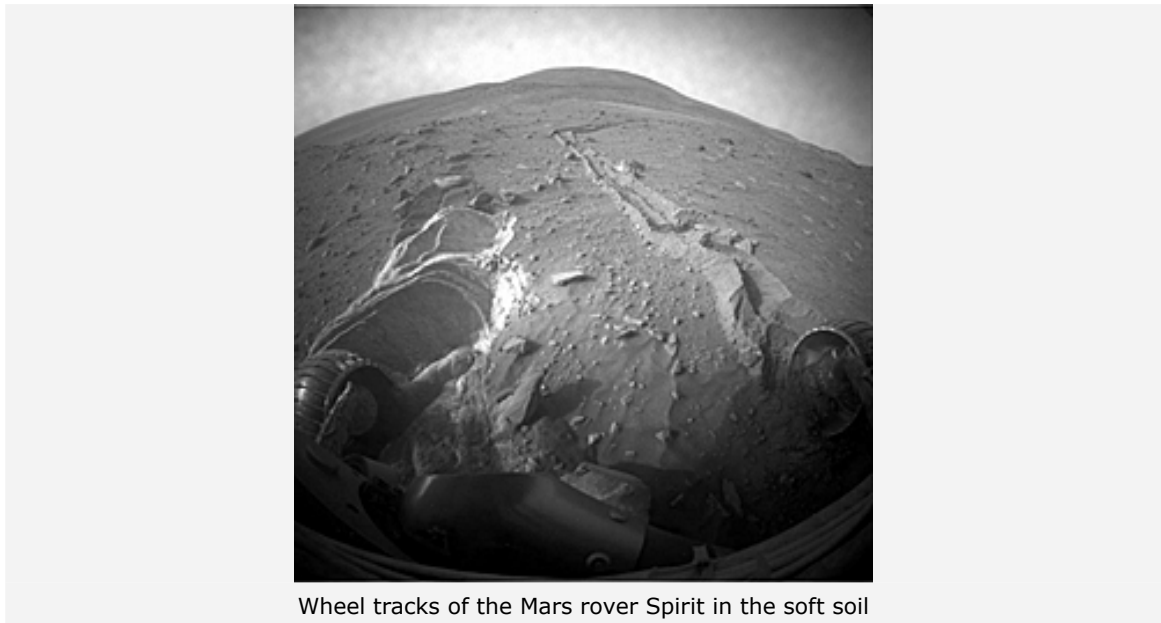

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Mars researchers battling to save NASA's rover Spirit

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Wheel tracks of the Mars rover Spirit in the soft soil

Wheel tests at the DLR Institute of Aerospace Systems

NASA's rover Spirit, which has been travelling across Mars for more than five years, has become stuck in soft soil. Mars researchers and the team operating Spirit are now searching for ways to get the rover, about the size of a camping table, moving again. Lutz Richter from the German Aerospace Center (Deutsches Zentrum für Luft- und Raumfahrt; DLR) Institute of Aerospace Systems in Bremen is testing the behaviour of the rover's wheels in a sand mixture that has been specially prepared to simulate conditions on Mars.

At first, the Martian plateau across which the Mars rover Spirit is currently travelling looked anything but dangerous. But the Mars soil was deeper and softer than the researchers anticipated. During an attempt to overcome this dangerous stretch of the rover's route, it dug itself deeper and deeper into the soft Martian soil. "The situation is pretty critical," says Dr Richter, who has been a member of the Spirit Science Team from the beginning. "At the moment, when Spirit's wheels are turning and the rover would normally move three metres, it currently moves just three millimetres. In addition, the rover is digging itself deeper and deeper into the Martian soil." That represents an increasing worry to the researchers and engineers who are driving Spirit across Mars, because underneath the chassis there are a number of medium-sized stones on which the rover could come to rest with the underpan of its chassis.

Scientists gather ideas to save Spirit



In order to avoid making the situation any worse, the rover team around Project Manager John Callas at the Jet Propulsion Laboratory (JPL) in California has currently suspended sending any further driving commands to Mars. Instead, Callas has summoned all the experts involved with the mission in the last five years and has asked for their assistance. At present, only a small team remains driving Spirit and the identically constructed rover Opportunity. Now the whole team is being brought together again to rescue the rover from its difficulties. "We have already collected 40 suggestions," says Dr Richter. The suggestions are now being tried out with great care on two test rovers at JPL in California. For this purpose the Mars researchers have prepared a special sand mixture to mimic as closely as possible the surface on which Spirit is currently driving.

Wheel testing facility at the Institute of Aerospace Systems in Bremen measures resistance in Mars soil

Lutz Richter, too, has had a load of Martian sand mixed for him. In Bremen, at the Institute of Aerospace Systems, he has a wheel test facility in which he can mount a Mars rover wheel. By this means Dr Richter can measure and numerically determine the resistance that the wheel must overcome to pass through the Mars soil. "Our measurements on one wheel can be extrapolated for the whole vehicle and supplement the tests which our colleagues at JPL are carrying out with their two test rovers," says Dr Richter. In two to three weeks the researchers intend to pool their results and decide on the best solution for rescuing Spirit from its precarious situation. "For example," Dr Richter says, "one possibility would be for the rover to shovel soil under its wheels with its arm, thus preventing it from sinking still deeper. Using this method, the rover could very gradually dig itself out of the soil."



Dr Lutz Richter

Across Mars in reverse gear

The Mars rover team has repeatedly found solutions to the difficult situations in which the rovers have found themselves on Mars. Spirit, for example, has been travelling across Mars in reverse using only five wheels since as long ago as April 2006 because its right-hand front wheel has failed. Furthermore, dust constantly settles on the vehicle's solar cells so that the energy supply has not always been ideal, particularly during the Martian winter. This problem solved itself a few weeks ago, however, when a storm swept the rover's solar cells clear again. "Actually it is rather sad that Spirit has got stuck now of all times, when there would be sufficient energy again for experiments and movement." On the other hand, the DLR researcher says, this also has its positive side: "It is reassuring that the energy supply is so good in the current situation."

Lutz Richter emphasises that both rovers, which have now been travelling across Mars for as long as five years instead of the originally planned three months, could fail at any time due to wear and tear. All the researchers were aware, Richter says, that these years have been a bonus period for them: "Mission Manager Steve Squyres has been saying for a long time that the day will come when he will have to pull the plug up there." But it has not come to that yet, Dr Richter hopes, and is reasonably confident that the experts will get the Mars rover moving again. "We have many ideas and plenty of time to consider the best approach, that is a great advantage."

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