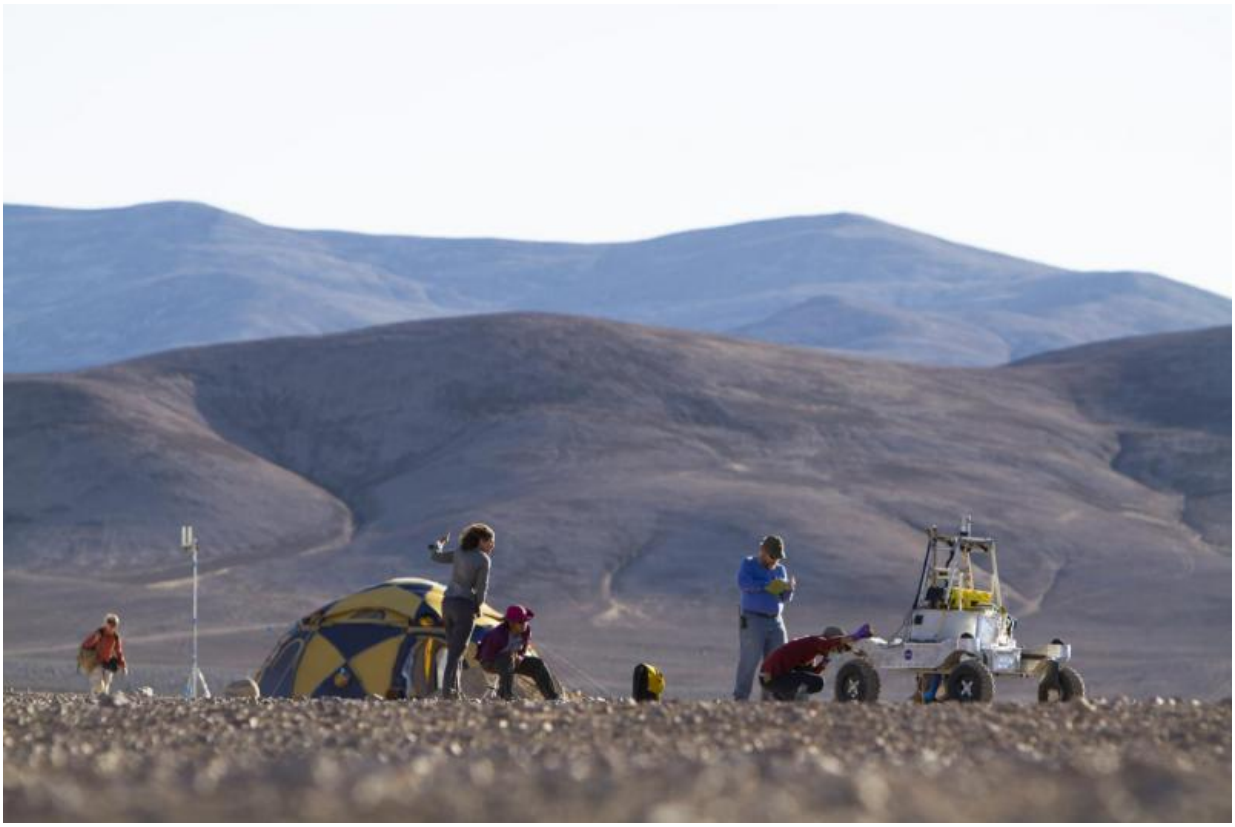
Mars rover tests driving, drilling and detecting life in Chile's high desert

March 15 2017, by Darryl Waller



Members of the ARADS team – NASA's Atacama Rover Astrobiology Drilling Studies project – start the day setting up the rover for test runs in Chile's Atacama Desert. Credit: NASA/CampoAlto/V. Robles

Due to its extreme dryness, the Atacama Desert in Chile is one of the

most important environments on Earth for researchers who need to approximate the conditions of Mars.

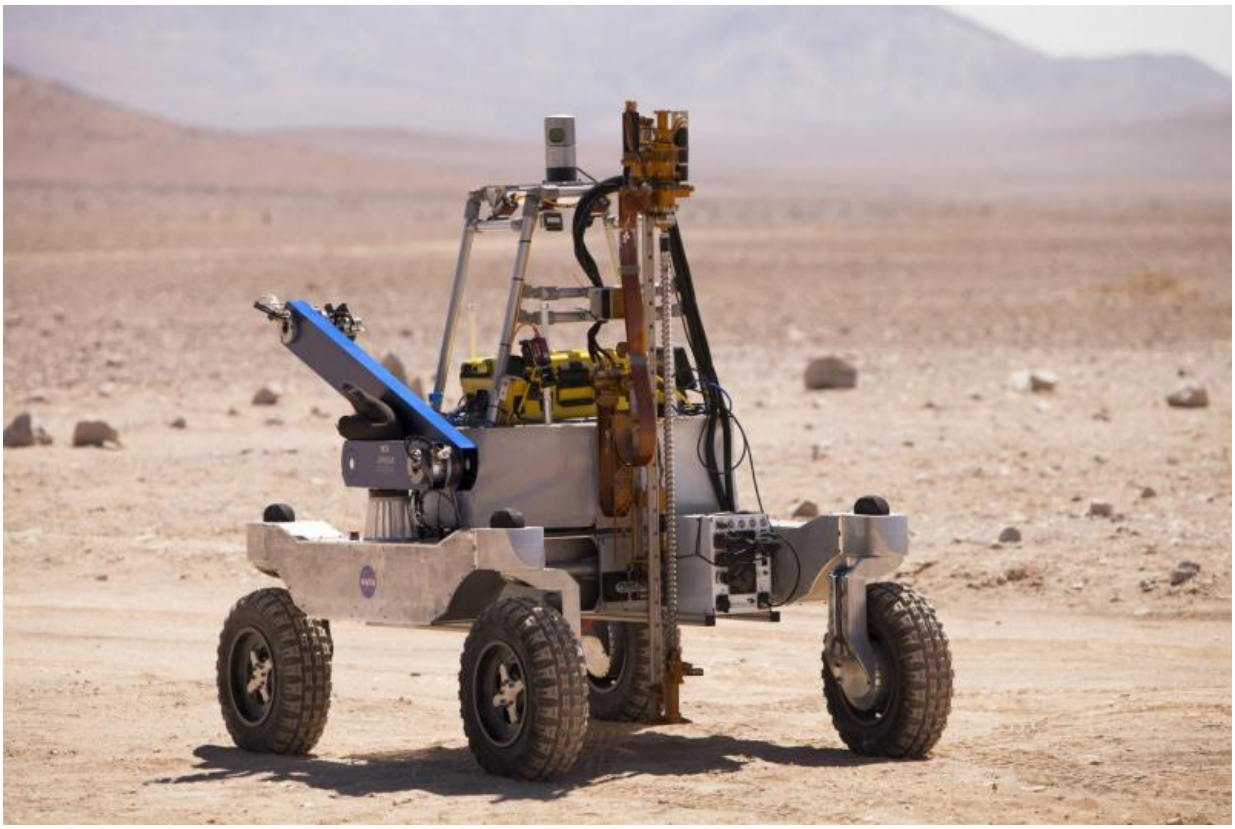
Working in 90-plus-degree heat in arguably the driest place on Earth, the team behind NASA's Atacama Rover Astrobiology Drilling Studies, or ARADS, project just completed its second season of tests. The project aims to show that roving, drilling and life-detection can all happen together, with the goal of demonstrating the technical feasibility and scientific value of a mission that searches for evidence of life on Mars.

Thirty-five researchers, scientists, engineers and support staff spent a month testing tools and collecting scientific data on how life exists in the high desert today and how it first developed in this environment.

Geological and soil mineral evidence suggests that extremely dry conditions have persisted in the Atacama Desert for at least 10 to 15 million years, and possibly far longer. Coupled with strong, persistent ultraviolet radiation from the sun, this means that what little life exists in the Atacama is in the form of microbes living underground or inside rocks.

Similarly, if life exists or ever existed on Mars, the planet's surface dryness and extensive radiation exposure would likely drive it underground. That makes locations like the Atacama good places to practice looking for life on Mars.

Roving, Drilling, Hunting for Life



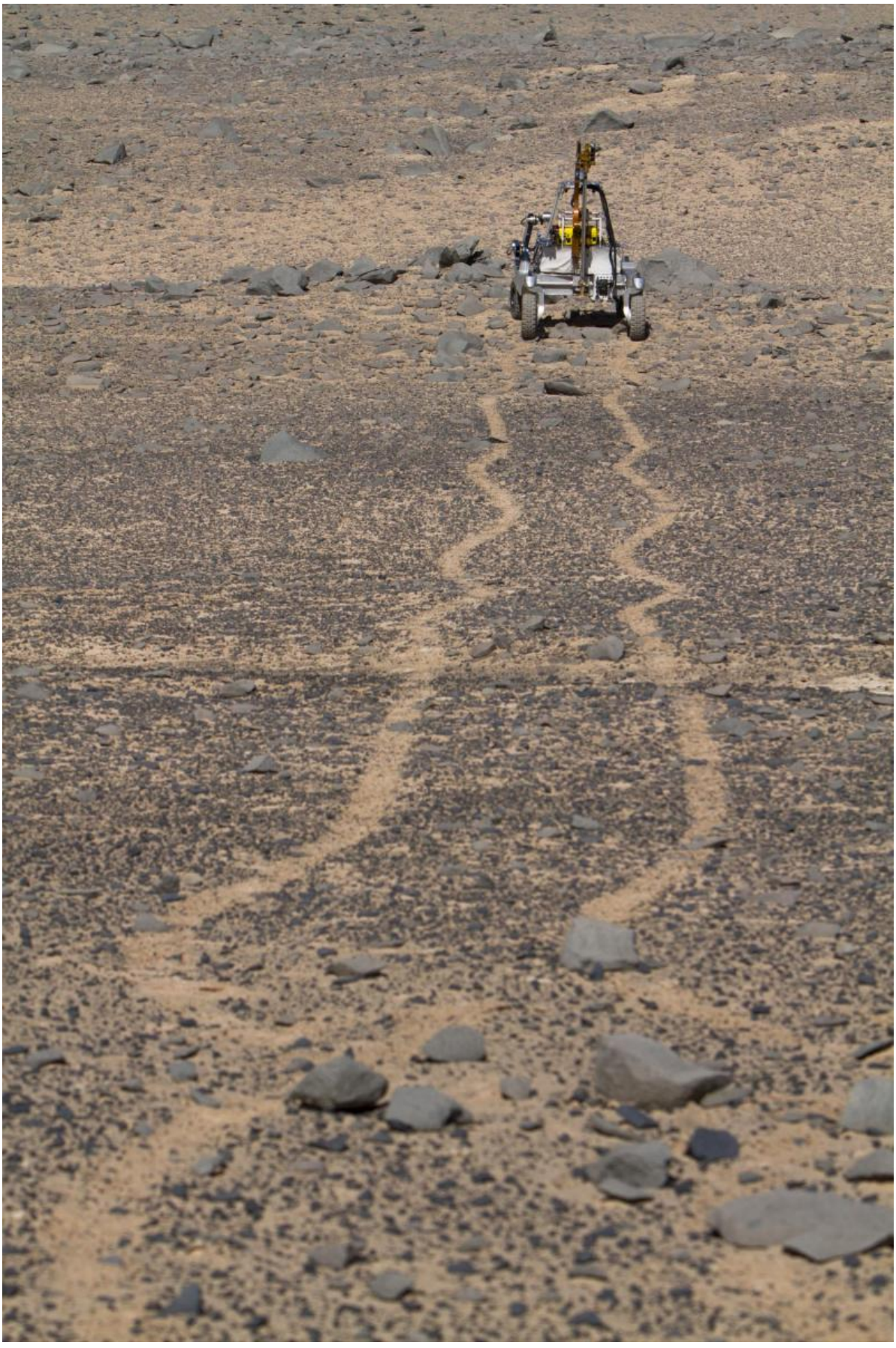
The rover in its mobile configuration with drill raised and visible at the front, arm stowed, and instruments closed. Credit: NASA/CampoAlto/V. Robles

Until human explorers arrive on the Red Planet, robotic missions will take the lead, with future missions probing the surface and drilling underground at promising locations. During their month in the hyper-arid core of the desert, near Estacion Yungay, the ARADS team tested technology for this purpose. Developed by NASA's Ames Research Center in California's Silicon Valley, the KREX-2 rover carries a lightweight, low-power, two-meter drill, along with a robotic sample transfer arm. This year it was accompanied by three life-detection instruments, positioned nearby, which were fed samples acquired by the rover's drill.

Designed to look for evidence of life, these tools include the Wet Chemistry Laboratory, an instrument developed by NASA's Jet Propulsion Laboratory that flew on the 2007 Phoenix mission to Mars, and the Signs of Life Detector, contributed by Spain's Center for Astrobiology. The latter uses biochemical methods distantly related to home medical tests. While diabetics, for instance, may monitor their blood sugar with a device that detects the presence of a single molecule – glucose – the rover instrument will search for 512 different biological compounds.

Both of these tools were tested in the first ARADS season in February 2016, and returned this year for a trial of some new modifications.

New for 2017 is the Microfluidic Life Analyzer from JPL, making its first field test. It processes minuscule volumes of fluid samples to isolate amino acids, a building block of life.



The KREX-2 rover navigates autonomously, avoiding obstacles as it moves from one sampling location to another. Credit: NASA/CampoAlto/V. Robles

The engineers and scientists working in the Atacama during the month of February were successful in their primary objective to drill from the rover to depths of up to two meters, acquiring samples that the three ARADS instruments searched for signs of current or past life.

"The drill, rover and robot arm combination behaved beautifully in the field," said ARADS Principal Investigator Brian Glass of Ames. "It was a steady platform that enabled us to go deeper than we expected."

This year was the second in a series of four annual tests planned through early 2019. Next year is expected to see the rover itself carry and operate the life-detection instruments, alongside the drill tested this year.

In our lifetimes, NASA and its partners will be able to answer some of humanity's fundamental questions about life beyond Earth, such as whether Mars was home to microbial life in the past, and if it still is today. Our robotic scientific explorers are now paving the way. Together, humans and robotics will pioneer Mars and the solar system.

Provided by NASA