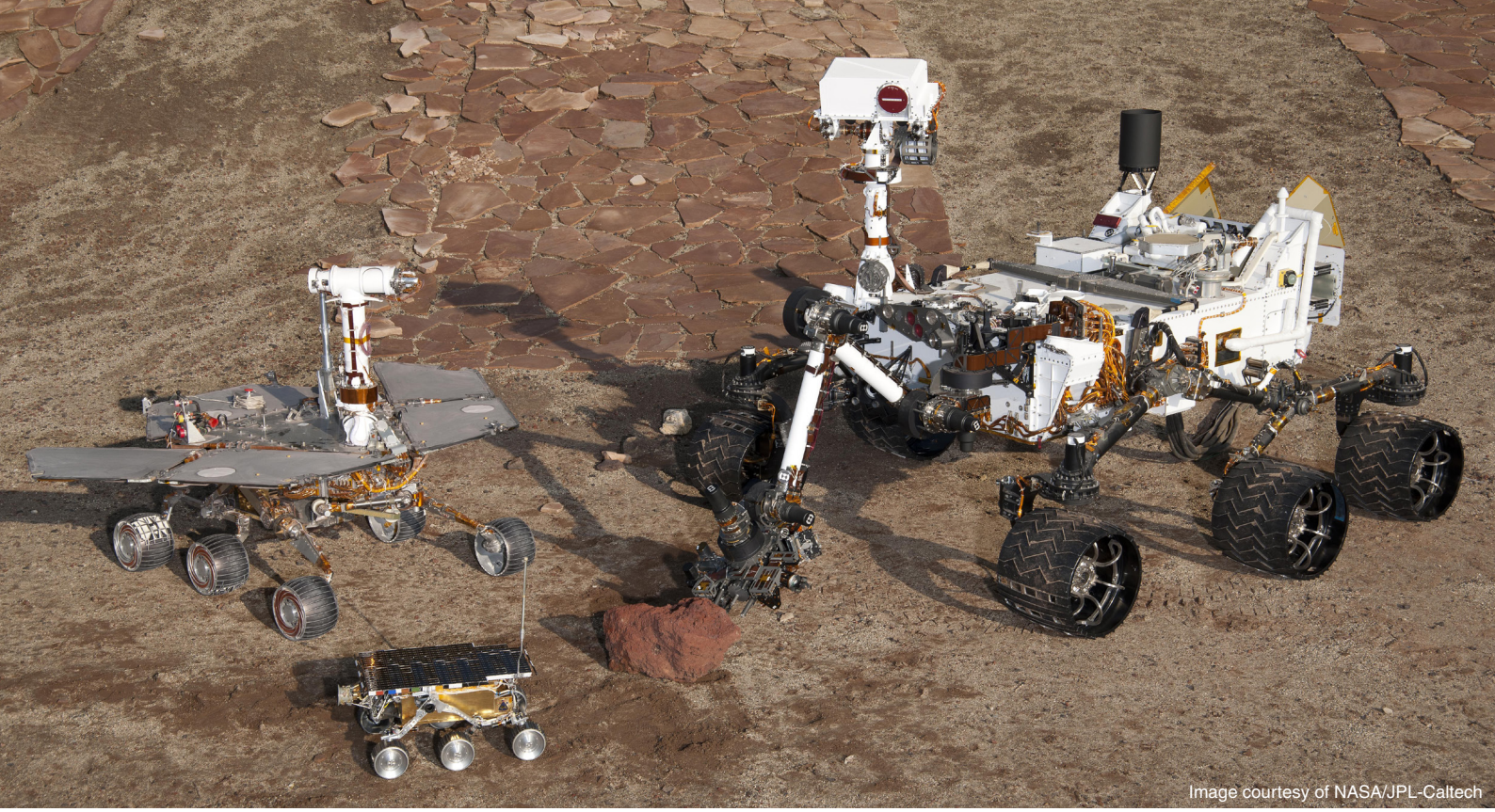


Image courtesy of NASA/JPL-Caltech

The Mars mission – technology for another world

We did not find any little green men on Mars, but we did find dried out lakes and river beds. The NASA missions keep discovering new secrets of the red planet. Always on board: Reliable DC motors by Swiss drive specialist maxon motor.

Perhaps mankind will soon start its first colonies on Mars. They will mine the ground for ice, use it as drinking water, and plant vegetables in greenhouses. And when it gets dark, they will look at the night sky, towards Earth, where the foundation for their mission was laid long ago. An unrealistic scenario? Not at all.

The research on Mars has advanced immensely in the past 20 years, and precision motors by maxon motor have made an important contribution. In four missions of the US space authority NASA, products of the Swiss company reached the surface of Mars. The data collected over the course of these projects is bringing us closer and closer to the goal of a manned mission to our neighbour planet. maxon motor also gains important new insights with every flight: CEO Eugen Elmiger comments: “In space, our brushed and brushless DC motors are confronted with very harsh conditions – extreme cold, heat, impact, and vibration. We have been able to use this experience to improve our products on Earth many times.”

The historic breakthrough

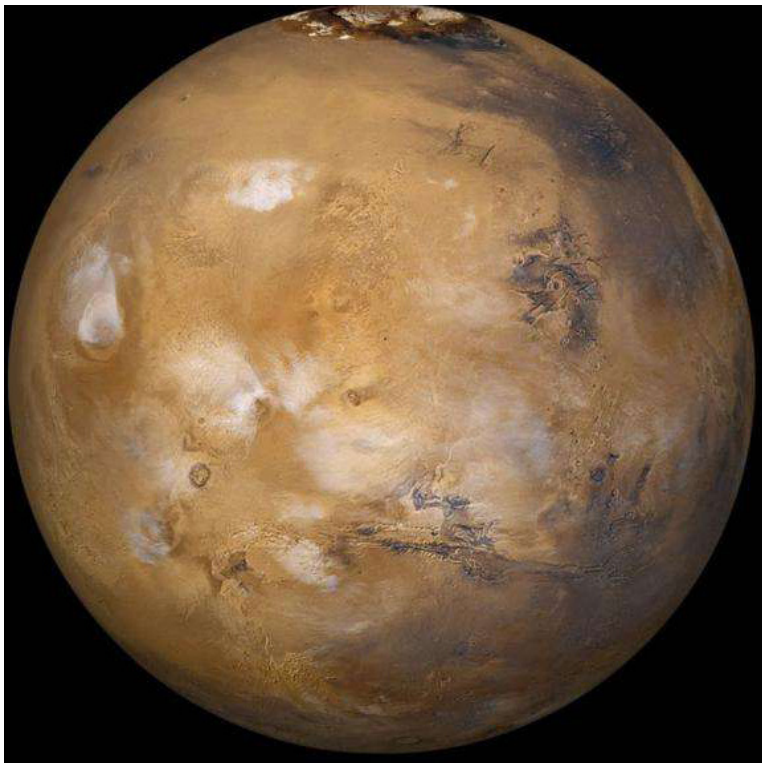
Currently we are still sending robots on the long journey to Mars. They explore the barren landscape, investigate rock samples, and take breathtaking photos. The first of these was Sojourner, a rover with six wheels, which landed on July 04, 1997. It was historic moment, as all previous attempts to send a vehicle to Mars had failed. Sojourner was small and weighed only 11.5 kg. For almost three months, it wandered across the sandy landscape and sent back images and data – much longer than planned. The vehicle was driven by electrical maxon DC motors. These high-quality motors with ironless windings,

were installed on the wheels and were used for the steering, as well as for the operation of the scientific equipment. Engineers worked with the NASA employees to make the project a reality. Its success fascinated the whole world. Since then, the terms “maxon” and “Mars” have been closely linked. Yet that was only the start.

The twins on the red planet

Driven by the success of the Sojourner mission, NASA soon started planning the next trip to Mars. This time, two identical rovers were to be sent up simultaneously: Spirit and Opportunity. They were significantly larger than their predecessors (around 185 kg) and equipped with more advanced technology. The rovers were able to take photos, scrape the ground with brushes, and drill into rocks. Their mission: Find evidence that there used to be water on Mars, and therefore maybe, even life.

“Today, ten years after its landing, Opportunity is still traveling the surface of Mars.”



The volume of Mars, our neighboring planet, is only a seventh of that of the Earth. Its surface is a wasteland covered in rocks and red dust. An unreal landscape, absolutely hostile to life. Breathing is impossible: The planet has only a very thin atmosphere that consists mostly of carbon dioxide. The average temperature on the surface is around –55 °C. Mars has many canyons and volcanoes. The largest is Olympus Mons, with a height of 22 km, which makes it the tallest mountain in our solar system. (Image: maxon motor)

The two vehicles exceeded all expectations. Their expected service life was three months. However, six years passed before Spirit sent its last signal to Earth. Its brother, Opportunity, is still going strong today, ten years later. Since the landing, it has traveled more than 40 km. Despite sand storms and temperature fluctuations from –120 to +25 degrees, the maxon DC motors are also still performing reliably. Each rover is equipped with 39 of these precision drives, which are responsible for driving the six wheels, the steering mechanism, the RAT (rock abrasion tool), the robotic arm and the camera.

Opportunity's great birthday present

Opportunity is still a source of great joy to the scientists on Earth, even though it is starting to suffer from some old-age ailments. In January 2014, just in time for its ten-year anniversary, it found traces of water in the rock formations it was investigating at the Endeavour crater. And what is more: The data shows that several billions of years ago, this was the site of a lake, possibly with good conditions to support organic life.

The hunt for the hidden ice

There is still ice on Mars, for example at the two polar caps. The researchers assumed that there is more ice in other regions – below the surface of Mars. Phoenix was sent to prove this theory. It landed on Mars in 2008. Unlike its predecessors, it was a stationary space probe. After just a short period, it provided the desired evidence, by heating up a Mars sample and finding water vapor in it. The Swiss motor specialist had supplied nine RE series precision motors. These brushed motors with special ball bearings were used to align the solar panels on Phoenix.

A new star on Mars

The researchers embarked on a new, daring project and planned to send another rover to Mars. This one exceeded all previous dimensions. Curiosity, the new star in the rover squad, weighed 900 kg and was the size of a compact car. It landed on the red planet in August 2012. Equipped with a robotic arm, a chromatograph, and a spectrometer for analysing rock and soil samples, it is on a constant search for signs of earlier life. Radionuclide batteries ensure a reliable energy supply. maxon MR encoders control the motors in the electromechanical joints.

Since its landing, Curiosity has made quite a few tracks in the red sand and collected valuable data to provide the scientists with new knowledge about Mars. For example, it discovered elements such as hydrogen, oxygen and carbon, the so-called building blocks of life, under the surface of Mars. This is a strong indication that the planet used to fulfill the prerequisites for life. Curiosity also shot landscape photos with such an impressive resolution that the viewer feels almost like he is standing on Mars himself. A feeling that could become reality in the near future: While there are still many obstacles to be overcome before the first manned flight can depart to Mars, the NASA rovers have already paved the way somewhat.

The Mars adventure continues!

ESA, the European Space Agency, is planning its own Mars mission in cooperation with the Russian agency Roscosmos. Under the name ExoMars, a probe will be launched towards our neighbor planet in 2016. A Mars rover is to follow two years later. It will be somewhat smaller than Curiosity, but it will come with a drilling unit that can retrieve rock samples from a depth of two meters. Samples will be analyzed directly in the rover. Once again, maxon motor is involved as mission partner and will supply precision drives from the DCX series for the ExoMars rover.

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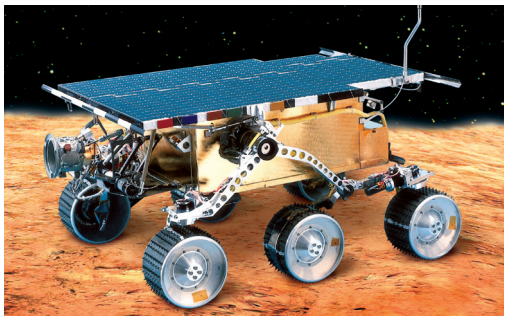
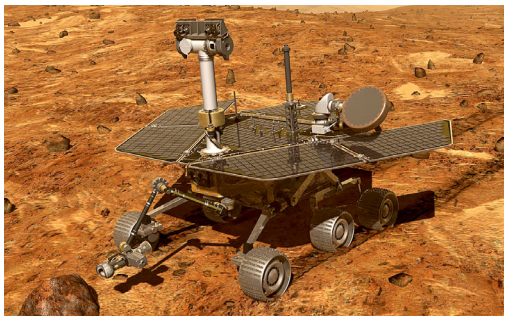
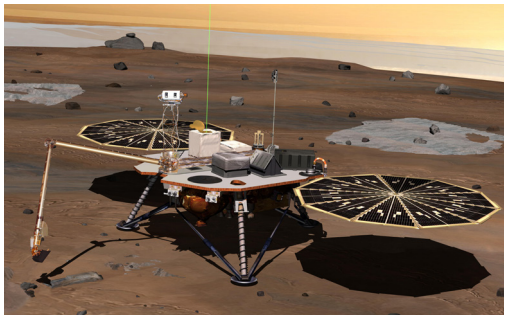
maxon drives in the Mars missions



Sojourner
The first Mars rover landed on July 04, 1997. Service life: Three months. maxon supplied eleven DC motors with a diameter of 16 mm for the drives, the steering and the scientific devices.



Spirit/Opportunity
The twin rovers landed on Mars in January 2004. Spirit collected data for six years, Opportunity is still active today. Both rovers were equipped with 39 maxon motors each. Thanks to a few modifications, the DC motors have no problem withstanding temperature fluctuations from –120 to +25 °C.



Phoenix
A stationary Mars probe that landed on Mars on May 25, 2008. With its robotic arm, it took rock samples from the ground and analysed them. Service life: Five months. maxon supplied nine brushed DC motors of type RE 25, with special ball bearings for aligning the solar panels.

Curiosity
The star of the rover squad landed on Mars in August 2012. It surpasses its predecessors not only with its technology: Curiosity is the size of a small car, weighs 900 kg, and is powered by a radionuclide battery. maxon motor supplied the precision encoders installed on the drive axles.