

Spirit Rover: Right-Front Wheel Rotations

December 18 2009



This three-frame animation aids evaluation of performance of the right-front wheel on NASA's Mars Exploration Rover Spirit during a drive on the rover's 2,117th Martian day, or sol (Dec. 16, 2009). Image credit: NASA/JPL-Caltech

(PhysOrg.com) -- Spirit's right-front wheel, which had stopped operating in March 2006, revolved with apparently normal motion during the first three of four driving segments on Sol 2117 (Wednesday, Dec. 16) but stopped early in the fourth segment of the drive.

The rover's right-rear [wheel](#), which stalled nearly three weeks ago, remained immobile during the entire Sol 2117 drive. The other four wheels all drove forward in this part of the continuing attempt to extricate Spirit from the sand trap where it is embedded. The sol's total commanded motion was 10 meters (33 feet) worth of wheel rotations. The resulting movement of the rover was about 2 millimeters (0.08 inch) forward and 4 millimeters (0.16 inch) downward. That ratio of forward to downward is well below what would be necessary over longer distance for extrication. Part of the downward motion on Sol 2117 resulted from

the right-front wheel digging in as it rotated about 10 times.

Engineers are analyzing results from the Sol 2117 drive and from electrical tests conducted prior to the drive. Movement of the right-front wheel for about 3.5 minutes was a surprise, despite an indication from an electrical-resistance test on Sol 2113 (Saturday, Dec. 12) that some motion might be possible by the long-disused wheel. It is not clear whether the wheel will work again, since it stopped during the final drive segment. It is also not clear whether extrication from the sand trap would be possible even with an operable right-front wheel.

The drive conducted on Sol 2117 had been planned for one sol earlier, but was delayed after analysis of the Sol 2113 test led to discovery of a new electrical issue on Spirit. Engineers learned that a persistent voltage now exists between the rover electric ground and the rover chassis where no voltage should exist. This condition might be related to problems with the right-rear wheel.

Spirit ran diagnostic tests related to this grounding issue on [Sol 2117](#) prior to driving and during the drive. The single-point ground showed a sustained minus 5 volts that increased to minus 25 volts whenever any of the six wheel-driving motors or four wheel-steering motors were powered. This suggests the unusual electrical behavior is associated with the rover motor controller board since the behavior is seen with all 10 motors associated with that electronics board. The rover has other motors not related to the wheels, but the persistent voltage has not been associated with any of those.

The plan ahead is to perform another set of low-voltage tests on the three right-side wheels and then command another four-step forward drive. This drive would not use the right-front wheel in conjunction with the others, but that wheel would be driven briefly by itself after each step to gain more information about its possible usefulness.

Provided by JPL/NASA

Citation: Spirit Rover: Right-Front Wheel Rotations (2009, December 18) retrieved 3 May 2024 from <https://phys.org/news/2009-12-spirit-rover-right-front-wheel-rotations.html>

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