



1
00:00:00,410 --> 00:00:03,700
Music

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00:00:03,700 --> 00:00:05,830
Ashwin Vasavada, MSL Deputy Project Scientist: The hope is that we can land there and

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00:00:05,830 --> 00:00:09,710
basically unlock the secrets of an environment that existed there a few billion years

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00:00:09,710 --> 00:00:24,150
ago on Mars that was potentially a place that life could have survived.

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00:00:24,150 --> 00:00:29,440
Narrator: Mars has beckoned to Earthbound observers for centuries, seeming to appeal

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00:00:29,440 --> 00:00:34,460
to astronomers to find out the secrets of the lone bright red dot among all the bright

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00:00:34,460 --> 00:00:37,800
white stars in the nighttime sky.

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00:00:37,800 --> 00:00:42,730
Those answers came sparingly, but as technology advanced on earth, astronomers were

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00:00:42,730 --> 00:00:47,450
provided new tools to get better and better looks at the planet closest to Earth in

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00:00:47,450 --> 00:00:49,740
terms of distance and make up.

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00:00:49,740 --> 00:00:55,980
NASA put a wheeled robot on Mars for the first time in July 1997.

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00:00:55,980 --> 00:01:00,880
About the size of a skateboard and weighing 23 pounds, the Sojourner showed Earth

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00:01:00,880 --> 00:01:05,690

unprecedented views of the red planet as it rolled over the surface for three months,

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00:01:05,690 --> 00:01:09,520

all within 500 meters of its base station.

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00:01:09,520 --> 00:01:13,790

Now, NASA is on the verge of launching another rover to Earth's nearest planetary

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00:01:13,790 --> 00:01:19,440

neighbor, one that is nearly 1,000 times heavier than Sojourner and packing a mobile

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00:01:19,440 --> 00:01:23,960

laboratory designed to look closely at what the planet is made of. The rover is

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00:01:23,960 --> 00:01:30,190

called the Mars Science Laboratory or MSL. It's also known as Curiosity, and its

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00:01:30,190 --> 00:01:35,000

results may answer one of the great questions of modern science.

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00:01:35,000 --> 00:01:37,660

Pamela Conrad, MSL Deputy Principal Investigator: Mars and Earth were made about the

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00:01:37,660 --> 00:01:41,890

same time and yet they've had very different evolutionary pathways. We seem to be

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00:01:41,890 --> 00:01:46,690

verdant and full of life and Mars is quite cryptic. So we would like to understand a

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00:01:46,690 --> 00:01:51,490

bit about the past of Mars and in fact we'd like to know if Mars has ever been

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00:01:51,490 --> 00:01:58,410

habitable, perhaps in some distant time, perhaps now, beneath the surface.

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00:01:58,410 --> 00:02:03,260

Narrator: When it comes to Mars, history has shown mission planners they cannot take

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00:02:03,260 --> 00:02:08,210

any aspect of the launch, flight or landing for granted. NASA, the Russians and

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00:02:08,210 --> 00:02:13,060

Soviets and the European Space Agency all lost missions to the red planet at one

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00:02:13,060 --> 00:02:14,830

time or other.

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00:02:14,830 --> 00:02:16,650

Omar Baez, MSL Launch Director: It is tough to land on Mars.

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00:02:16,650 --> 00:02:24,490

Sometimes it's even tough to orbit Mars, so Mars is difficult. Anytime you're going

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00:02:24,490 --> 00:02:34,230

that far out and you're making that transition from not only orbiting and taking

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00:02:34,230 --> 00:02:41,690

pictures but add the complexity of slowing yourself down, putting a target on that

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00:02:41,690 --> 00:02:47,460

planet and landing there, that's awesome.

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00:02:47,460 --> 00:02:50,860

Narrator: Launches to Mars also come with a strict time limit when the planets are

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00:02:50,860 --> 00:02:53,390

aligned correctly to allow a flight.

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00:02:53,390 --> 00:02:56,640

Wanda Harding, MSL Mission Manager: For MSL, we only get an opportunity every 24 to

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00:02:56,640 --> 00:03:00,540

26 months. If you miss it, you have to wait.

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00:03:00,540 --> 00:03:05,080

Narrator: Curiosity is to begin its flight to Mars packed inside the nosecone of an

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00:03:05,080 --> 00:03:10,320

Atlas V rocket. It will fly through space for nine months before beginning its work

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00:03:10,320 --> 00:03:16,310

on the surface in August 2012. Like every mission to Mars, this one carries the most

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00:03:16,310 --> 00:03:20,980

advanced tools available to conduct experiments on its own, millions of miles from

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00:03:20,980 --> 00:03:22,310

Earth.

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00:03:22,310 --> 00:03:27,580

Vasavada: The real new thing for this rover is the ability to drill in to the rocks

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00:03:27,580 --> 00:03:31,460

on Mars, collect the powder from those rocks and deliver that powder to

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00:03:31,460 --> 00:03:36,570

two relatively large analytical chemistry laboratories that are located inside the

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00:03:36,570 --> 00:03:41,760

rover itself. So we deliver that powder and we can uniquely determine its mineralogy,

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00:03:41,760 --> 00:03:46,180

what minerals are present, as well as what chemical elements are present and this

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00:03:46,180 --> 00:03:49,520

will really give the scientists the core information they need to figure out

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00:03:49,520 --> 00:03:51,730

whether Mars was a habitable environment.

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00:03:51,730 --> 00:03:54,790

Harding: The MSL rover is essentially like a geologist in a self-contained

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00:03:54,790 --> 00:04:00,180

laboratory and the capabilities that exist are probably the next best thing to

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00:04:00,180 --> 00:04:03,170

sending a human to do the same job.

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00:04:03,170 --> 00:04:07,220

Narrator: It will also beam back remarkable views from the surface using

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00:04:07,220 --> 00:04:10,890

state-of-the-art cameras, including 3-D lenses.

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00:04:10,890 --> 00:04:18,610

Baez: This is a vehicle on Mars, cruising around, drilling into rocks, chipping

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00:04:18,610 --> 00:04:24,440

away at stuff to see what that planet's made out of. And even if it didn't do that,

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00:04:24,440 --> 00:04:30,560

if it just cruised around Mars and took pictures, the value in that is tremendous.

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00:04:30,560 --> 00:04:34,080

Narrator: Curiosity is not headed to just anywhere on the red planet.

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00:04:34,080 --> 00:04:38,610

Scientists spent years searching for the best place to land the rover, somewhere that

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00:04:38,610 --> 00:04:43,990

had the best chance to show the true past and present of Mars.

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00:04:43,990 --> 00:04:48,770

That place is called Gale Crater. A three-mile high mountain stands in the center of

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00:04:48,770 --> 00:04:54,000

the crater and Curiosity will explore the sediments that have built up there in hopes

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00:04:54,000 --> 00:04:57,570

that the soil will complete parts of the Martian puzzle.

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00:04:57,570 --> 00:05:01,570

Conrad: What's special about Gale is it has the thickest package of sediment that

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00:05:01,570 --> 00:05:06,980

we've been able to identify on Mars, so it represents a lot of time and hopefully

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00:05:06,980 --> 00:05:11,270

we'll get some idea about what has happened over time.

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00:05:11,270 --> 00:05:15,560

Narrator: If Mars was ever home to vast lakes and flowing rivers, which data

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00:05:15,560 --> 00:05:20,830

from other spacecraft suggest, then the rocks and minerals at Gale Crater could

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00:05:20,830 --> 00:05:25,400

reveal unimagined secrets about our closest planetary neighbor.

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00:05:25,400 --> 00:05:29,740

Conrad: They suggest in a tantalizing way that perhaps they could have been

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00:05:29,740 --> 00:05:35,110

deposited under water. And we associate water with the possibility, the potential

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00:05:35,110 --> 00:05:36,940

for habitability.

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00:05:36,940 --> 00:05:40,480

Narrator: It's an ambitious mission, and the robot designed to pull it off is

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00:05:40,480 --> 00:05:43,920

unlike any planetary rover devised so far.

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00:05:43,920 --> 00:05:48,280

Harding: My first thought, and I won't lie, was, "Wow!" It's a very impressive

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00:05:48,280 --> 00:05:55,110

spacecraft. The rover itself is much larger than anything we've sent up before.

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00:05:55,110 --> 00:06:00,420

It's a very, very impressive spacecraft and we're looking forward to some great

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00:06:00,420 --> 00:06:02,520

science coming out of the mission.

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00:06:02,520 --> 00:06:06,710

Vasavada: We couldn't use airbags this time because of the weight of Curiosity,

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00:06:06,710 --> 00:06:11,130

so we went back to using rockets. But the novel design is this little rocket jetpack

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00:06:11,130 --> 00:06:15,260

that flies the rover down and then lowers the rover down on a tether,

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00:06:15,260 --> 00:06:19,200

lands the rover on the ground and then that rocket jetpack flies off and we're done

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00:06:19,200 --> 00:06:25,830

with it. That leaves the rover ready to rove around on its wheels and explore Mars.

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00:06:25,830 --> 00:06:30,580

Narrator: Relying on solar cells was ruled insufficient for a mission as ambitious as

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00:06:30,580 --> 00:06:35,430

the Mars Science Laboratory. Simply put, they did not provide electricity for a

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00:06:35,430 --> 00:06:40,010

year-round mission, nor would they produce enough power for the 10 instruments on the

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00:06:40,010 --> 00:06:46,190

rover, some of which have to operate at the same time to fulfill their research goals.

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00:06:46,190 --> 00:06:51,050

The rover may cover 12 miles or more during its 23-month mission, a goal that

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00:06:51,050 --> 00:06:54,150

requires a steady amount of power.

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00:06:54,150 --> 00:06:58,170

So the Department of Energy built for NASA a nuclear-powered electrical

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00:06:58,170 --> 00:07:03,250

system instead, called a multi-mission radioisotope thermoelectric generator,

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00:07:03,250 --> 00:07:09,350

or MMRTG. It has no moving parts, but converts heat from a small core of plutonium

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00:07:09,350 --> 00:07:15,120

into about 110 watts of electricity around-the-clock and all year.

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00:07:15,120 --> 00:07:20,310

It's the same power source that enables probes to work in deep space on missions such

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00:07:20,310 --> 00:07:26,440

as Galileo's examination of Jupiter, Cassini's unprecedented look Saturn and the New

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00:07:26,440 --> 00:07:31,410

Horizons mission to Pluto and the farthest boundary of the solar system. It was also

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00:07:31,410 --> 00:07:37,010

used on the surface of Mars by the Viking landers in 1976.

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00:07:37,010 --> 00:07:41,340

Narrator: NASA also takes extra precautions because of the power supply, including

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00:07:41,340 --> 00:07:49,180

working with other federal agencies to ensure its safety on Earth and during launch.

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00:07:49,180 --> 00:07:53,950

Looking at Mars through a telescope over the decades, astronomers have wondered what

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00:07:53,950 --> 00:07:59,460

secrets the planet conceals. Even looking at the surface doesn't tell the whole story,

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00:07:59,460 --> 00:08:05,400

which is why scientists have been eager to dig deeper every time they get a chance.

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00:08:05,400 --> 00:08:10,890

Baez: Those folks that actually had a hands-on role in building this thing, there's

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00:08:10,890 --> 00:08:16,960

some separation anxiety, I bet you. But now the next phase is, hey, I get to drive

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00:08:16,960 --> 00:08:21,120

this thing or I get to use the hammer drill on something,

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00:08:21,120 --> 00:08:25,030

so that aspect of it is great.

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00:08:25,030 --> 00:08:29,020

Conrad: I've been working on Mars Science Laboratory for seven years and

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00:08:29,020 --> 00:08:33,920

I'm extremely excited we're getting ready to launch.

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00:08:33,920 --> 00:08:37,150

Harding: Twenty years from now I think they'll look back on this and consider