

## Mars 2020: Terrain Relative Navigation Transcript

Andrew Johnson: We are in Death Valley, testing Terrain Relative Navigation, the new technology for Mars 2020. The terrain in Death Valley is very much like Mars. It has a lot of sand dunes and steep slopes. It's quite similar to the landing site that Mars 2020 will be going to. We're taking a copy of the system that will be on the spacecraft and we're testing it in the way that it would be used during the flight mission.

Allen Chen: Terrain Relative Navigation gives the vehicle the ability to figure out where it is. This is kind of along those same lines as what the Apollo astronauts did with people in the loop, back in the day. Those guys were looking out the window and looking for different craters and other features on the Moon that they knew of from the maps we had in the Moon. So, that way they could figure out where they are and figure out where they needed to land to be safe. So, for the first time here on Mars, we're automating that.

Andrew Johnson: What Terrain Relative Navigation gives you is the ability to avoid hazards that you already know about. So, large hazards — hills, craters, things that you've seen before. With the camera we take images as we're descending and we match pieces of the image to orbital imagery that we have stored onboard. And if we make many of these matches, we are able to figure out where we are relative to the map.

Swati Mohan: If we didn't have Terrain Relative Navigation, the probability of landing safely at Jezero Crater is about 80 to 85%. But with Mars 2020, we can actually bring that probability of success of landing safely at Jezero Crater all the way up to 99% safe every single time.

Allen Chen: We don't have an astronaut that we can put onboard Mars 2020. But we can put this system, this Terrain Relative Navigation system so that the spacecraft could figure it out on its own.

Andrew Johnson: I could see it being used on lunar missions, science missions, as well as human missions, future Mars missions, of course, Mars sample return, Europa lander, landing on a comet, pretty much everywhere you wanna land, you're gonna want to have Terrain Relative Navigation.