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Press Release

Missions to Mars: where are the 100 maxon DC motors that have been sent to the red Planet?

We take a look at the role that maxon DC motors played in all their missions to Mars, starting from 1997 when the first DC motors arrived, through to now when the Perseverance Rover took off on 30 July, 2020.

More than 100 maxon DC motors have been used on Mars over the past 20 years. These DC motors have withstood cosmic radiation, dust storms and extreme temperature variations. With the Perseverance rover, maxon DC motors are once again on their way to the Red Planet.

Sojourner Rover

In 1997, for the first time in history, NASA's Sojourner Rover, with six wheels and weighing just 11kgs, was a vehicle exploring the surface of Mars taking photos and investigating the soil. In order to maximise scientific results, a large number of experiments were designed for the mission. This was possible due to a large collaboration that included the 11 maxon DC motors used for the propulsion, steering and operation of scientific instruments. The maxon DC motors, with their typical ironless rotor and rhombic winding, were more powerful and more dynamic than conventional DC motors. The brushes and the lubricants were modified by maxon engineers, who, at the time, were unsure if the modifications would be enough for a successful Mars mission. A completely new blueprint, there were no previous missions to aid maxon. The DC motors had to survive strong vibrations during the rocket launch, vacuum and cosmic radiation during the journey, a hard landing on Mars, dust storms and temperature fluctuations from -120 to +25°C. The mission was a success and maxon became world-renowned.

The inclination to undertake further exploratory missions to Mars grew among space agencies. Questions arose such as: is there water or ice on Mars? Does life exist there or could life at least have existed in the past? And why did the planetary neighbours Earth and Mars develop in such different ways?

Spirit and Opportunity rovers

In January 2004, two more NASA rovers, Spirit and Opportunity, landed on Mars. Weighing 185 kilograms, the rovers were equipped with instruments that could brush the ground and drill into Mars. The mission was intended to last up to three months. Spirit ultimately worked for six years before getting stuck in the sand. Its twin Opportunity was operational for 15 years, during which it travelled more than 45 kms.

Maxon DC motors made an important contribution: 35 brushed DC motors with diameters of 20 or 25 mm were used in each of the vehicles, responsible for propulsion, control and the robotic arm. Another 8 DC motors were in the rovers' landing unit.

Phoenix probe

Similar DC motors were used again in NASA's 2008 mission, sending the stationary Phoenix probe. It searched for frozen water and finally found it in a soil sample that was heated for analysis. maxon's DC motors aligned the solar panels of the probe and moved its robotic arm.

Curiosity rover and Insight probe

The Curiosity Rover landed in 2012 and Insight, another stationary probe arrived on Mars in 2018.

Curiosity Rover weighs almost a ton and is equipped with 10 instruments. In this project, maxon's contribution is small, but crucial. MR encoders were provided for control of the motors.

InSight, the next stationary probe, landed in 2018. To extend its solar panels, the NASA engineers used the attested RE 25 DC motors that were previously installed in the twin rovers Spirit and Opportunity. What was then a new brushed DCX DC motor was deployed for the first time, in order to hammer a temperature probe (called a "mole") several meters into Mars's soil.

Perseverance Rover

Perseverance rover has a mission to hopefully help discover traces of former life. Its most important job is to take multiple soil samples, seal them in containers and deposit them on the surface of Mars so that a future mission can return them to Earth. Several maxon brushless DC motors operate to handle the samples inside the rover. Some are installed in the robotic arm which will move the samples from station to station. maxon DC motors will also be used when sealing and depositing the sample containers.

These DC motors are based on standard products from maxon – nine EC 32 flat motors and one EC 20 flat DC motor in combination with a GP 22 UP planetary gearhead. These DC motors have been modified and thoroughly tested over many years, in conjunction with specialists from the Jet Propulsion Laboratory (JPL), which handles all unmanned missions for NASA.

The Perseverance rover is expected to land on Mars on February 18, 2021 and, it won't be alone. It will carry with it the helicopter drone, Ingenuity. The drone weighs 1.8 kgs, is solar powered and is designed to take aerial photographs during short flights. This experiment will primarily test the concept for further drones of this kind to land on Mars. maxon DC motors are involved in this device too. Six brushed DCX DC motors with a diameter of 10 mm control the tilt of the rotor blades, which determines the direction of flight. If the helicopter takes off, maxon will once again be part of a great engineering achievement on Mars – 24 years after the first mission, Sojourner.

Rosalind Franklin Rover

More than 50 drive systems from maxon are installed in the ExoMars rover that the European Space Agency (ESA) is sending to Mars. The rover, named "Rosalind Franklin" will launch in 2022. Many different combinations of DC motors systems comprising DC motors, gearheads and encoders are needed to move and control the rover, drive its drill, move its solar panels, its camera head, and much more.

The Aerospace Team @ maxon

maxon has a dedicated team for all space projects. Starting with the standard catalogue product, then modifying and testing over and over again, until all requirements are satisfied. This approach is playing an important part in the current revolution in space missions. High-priced specialty products are increasingly being replaced by modified industrial products. This results in lower project costs, which, in turn, opens up access to space for a broader range of participants. maxon are looking to develop many more exciting applications for this "New Space" market in the years to come.

maxon has proven to be an important supplier for space projects. The DC motors are found in satellites, used to regulate rocket engines and are installed on the International Space Station (ISS). This success is no accident. maxon's engineers have learned a great deal over the years – particularly from their close collaboration with customers, especially the Jet Propulsion Laboratory (JPL). As a result, quality standards have been progressively raised and new test procedures and processes have been developed.

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The press release is available on the internet at: www.maxongroup.net.au

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The Swiss specialist for quality drives

maxon is a developer and manufacturer of brushed and brushless DC motors. as well as gearheads, encoders, controllers, and entire mechatronic systems. maxon drives are used wherever the requirements are particularly high: in NASA's Mars rovers, in surgical power tools, in humanoid robots and in precision industrial applications, for example. To maintain its leadership in this demanding market, the company invests a considerable share of its annual revenue in research and development. Worldwide, maxon has more than 3000 employees at nine production sites and is represented by sales companies in more than 30 countries.