Moons Of The Solar System
Phobos and Deimos

Narrator:
Circling the red planet Mars, are two tiny moons, Phobos and Deimos, each less than fifteen miles across.

Dr Emily Baldwin:
The really interesting thing about Phobos and Deimos to me is that I've always thought of them as kind of underdogs of the Solar System in terms of the way all the other moons are. They might not immediately jump out as being places to look for water or life but they do still have a very interesting story of their own to tell.

Dr Andrew Ball:
They are quite different from our Moon in that they are very much smaller and are perhaps related to asteroids from the asteroid belt, but their origin isn't completely clear.

Dr John Murray:
I first became interested in Phobos and Deimos really because they were so exciting and exotic and so different from what we have every day here on Earth. The discovery of the satellites of Mars occurred in 1877, which was a year when Mars was much closer to the Earth than it had been for some time and an American, Asaph Hall, actually used a new telescope in Washington with a twenty six inch refractor and he found not just one satellite but two.

Narrator:
The moons Asaph Hall discovered were just tiny pinpoints of light. It was to be another century before we learned anything about them.

Dr Andrew Ball:
Spacecraft first started to visit Mars in the nineteen sixties, initially by flying by and then in the nineteen seventies the first orbiters went into orbit around Mars. In terms of Phobos and Deimos they are always there for these Mars missions and so they've often been kind of an add on rather than the focus of a mission.

Dr John Murray:
The first thing that was extraordinary about them of course was that they weren't round. All the other moons that we'd seen are round.

Dr Andrew Ball:
Small bodies don't have enough gravity to pull themselves into spherical forms, so Phobos, is indeed, like most asteroids, in fact, potato shaped.

Dr John Murray:
The very first close-up pictures of Phobos, taken by the NASA Viking missions in 1976 were really quite spectacular. They showed the surface of Phobos to be covered with these parallel grooves right the way across it and these were astounding. Nothing like this had ever been seen before and they've remained, really, since that time, one of the wonders of the solar system.

Dr Emily Baldwin:
These strange grooves looked like they were coming out of the Stickney crater, which is the largest crater on Phobos and at first it seemed likely that perhaps these grooves had something to do with that crater.

Narrator:
In 1988 the Russians decided to take a closer look with their spacecraft, Phobos 1 and Phobos 2.

Dr Andrew Ball:
The highlight of the mission was going to be a low hovering phase over the surface of Phobos and the deployment of two landers, a stationary lander and a hopping lander.

Dr Emily Baldwin:
But the Russians really weren't too lucky and in fact Phobos 1 failed en route and Phobos 2 failed shortly before it was going to take all these fantastic close-up images of the surface.

Dr John Murray:
That was really disappointing because I thought, well, we have a chance this time to photograph all of Phobos and to photograph it from very close up, because the ideas I'd been thinking of really required better imagery than we got from Viking.

Dr Emily Baldwin:
It's really with the modern era of spacecraft, with these really high-resolution cameras, that we are seeing incredibly beautiful and detailed pictures of these moons and some of the images of Phobos are truly spectacular. We are seeing the giant Stickney crater close up in incredible detail to the point that we can even see mini avalanches of material that have slumped down inside the crater walls and they are just truly spectacular.

Because Phobos is that bit closer to Mars and because these missions are Mars exploration missions, it's just a function of that that Phobos is the one that tends to be photographed in much more detail than Deimos.

Dr John Murray:
Deimos is the kind of poor relation of Phobos and Deimos I think. It's much smaller and it doesn't have those spectacular grooves and the surface is also very much smoother and rather more rounded than Phobos.

Dr Emily Baldwin:
Until we actually get a bit closer to Deimos that part of the Phobos and Deimos story is going to have to wait for a later mission.

Narrator:
Better photography has also led John Murray at the Open University to develop an intriguing theory explaining the mysterious grooves of Phobos.

Dr John Murray:
They didn't really look like fractures, which was the main ideas that people were proposing at the time. So then I started thinking well they must be impact craters from somewhere, and then it suddenly struck me of course it's very close to Mars. There are a lot of big impacts on Mars. A lot of debris is being thrown out all the time.

Dr Emily Baldwin:
Bearing in mind that Phobos is only 6,000 kilometres from the surface of Mars, it's a very short distance indeed so when Phobos is travelling in its orbit around Mars it just happened to intersect this material.

Dr John Murray:
Well here we've got a picture of Phobos and you can see that these grooves running across it. These two for example are completely parallel. They look almost as if they could have been ruled with a ruler they are so straight. Now these, I believe, were formed by impacts of material into Phobos and so this end of the groove would have been formed first and as Phobos moves in this direction so you get this string of impacts occurring on the surface, rather like a machine gun firing at a moving target.

Narrator:
Undaunted by their earlier failures, the Russians are now planning to go back to Phobos.

Dr Andrew Ball:
Phobos Grunt, this new mission from the Russians, is a fantastically ambitious and interesting mission. They are attempting to not just go back to Phobos but to take a sample from the surface and bring it back to Earth. This will be the first time that a sample has been returned from another body in the solar system since 1976.

Dr John Murray:
Phobos Grunt means Phobos ground and that's because it's a lander mission and will be sampling part of the ground of Phobos, that is the soil of Phobos. So it will be something like the soil in my garden in terms of grain size, except that it won't have any plants or organisms in it and that is actually called not soil but regolith.

Dr Emily Baldwin:
The Phobos Grunt mission is going to scoop up samples of this regolith and bring them back to Earth so we'll be able to find out just exactly what Phobos is made of and how old this material is.

Dr Andrew Ball:
Of course having a sample in the lab is fantastically useful. There's only so much information that you can get from 'in situ' data. People say that a picture is worth a thousand words, well a sample is worth a thousand pictures.

Dr Emily Baldwin:
Phobos and Deimos are the only two other moons in the inner solar system, aside from Earth's own moon of course, so in that respect they're the next accessible moons to study . . . and perhaps understanding where they came from will help us to learn more about how the solar system itself was put together as a whole.