

Video: Rover escapes from sand trap in Mars terrain simulator

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The ExoMars rover used in the Earth-based Mars Terrain Simulator makes escaping from a sand trap look easy in this exercise.

The [rover](#) initially has its front two wheels almost completely buried in sand, but easily escapes using its unique wheel-walking mode.

It takes about 20 minutes to complete the 2 m drive—slow and careful being the key to getting out of a difficult situation.

Rovers on Mars have previously been caught in sand, and turning the wheels dug them deeper, just like a car stuck in mud or snow. To avoid this, the ExoMars rover Rosalind Franklin—and its replica—has a unique wheel walking locomotion mode. Similar to leg movements, wheel-walking combines motions of the deployment actuators (the legs) with the rotation of the wheels to progress without slippage. This motion gives very good traction in soft soils and high slopes, such as dunes.

"We hope to never need to use wheel walking on Mars to escape dangerous sand traps, but we are glad to have such functionality to potentially safeguard the mission," comments Luc Joudrier, ESA ExoMars Rover Operations Manager. "From a rover operational point of view, this is really our insurance against difficult terrains."

In the test run seen here, the back wheels drag once the front four wheels have gained good traction on firmer terrain. The reason is that the wheel-walking sequence tested here has rather been optimized for climbing

steep slopes with loose soils. In this sequence of commands, a short rotation of the [wheel](#) follows each movement of the legs. This is to anchor the wheels, digging them a little bit into the soil, before moving the rest—like when you climb a slope with snow and firm up each step before making a new one. On firmer soils, the anchoring rotation is not as effective (it can create the dragging effect) and therefore can be excluded from the command sequence.

The activity took place in the Mars Terrain Simulator at the Rover Operations Control Centre at the ALTEC premises, at Thales Alenia Space facilities in Turin, Italy in November 2021. It is from here that rover science operations will take place once Rosalind Franklin lands on Mars in June 2023. In the meantime, the facility is being used for training rover operators and simulating science operations that will be expected in the main mission.

Provided by European Space Agency

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