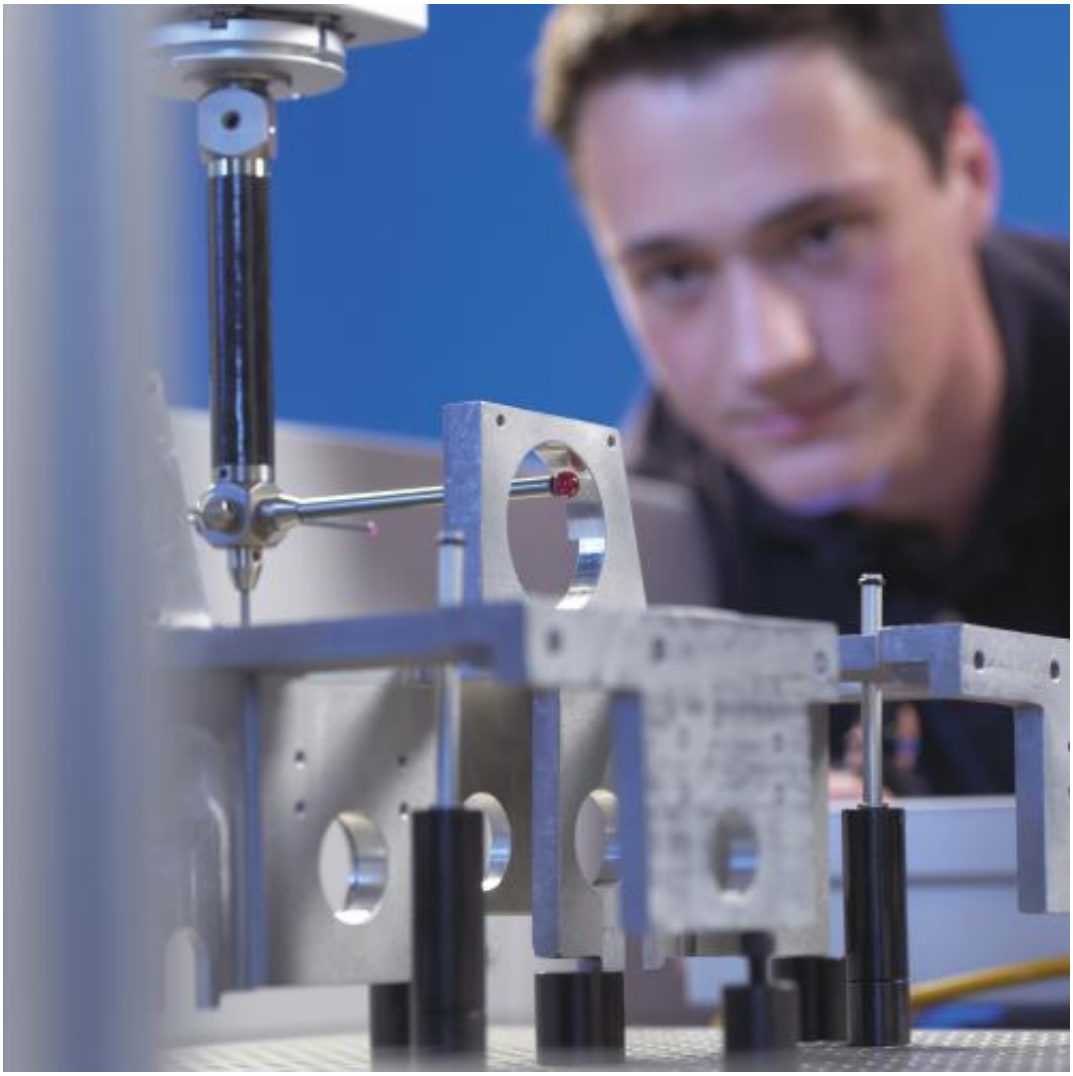
Mars and the machine

April 23 2013



Calipers for maximum precision measurement from Carl Zeiss that help make airplanes safer, improve cars and make plastic parts more resilient. Credit: Carl Zeiss

Without hi-tech magnetic sensors, rovers wouldn't be able to roam around Mars. These same sensors will soon boost terrestrial travel by improving the machinery that moulds parts for cars and aircraft here on Earth.

These devices will 'feel' parts in exquisite detail, noting features like the width and depth of drilled holes, helping to create perfect 3D pictures of each highly complex piece.

It takes up to 20 minutes to beam information from Mars to Earth – more than enough time for a rover to become fatally stuck if it were being remotely driven by a human here.

To help avoid this problem, engineers have turned to a 'magneto-resistive' sensor that converts magnetic pulses into electrical signals. Attached to the motor shaft, the sensor registers how many times the wheel has rotated, which helps the rover to navigate itself.

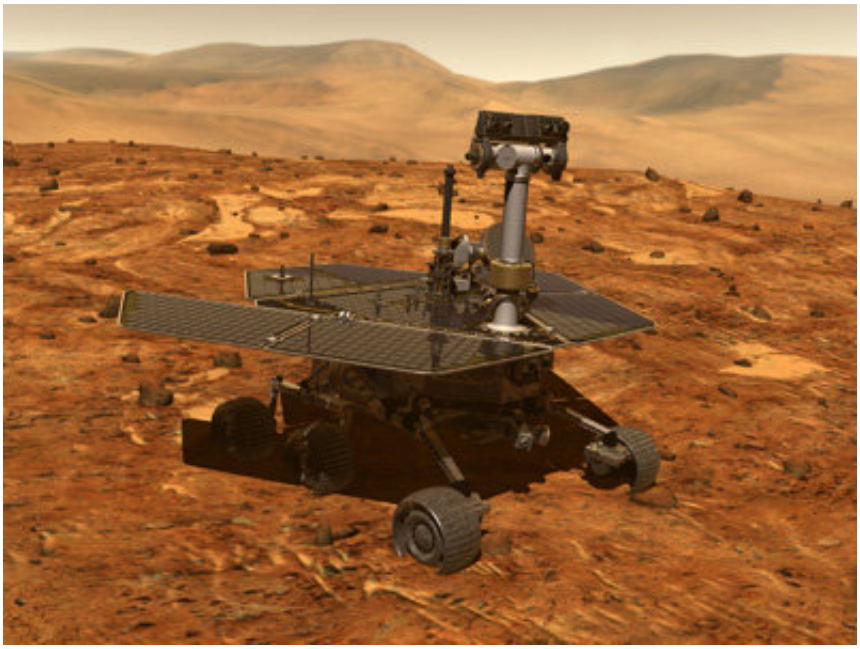
"Our technology was a pretty important enabler for the bigger rovers on Mars," said Dr Rolf Slatter, CEO of Sensitec, the German maker of the sensors. On NASA's Spirit, Opportunity and Curiosity Mars rovers, these sensors measure the motor positions for the wheels and the robotic arms.

"We use a slightly different Sensitec angular sensor in ESA technology programmes for two walking robots," said Gianfranco Visentin, Head of ESA's Automation and Robotics. "They are mounted in the leg mechanisms to help the Aramies and SpaceClimber robots walk."

"Really serious rover business goes hand and hand with this technology," added Dr Slatter, whose company sent their first sensors to Mars in 2004.

"There were rovers before, but most used other technology that was

either much bigger or less robust."



Artist's impression of NASA's MER Spirit rover on the surface of Mars. Credit: NASA

Spin-off from ESA event

At a workshop organised by ESA's Technology Transfer Programme Office and its German technology broker company MST Aerospace, this special magnetic sensor space technology was spotted by Carl Zeiss Industrielle Messtechnik GmbH.

"I'm always looking for some sort of improvements, and this caught my eye," said Thomas Engel, Manager of Sensor Systems Development and Innovation Management at Carl Zeiss, which builds the complex machines used to create anything from car parts to medical devices.

"Discussing with Carl Zeiss, we understood that this special technology developed for rovers to make them able to drive around exploring Mars could help the company in their development of customised, robust and precise production machines," said MST's Dr Werner Dupont.

Five months later, the spin-off was on the way, noted Mr Engel: "We sketched the first ideas on a napkin."

Space sensor turns out 3D pictures

At Carl Zeiss, these sensors will have an entirely new role. Instead of tracking the distances travelled across the surface of Mars, they will measure the very small, very complex mechanical parts that go into the machinery they build, to produce parts for medical equipment, semiconductors, cameras, dental prosthetics and others.

"We want to increase accuracy," said Mr Engel. They are testing sensors that touch the sides of a part, noting features like the size, width and depth of various drilled holes. The objective is to create perfect, 3D pictures of each highly complex part.

In addition to its extreme accuracy, "This sensor technology doesn't make very much noise, which is better for precision measurements."

The whole process of developing these sensors for Mars rovers was important for the company, helping to verify the technology's accuracy and strength.

"For space, very extreme, very extensive and expensive tests are conducted, and learning about the technology's robustness in space is of huge advantage to us," emphasised Dr Slatter.

"If a sensor can survive in space, then 99 out of 100 times Earth

applications are peanuts."

The next space voyage for Sensitec's sensors could be on ESA's Bepicolombo mission to Mercury.

Provided by European Space Agency

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