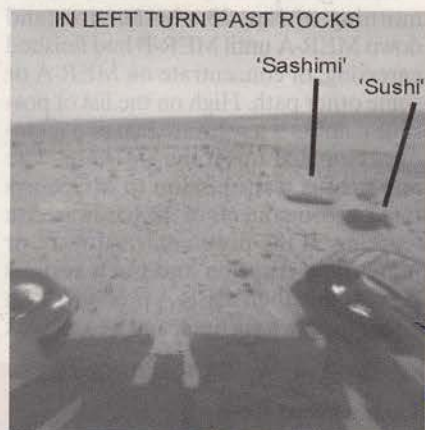
At 1 p.m. MLT commands were sent to MER-A via the direct X-band link at a low 31.25 bits/sec. rate to confirm it was receiving Earth. Two 5-min. beacon signals starting at roughly 1:30 p.m. MLT from MER-A said these commands had been received and were being executed.

At 2 p.m. MLT nothing was heard from Spirit during the scheduled high-gain antenna direct-to-Earth session. Similarly, at 4 p.m. MLT the Mars Odyssey satellite did not hear any of the expected UHF transmission.

On Sol 19 at roughly 2 a.m. MLT the Mars Global Surveyor satellite flew overhead and received an empty UHF signal—RF carrier but no data. That is a hopeful sign, because it means that enough of the computer was working to transmit at the scheduled time, as well as the power system, radio, antenna and other systems, but something was wrong because there were no data, Cook said.

Also, the transmission only lasted 2.5 min. whereas it should last 12-13 min.

After that at 4 a.m. MLT Odyssey again received no UHF signal, and when the spacecraft should have woken up again at 8:45 a.m. MLT and transmitted X-band direct-to-Earth, no signal was heard. If the spacecraft thought it was in a fault state it should have transmitted



at 11 a.m. MLT but no signal was heard then either.

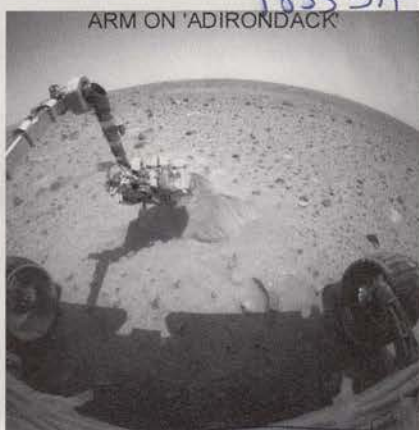
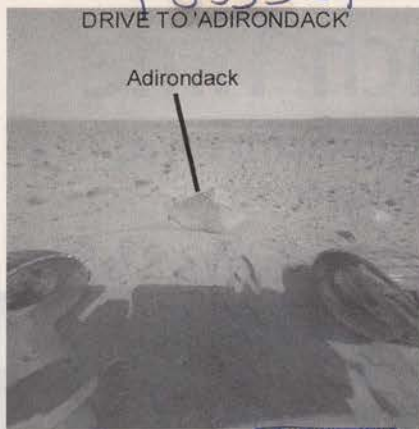
However, an encouraging sign happened around 3 p.m. MLT on Sol 19, which was about 9 a.m. PST on Jan. 22. A direct X-band command was sent at 7.8 bps, telling Spirit to phone home now. The rover responded with a 7.8-bps. signal, which indicated it was in a fault mode—but at least it was responding. It did not respond to a 31.25-bps. signal sent shortly before.

The enigma is that if Spirit is in a fault state, why didn't it send a signal earlier at the 11 a.m. window reserved for this case, said Firouz Naderi, the Mars Exploration Program chief at JPL. Engineers planned to send commands early on Jan. 23 (Sol 20) asking Spirit to send engineering data direct to Earth at 40 bps. for further diagnosis.

The nominal Sol 18 commands were run in the rover testbed at JPL and showed no anomalies, Cook said. The engineering team stayed up through the Jan. 21 night but could not find a single fault that fit all the observed behavior. They were sent home to sleep and return for more work in the early evening of Jan. 22. At that point there were to be more MGS and Odyssey UHF passes in the early morning MLT on Sol 20.

Managers planned to decide on the morning of Jan. 23 whether to stand down MER-A until MER-B had finished egressing, or concentrate on MER-A or some other path. High on the list of possible culprits is a software bug or a memory error that upset the software. The anomalous transmission to MGS says that key components of the hardware are working. If the problem is software or memory corruption and not a serious power fault, then MER-A probably "can go for quite a long time, and we can pick

Top two frames show final approach to rock and placement of instrument arm, which is the position of Spirit when anomalies started. The lower small frame is a rear view from the end of the drive, showing tracks from 40-deg. turn and 60-deg. turn-in-place; tip of lander is at right. Bottom photo is of empty lander, taken by the Pancam at Adirondack.



up the pieces again later," said Peter C. Theisinger, MER project manager.

The problem stands in contrast to the prior success. Spirit rolled off its lander on Jan. 15 in Sol 12, three days later than the nominal Sol 9 because tips of the airbags posed a hazard to the primary forward rolloff direction. Instead the rover turned 115 deg. to the right on the lander to exit in a clearer direction (*AW&ST* Jan. 19, p. 397).

The next morning the instrument deployment device (IDD) robot arm had its first use. The IDD tip has four instruments on a turret—the rock abrasion tool (RAT), the microscopic imager (MI), the MB and the alpha particle X-ray spectrometer (APXS). The RAT was checked for proper operation, then the microscopic imager was hovered over the soil to take pictures.

On Sol 14 (Jan. 16-17) the MB and APXS made their first measurements on the soil. On Sol 15 the MI took a picture of the spot where the MB had rested with 4-oz. force, and found essentially no impression, suggesting a thin cohesive crust on top of the soil.

The arm was stowed on Sol 15, and the rover made a 2.85-meter (9.3-ft.) curving drive to a rock named "Adirondack." This was the first move since the rover rolled off the lander three Sols earlier. The drive took 30 min., including frequent imagery, said Eddie Tunstet, the rover mobility engineer. The actual rolling time was just 2 min., or an average of 0.93 in./sec.

Scientists and engineers spent Sol 16 (Jan. 18-19) figuring how to place the arm on Adirondack, and took a Pancam portrait of the lander. On Sol 17 the MI took pictures and the APXS examined the rock for 6 hr., then the MB was placed on it for an overnight integration.

The plan was to grind a fresh spot on Sol 18 and repeat the measurements to compare surface and internal characteristics, but the rover troubles intervened.

Controllers gave what was probably the final course correction to MER-B Opportunity on Jan. 16, ensuring it was properly aimed at the surface target in the Meridiani Planum region.

Handwritten number: 23172

NASA ANNOUNCEMENT : 27 JANUARI 2004.

MARTIAN LANDMARKS DEDICATED TO APOLLO 1 CREW.

NASA memorialized the Apollo 1 crew – Gus Grissom, Ed White and Roger Chaffee – by dedicating the hills surrounding the Mars Exploration Rover Spirit's landing site to the astronauts. The crew of Apollo 1 perished in flash fire during a launch pad test of their Apollo spacecraft 37 years ago today. "Through recorded history explorers have had both the honor and responsibility of naming significant landmarks," said NASA administrator Sean O'Keefe. "Gus, Ed and Roger's contributions, as much as their sacrifice, helped make our giant leap for mankind possible. Today, as America strides towards our next giant leap, NASA and the Mars Exploration Rover team created a fitting tribute to these brave explorers and their legacy." Newly christened "Grissom Hill" is located 7.5 kilometers (4.7 miles) to the southwest of Spirit's position. "White Hill" is 11.2 kilometers (7 miles) northwest of its position and "Chaffee Hill" is 14.3 kilometers (8.9 miles) south-southwest of rover's position. Lt. Colonel Virgil I. "Gus" Grissom was a U.S. Air Force test pilot when he was selected in 1959 as one of NASA's Original Seven Mercury Astronauts. On July 21, 1961, Grissom became the second American and third human in space when he piloted Liberty Bell 7 on a 15 minute sub-orbital flight. On March 23, 1965 he became the first human to make the voyage to space twice when he commanded the first manned flight of the Gemini space program, Gemini 3. Selected as commander of the first manned Apollo mission, Grissom perished along with White and Chaffee in the Apollo 1 fire. He is buried at Arlington National Cemetery, Va. Captain Edward White was a US Air Force test pilot when selected in 1962 as a member of the "Next Nine," NASA's second astronaut selection. On June 3, 1965, White became the first American to walk in space during the flight of Gemini 4. Selected as senior pilot for the first manned Apollo mission, White perished along with Grissom and Chaffee in the Apollo 1 fire. He is buried at his alma mater, the United States Military Academy, West Point, N.Y. Selected in 1963 as a member of NASA's third astronaut class, U.S. Navy Lieutenant Commander Roger Chaffee worked as a Gemini capsule communicator. He also researched flight control communications systems, instrumentation systems, and attitude and translation control systems for the Apollo Branch of the Astronaut office. On March 21, 1966, he was selected as pilot for the first 3-man Apollo flight. He is buried at Arlington National Cemetery, Va.

83394

BBC : 28 JANUARI 2004.

SPIRIT SEEKS EARLY RETURN TO WORK.

Nasa engineers believe they may have the Spirit rover back exploring the surface of Mars early next week. The vehicle has had a flash memory glitch that has stopped it working properly on the planet since Thursday. But the Nasa team is now preparing to use the vehicle's high-gain antenna again which should significantly improve probe-to-Earth communications. "So you can imagine the additional data we'll get to debug the problems," said mission manager Dr Jennifer Trosper. Spirit was poised in front of a football-sized rock in Gusev Crater ready to run a series of tests when it broke down. Initially, it was thought the high-gain antenna was at the root of the failure and all traffic was sent through the buggy's low-gain antenna instead. The difference in data flow is huge - 11,000 bits per second (bps) compared with just 40-120 bps. The slow information transfer has hampered engineers as they have grappled with the real problem, which affects the software that controls file management in Spirit's flash memory system. The US space agency's Dr Trosper said the team was now making good progress, and explained the eventual fix could involve the deletion of a great many unnecessary files currently sitting in the memory. "If we're on the right track we would hope to be back doing science early next week," she added. Spirit's twin rover, Opportunity, is on the far side of the planet at Meridiani Planum. It is being prepared for its roll on to the Martian surface, probably on Sunday. Engineers are going through the process of making the vehicle "stand up" on its lander pad so its wheels can be unpacked ready for the drive. In between the commissioning work, Opportunity is sending back colour images of its surroundings, including high-definition pictures of the rock outcrop just eight metres away that has so excited geologists. These layered rocks measure 10 centimetres (4 inches) in height and are thought to be either volcanic ash deposits or sediments carried by water or wind. "At this resolution, without compressing the data, you can start to see the small grains, pebbles and cobbles ...many of the layers look as though they may be composed of these pebbles and granular material," said image scientist Dr Jim Bell. Opportunity has now acquired its "mission success panorama" - a full, colour sweep of its landing area - with 75% of the data returned to Earth. Nasa has also announced that three hills visible from Spirit's Gusev Crater landing site will be named after the Apollo 1 crew - Gus Grissom, Ed White and Roger Chaffee - who died in a launch pad fire at the Kennedy Space Center 37 years ago. "Through recorded history explorers have had both the honour and responsibility of naming significant landmarks," said Nasa administrator Sean O'Keefe. "Gus, Ed and Roger's contributions, as much as their sacrifice, helped make our giant leap for mankind possible. Today, as America strides towards our next giant leap, Nasa and the Mars Exploration Rover team created a fitting tribute to these brave explorers and their legacy." The Spirit landing zone has already been named in memory of the Columbia shuttle crew which was killed on re-entry into the Earth's atmosphere last February.

83395

SPACEFLIGHT NOW : 28 JANUARI 2004.

PHOTO RECEIVED FROM RECOVERING SPIRIT ROVER.

Working as space-age surgeons 100 million miles away, ground controllers are trying to precisely pinpoint the software glitch that halted the Mars rover Spirit's mission to explore Gusev Crater last Wednesday. If successful, officials say the robot geologist could be out of recovery and back at work early next week. In a promising development late today, Mission Control released the first photograph taken by Spirit since the rover's computer problems began. It shows the rover's science arm reaching out to examine a pyramid-shaped rock nicknamed Adirondack. As seen by the rover's front-facing hazard-avoidance camera, the arm remains where it was on the morning of Sol 18 when things began to go awry. The German Mossbauer Spectrometer instrument is seated over the rock in a search for iron-bearing minerals. After finishing the Mossbauer investigations, the arm was supposed to use the Rock Abrasion Tool to scratch away part of Adirondack's exterior to create a window inside. But that never occurred. Spirit's computer system, its flash memory bogged down by too many data files, began a continuous series of resets. Contact with Earth was lost for a time. Now, controllers have managed to get a better handle on their \$400 million spacecraft to find the exact source of the problem and delete old files that aren't needed. "We are attempting to get a trace from the flight software of the problem and compare that to what we believe it to be, what we have seen in the testbed, make sure we are correct and then move forward in deleting some of the files from our flash file system as a result of understanding the problem," mission manager Jennifer Trosper said Wednesday. "We are extremely careful because we want to make sure that we don't make an error in deleting files. The we have done file deletes on the spacecraft before, so we've shown that does work. The file directories have all different names and you can convince yourself that you are actually deleting the right thing." Controllers are trying to run a computer script in the rover to track down the bug. But as of mid-day Wednesday, Trosper said things had not gone according to plan. "Over the past two days we have had some difficulty getting the script to run on the vehicle. So we are continuing to work that problem. "The method we are using right now in running this script -- it's kind of a back door into the flight software -- is a fairly surgical technique to identify the exact problem and deal with that little problem. "If we are not able to successfully complete our surgical technique, we have larger hammers, we like to say, that we can use in order to solve this problem." By strategically going after the bug, officials hope to preserve useful data still stored in the flash memory for later playback to Earth. "The intent of the last few days has been to maintain the state of the flash memory. We actually think that the flash is not corrupt. We would like keep the data that's in the flash memory. If we can't do that based on the technique we're trying to use then the next step we have is to actually delete the data that is in the flash memory. We've talked to the science team. Almost all of the data is replaceable." Science information waiting in the flash memory includes the Alpha Particle X-Ray Spectrometer and Mossbauer Spectrometer data collected during studies of the Adirondack and earlier collaborative observations between Spirit and the European Mars Express orbiter. The preview-like thumbnail images of the joint rover/orbiter research have already been received from Spirit, giving scientists some data to use if the rest can't be recovered. "Most of the science that was desired to be done can be done from the thumbnail images. The science team has agreed that is adequate for the focus of the experiment we had with Mars Express. Clearly, they would like to get the rest of it down. But in order to get all the data down it would take many sols and we have make a risk trade here and a time trade," Trosper said. "We will attempt the surgical technique about one more day. If that doesn't work, we will move forward to the less-surgical techniques. And hopefully if we are on the right track we would hope at the earliest be back doing science early next week. If we're not on the right track, it could take longer than that." A specialized group of engineers were brought together to revive Spirit last week and coax the rover back into action. The control team will be returning to its full size in the coming days, if all goes well. "The anomaly team right now is probably 15 to 20 people because it is a focused effort on solving this flight software problem. Last night, we went to adding probably another 10 people to move towards doing our nominal timeline. And in a few nights, we will go to the full overnight timeline of staffing with the science and engineering teams in preparation for getting Spirit back on its feet for the science mission."

83396

23174

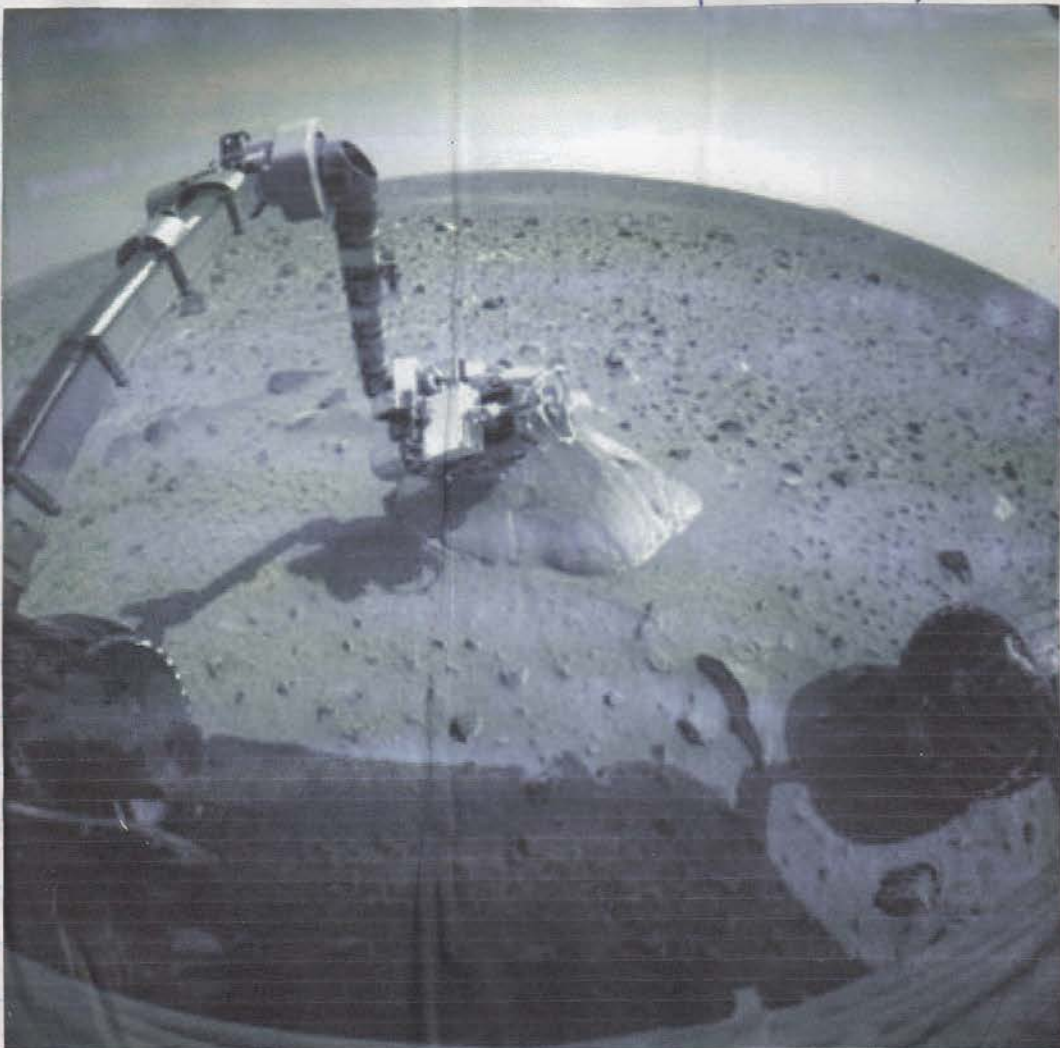
SPACE.COM : 29 JANUARI 2004

SPiRiT SENDS FIRST PHOTOf SINCE TROUBLES BEGAN.

NASA's troubled rover Spirit has sent a new photograph back from Mars. It is the robot's first significant data transmission since its computer went haywire last week. The image was taken and sent back Wednesday. It was captured by the rover's front hazard avoidance camera and shows the robotic arm extended to a rock previously named Adirondack. Mission managers did not say whether it was an indicator of Spirit's health. Spirit's science operations halted just as it crawled to the pointy rock and was about to begin drilling into it. The rover's computer rebooted itself more than 100 times over a two-day period and, at first, sent back beeps but no data. Engineers have since determined that the problem appears to involve too many files overloading the onboard computer memory. A spectrometer, which would identify minerals in the rock, is still placed on Adirondack, as it had been instructed prior to the computer glitch. "Engineers are working to restore Spirit to working order so that the rover can resume the scientific exploration of its landing area," a NASA statement accompanying the picture said. No other details have been provided about the rover's condition since a Wednesday morning press briefing. "Right now we're working to get complete control of the vehicle, and we're still not quite there," Jennifer Trosper, Mission Manager for the Mars Exploration Rover program at NASA's Jet Propulsion Laboratory, said earlier Wednesday. "If we're on the right track, we hope to be back doing some science by early next week. If we're not on the right track, it could take longer than that." Spirit is in the Gusev Crater on Mars. Its twin, Opportunity, is on the other side of the planet and preparing to roll off its landing pad, possibly as early as Sunday. The combined mission cost is \$820 million and is designed to determine whether Mars was once wetter, possibly with the conditions necessary for life

83397

83398



0 J F 1 8 >

23175

SPIRIT ON THE MEND : BUT DESPITE DELICATE SURGERY, FAR FROM FIXED.

PASADENA - The glitch-struck Spirit Mars Exploration Rover is on the mend as computer experts consider delicate electronic surgery on the robot's software smarts. The hope is fixing the rover and returning it to science-gathering tasks at Gusev Crater by early next week. There remain nagging worries, however, that what ails Spirit can't be fully understood. If that's the case, engineers here at the Jet Propulsion Laboratory (JPL) are taking slow steps in certifying that Spirit's twin - Opportunity that now rests halfway around Mars - won't run into the same problems. Engineers have found a way to halt Spirit's computer from resetting itself by putting the spacecraft into a mode that avoids use of flash memory. Flash memory is a type common in many electronic products, such as digital cameras, for storing information even when the power is off. The Mars Exploration Rovers have random-access memory. But the robots cannot hold onto information during overnight sleep sessions. One of the next steps planned for Spirit is to erase from flash memory the files stored there from the spacecraft's cruise to Mars from Earth. That is intended to lessen the task of managing the flash memory files. This requires care in abstracting the correct files, said JPL's Jennifer Trospen, Mission Manager for the Mars Exploration Rover (MER) project. "If we are not able to successfully complete our surgical technique...we have larger hammers that we can use in order to solve this problem," Trospen said yesterday at a morning press briefing here at JPL. Trospen said that the intent of the last few days has been to maintain the state of the flash memory. "We actually think that the flash is not corrupted. We would like to keep the data that's in the flash memory," she said. But if that proves unsuccessful, the next step is to actually delete the data that's in the flash memory. This heavy hammer approach would wipe out science data collected by Spirit before it ran into trouble on the 18th day of Mars operations. Trospen said that, in talks with science teams, almost all of the onboard science data is replaceable. Of the scientific information that would be lost, however, a coordinated, data-gathering session with Europe's Mars Express is the most unique, she said. This activity involved Spirit's instruments looking up while Mars Express science equipment peered down at Gusev Crater. Trospen said that Spirit did relay thumbnail images from that coordinated look-up/look-down session with Mars Express. "So most of the science that was desired to be done can be done from the thumbnail images," she said. The science team has agreed that smaller, thumbnail images should prove adequate to glean data that was the focus of the coordinated experiment. "Clearly they would like to get the rest of it down. But in order to get all of the data down it will take many sols [martian days]. We have to make a risk trade and time trade. The science team, I believe, would prefer to have more sols to do new things," Trospen told SPACE.com. Teams of troubleshooting software and hardware experts remain perplexed in trying to find "the scene of the crime" that led to Spirit's predicament. If surgical removal of files in flash memory doesn't solve the problem, reformatting that memory is the next phase, in order to move forward and get back to the science of the mission. "We can muck around with this thing for a while, clearly. There's something that we don't understand about the problem," Trospen said. It's also entirely possible that the "heavy hammer" approach of reformatting won't do exactly what is expected. By going down the pathway of reformatting the flash memory, all evidence of what happened onboard Spirit would be destroyed. On the other hand, all that evidence may have already been destroyed after the initial reset, Trospen said. "We just need to weigh the risks against the time it would take to do some of these things and get back on track." Trospen said that there is a suspicion as to where Spirit's self-thinking problems occur. "We believe that the flash memory is fine. But it might be that the only way we can get beyond this is just to wipe that flash memory clean," she said. The good news, Trospen said, is that Spirit's mission can be done in the state the robot is in right now. The rover could be hardwired in a "don't go there" mode of thinking. The outcome of this approach would be that Spirit carries out a more restrictive start-stop type of mission, but still yield a wealth of science during long-distance roving. "We're still very mindful of the fact that Spirit is out there and many of us on the team want to get back into that investigation and try and solve the puzzles of Gusev," said Jim Bell, Payload Element Lead for the Panoramic Camera from Cornell University.

83399

SPIRIT ROVER REGAINS SCIENCE CAPABILITY.

PASADENA - Software engineers here at the Jet Propulsion Laboratory (JPL) have been successful in restoring Spirit's ability to conduct science. Work is still underway to fully characterize the computer hiccups that the robot experienced over a week ago. The plan now is to delete from the rover's flash memory loads of information stored before its landing in Gusev Crater. Once that task is done, engineers reported here today that Spirit should then resume its day-to-day workload in normal mode and make use of flash memory. Computer experts remain unsure of exactly why the robot went into its computerized tantrum. However, at the same time, they are now confident they are on target to identify and rid the robot of the malady. Mark Adler, JPL Mission Manager for the Mars Exploration Rover (MER) program said team members are hopeful to resume normal operations of Spirit. Part of that process is reformatting the robot's flash memory. "The seats in mission control are never cold," Adler said during a press briefing today here at JPL. And while engineers continue to tinker with Spirit's software, the rover sent back its first new science data since being crippled by computer troubles. On Thursday, it took and transmitted panoramic camera images at Gusev Crater, including snapshots of two light-colored rocks, nicknamed Cake and Blanco. Scientists are considering those rocks as possible targets for up-close examination after Spirit finishes examination of the rock called Adirondack over the next few days. Bodo Bernhardt, MER Science Team Member from the University of Mainz, Germany, proudly displayed the first spectrum ever taken of a rock on another planet. The data was accumulated prior to the rover's computer problems using the German-provided Mössbauer spectrometer. Twelve hours and twenty-nine minutes of data was collected in studying the martian rock nicknamed Adirondack, Bernhardt told SPACE.com. "There is no doubt what we see here," Bernhardt said. Dick Morris, MER Science Team member from the NASA Johnson Space Center in Houston, Texas said the mineral makeup of Adirondack include olivine, pyroxene and magnetite. That composition is common in volcanic basalt rocks on Earth. "On Earth, olivine-bearing basalt is one of the most common kinds of rock that we find," Morris said. On Mars, what that type of rock will tell or not explain about the history of Gusev Crater remains to be seen. Ray Arvidson, MER Deputy Principal Investigator from Washington University in St. Louis said those images suggest Adirondack is a hard, very fine-grain crystalline rock. "If you were a geologist on Mars...and had a hammer and whacked that rock, it would ring," Arvidson explained. Given Spirit's overall health, scientists want to pick up where they left off due to onboard software glitches. They'll use the robot's Rock Abrasion Tool - the RAT - to grind the weathered surface off of a small area on Adirondack and inspect its interior with microscope and spectrometers. "There's a lot of unfinished business with Adirondack," JPL's Adler told SPACE.com. "Then we'll start to move out." Later plans include the rover wheeling toward a crater now tagged Bonneville - roughly 820 feet (250 meters) away. Once at Bonneville, scientists operating Spirit are prepared to search for rocks that may have been excavated from below the surface and tossed outward by the impact that dug the crater. If Spirit can rove up to the crater's rim, outcrops in the crater walls can be scanned by the robot's Panoramic Camera and its Mini-Thermal Emission Spectrometer (Mini-TES), an instrument that sees infrared radiation emitted by objects. Spirit would then "turn and head for the hills" to the southeast, Arvidson said. "We may not get there, but we'll get more and more high-resolution views with the Panoramic Camera and the Mini-TES in terms of trying to understand the mineralogy," he said. "I think the science for spirit is just beginning," Arvidson concluded.

83400

2718 S

23176

CNN : 02 FEBRUARI 2004.

MARS MISSION SPIRIT ENTERS FULL SWING.

PASADENA - NASA's twin rovers reached out their robotic arms to touch the surface of Mars on Monday, marking the first day of the joint \$820 million mission that both spacecraft were in full swing. Opportunity and Spirit, 6,600 miles apart on opposite sides of the planet, began the work week gearing up for in-depth analyses of the soil and rocks beneath their wheels. Opportunity rolled onto the martian ground on Saturday, a week after it landed. Spirit arrived January 3 but broke off its science work nearly two weeks ago after software problems crippled the vehicle. On Monday, mission manager Jennifer Trosper said Spirit had joined Opportunity back at work, even as engineers worked out the last kinks in its software. "We have two operational rovers on Mars," Trosper said at NASA's Jet Propulsion Laboratory. Also, NASA unveiled the first 360-degree color panoramic image taken by Opportunity of its landing site. The rover touched down in one of the flattest, smoothest regions on Mars but ultimately came to rest inside a crater 72 feet across. "It provides us with a real sense of 'you are there,'" said scientist Jeff Johnson of the U.S. Geological Survey office in Flagstaff, Arizona. Johnson likened the mosaic image to the overlapping snapshots tourists often take of the Grand Canyon to capture its full sweep. Opportunity stretched out its robotic arm and photographed in detail each of the four instruments it carries. The arm -- formally known as an "instrument deployment device" -- is the most complex mechanism on each rover and was reported to be working well. Spirit resumed use of its own arm, picking up where it left off. NASA planned for it to brush the dust off a volcanic rock dubbed Adirondack, allowing the rover's to photograph it in extreme close-up. NASA launched the pair of vehicles to find geological evidence of past water activity on Mars. That could show the planet was hospitable to life perhaps billions of years ago. It appears Opportunity has not had to venture far to find such evidence: It has already discovered an iron-rich mineral called gray hematite, and preliminary measurements suggest it is of a variety that forms in liquid water. Spirit, in contrast, may have to drive hundreds of yards, to a nearby crater called Bonneville, to uncover similar geologic proof. "Spirit is the driving mission. We are already theorizing how to drive far and fast," Trosper said.

83401

SPACEFLIGHT NOW : 02 FEBRUARI 2004.

THOUSANDS OF FILES DELETED ON SPIRIT TO FIX COMPUTER TROUBLE.

A week-and-a-half after falling ill to computer woes, NASA on Sunday declared its Mars Exploration Rover Spirit was healthy again. "We have confirmed that Spirit is booting up normally. Tomorrow we'll be doing some preventive maintenance," mission manager Mark Adler reported Sunday. Controllers worked to fix the computer ailment afflicting Spirit by purging thousands of data files from its flash memory. The no-longer-needed files piled up on the rover and prevented its computer system from successfully accessing the flash memory, triggering Spirit's computer to reset itself over and over again. The flash memory stores engineering and scientific data even when the power is turned off, similar to electronic products like. Many of the tossed files were left over from the spacecraft's cruise to Mars. A scan of the flash memory was performed late last week, providing engineers important diagnostic information, Adler said. "We are now able to tell that when we mount the flash memory, it does in fact take a lot of the system RAM in the process. In fact, more system RAM than is available. So that's helping confirm the theory we had that the reason the restarts were hanging up was because we were running out of memory when we are trying to Contact with Spirit was lost after the trouble began on Wednesday, January 21. Wrestling to regain control of the craft, engineers developed a plan to put the rover into a "cripple" operating mode that didn't use the flash memory. With the file deletions completed, Spirit's computer has been "stable" while working in the standard mode with access to the flash memory. "To be safe, we want to reformat the flash and start again with a clean slate," Adler said Sunday. mount the flash memory," he explained during a news conference Friday. Monday's reformatting will erase everything stored in the flash file system and install a clean version of the flight software. In preparation for that reformatting, Spirit was expected on Sunday to transmit priority data remaining in the flash memory. The information included data from atmospheric observations made in mid-January when the European Space Agency's Mars Express orbiter flew overhead. Engineers say the flash may need to be reformatted every one-to-two weeks to prevent further trouble. Similar measures are likely for sister-rover Opportunity. In the upcoming days, Spirit will finish the study of its first rock, nicknamed Adirondack. The Rock Abrasion Tool will be used to scrub off the rock's surface to give the science instruments a window into Adirondack's interior. Spirit's Mossbauer Spectrometer made readings of the pyramid-shaped, football-sized rock's composition and the microscopic imager snapped extremely close-up views prior to the computer problems. That data was finally transmitted to Earth late last week. "If you had a hammer and whacked that rock, it would ring," said Ray Arvidson, rover deputy principal investigator. Adirondack is a hard, crystalline rock that contains olivine, pyroxene and magnetite minerals. Researchers say that composition is common in Earth's volcanic basalt rocks. It isn't the proof of past water on Mars that the rovers were sent to find. "Adirondack seems to be a good, hard volcanic rock," Arvidson said. "That suggests to us that we may be looking at material either excavated from below by craters, or broken out lava flows or transported in. It's not the kind of smoking gun evidence that we are looking for in terms of climatic history." Next, Spirit will drive to a nearby light-colored rock for study. Future plans call for the rover to head toward a crater, nicknamed Bonneville, about 820 feet away to study rocks thrown outward by the crater-forming impact. "I suspect what we will do is take a look at some of these so-called white rocks that might be dusted basaltic rocks. If they don't look interesting, as quickly as possible do a traverse up to Bonneville Crater," Arvidson said. Nearing the one-month mark of its planned three-month mission on Mars, Spirit is just beginning its science work. Officials are quick to point out the rover's wheels won't fall off when the 90-day primary mission period ends, giving hope that the craft will continue to explore in an extended life. "We have gone through a third of our warranty, I guess, on the mission. But we think we have quite a few more months to go. I expect once we get the vehicle back in operation we will make pretty rapid progress in getting through the science objectives that we have in sight," Adler told reporters.

83402

BF183

23177



83403

83404

Spirited Revival

Rover may emerge unscarred from problems that appear to be in memory file manager

MICHAEL A. DORNHEIM/PASADENA, CALIF.

Engineers working on the Mars Exploration Rover Spirit are planning to restart normal science operations this week as they close in on problems that have crippled the spacecraft since Jan. 21.

The leading suspect is the file management system for one of the main types of memory. It probably can be fixed in the near term by limiting the number of files stored, which may have little or no operational impact. It may also be possible to later upload a permanent fix.

Controllers were planning late last week to delete unnecessary files on Spirit—for example, hundreds of files that had built up during the seven-month cruise that are no longer needed. They took similar steps on Jan. 28 for Spirit's twin, Opportunity, deleting about 700 files connected with flight software that

had been replaced in early December.

The problems that started on the 18th Martian day of the mission (Sol 18) at 9:17 a.m. Mars Local Time had officials nervous (*AW&ST* Jan. 26, p. 27). They were essentially completely out of control for a day, and were only slowly able to regain command. The rover normally shuts down at night to conserve battery power, but stayed up two nights in a row while the computer constantly reset itself every 15-60 min., draining its batteries to zero. Fortunately it was able to wake up on solar power alone after sunrise, and the lithium-ion batteries were not damaged. It conducted at least 77 computer resets in a two-day period.

There are three types of memory on Spirit:

- 256 megabytes of flash memory, which is retained when the power is off.

- 128 MB of random access memory (DRAM), which is lost when the rover goes to sleep.

- 11 MB of electrically erasable programmable read-only memory, also retained during power-off sleep.

The errors that caused the persistent rebooting appear to be connected with the flash memory—not from the memory itself, but from the memory file manager, which actually operates in the DRAM. The flash is split into two parts—a “raw” part that’s directly accessed by the computer, and a file system that goes through the file manager, said Glenn E. Reeves, the Mars Exploration Rover flight software architect at the Jet Propulsion Laboratory (JPL). The file system stores things like science data.

The leading theory is that the file manager software uses too much DRAM, halting further access to its flash files. The flash memory itself seems intact; it is the management system operating in DRAM that appears to have a bug.

Two identical copies of the 8.1-MB

Spirit lander, parachute and heat shield are visible in this Mars Global Surveyor image of Gusev Crater site—the first unambiguous orbital view of man-made objects off Earth.

FFIES

23178

about 12-meter altitude. The lander experienced only about 3g at touchdown and is designed for up to 40. The vehicle bounced, all the while transmitting data to Earth in the western sky.

It was during these bounces that the lander plopped fortuitously into a shallow crater where it dribbled like a basketball, then rolled like a marble in a soup bowl, coming to rest in the center of the 20-ft. wide depression. That was extremely good luck because the object that created the crater had also excavated the bedrock. The airbag's bouncing also proved to be an excellent first science experiment, leaving such detailed impressions that the airbag stitches sewn into the bag by the staff at ILC in Dover, Del., have now been sharply imprinted on Mars. 83405

The vehicle came to rest 24 km downrange from its formal target area, but in a more scientifically rich spot than had it been on target. The lander settled on a side petal, which also was fortunate, because unlike with Spirit, it allowed the airbags on the preferred forward drive-off direction to be fully reeled in before the rover was flipped onto its base petal.

So far the crater in which the spacecraft landed shows signs of what geolo-

gists expected—that if hematite is there, it is on top of a 200-300-meter stack of sedimentary deposits, visible when excavated by erosion or meteorite impact. The question is whether the hematite was formed by water or volcanic-related processes. 83406

As expected, the site, with a reflectance ratio of only 10-15%, has the darkest material ever seen on Mars—totally unlike the two Viking, Pathfinder or Spirit sites (see front cover).

A FIRST ORDER of business this week is to use the instruments on the arm to look for hematite in the soil. But Squyres believes the rover will have to drive out of the crater to more likely find it on the slightly higher terrain. That will come in a month or so when this second rover in effect makes its second landing on Mars by driving out of the crater and looking around at what again will be a whole new world not clearly visible from inside the 3-ft.-deep depression.

At JPL I also visited their In Situ Instrument Laboratory where an engineering rover was climbing a dirt slope similar to the crater where Opportunity landed as a technician carefully monitored rover angles.

The soil, as first indicated by the airbag impact, is an extra surprise that

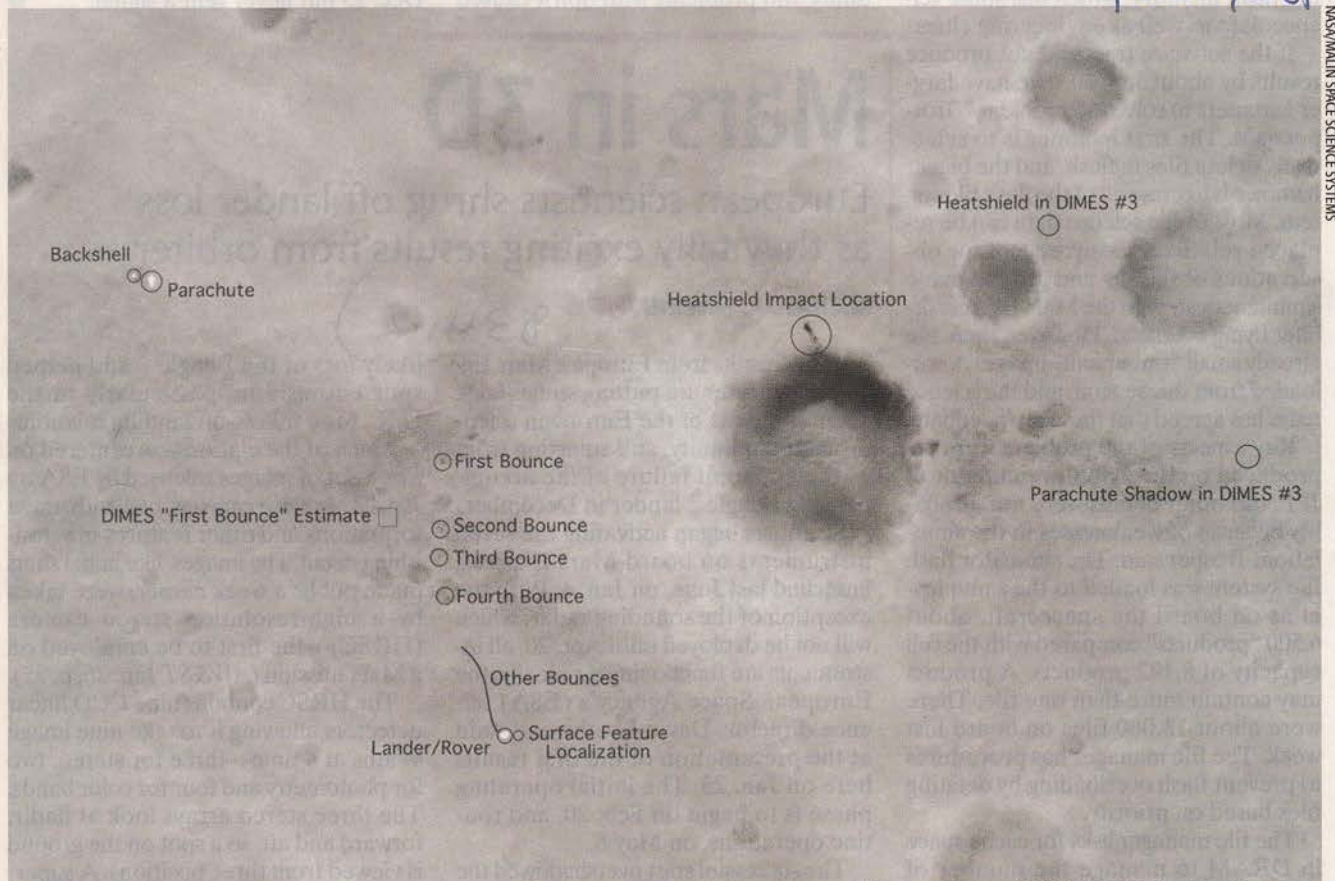
will keep the rover almost as busy as the bedrock. Soderblom noted that when disturbed by the airbags it looks as if it has become a nicely sculptured "Japanese rock garden." "The soil and physical properties group is going wild."

... Everybody is having a wonderful time arguing about it," Squyres said.

"When you look at this soil and you try and interpret what the heck you are looking at, there are two schools of thought," he said. "One, that we have soil with two distinct components. That there are coarse grayish grains and much finer reddish stuff. And when the airbags hit it and push the coarse gray grains into the red stuff, then all you see is red stuff. The other idea is that we have aggregates of grains that appear grayish but when impacted they somehow turn red." 83407

But researchers are also beginning to see pebbles with multiple colors. What they may be, nobody has figured out yet.

And there are some innovative ideas on what could cause such a unique powdery soil that changes character when compressed. One idea is a "flash water" phenomenon where liquid water may have existed briefly on the surface—perhaps just a second or two in some wide area event, which altered electrical charges in the soil. 83408



83409

83410

83411

flight software are in the raw part of flash and are directly loaded when the computer boots up. This loading process is not affected by file manager problems.

It was difficult to communicate with the spacecraft due to the constant re-setting, but on Sol 20 (Jan. 23) some data were retrieved, including the large number of resets. But other data retrieved that day said it was the year 2053, which caused concern.

Reeves suspected that flash memory was causing the problem, and on Sol 21 commands were sent to not mount flash during computer bootup. Instead, a file system with the same name was created in DRAM. Because it was fresh and empty, it did not overtax the file manager. The scheme worked, but it has to be commanded manually for every bootup. For the first time in several days the software was behaving normally again. "It was a fantastic moment," said Jennifer Trosper, the surface development manager.

Since then, the flash memory is being read out, chunk by chunk, but it could take a few weeks to send it all to Earth—way too long of a diversion. Engineers were trying to upload and run a trace program to discover where the problem is, but last week were having difficulty getting it to work. This "surgical" technique was preferred because it preserves the flash memory, which has some science data as well as engineering clues.

If the software trace did not produce results by about Jan. 30, "we have larger hammers to solve the problem," Trosper said. The first hammer is to selectively delete files in flash, and the bigger hammer is to erase all of the flash file system. Most of the science data can be replaced relatively easily, except for observations of the sky and ground made simultaneously with the Mars Express orbiter flying overhead. However, there are already small "thumbnail" images downloaded from this session, and the science team has agreed that these are adequate.

Key aspects of the problem were reproduced on the avionics simulator at JPL, but other details were not, probably because of weaknesses in the simulation, Trosper said. The simulator flash file system was loaded to the same level as on board the spacecraft, about 6,500 "products" compared with the full capacity of 8,192 products. A product may contain more than one file. There were about 13,000 files on board last week. The file manager has procedures to prevent flash overloading by deleting files based on priority.

The file manager asks for cache space in DRAM to manage the number of

rewrites to flash, and has no limit on the amount of DRAM it can request. The amount of free DRAM is about 4 MB, and developers did not anticipate it would ever use this much, but apparently it did. The mounting of flash during bootup now apparently uses almost all the free DRAM, then the first request to access the file system freezes it, Reeves said. This request usually comes from a routine that converts flash data into packets for telemetry.

THE FILE MANAGER software, which was configured by JPL from the Wind River operating system used by the rovers, was run to capacity in development tests without trouble. However, even accelerated tests do not reproduce all that happens in seven months of cruise and 18 days of surface operations. "We were caught by surprise; we had left files onboard that we'd intended to delete," Reeves said. "We expected in tests that they would be deleted. We probably got close to exposing the problem in the testbed."

The high-gain antenna (HGA) was moved for the first time since the problem on Sol 25 (Jan. 28) and successfully communicated with Earth that day. There was early speculation that the problem might be connected with the HGA, but that is largely discounted.

The simultaneous landing of Opportunity and problems with Spirit caused

a staffing crunch. But once Spirit was able to keep its thermal and power condition acceptable, its team was reduced to 15-20 specialists working on the problem. Spirit staffing started growing Jan. 27 to resume active science operations.

The Mars Global Surveyor satellite camera took remarkable pictures clearly showing the Spirit lander, parachute and backshell, and heat shield (see p. 37). "I've been in this business a long time and this is absolutely amazing stuff," said Peter C. Theisinger, the Mars Exploration Rover project manager.

The camera normally has about 1.5-meter/pixel resolution with its push-broom detector from the 400-km. orbit, but by pitching it to look at the site longer this was improved to about 0.7 meter/pixel, which was good enough to put several pixels on the lander and sense its orientation.

The rover is off the lander but lost in its glare, said Michael Malin, head of Malin Space Science Systems (MSSS) and a rover science team member. When the rover is farther away from the lander it probably can be detected, he said. High-resolution images are on the MSSS website at www.msss.com.

MSSS plans to take several pictures starting in February to look for the Beagle lander, which hit the planet on Dec. 25 but never sent a signal. ☐

Mars in 3D

European scientists shrug off lander loss as they tally exciting results from orbiter

MICHAEL A. TAVERNA/PARIS

83412

Initial results from Europe's Mars Express orbiter are putting smiles back on the faces of the European scientific community, still smarting from the apparent failure of the accompanying Beagle 2 lander in December.

Scientists began activating the seven instruments on board Mars Express, launched last June, on Jan. 4. With the exception of the sounding radar, which will not be deployed until Apr. 20, all instruments are functioning nominally, the European Space Agency's (ESA) science director, David Southwood, said at the presentation of the first results here on Jan. 23. The initial operating phase is to begin on Feb. 20, and routine operations, on May 8.

The successful start overshadowed the

likely loss of the Beagle 2 and helped spur enthusiasm, particularly in the U.K., for a follow-on landing mission.

Much of the elation was centered on a new set of images released by ESA on Jan. 23, showing canyons, badlands, mesa formations and other features in astonishing detail. The images, like initial shots made public a week earlier, were taken by a high-resolution stereo camera (HRSC)—the first to be employed on a Mars mission (*AW&ST* Jan. 26, p. 25).

The HRSC contains nine CCD linear detectors allowing it to take nine image swaths at a time—three for stereo, two for photometry and four for color bands. The three stereo arrays look at nadir, forward and aft, so a spot on the ground is viewed from three positions. A super-

23180

flight software are in the raw part of flash and are directly loaded when the computer boots up. This loading process is not affected by file manager problems.

It was difficult to communicate with the spacecraft due to the constant re-setting, but on Sol 20 (Jan. 23) some data were retrieved, including the large number of resets. But other data retrieved that day said it was the year 2053, which caused concern.

Reeves suspected that flash memory was causing the problem, and on Sol 21 commands were sent to not mount flash during computer bootup. Instead, a file system with the same name was created in DRAM. Because it was fresh and empty, it did not overtax the file manager. The scheme worked, but it has to be commanded manually for every bootup. For the first time in several days the software was behaving normally again. "It was a fantastic moment," said Jennifer Trosper, the surface development manager.

Since then, the flash memory is being read out, chunk by chunk, but it could take a few weeks to send it all to Earth—way too long of a diversion. Engineers were trying to upload and run a trace program to discover where the problem is, but last week were having difficulty getting it to work. This "surgical" technique was preferred because it preserves the flash memory, which has some science data as well as engineering clues.

If the software trace did not produce results by about Jan. 30, "we have larger hammers to solve the problem," Trosper said. The first hammer is to selectively delete files in flash, and the bigger hammer is to erase all of the flash file system. Most of the science data can be replaced relatively easily, except for observations of the sky and ground made simultaneously with the Mars Express orbiter flying overhead. However, there are already small "thumbnail" images downloaded from this session, and the science team has agreed that these are adequate.

Key aspects of the problem were reproduced on the avionics simulator at JPL, but other details were not, probably because of weaknesses in the simulation, Trosper said. The simulator flash file system was loaded to the same level as on board the spacecraft, about 6,500 "products" compared with the full capacity of 8,192 products. A product may contain more than one file. There were about 13,000 files on board last week. The file manager has procedures to prevent flash overloading by deleting files based on priority.

The file manager asks for cache space in DRAM to manage the number of

rewrites to flash, and has no limit on the amount of DRAM it can request. The amount of free DRAM is about 4 MB, and developers did not anticipate it would ever use this much, but apparently it did. The mounting of flash during bootup now apparently uses almost all the free DRAM, then the first request to access the file system freezes it, Reeves said. This request usually comes from a routine that converts flash data into packets for telemetry.

THE FILE MANAGER software, which was configured by JPL from the Wind River operating system used by the rovers, was run to capacity in development tests without trouble. However, even accelerated tests do not reproduce all that happens in seven months of cruise and 18 days of surface operations. "We were caught by surprise; we had left files onboard that we'd intended to delete," Reeves said. "We expected in tests that they would be deleted. We probably got close to exposing the problem in the testbed."

The high-gain antenna (HGA) was moved for the first time since the problem on Sol 25 (Jan. 28) and successfully communicated with Earth that day. There was early speculation that the problem might be connected with the HGA, but that is largely discounted.

The simultaneous landing of Opportunity and problems with Spirit caused

a staffing crunch. But once Spirit was able to keep its thermal and power condition acceptable, its team was reduced to 15-20 specialists working on the problem. Spirit staffing started growing Jan. 27 to resume active science operations.

The Mars Global Surveyor satellite camera took remarkable pictures clearly showing the Spirit lander, parachute and backshell, and heat shield (see p. 37). "I've been in this business a long time and this is absolutely amazing stuff," said Peter C. Theisinger, the Mars Exploration Rover project manager.

The camera normally has about 1.5-meter/pixel resolution with its push-broom detector from the 400-km. orbit, but by pitching it to look at the site longer this was improved to about 0.7 meter/pixel, which was good enough to put several pixels on the lander and sense its orientation.

The rover is off the lander but lost in its glare, said Michael Malin, head of Malin Space Science Systems (MSSS) and a rover science team member. When the rover is farther away from the lander it probably can be detected, he said. High-resolution images are on the MSSS website at www.msss.com.

MSSS plans to take several pictures starting in February to look for the Beagle lander, which hit the planet on Dec. 25 but never sent a signal.

83413

83414 Mars-Rover „Spirit“: Störung behoben

Die durch einen Softwarefehler ausgelöste mehrtägige Kommunikationsstörung beim Mars-Rover „Spirit“ ist behoben. Gestern erklärte die US-Weltraumbehörde Nasa, dass der Computer des Roboters wieder funktioniert. Noch in dieser Woche soll „Spirit“ seine vor anderthalb Wochen unterbrochene Untersuchung eines nahen Felsbrockens fortsetzen. Derweil beginnt der am Samstag von der Landebasis auf den Mars-Boden gerollte Zwillingroboter „Opportunity“ mit seinem wissenschaftlichen Erkundungsprogramm. Der Rover soll jetzt die mineralogischen Bestandteile des Bodenmaterials an der Landestelle untersuchen. ddp

Rheinische Post:
03-02-2004

28183

23181

HOUSTON CHRONICLE : 04 FEBRUARI 2004.

MARS ROVER'S WORK DELAYED OVER MEMORY GLITCH.

PASADENA - The Mars rover Spirit briefly resumed science operations before NASA once again halted the work to finish correcting a computer memory problem that has stymied the wheeled robot's mission. Mission officials had hoped the rover would brush off and examine a rock that it has faced since January 18, but ongoing software problems forced engineers to delay gathering the data until Thursday, a day after they planned to reformat the rover's flash memory. "We decided it would be better to not try new things until we got the flash reformatted," deputy project manager Richard Cook told The Associated Press on Tuesday. Spirit landed on Mars on January 3, followed three weeks later by its twin, Opportunity, on the opposite side of the Red Planet. In the meantime Spirit was suddenly crippled by a problem with its flash memory. "We're just trying to get Spirit back to nominal operations, so we can have two missions operating in parallel," project manager Pete Theisinger said. Opportunity was continuing to work well, taking microscopic photographs of soil that scientists believe could contain evidence the dry planet once was a wetter world capable of sustaining life. The pictures, released Tuesday, show a coin-sized patch of grainy soil, peppered with what look like minute pebbles. Opportunity captured the images with its microscopic imager, one of four instruments at the end of its robotic arm. Opportunity also began a 24-hour analysis of the tiny patch of soil, this time using its Mossbauer spectrometer. The German-built instrument measures the composition and abundance of iron-bearing minerals. Scientists hope the spectrometer can provide the second eureka moment of Opportunity's mission. Within days of landing, Opportunity used another instrument, its mini-thermal emissions spectrometer, to discover an iron-rich mineral called gray hematite at its landing site. Preliminary measurements suggest the mineral is of a variety that forms in liquid water, providing the first hint that the site once was wet. NASA launched the \$820 million pair of rovers to find geological evidence of past water activity on Mars. Scientists are now eager to learn if the Mossbauer can reveal the presence of either of two other iron-bearing minerals, goethite and magnetite. Finding one or the other should confirm or deny their hypothesis. Finding goethite, named for the German poet Goethe, would point to a watery origin for both it and the previously discovered hematite. Otherwise, if Opportunity discovers magnetite in the soil, that would suggest that it and the hematite formed from iron-rich volcanic lava. The process does not require water. NASA expected the Mossbauer results early Wednesday. It was not immediately clear when the space agency would release them to the public. "I'm waiting for it, too, because I want to know it says," Theisinger said of the Mossbauer results. NASA plans to continue hammering away at Mars throughout the decade.

83415

21788

SPACE.COM : 06 FEBRUARI 2004.

MARS ROVER SPIRIT UPDATE : OUR PATIENT IS HEALED.

The computer woes of the Spirit Mars Exploration Rover appear to be solved. The robot is now being readied for wheeling itself to a large-sized crater within the Gusev Crater landing site. All indications are that the memory surgery on Spirit "worked extremely well," said Jennifer Troser, JPL's Spirit Mission Manager. She said that the patient is healed of a computer overload problem, fixed by carefully erasing and reformatting Spirit's flash file system. Spirit is in great health, Troser said during an early morning press briefing at the Jet Propulsion Laboratory (JPL) in Pasadena, California. Troser said that on Thursday a demonstration link between Spirit and Europe's Mars Express worked very well. "We have our international interplanetary communications network established even more so out there at Mars." Science duties by Spirit include giving the rock nicknamed Adirondack the brush off. Thanks to a brush on the robot's Rock Abrasion Tool (RAT) a surprise coating on Adirondack was whisked away, said Stephen Gorevan, Payload Lead for the RAT and head of Honeybee Robotics in New York. "This was a big surprise...the greatest interplanetary brushing of all time." Today, Spirit will use the RAT to help scientists glean more information about Adirondack's internal composition. Spirit is expected to begin driving on Saturday about 270 yards (250 meters), on a step-by-step jaunt toward a crater nicknamed Bonneville. "There's going to be a lot of driving on Spirit," Troser said. Scientists are eager to study the walls of Bonneville for geological clues regarding the history of Gusev Crater. Bug in our court Glenn Reeves, JPL's Flight Software Architect for the Mars Exploration Rover (MER) project said that sorting out what ailed Spirit was a major effort, one that has now led to stabilizing the problem and debugging the robot's software. The investigation into the computer glitch is still on-going, Reeves said. "This is definitely a bug in our court that we have to fix." "The first problem is that we ran out of memory. A subsequent problem after that is we managed to corrupt the file system," Reeves said. "In a sense, we're back to the beginning...and I think at this stage we're very confident that we understand what the problem is. We have a procedure in place...to work around this problem indefinitely if we have to," he said. Reeves told SPACE.com that the computer issue on Spirit has the same potential to crop up on Opportunity. Procedures have been put in place to prevent the software glitches from reoccurring on Spirit and showing up on the Opportunity rover on the other side of Mars, he said.

83416

18185

23182

SPACE.COM : 07 FEBRUARI 2004.

SPIRIT ROVER DRILLS "FIRST PLANNED HOLE" IN MARTIAN ROCK.

The Spirit Mars Exploration Rover has achieved a "hole in one" – that is, grinding a hole in the rock dubbed Adirondack. Sitting at its landing site within Gusev Crater yesterday, Spirit's Rock Abrasion Tool (RAT) used two tiny diamond cutting heads that spin at high speed to cut into the rock's surface. The rock had been prepped for the RAT, with the same hardware brushing off a select spot on the rock earlier. After three hours of whirring, the RAT excavated a hole 1.8 inches (45.5 millimeters) in diameter and roughly 0.1 inch (2.7 millimeters) deep. The RAT exposed fresh interior material of the rock for close inspection with Spirit's microscopic imager and two spectrometers on the robotic arm. "We put the first planned hole in a rock on Mars," said Stephen Gorevan, Payload Lead for the RAT and head of Honeybee Robotics in New York, maker of the hardware. "It's a really great day for robotics and planetary exploration everywhere." Gorevan pointed out that the rock was found to be very strong. "It gave us a lot resistance...and that's why we needed at least 3 hours to be able to go this deep." The RAT did not use a great deal of strength to grind the rock, Gorevan told SPACE.com, using a modest 45 newtons, or 10 pounds of force. There was much preparation in making the historic grind. Hours were spent looking at the rock. Great care was taken in deciding the correct joint angles of the arm that holds the RAT. "We're remembering it here, already, as the assault on Adirondack...if you throw in the brushing too," Gorevan added during a telephone briefing today with reporters. Spirit's robotic arm was repositioned over the rock to lower a Mössbauer spectrometer into the RAT hole, said Matt Wallace, Mars Exploration Rover (MER) Mission Manager at the Jet Propulsion Laboratory (JPL) in Pasadena, California. The Mössbauer spectrometer is built to determine the composition and abundance of iron-bearing minerals in rock and soil. What scientists have learned about Adirondack's geological innards is forthcoming, Wallace said. The plan now, Wallace stated, has Spirit carrying out more study of Adirondack with the rover's other scientific tools. The robot would then drive about 9 feet (2.8 meters) towards a rock called "White Boat." From there, Spirit's handlers at JPL are getting ready to begin a step-by-step drive toward a crater that has been tagged as Bonneville. Scientists are anxious to steer Spirit to the crater, approximately 1,150 feet (350 meters) away – setting a new distance record for a wheeled vehicle on Mars in the process.

83417

83418



LEIN

048185

23183

Ready To Roll

Spirit poised for long traverse after memory is fixed

MICHAEL A. DORNHEIM/PASADENA, CALIF.

The Mars Exploration Rover Spirit appears to have recovered from its memory breakdown last week and planned to celebrate by brushing dust off a rock for better measurements of its surface—the first such cleaning on Mars.

If all went well with subsequent observations of the rock “Adirondack” late last week, the rover should be on its long drive to the Bonneville Crater this week. The 200-meter-dia. crater is about 300 meters (1,000 ft.) northeast of the rover, and scientists want to find and inspect deep-lying material that was ejected to the surface when the crater was formed, as well as possibly peer into its rim (AW&ST Feb. 2, p. 36). This long drive will be another first.

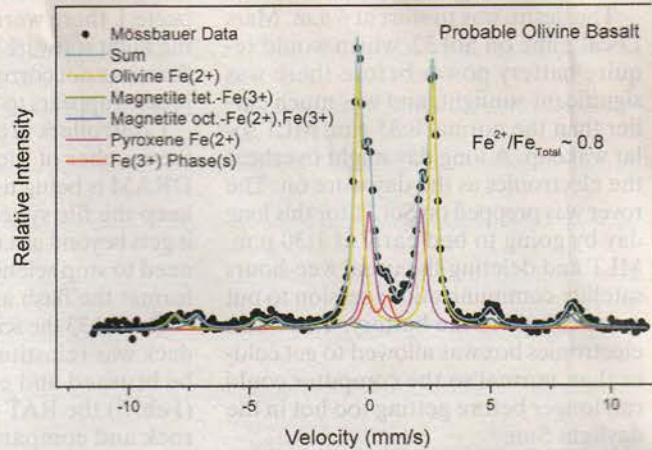
DIAGNOSING AND FIXING the flash memory problems took about 14 Martian days (Sols). A Sol is 39 min. 35 sec. longer than an Earth day, and Sol 1 is the day the spacecraft landed on Mars. The problem started on Sol 18 (Jan. 21) and the last major repair effort was on Sol 32 (Feb. 4), engineers hope. That means the rover was largely out of commission for 44% of the first 32 Sols, compared with an expected rate of 33%. However, it was

doing very well during the first 18 Sols, and if that experience continues the rover should soon be back to exceeding expectations.

The rover has 256 megabytes of non-volatile flash memory. Most of that is a 224-MB file system that stores things like science data, and this is where the problem occurred. The software that manages the file system operates in part of the 128 MB of volatile random-access memory (DRAM) and the leading theory is that this flash file manager used up too much DRAM, causing the computer to reset itself repeatedly. Engineers were not absolutely sure that was the cause but were able to convince themselves last week there wasn't a hardware problem, though they still aren't certain why the software asks for so much DRAM.

The remaining 32 MB of flash contains both copies of the flight software. This area of flash is directly accessed by the computer and does not go through the file management system, but engi-

Mössbauer Spectrum of Adirondack Rock (Sol 18, Gusev Crater, Mars)



Moessbauer spectrometer detects the state of iron (Fe) in samples, which may determine if they were formed in water. This first Martian rock measured is likely volcanic.

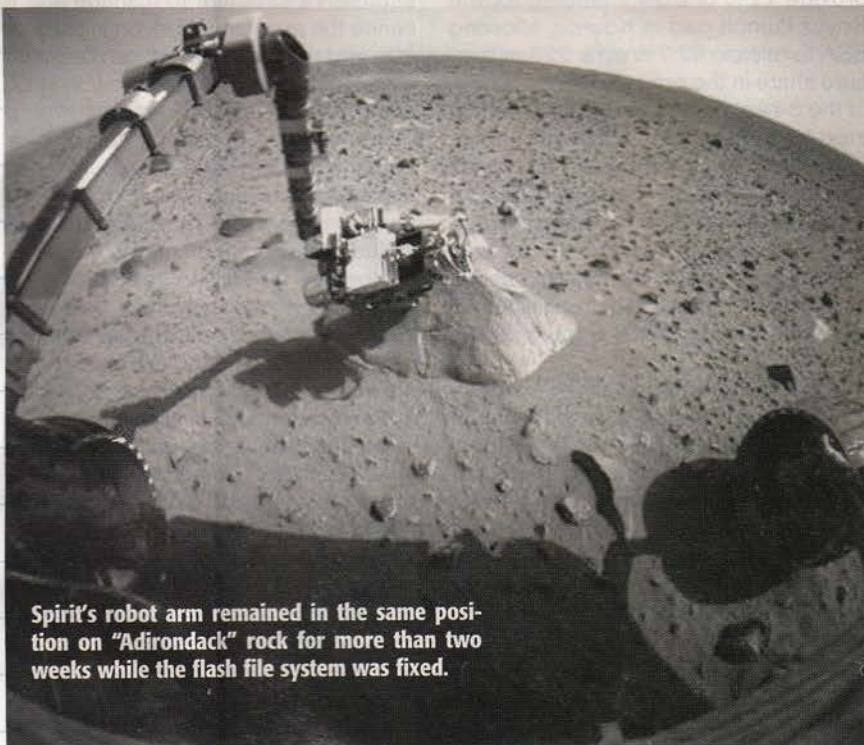
neers wanted to be extra careful that repairing the file system did not disrupt the flight software.

On Jan. 30, Spirit followed commands to delete roughly 1,000 leftover cruise files from the file system. Over the Jan. 31-Feb. 1 weekend, science and engineering files were transmitted to Earth from flash, helping to confirm the leading theory, said Jennifer Trospen, the Spirit mission manager.

But things didn't go so well on Feb. 2 (Sol 30). The plan was to resume science operations by using the brush on the rock abrasion tool (RAT) at the end of the robot arm to clean Adirondack, then view it with the microscopic imager and analyze it with the alpha particle X-ray spectrometer (APXS). The arm had been at the rock since Sol 17 and had not moved during all the file system problems.

BEFORE THESE science observations, however, Spirit tried to find the Sun with its panoramic camera to orient itself, and this operation failed to complete. The solar orientation was successful later in the day, but the science session was scratched. Demand on computer resources from another rover operation may have caused the Sun search to time out, said Mark Adler, Spirit deputy mission manager.

There was concern that the file system anomaly may have had side effects on the flash memory itself. Engineers finally were able to get a copy of Spirit memory showing that the problem was with file system DRAM allocation. They found corrupted files in flash and decided the best course was to reformat the flash file system. This had been planned for Sol



Spirit's robot arm remained in the same position on "Adirondack" rock for more than two weeks while the flash file system was fixed.

183419

31, but was shifted to Sol 32 when they realized how long it would take.

The desire was to start at 6 a.m. Mars Local Time on Sol 32, which would require battery power before there was significant sunlight, and was much earlier than the normal 8:35 a.m. MLT solar wakeup. A long day might overheat the electronics as the day wore on. The rover was prepped on Sol 31 for this long day by going to bed early at 1:30 p.m. MLT and deleting the usual wee-hours satellite communications session to put more charge in the battery. The warm electronics box was allowed to get colder than normal so the computer could run longer before getting too hot in the daylight Sun.

On Sol 32, the 224-MB flash file system was erased and the hardware was checked to ensure it had no faults; then it was formatted. Engineers had practiced

for four days on the ground testbed to make sure the results were exactly as expected, there were no side effects, and the flight software in the other 32 MB of flash was not corrupted, Adler said. The process appears to have gone as planned.

Controllers are now checking daily the number of files in flash, how much DRAM is being used and other data to keep the file system out of trouble. "If it gets beyond a certain number, we may need to stop science operations and reformat the flash again," Trosper said.

On Sol 33 the science plan for Adirondack was reinstated, with the rock to be brushed and examined. On Sol 34 (Feb. 5) the RAT was to grind into the rock and comparative measurements made of the interior. And on Sol 35 Spirit may be moved to the north side of the lander, from where it can start a straight shot to Bonneville Crater.

Before erasing the flash, controllers downloaded observations made in conjunction with the Mars Express satellite on Sol 13, and Moessbauer spectrometer data taken of Adirondack for more than 12 hr. on Sol 17-18. The Moessbauer detects what form of iron is in a sample, and this was the first such data taken of a rock on another planet.

The overall result is that Adirondack is probably an olivine-bearing basalt—a volcanic rock that would be very common on Earth, said Richard V. Morris, a science team member from Johnson Space Center. Morris agreed the rock composition is a "smoking gun" for no water. "It's a good hard rock, maybe excavated from a crater," said Ray Arvidson, the project deputy principal investigator. Arvidson noted that on Earth a basalt can be found right next to limestone, formed by water.

83420

4818

83421 „Spirit“ bohrt den Mars an

WASHINGTON (afp). Der US-Roboter „Spirit“ hat auf dem Mars einen Felsen angebohrt und damit Raumfahrtgeschichte geschrieben. Der Roboter habe ein rundes Loch von 4,55 Zentimeter Durchmesser und 2,65 Millimeter Tiefe gebohrt, teilte die US-Raumfahrtbehörde NASA mit. Es war das erste Mal, dass auf dem Mars Gestein angebohrt wurde. Das „Spirit“-Geländefahrzeug war Ende Januar wegen eines Computerproblems tagelang ausgefallen. Mittlerweile arbeitet das Gerät wieder normal. Nach der Gesteinsprobe soll es einen rund 250 Meter entfernt liegenden Krater untersuchen.

Rheinische Post:
09-02-2004.

83422 Spirit boort gaatje in Marsgesteente

De Marssonde Spirit heeft afgelopen weekeinde op de rode planeet geschiedenis geschreven door een gaatje te boren in een blok basalt. „Wij hebben het eerste bewust geplande gat gemaakt op Mars“, jubelde de NASA-onderzoeker Stephen Gorevan.

De Spirit bevindt zich al ruim een maand op Mars. Vanwege een computerstoring was de sonde twee weken niet de bedienen. Sinds vrijdag is de Spirit weer volledig inzetbaar. „Onze patiënt is genezen“, zei projectleider Jennifer Trosper in het vluchtcentrum in Pasadena. Het gaatje in de steen, die de naam Adirondack heeft gekre-

gen en de grootte heeft van een voetbal, is 2,7 millimeter diep en heeft een doorsnee van 45 millimeter. Onderzoekers hopen dat het binnenste deel van de steen meer duidelijk maakt over de geologische opbouw van de planeet. Het boren van het gat duurde drie uur. Na het analyseren van het basaltblok maakt Spirit nog enkele foto's van de steen, en rijdt dan drie meter verder, naar een andere rots. Aan de andere kant van Mars nadert de Opportunity, de tweelingsonde van de Spirit, intussen een bijzondere rotsformatie, om die in detail te onderzoeken. Wetenschappers zijn geïnteresseerd in de rotsformatie omdat die door water lijkt te zijn gevormd.

DDL: 09-02-2004.

23185

23185

SPIRIT SETS MARTIAN TRAVEL RECORD.

LOS ANGELES - The Spirit rover shattered a one-day distance record on Mars, rolling nearly 70 feet across the planet's rocky surface, NASA said Tuesday. NASA's Spirit Rover captured this image using its navigation camera during its 37th "Sol," or Martian day. The track marks indicate the 70 feet the rover traveled during one day, setting a Mars rover travel record. The drive covered more than three times the greatest distance that NASA's tiny Sojourner rover ever traveled in a day on its own 1997 mission to Mars, mission manager Jim Erickson said. "The basic goal was to drive as far as they could and see how things went in the time that they had," Erickson said of the drive, which ended late Monday without any problems. Spirit drove "blind" about half the distance, following a planned route to a stopping point. For the second half of the short trip, the rover drove to a second stopping point, autonomously executed a turn, and then rolled onward before stopping, Erickson said. "Everything seemed to go fine there. Tomorrow's plan is further driving. The day after that is driving even further," Erickson said. NASA sent Spirit toward a crater nicknamed "Bonneville" that sits about 800 feet from where the spacecraft landed. NASA hopes the six-wheeled rover eventually will cover as much as 140 feet a day, Erickson said. Spirit's twin, Opportunity, also was on the move at its landing site, halfway around the planet. NASA sent the pair of rovers on an \$820 million mission to look for geologic evidence that Mars was once a wetter place that might have been hospitable to life.

83423



83424

Nummer 48 - 15 februari 2004

Het zonnestelsel in / Spirit.

83425

Op 4 januari om 04:35 uur GMT is de Amerikaanse rover Spirit succesvol op Mars geland in de Gusev krater. De Spirit was direct vanuit haar interplanetaire baan met meer dan 19.000 kilometer per uur de atmosfeer binnengevlogen waarna een parachute en airbags voor een zachte landing zorgden. Tijdens de afdaling werden de signalen van Spirit gerelayeerd door de Mars Global Surveyor en Mars Odyssee kunstmanen in een baan rond de rode planeet, zodat vluchtleiders het verloop van de afdaling konden volgen. Door de afstand tussen Mars en aarde duurde het 9 minuten en 28 seconden voor het signaal bij de aarde aankwam. Na de landing bleek dat Spirit was met de bodemplaat naar beneden tot stilstand gekomen, wat het intrekken van de airbags en het openklappen van de zijpanelen alleen maar makkelijker maakte. Binnen een uur was dit gebeurd en begon Spirit met het maken van de eerste foto's van het landingsterrein. Op 15 januari rolde de Spirit van het landingsplatform op het oppervlak. Drie dagen later begon de eerste tocht van bijna drie meter naar de eerste steen die vervolgens van dichtbij onderzocht werd. Vanaf 21 januari ontstonden er echter communicatieproblemen met de Spirit. Na enkele dagen ontdekten vluchtleiders dat een software probleem ervoor zorgde dat de boordcomputer bijna continu herstartte. Het bleek dat het geheugen te vol stond met wetenschappelijke metingen, en nadat reeds verzonden gegevens werden verwijderd was het probleem opgelost. Vanaf 29 januari kon Spirit weer enkele waarnemingen en nieuwe foto's doorsturen. Nadat het onderzoek van de steen was afgerond, vervolgde Spirit op 9 februari haar weg. Het eerstvolgende doel is de Bonneville krater, ongeveer 340 meter van de landingsplaats.

Op 12 februari had de rover 58 meter afgelegd

23186



83426

83426

83426

Hartelijke groeten van Mars

Nooit was Mars zo dichtbij. En de vakantie-foto's zijn te zien op <http://marsrovers.jpl.nasa.gov/gallery/all>. De twee marslandertjes van de NASA rijden rond en fotograferen ijverig. Veel nieuws is nog niet ontdekt, maar de foto's zijn adembenemend. De NASA zet in principe vrijwel alles op het net, duizenden 'raw images'. Kijk mee met het rovertje Spirit als hij voorzichtig door de marswoestijn rijdt en vergeet daarbij de re-

sultaten van zijn zes verschillende camera's. Onderstaande foto is afkomstig van de rechter 'navigation camera' van de Spirit, op de 39e dag van zijn missie (12 februari) om 14h06, plaatselijke tijd. Spirit brak toen weer een record: 24,4 meter rijden op een dag. Spirit heeft 's morgens wel een beetje last van de koude bij het opwarmen van zijn motoren, maar verder gaat het 'toppie'. HS

NRC Handelsblad:
15-02-2004

FLORIDA TODAY : 16 FEBRUARI 2004

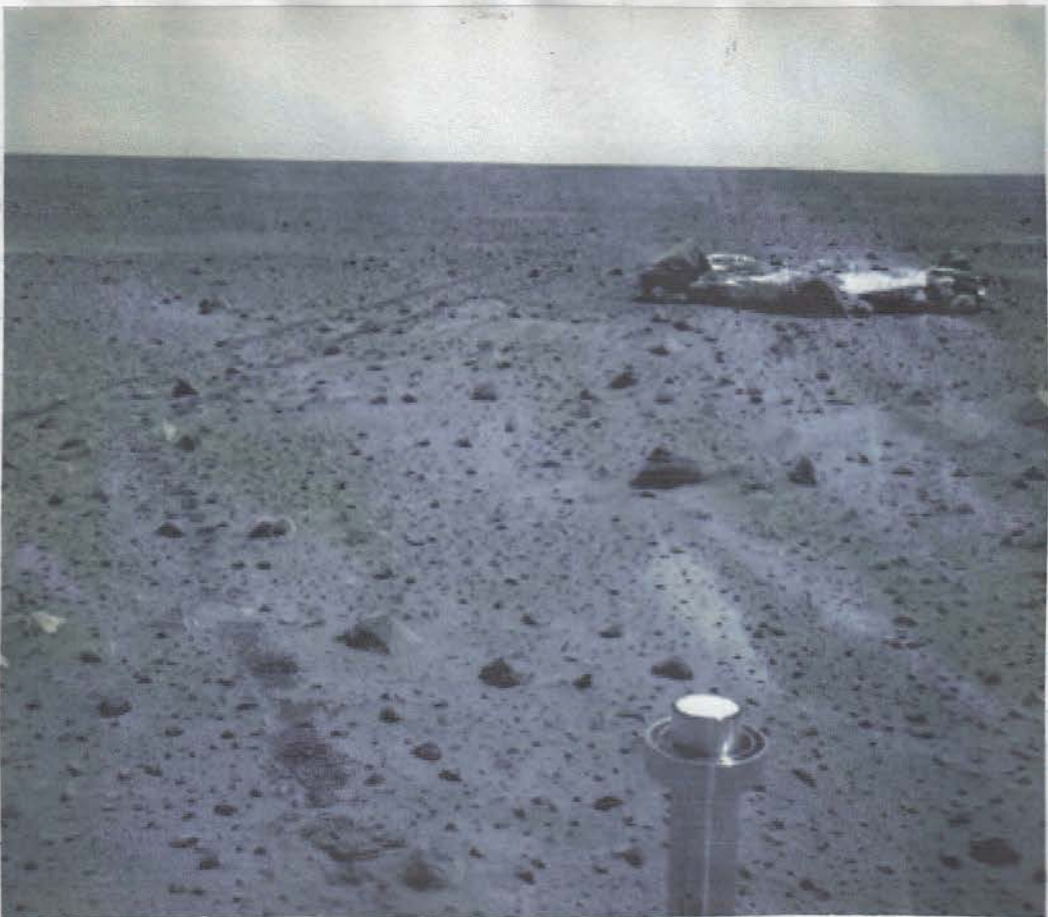
SPIRIT ROVER PREPS FOR A RECORD 1-DAY TREK.

83427

LOS ANGELES - NASA's Spirit rover stopped to examine an unusual, flaky rock on the surface of Mars on Sunday as scientists prepared to send it on a trek that would more than double its one-day distance record. The Mars Explorer team hopes the rover will travel about 82 feet this morning and make the same distance again during the afternoon. Spirit's longest previous trek was 70 feet in a day, the record for any robot on the Martian surface. Before setting out on today's trek, Spirit is examining the flaky rock, dubbed "Mimi." Mission manager Jim Erickson said scientists would like to know why Mimi is flaky but its neighboring rocks are not. He said flakiness may indicate layering, an indication a rock was formed over time instead of all at once, as might be the case with rock produced by a volcanic eruption. Examining a rock's layers can give scientists hints about the geologic history of the region where it was found. Mimi is just one stop along the way as Spirit moves toward a crater called "Bonnevillie," about 800 feet from its landing place. It is expected to take about 18 days to get there, Erickson said. On the other side of the planet, the twin rover Opportunity was in position to dig a trench today in "Hematite Slope," an area named for an iron-bearing mineral that typically forms in water. The trench would allow scientists to study soil beneath the surface. Opportunity concentrated on examining the surface soil at the spot Sunday for comparison.

83426

23187

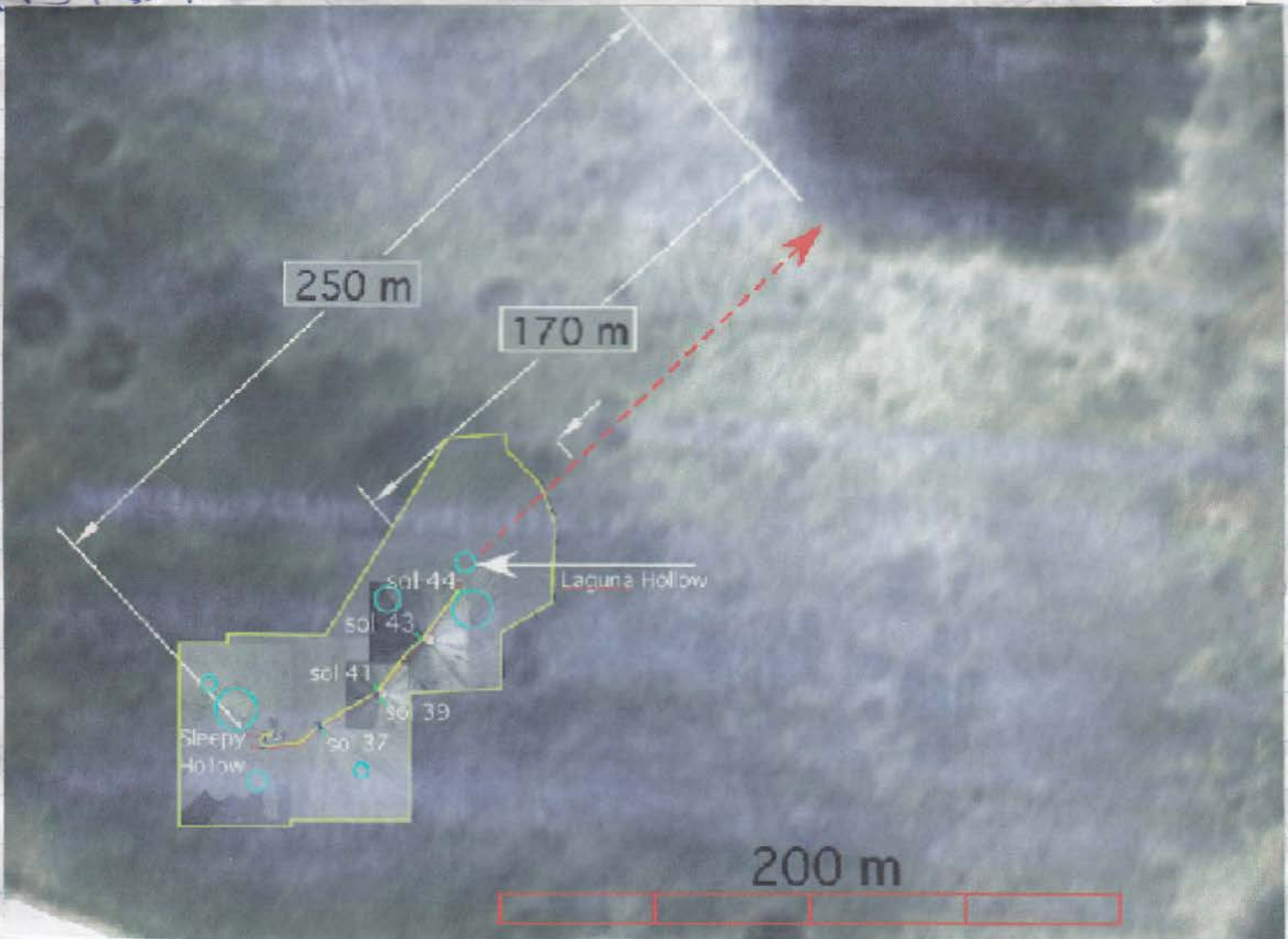


83428

83429

Navigation and Positioning Camera
 Mars Science Laboratory
 Mars Reconnaissance Orbiter

83428



83428

23188

83430

Rij de Chileense Atacama-woestijn in, maak een paar digitale kiekjes van de omgeving, rommel wat met de kleuren, en je hebt Mars. Een rode steenwoestijn met een zalmroze hemel. En zo dood als een pier.

Houdt de Amerikaanse NASA ons voor de gek? Zijn de foto's van de Marslanders Spirit en Opportunity stiekem gewoon op aarde gemaakt? Die conclusie gaat de meeste twijfelaars te ver, maar één ding is zeker: er is iets goed mis met de kleur van Mars.

83431

Komen NASA's Marsbeelden niet uit Chili?

Het is niet voor het eerst dat de NASA ervan wordt beschuldigd de kleurverzadiging wel érg ver op te schroeven als het om Mars gaat. De Rode Planeet móet er immers wel rood uitzien. Maar als blauwe verf op een kleurenfoto opeens een vuurrode tint krijgt, is er iets anders aan de hand.

Half januari, nog geen twee weken na de landing van Spirit, deden de eerste samenzwerings-theorieën op internet de ronde. Op de lander is een soort 'kleurenkaart' aangebracht, maar wat daarop donkerblauw hoort te zijn, zag er op sommige Spirit-foto's knalrood uit. Blauwe kabelisolatie en het eveneens blauwe NASA-logo hadden op de foto's een bijna fluorescerende, hardroze kleur. Conclusie: NASA rotzooit met de kleuren. En dus is ook de Marshemel niet roze maar blauw. Mars lijkt veel meer op de aarde dan de NASA ons wil doen geloven. Blijkbaar zijn er dingen ontdekt die niemand mag weten.

Koren op de molen van pseudo-wetenschappers die al jaren

beweren dat er resten van oude beschavingen op Mars zijn gevonden, dat plantengroei wordt weggeretoucheerd, en dat al die zogenaamd mislukte ruimtesondes in werkelijkheid door de CIA gebruikt worden om te communiceren met Marsmannetjes.

Blijft natuurlijk de vraag hoe die merkwaardige kleuromkering verklaard kan worden. Wakergeschud door alle commotie heeft het camerateam van de twee Marslanders daar nu eindelijk tekst en uitleg over gegeven.

De digitale camera's van Spirit en Opportunity kunnen alleen zwartwit-foto's maken, dus om een kleurenbeeld te componeren, worden drie opnamen gemaakt, door verschillende kleurfilters: rood, groen en blauw. In een beeldbewerkingsprogramma - ook bij de NASA gebruiken ze Photoshop - worden die drie opnamen samengevoegd.

Maar de Marslanders hebben veel meer dan drie filters aan boord. In totaal zijn het er wel veertien, niet alleen voor zichtbare kleuren, maar ook voor ultraviolet en infrarood, vooral voor geologen.

Volgens de NASA zijn die infraroodbeelden soms ook gebruikt om kleurenfoto's te genereren. Wat helder is in het infrarood (zoals het pigment in blauwe verf) gaat er op de foto dan knalrood uitzien. Voor de dampkring van Mars geldt dat niet, maar het zal duidelijk zijn dat de resulterende kleuren van het Marslandschap nooit kunnen kloppen met wat je zou zien als je er zelf rondliep.

Met al die kleurfilters aan boord, en met tienduizenden kalibratie-opnamen op zak die op aarde zijn gemaakt onder uiteenlopende omstandigheden, moet het de Photoshoppers van de NASA uiteindelijk een keer lukken een realistische kleurenfoto van de Rode Planeet te produceren. De vraag is alleen wie er tegen die tijd nog in gelooft.

Volkscrant:

14 - 02 - 2004

23189

Chaffee Hill
195.0° Azimuth
14.3 Kilometers

Grisson Hill
212° Azimuth
7.5 Kilometers

Yukon Hill
223.5° Azimuth
11.2 Kilometers



83432

APOLLO 11 HILLS

83433

83434

Apollo 11 Hills



28185

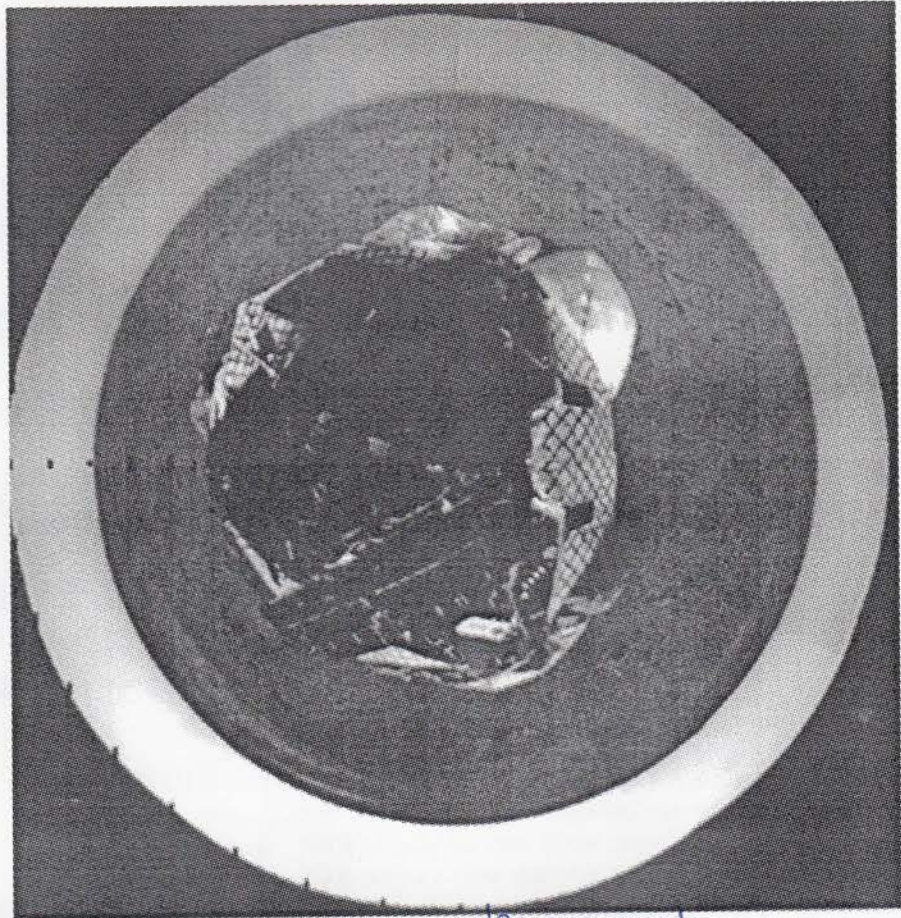
23190

succesvolle landing van Amerikaanse Spirit op Mars

In enkele dagen tijds behaalde Amerika op ruimtevaartgebied opnieuw een fraai sukses. Op 4 januari voerde de Spirit met sukses een zachte landing uit op Mars. Na de twee Vikings, de Sojourner is dat het vierde ruimtevaartuig dat foto's vanaf het Marsiaanse oppervlak naar de aarde stuurde. En ze mochten er zijn. Van geweldige kwaliteit alsof we er zelf stonden en door een raampje keken.

Natuurlijk was het die vierde januari erg spannend. Want na een tweetal mislukte Marsmissies van de Amerikanen en de mislukking van de Beagle 2 van ESA, rees opnieuw de vraag "Zal het lukken?"

Op 3 januari 's avonds ontmoette de lander in zijn baan planeet Mars. Op een hoogte van een kleine 130 kilometer dook het de atmosfeer in met een snelheid 5,4 km per seconde. Een hittedeksel zorgde tijdens de afremming dat de sonde niet verbrandde. Nadat de snelheid behoorlijk was teruggelopen ontvouwde zich een parachute. Acht seconden voor de landing bliezen de airbags zich op en te 5.35 uur (Ned. tijd) stuiterde de Spirit omgeven door airbags op het oppervlak. En daarna werd het stil. Een kleine twintig lang durende minuten. Via Mars Odyssey moest het signaal binnen komen dat alles in orde was. Mars Global Surveyor ving als eerste signalen op, die kort daarop heel sterk eveneens door de Mars Odyssey ontvangen werden. Yes, het was gelukt. Om 5.55 uur wist men het zeker. Het toestel was goed terecht gekomen. Grote vreugde in het vluchtleidingscentrum. Het zou nog een dik half uur duren, alvorens de airbags waren verwijderd. Kort daarop werd de eerste haarscherpe foto overgeseind, gevolgd de dagen erna door



83436

vele tientallen zeer fraaie plaatjes van de omgeving van de Spirit. We hebben nu in een aardig idee hoe de Gustav krater (15 graden ten zuiden van de evenaar) eruit ziet, waar de Spirit is geland. Een gebied waar de wind de meeste stof heeft weggeblazen. Een ideaal gebied om op zoek te gaan naar sporen van water en eventueel leven. Er liggen de nodige stenen, maar gelukkig niet veel grote.

Zo'n drie tot vier miljard jaar geleden moet deze krater door een meteorietinslag ontstaan zijn. Kanaalachtige lijnen doen zeer sterk vermoeden dat hier ooit water, met of zonder ijs, gestroomd moet hebben. Wetenschappers verwachten hier toch een 1000 meter dik slib aan te treffen, dat de laatste twee miljard jaar geleden bedekt is geworden met stof en zand. Maar ook lava, ijs en wind hebben dit landschap een

Een van de eerste foto's die de camera's aan boord van de Spirit maakte. Zo stond het dus op Mars

ander aanzien gegeven. Gedurende drie maanden zal de Spirit in deze krater gaan rondrijden en naar we hopen op vele vragen een antwoord geven. Het wagentje is uitgerust met zes wielen en weegt in totaal zo'n 180 kg.

Zeker is dat wij aardbewoners onze fotoalbums over Mars met heel wat plaatjes kunnen aanvullen.

Leuk is ook nog te weten dat na de eerste nacht Spirit 'gewekt' werd met het liedje van The Beatles "Good Morning, Good Morning".

Op 25 januari moet de Opportunity geland zijn. Meer hierover in onze volgende Astruim.

83435

83437

83438

André Koenigs veld als kind
als ruimtevaarders wisten



83439



83440

202 23192

FLORIDA TODAY : 24 maart 2004.

NASA DUSTS HISTORIC LAUNCH TOWER.

CAPE CANAVERAL - NASA will begin demolishing remnants of a historic Apollo launch tower today after a failed private bid to raise money to erect it as a national monument. Under pressure to comply with federal environmental regulations, NASA has given the go-ahead to a contractor to proceed with a \$2 million effort to dispose of segments of Launch Umbilical Tower-1, or LUT-1. The 380-foot gantry served as the starting point for eight Apollo and Skylab flights, including the mission that took Neil Armstrong and Buzz Aldrin to the moon in July 1969. The tower was dismantled in 1983, and segments have been rusting in a five-acre "bone yard" at Kennedy Space Center, creating an environmental hazard. Heavy metals and toxic substances within orange gantry paint are leeching into the soil at the open-air site as well as the water table beneath it. The six-month demolition effort is aimed at bringing NASA into compliance with federal regulations. "We have evidence that indicates that the structure is causing environmental contamination, and we've got a responsibility to deal with that," said Burt Summerfield, chief of the safety, health and environmental division at KSC. "We need to move on with the problems we have at hand." A decontamination effort started in early February but the demolition of gantry segments was put on hold after the Space Restoration Society launched a "Save the LUT" campaign. The preservation group presented a proposal to NASA but was unable to raise the estimated \$40 million needed to re-erect the gantry. Several previous efforts to save the tower also failed. Said Ross Tierney, chief operating officer of the society: "I think we're losing a national treasure here." Tierney said the group still hopes a wealthy benefactor will emerge before the demolition work reaches a point where the tower cannot be restored. "We think this is a major blow to our effort," he said. "But we're not giving up yet."

83441

83442
83443
83444

83442



83443

83444



UPE189

23193

BBC: 09 MAART 2004

HUBBLE'S DEEP VIEW OF THE COSMOS.

The Hubble Space Telescope has obtained the deepest view ever of the cosmos, detecting the youngest and most distant galaxies ever seen by astronomers. The Hubble Ultra Deep Field is the result of a prolonged look over four months at just one small patch of sky. This historic image takes astronomers close to the Big Bang itself, unveiling the first galaxies that emerged from the end of the so-called "dark ages." The image is expected to be unsurpassed until a new telescope is put in orbit. To produce the image, Hubble peered at the same point in the heavens for periods of many minutes between 24 September 2003 and 16 January 2004. Click here to see how far back in time Hubble has gone in what amounts to a million-second-long exposure, the first galaxies that developed after the Big Bang can be seen. This was a time in cosmic history when the first stars were reheating a cold, dark Universe. When the observations ended Steven Beckwith, director of the Space Telescope Science Institute, told BBC News Online: "We have seen things that are fainter than anyone has ever seen before." The Hubble Ultra Deep Field (HUDF) contains an estimated 10,000 galaxies. It is centred on the constellation Fornax, below the constellation Orion. In ground-based images, the patch of sky (just one-tenth the diameter of the full Moon) is largely empty. But the Hubble image, according to Dr Beckwith, is "just beautiful - rich, with many different, intriguing things". This historic view is actually a combination of two separate images taken by Hubble's Advanced Camera for Surveys (ACS) and its Near Infrared Camera and Multi-object Spectrometer (Nimmos). Both images reveal galaxies that are too faint to be seen by ground-based observatories, or even in Hubble's previous faraway looks, called the Hubble Deep Fields (HDF), taken in 1995 and 1998. The final ACS image is studded with a wide range of galaxies of various sizes, shapes, and colours. There is also a "zoo" of oddball galaxies littering the field. A few appear to be interacting. Their strange shapes are different from the spiral and elliptical galaxies we see today. These unusual galaxies chronicle a period when the Universe was more chaotic, order and structure were just beginning to emerge. The Nimmos sees even farther than the ACS. It reveals the farthest galaxies ever seen, because the expanding Universe has stretched their light into the near-infrared portion of the spectrum. Object identification "Nimmos provides important additional scientific content to cosmological studies in the HUDF," said Rodger Thompson, of the University of Arizona, and the Nimmos principal investigator. The entire HUDF also was observed with the advanced camera's "grism" spectrograph, a hybrid prism and diffraction grating. "The grism spectra have already yielded the identification of about a thousand objects," Thompson added. "Included among them are some of the intensely faint and red points of light in the ACS image, prime candidates for distant galaxies," said Sangeeta Malhotra of the Space Telescope Science Institute and the principal investigator for the Ultra Deep Field's ACS grism follow-up study. "Based on those identifications, some of these objects are among the farthest and youngest galaxies ever seen."

83445
83446

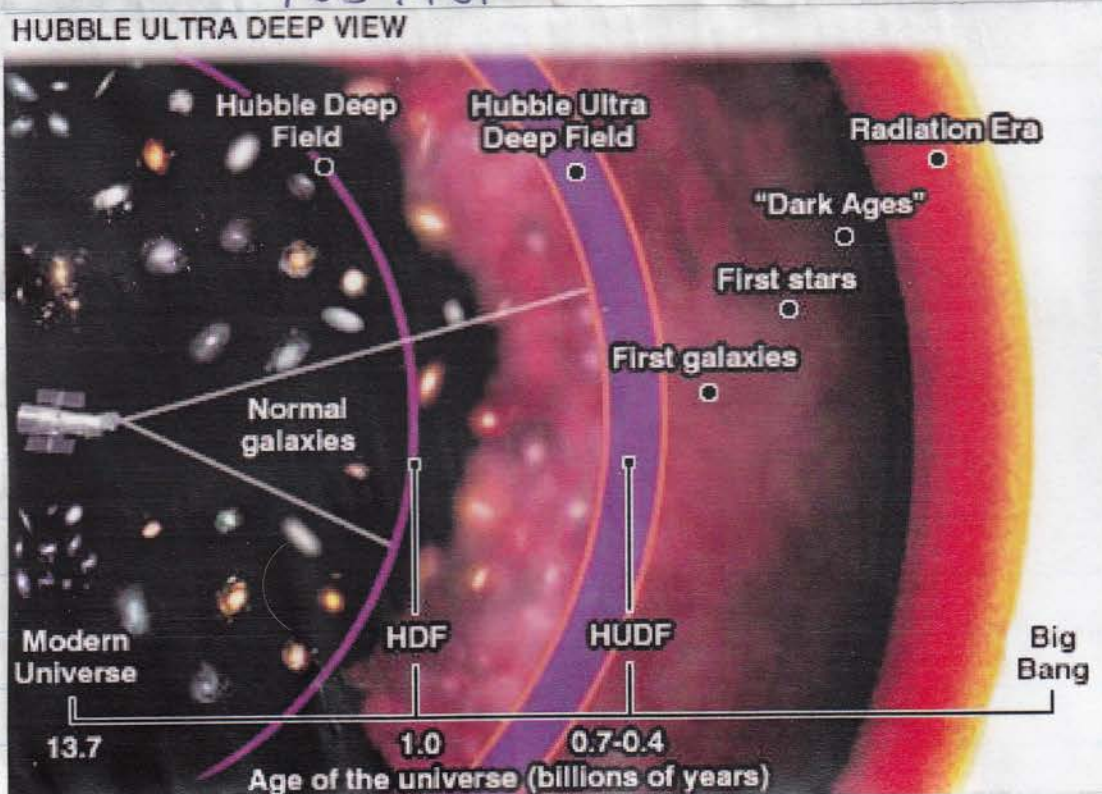


80182

23194



83447
83448



Op een steenworp van de 'big bang'

834491

83450

ROTTERDAM, 10 MAART. Astronomen hebben dieper in het heelal gekeken dan ooit tevoren. Een door de ruimtetelescoop Hubble gemaakte compositiefoto die gisteren is vrijgegeven, toont enkele nabije, maar ook zeer verre sterrenstelsels, gevormd kort nadat het heelal is ontstaan.

„De beelden van de Hubble brengen ons op steenworp afstand van de *big bang*”, aldus Massimo Stiavelli, leider van het internationale projectteam achter het gisteren gepresenteerde 'plaatje'. „Dit beeld zal de komende jaren in vele astronomieboeken gebruikt worden”, verklaarde Steven Beckwith, directeur van het Space Telescope Science Institute aan de Johns Hopkins Universiteit in Baltimore, waar het materiaal gisteren is gepresenteerd.

De Hubble-opname (Hubble Ultra Deep Field) toont naar schatting tienduizend sterrenstelsels. De jongste bestonden waarschijnlijk pas 400 miljoen jaar toen ze het licht uitzonden dat nu is vastgelegd. Ze zijn dus jong in vergelijking met de totale leeftijd van het heelal, momenteel geschat op 13,7 miljard jaar.

Het beeldmateriaal komt twee maanden nadat de Amerikaanse ruimtevaartorganisatie NASA heeft aangekondigd dat zij de Hubble-telescoop opgeeft, omdat het onderhoud ervan te duur en te omslachtig is. De veiligheidsprocedures van de NASA zijn aangescherpt naar aanleiding van het neerstorten, in februari vorig jaar, van de spaceshuttle Columbia. Het is nu verder afwachten hoe lang de ruimtetelescoop nog zonder onderhoud blijft functioneren.

Het Hubble-Ultra-Deep-Field-beeld is opgebouwd uit infrarood en optisch beeldmateriaal dat is verzameld tussen 24 september 2003 en 16 januari van dit jaar. De Hubble had 400 rondjes om de aarde nodig om met zijn telescoop in totaal 21 minuten hetzelfde kleine deel van het firmament te fotograferen. Het beeld heeft een breedte zo groot als circa eentiende van de diameter van de volle maan. De astronomen hebben gekozen voor een deel van de sterrenhemel juist onder het sterrenbeeld Orion. In dit gebiedje staan weinig sterren van de melkweg. Het licht en andere straling van het sterrenstelsel, waarin ook de zon en de aarde zich bevinden, zou de straling van verafgelegen stelsels verstoren.



Den bislang tiefsten Einblick ins All gab das Teleskop „Hubble“. Bei diesem Anblick fällt es nicht schwer, an göttliches Wirken zu glauben. Foto: afp

83451

„Hubble“ gibt tiefsten Einblick ins All

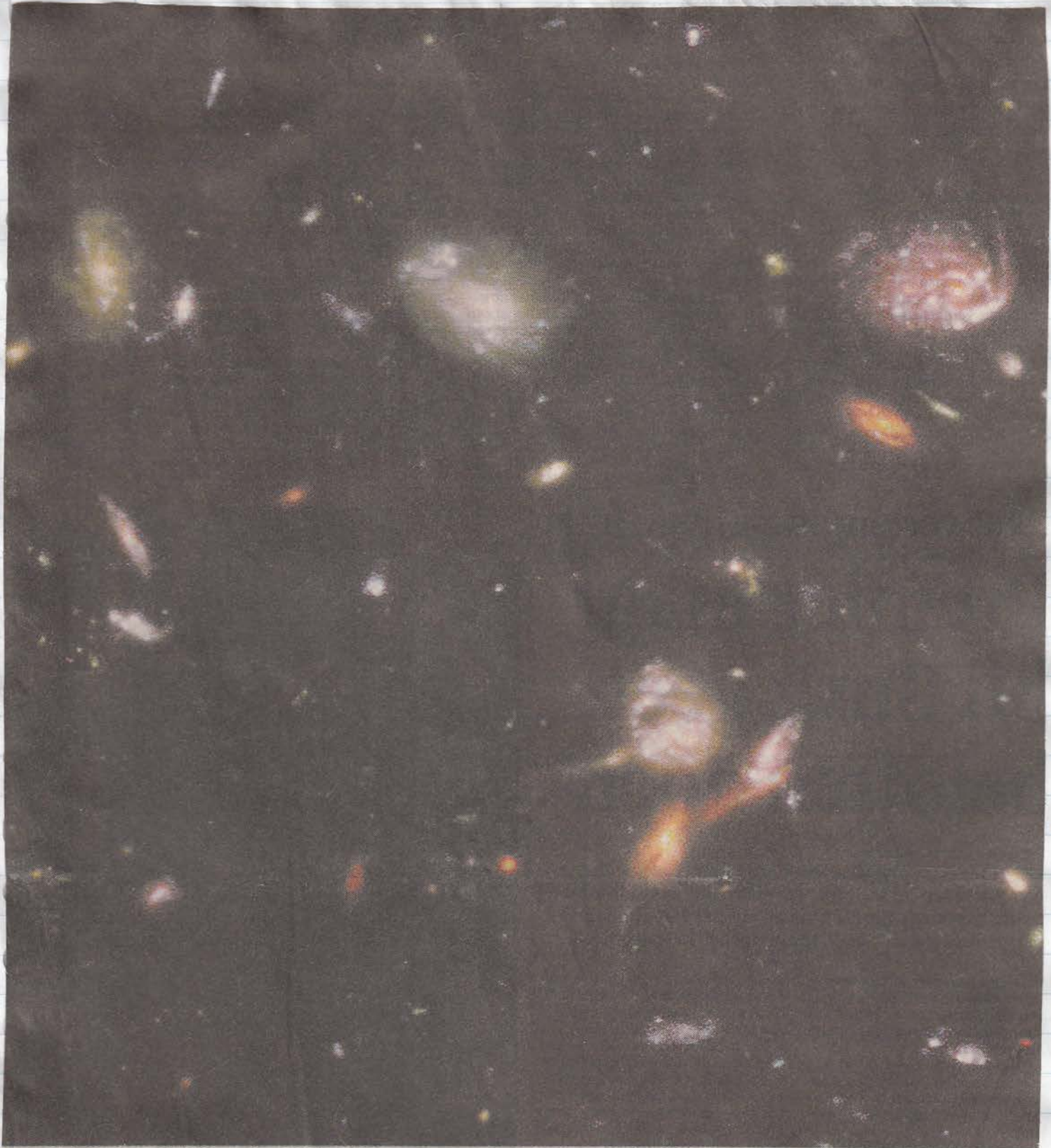
Dem US-Weltraumteleskop „Hubble“ ist ein einzigartiger Blick in die Kinderstube des Universums gelungen. Die gestern in Baltimore veröffentlichte Aufnahme stellt den tiefsten Blick ins All dar, der je gewagt wurde. Auf dem Bild sind Galaxien aus der Zeit vor 13 Milliarden Jahren zu sehen, als nach dem Urknall die ersten Sterne zu leuchten begannen. „Hubble hat uns zu einem Punkt geführt, der nur einen Steinwurf vom Urknall entfernt ist“, sagte der Leiter des Projekts, Massimo Stiavelli. Auf der Aufnahme sind annähernd 10 000 Galaxien zu erkennen.

Rheinische Post:
10-03-2004.

83452

23196

58122



Compositiefoto toont drie botsende, relatief nabijgelegen sterrenstelsels (rechts onder het midden). Vage rode vlekjes zijn verre stelsels van kort na de oerknal. Het blikveld is beperkt; alsof het firmament wordt waargenomen door een 2,5 meter lang limonaderietje

83453

NRC Handelsblad:
50-03-2004

080185

23195

False Reprieve

Hubble reveals bizarre infant universe as expansion of debate over telescope servicing accelerates

CRAIG COVAULT/CAPE CANAVERAL



The National Academy of Sciences will reassess a decision by NASA Administrator Sean O'Keefe to cancel a final servicing mission to the Hubble Space Telescope and also examine other non-shuttle related Hubble life-extension moves. That reassessment is coming in the wake of a Senate subcommittee request for a more narrowly focused shuttle servicing study—which O'Keefe rejected—and a judgment by Columbia Accident Investigation Board Chairman Harold Gehman, that O'Keefe's earlier decision may not necessarily be an open-and-shut case.

After appearing before NASA's Senate appropriations subcommittee, O'Keefe said that even if the Academy offers a positive assessment on shuttle servicing, he is unlikely to change his mind about the Hubble mission cancellation because of shuttle risk.

Gehman has written the subcommittee that "only a deep and rich study of the entire gain/risk equation can answer the question of whether an extension of the life of the 'wonderful' Hubble telescope is worth the risks involved."

"That is his view," O'Keefe said.

Gehman's view, by inference at least,

Hubble Ultra Deep Field imaged 10,000 new galaxies, many shown here. The image pushed back 13.3 billion years to within 400 million years of the Big Bang.

raises the question as to whether O'Keefe's earlier decision was supported by adequate data.

Gehman noted that a Hubble mission would have "slightly" more risk than an International Space Station mission, since a Hubble visit would offer no ISS safe haven option. And he said, "The Board [itself] is split on the merits of flying this mission."

83454

23198

O'Keefe told Sen. Barbara Mikulski (D-Md.) he concurred with her request for a National Academy of Sciences study through the National Academy of Engineering, but only if it avoided a narrow focus on servicing and included assessments of non-shuttle servicing options to extend Hubble's life.

O'Keefe said in January at the Jet Propulsion Laboratory in Pasadena, Calif., that given the decision process which led to cancellation of the final and fourth planned servicing mission, "NASA did not understand the extent of the risk" in undertaking the three previous servicing missions and "got lucky" on those flights that no accident occurred.

And he pretty much stuck to that view last week after coming out of the sub-

Ultra Deep Field project. The telescope has found a menagerie of extremely young oddball galaxies, chronicling these gigantic bodies as out-of-control toddlers before order and structure emerged in the firmament. This deepest portrait of the universe ever taken is being hailed as one of the most important space science results achieved by the National Aeronautics and Space Administration.

"The image you see is full of superlatives," said Steven Beckwith, director of the Space Telescope Science Institute in Baltimore. "For the first time, we're looking back at stars that are forming out of the depths of the Big Bang. . . . The image will be in astronomy textbooks for years," he said.

Made by combining data from two of

the constellation Orion. Thousands of new galaxies in the image were all in existence and perhaps died billions of years before the Sun, Earth and the rest of the solar system were even formed.

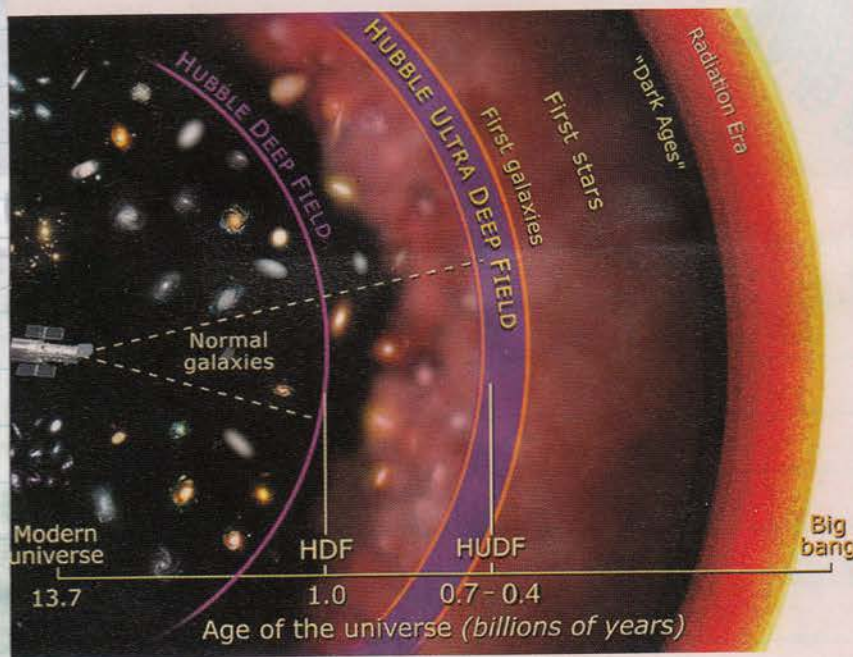
Hubble in both 1995 and 1998 spent several days looking repeatedly at a different portion of the sky in two original Deep Field projects that caused a sensation among astronomers when they reached to within about 1 billion years of the Big Bang.

But with the longer exposure time involved with the Ultra Deep Field, Hubble has reached back so far that it has captured a much different universe—one with galaxies shaped like toothpicks and other bizarre forms often colliding.

That sharp distinction between the state of the universe early in its formation and the one more visible now will be a major topic of research spawned by the Ultra Deep Field imagery.

This historic new view is actually two separate images taken by Hubble's Advanced Camera for Surveys (ACS) and the Near Infrared Camera and Multi-

Diagram shows penetration of the Hubble Ultra Deep Field toward the Big Bang compared with earlier Deep Field projects. New image found a much more chaotic universe.



object Spectrometer (Nicmos). Both images reveal galaxies that are too faint to be seen by ground-based telescopes, or Hubble's previous Deep Fields.

Installed in 2002 during the last servicing mission to the Hubble telescope, the ACS has twice the field of view and a higher sensitivity than an older workhorse camera on Hubble, giving the telescope the ability to look back to 800 million years after the Big Bang.

On the other hand, Nicmos, with greater sensitivity, extends Hubble's view back to 400 million years after the Big Bang, said Roger Thompson of the University of Arizona and the Nicmos principal investigator. An important area of research will be to bring the two light-year estimates—the 800 million and 400 million figures—closer together to better nail down events in the post-Big Bang universe that were happening relatively quickly on a cosmological scale.

The Ultra Deep Field observations began on Sept. 24, 2003, and continued through Jan. 16, 2004.

Only four astronomers looked at the combined images and were sworn to secrecy before its release giving thousands of astronomers around the world an even start at assessing the data for even more discoveries.

committee hearing, saying it was highly doubtful NASA could comply with Columbia Accident Board recommendations and still mount a return shuttle mission to Hubble (*AW&ST* Mar. 8, p. 56).

The decision to abandon Hubble servicing on shuttle safety grounds has also been supported by astronomer John Grunsfeld, NASA's chief scientist. Grunsfeld is the agency's top advocate for science and a shuttle astronaut who has twice launched on shuttle missions to service the telescope. He has characterized a return visit to Hubble as "not prudent." Many other astronauts strongly disagree, however.

The controversy has soared as Hubble has just finished looking back in time a record 13.3 billion years as part of its

Hubble's instruments, the Ultra Deep Field image shows red infant galaxies that astronomers believe could have been formed only 400 million years after the Big Bang, just 5% into the existence of the visible universe (see chart above).

To achieve the Ultra Deep Field Image, Hubble made about 800 separate images all focused on a tiny, seemingly empty region of space. The imagery involved about 1 million sec. of exposure time during 400 orbits accumulated over four months. Looking into this void, Hubble discovered an estimated 10,000 new galaxies.

The patch of sky in which the galaxies reside is just one-tenth the diameter of the full Moon. It is located in the constellation Fornax, a region just below

83455

83455

23199

HUBBLE FINDS FARTHEST GALAXIES.

Astronomers using the Hubble Space Telescope (HST) unveiled the deepest look into the universe yet, a portrait of what could be the most distant galaxies ever seen. The new image, called the Hubble Ultra Deep Field (HUDF), includes objects that until now have been too faint to be seen and includes ancient galaxies that emerged just 700 million years after the Big Bang theory from what astronomers call the "Dark Ages" of the universe. "This image is the deepest view in the visible that we've ever taken, where an object about as bright as a firefly on the Moon would be visible," said Massimo Stiavelli, of the Space Telescope Science Institute (STScI) in Baltimore and the HUDF project leader. Stiavelli said the new image is six times more sensitive than previous deep sky surveys and four times better than even Hubble's last faraway looks, the Hubble Deep Fields (HDFs), taken in 1995 and 1998. "It has these extra colors with extra red shifts, which leads you to the end of the Dark Ages, something you couldn't do with the HDF," he added. The HUDF field contains an estimated 10,000 galaxies in a patch of sky one-tenth the diameter of the full moon located in the constellation Fornax, a region just below the constellation Orion. Hubble took one million seconds to take the HUDF, which appears in an area of the sky that appears largely empty if observed by ground-based instruments. This new view is actually two separate images taken by Hubble's Advanced Camera for Surveys (ACS) and the Near Infrared Camera and Multi-object Spectrometer (NICMOS). The combination of ACS and NICMOS images will be used to search for galaxies that existed between 800 and 400 million years after the Big Bang. But it's the NICMOS instrument that will reveal the farthest galaxies ever seen, because only it can detect light stretched past the visible, far into the near-infrared spectrum. Astronomers can tell how old a galaxy is by measuring the light it emits, specifically the amount of light that has been shifted toward the red end of the spectrum. The higher red shift a galaxy has, the more distant it is and the earlier it existed in the universe. Hubble researchers are confident their new image contains galaxies whose light has been stretched to a red shift of 6 or more. STScI researchers said there's even a good case that it contains ancient galaxies of red shift 12, which would place them about 300 million years after the Big Bang. Mario Livio, head of the Institute Science Division at Space Telescope Science Institute, says that if red shift 12 galaxies are indeed in the image, they will be found soon. "It could happen this afternoon," Livio said in an interview prior to the Hubble announcement. "That might be stretching it a bit, but it will be easy." Stiavelli, head of ultra deep field observations, said that finding a red shift 12 galaxy will be important because it will be done not with a gravitational lens, but "by brute force." The ACS field is studded with a wide range of galaxies of various sizes, shapes, and colors. In vibrant contrast to the image's rich harvest of classic spiral and elliptical galaxies, there is a zoo of oddball galaxies littering the field. Some look like toothpicks, others like links on a bracelet. A few galaxies appear to be interacting. These oddball galaxies, that existed 800 million years after the Big Bang, chronicle a period when the universe was chaotic, when order and structure were just beginning to emerge. "The images will also help us prepare for the next step from NICMOS on Hubble to the forthcoming James Webb Space Telescope. The NICMOS images reach back to the distance and time that Webb is destined to explore at much greater sensitivity," explained Rodger Thompson of the University of Arizona and the NICMOS principal investigator. The entire HUDF was observed with the advanced camera's "grism" spectrograph, an instrument used to measure distances to these distant objects. "The grism spectra have already yielded the identification of about a thousand objects. Included among them are some of the intensely faint and red points of light in the ACS image, prime candidates for distant galaxies," said Sangeeta Malhotra of the STScI and Principal Investigator for the Ultra Deep Field's ACS grism follow-up study. "Based on those identifications, some of these objects are among the farthest and youngest galaxies ever seen. The grism spectra also distinguish among other types of very red objects, such as old and dusty red galaxies, quasars and cool dwarf stars," she said. The ACS picture required a series of exposures taken over the course of 400 HST orbits around Earth from September 24, 2003, to January 16, 2004. The size of a phone booth, ACS captured ancient photons of light that began traversing the universe even before Earth existed. Photons of light from the very faintest objects arrived at a trickle of one photon per minute, as opposed to millions of photons per minute from nearer galaxies. Astronomers are eager to see the Hubble receive a stay of execution in the form of future servicing missions by NASA's space shuttles to extend the telescope's lifetime. Adam Riess, a supernova researcher for STScI, said an extension could help astronomers find supernova early in the universe's lifetime. "There are no supernovae in this deep field, but the results show that supernova in the early universe could be found if Hubble could be extended," Riess said. "Those could provide valuable insight into dark energy and fate of the universe." The STScI is operated by the Association of Universities for Research in Astronomy, Inc. under contract with NASA's Goddard Space Flight Center, Greenbelt, Maryland. The HST is a project of international cooperation between NASA and the European Space Agency.

83456



83457

00185

23200