

## Challenges

Mike Seibert

Operating a rover on Mars is tricky even when the rover is working correctly. But when the rover starts having problems, it takes the ingenuity of the entire team to try to figure out how to solve it.

Scott Lever

Engineers love boring. Boring means clear skies, no problems, work is a little easier, and scientists get data they want. But if you want to get an engineer excited, you throw them a curve ball, maybe some danger, maybe an anomaly.

Jennifer Herman

A heater that's stuck in the "on" position.

Mike Seibert

The robotic arm didn't want to unstow.

Matt Keuneke

The real dust storm began.

Mark Maimone

Got stuck in a dune.

Bekah Sosland

An elevated current in the right front wheel.

Scott Lever

A massive dust storm.

Mark Maimone

We had to learn to drive with broken steering.

Bekah Sosland

The gears were being worn on one side.

Matt Keuneke

We had to get very creative very quickly.

Mark Maimone

But happily we made it through those challenges, and challenges of difficult terrain, navigating high slopes, or having to survive the winter by finding places that are safe for the rover to park and hibernate over the winter.

Matt Keuneke

And I think to this day, you say “dust storm,” and it strikes a little needle of terror into all of our hearts.

Mark Maimone

It’s been a real fun challenge to have problems and try to work out solutions, you know, discover what we can do, and think about ways we can solve them.

Mike Seibert

Do diagnostics.

Matt Keuneke

Brainstorming.

Brenda Franklin

Workaround.

Mike Seibert

Workaround.

Jennifer Herman

Workaround.

Mike Seibert

We’re coming up with new workarounds to allow this hardware that’s still functioning on the surface of Mars to continue to function, and return excellent science to the science team.

Scott Lever

Every day we’re shocked that it’s still going. Yet, as engineers we’re going to fight really hard to make sure it keeps going, and going, and going.

Brenda Franklin

The most valuable thing we’ve learned from these rovers lasting so long is that if something breaks, you can find, usually, something that will allow you to continue the mission even though one item on the rover has stopped working.

Mark Maimone

We can make changes on a rover that’s hundreds of millions of miles away. We make changes on Earth, test them out here, make sure they’re going to be good, then send it up to Mars.

Brenda Franklin

A piece of equipment that has not been serviced by human hands in over 10 years is still working. I don’t think your car works that good.

Mike Seibert

We're going to keep pushing the rover like we were meant to ever since we landed, and see what we can see, see what's over the next hill and what's at the next crater. Stay tuned, there's more to come from opportunity.