## Horizon

### Episode 2, 2012-2013, Mission to Mars

### KEYWORDS FROZEN

Landing a big rover is a tough business.

It means that everything about the system gets bigger and therefore harder. This will be no ordinary landing. It will be winched down by a crane hovering in the Martian sky.

1m

It's so ambitious, it's so audacious, it's so unconventional. Horizon has been behind the scenes with NASA's team as they follow their rover across 350 million miles of space.

When Curiositycomes over the horizon, this guy is already pointed that direction and as she comes up, then we're talking.

Curiosity's mission is to discover if Marscould ever have supported life.

But the Red Planet has become known as the Bermuda Triangle of space. Two-thirds of missions there have ended in failure. In just under a week, the world will learn if Curiosity can overcome the odds and touch down on Mars.

[SPEECH OVER RADIOS]

2m

It's 10pm at the Jet Propulsion Laboratory in California. OK, copy and we'll make that report to the surface team when they come onboard. The team behind the Curiosity mission are locked in a crucial test at the space flight control centre.

We're now about five and a half minutes to entry. They're practising for a landing they know is the most audacious ever attempted on another planet. Three minutes to entry.

They've been rehearsing and testing day and night for months, running through each individual step of the mission in painstaking detail. Confirming that we have parachute deploy.

Brian Portock is the flight director for the 350 million-mile journey to Mars. Ann Devereaux helped devise a way to stay in touch with the rover. Adam Stelzner will mastermind the daredevil landing.

3m – **UNFREEZE KEYWORDS**

And leading this test is Chief Engineer, Joel Krajewski.

The fate of this mission is central to everybody's soul, really. Most folks have worked on this for three years, five years, eight years.

You don't get to do many in a given career. You only get to do a few if you're lucky. So the stakes for everybody are as high as they can be. This is just a rehearsal, but on the 6th of August, they'll be doing it for real, hoping the **Curiosity** rover will arrive safely at its destination.

4m

**Mars**, the Red Planet. It's become known as the Bermuda Triangle of space. Since the launch of the first rocket there in the 1960s, two-thirds of all missions have ended in disaster.

The mission logs make scary reading. "Failed to launch." "Missed the planet." "Lost radio contact." "Lost on arrival."

The team knows Curiosity might never reach the surface of Mars.

It's Joel Krajewski's job to make sure this mission is a success. His day may begin like many Californians... but then he heads to NASA's Jet Propulsion Laboratory.

5m

Like anyone else, I drive into work every morning but every morning as I do so, I pinch myself because I get to work on a space mission and that is, that is pretty cool.

For more than a decade, Joel has been engineering rovers to send to the Red Planet. Before I got into working on rovers, of course like anybody else I thought it was going to be a kind of a tricky business.

It sounds hard throwing things up into space and exploring other planets. Once I got into it, I learned that it's even harder than I thought.

This is the third rover that Joel has worked on.

But even for a Mars veteran like him, Curiosity has been a huge challenge.

6m

Curiosity is the most complex vehicle we have sent to Mars. Hundreds of people have worked on it for more than eight years and we're still working on it.

Different people understand different aspects of it, but nobody knows it all.

As the real Curiosity hurtles through space, its clone is hidden in a garage at the Jet Propulsion Laboratory.

It runs on its very own nuclear generator.

Its components can withstand forces greater than those exerted on a supersonic jet.

7m

And its electronics are designed to work at temperatures far lower than the coldest places on Earth.

It's the most advanced moving vehicle ever sent into space.

Today, Joel's team are testing the wheels of Curiosity's twin. They're low class. Is that what we call them? That's what we call them.

8m

It's just one of hundreds of tests the rover has been through in the past nine months. That's great. The scientists want to land on Mars and explore. They want to explore where we land and then also explore kilometres away from where we land, and that means we have to drive.

We'd like to be able to drive over big rocks so that we can drive close to a straight line, not too much meandering around, and therefore we designed a big rover. That makes it tricky.

The reason Curiosity is so big and expensive is because of the science it will be conducting on Mars. It will have to drive across difficult terrain while carrying a lab full of equipment.

The scientists would like an infinitely capable vehicle. But in the real world, the machine has to fit within a certain volume. It has to fit within a certain mass. We can only lift so much mass off the Earth and have it land safely on Mars.

The rover is five times as heavy as any vehicle they've ever launched, which makes landing it on another planet more difficult than anything they've attempted before.

9m

Landing a big rover is a tough business. The landing system is more complex, parachutes are bigger, everything gets much bigger and therefore harder.

# There's a starman   
waiting in the sky... #

\*\*\*NASA's engineers have never shied away from tricky landings.

# There's a starman... #

During the **Apollo missions** of the 1970s, they weren't satisfied just to put a **man on the moon**. But landing a car on Mars is an entirely different proposition.

Adam Stelzner has spent years working out how to do it.

10m

He will take control of the rover as it begins to enter the Martian atmosphere. He won't be able to rely upon the systems that got the lunar rover down safely onto the surface of the moon.

Mars is tough. The moon, where we've landed lunar modules on the moon before, does not have any atmosphere and it makes the process of getting down to the surface kind of simple.

You take a rocket engine, you turn it on and you slow yourself down until you touch down on the surface. Unlike the lunar rovers, Curiosity will have to battle an unpredictable **atmosphere**.

Historically, Mars has been evil. You don't know what the weather's going to be like, you don't know whether the atmosphere's going to be dense or diffuse. Will it be a hot day and not so dense, or a cold and dense day? If it's cold and dense,

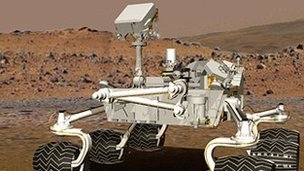
you slow down faster, you end up shorter. If it's hot and low density, you end up flying farther. The dangers of this unpredictable atmosphere are heightened by the speed the spacecraft has to travel at to get to Mars.

11m

It will arrive at 13,000 miles per hour. We have enough energy of motion in the spacecraft that we could vaporise the spacecraft in the atmosphere of Mars just by slamming into that atmosphere and developing so much friction that the vehicle would burn up.

So it's a challenge.

***“Curiosity”***



### Science lab on wheels

### What sets Curiosity apart from other Mars Rovers?

<http://www.bbc.co.uk/news/science-environment-20094052>

***“Mars”***

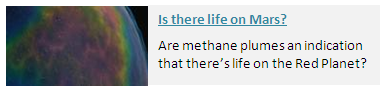
### Mission to Mars

What dangers would you face on a journey to the Red Planet?



<http://www.bbc.co.uk/science/space/solarsystem/sun_and_planets/mars#p005xzlb> **(MOST RELEVANT TO SCRIPT)**

**OR………………**



<http://www.bbc.co.uk/science/space/solarsystem/sun_and_planets/mars#p007bb7s>

***“Apollo missions”***

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### What did Apollo achieve?

### Was the space programme a great achievement or a waste of money?

<http://www.bbc.co.uk/science/space/solarsystem/space_missions/apollo_program#p0069v7z>

***“Man on the moon”***



### ‘The Eagle has landed’

### Why was it so difficult to land Apollo 11 on the Moon?

<http://www.bbc.co.uk/science/space/solarsystem/space_missions/apollo_program#p00699f6>

***“atmosphere”***



### What makes Mars so hostile?

### If life flourishes on Earth, why does the Red Planet seem so lifeless?

<http://www.bbc.co.uk/science/0/20915340>

**OR………………**



### Where did our oxygen come from?

### It happened over 3 billion years ago; what made the difference?

[http://www.bbc.co.uk/science/earth/atmosphere\_and\_climate/atmosphere#p00gczg5](http://www.bbc.co.uk/science/earth/atmosphere_and_climate/atmosphere%23p00gczg5)