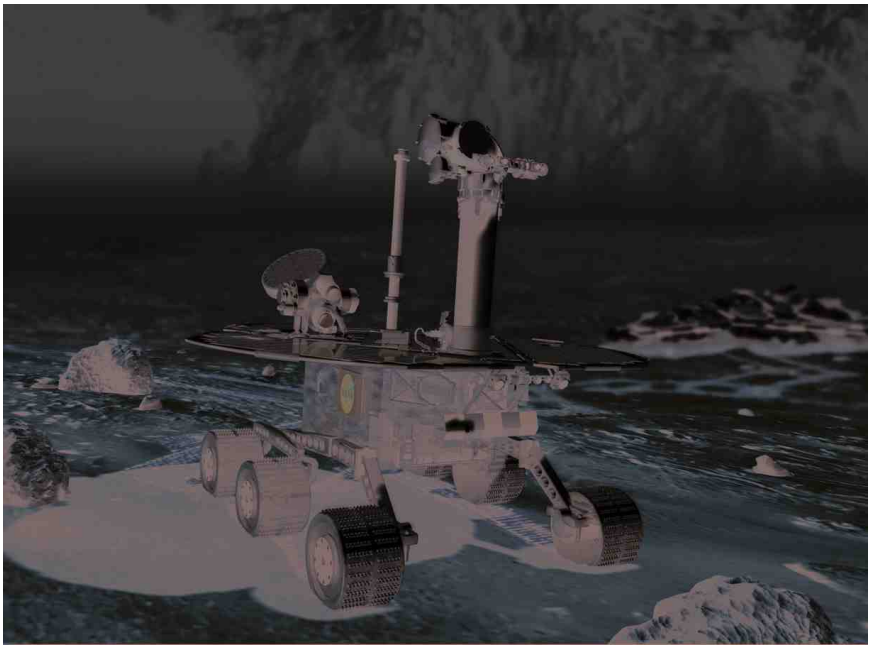
Magnaplate Develops High Friction Coating For Decent Rate Limiter on Mars Explorer

A traveling robotic geologist from NASA, the first of two Mars rovers launched last summer, landed successfully at 11:35 p.m. (EST) on January 3, 2004. Upon landing, the Spirit Rover sent a radio signal and began sending back images of the area around its landing site in Gusev Crater.

About a year before launch, the project faced a hardware need that threatened to delay progress toward launch. The problem was part of the development of the entry, descent and landing system of the Mars Exploration Rover (MER) project, which is designed to take the explorer from a speed of about 17,000 miles per hour to zero for a safe landing.

A parachute is deployed when the speed of the vehicle is reduced to around 1,500 miles per hour, with the aim of further reducing the speed to 200 miles per hour. The design of the spacecraft requires the Lander to drop 20 meters below the backshell.



The Mars Exploration Rover was able to land safely on the planet partly because of a new surface finish developed by Magnaplate.

Modifications Needed

During the 1997 Mars Pathfinder mission, NASA used a descent rate limiter to enable the Lander to descend the required 20 meters. However, the MERs are bigger and heavier than the Pathfinder, so the team at NASA's Jet Propulsion Lab found that the descent rate limiter used with Pathfinder couldn't withstand the greater mass increases and the tougher requirements. The key to the problem was a steel strap that was not strong enough to cope with the new requirements.

A troubleshooting team for the project was formed to try to develop a device that could use synthetic rope, such as Kevlar, that was strong and flexible enough to be used in place of the steel strap. When the rope was wound on a large spool, however, it could not take a large load, because the top winding started to bury itself in the other layers of rope. The troubleshooting team needed a device that would enable it to store the Kevlar rope at low tension on two spools and pass the cord around a separate shaft to engage the brakes. That's where General Magnaplate Corporation became involved.

Solving the Problem

Mike Prager, head of Magnaplate's California facility explained it like this: "NASA's Jet Propulsion Lab had previously come to us with a problem where the support pads used to test the MER needed to have high friction levels so that the equipment would not move. This was a highly unusually problem for use, because normally Magnaplate is asked to provide dry-lubricant coatings that actually reduce levels of friction.

"To solve the problem, we did some R&D work on our Plasmadize® product, which is an enhanced thermal spray composite coating that provides high levels of wear and corrosion resistance at temperatures as high as 1300°F, and normally offers low-resistance dry-lubricity. We developed a new version of the product to provide high levels of friction especially for this project, and the results were very successful."

Successful Results

The day after learning of the high-friction application, the rover project's troubleshooting team leader took the brake-engaging shaft to the General Magnaplate facility in Ventura, CA, which had it coated and delivered back to the Jet Propulsion Lab before the end of that day. Working with Magnaplate enabled the MER team to develop a solution that doubled the load carrying capacity of the original device and "the rest is history."

With headquarters in Linden, NJ, General Magnaplate Corporation is home for a number of members of the AESF Garden State Branch. The company is a leader in the science of surface enhancement for metals and other substrates. ***P&SF***