[MUSIC PLAYING]

KAREN FOLEY: OK. My next guest is Rhian. Rhian, thank you for coming in. Now this is the bit that's been very, very at the forefront of most of the news right now because your session, we've gone down from the Trace Gas Orbiter to the atmosphere and now we're looking at the lander, the Schiaparelli Lander.

And David asked the question, saying, "Has the EDM been in contact since chute deployment," which was obviously the parachute. And we've heard broadly about some of the issues around there. What is the lowdown on it?

RHIAN CHAPMAN: Well, we did hear from it after the chute deployment. It worked very well as it went through the upper atmosphere. The heat shielding around it was working fine and it slowed down to the right sort of speed. The parachute was deployed correctly, as far as we know, and that slowed it down even further. And the heat shield popped off the front successfully. So a lot of the things that we planned to happen during the descent did happen correctly.

There was a point where things didn't go quite to plan. The radar that interacts with the surface so we know what altitude the lander is at as it goes down did start operating. So we've got a lot of information on the way down to the surface. Then the parachute was ejected earlier than expected.

So it was working as it slowed down the lander. After a certain point, the lander lets go the parachute so it would then activate retro thruster rockets to lower it right to the surface. The parachute was ejected earlier than expected, the thrusters fired but not for as long as expected, and then the lander stopped talking back to us. So that's when we lost contact, which was about 50 seconds before its expected landing time and that's as far as we know.

KAREN FOLEY: So how important is that then, in terms of the whole process of the lander because it's obviously taking a lot of data as it's descending? And it got very, very close, didn't it?

RHIAN CHAPMAN: It did, yes. We've got data actually from an altitude of 120 kilometres all the way down to about one kilometre from the surface. So we've got about 99% of the descent data that we were aiming to capture, which for what I'm doing is really important. So I've got most of the data that I was interested in getting. So that is definitely a success.

KAREN FOLEY: Which is fine for you but what about for everyone else? You say the 99%. Is that 1%, in terms of the actual-- how important is that 1% in terms of the overall picture? Clearly, it's a very important part for the next part of the mission, when the rover lands, to get that last kilometre.

RHIAN CHAPMAN: It is and we do want the rover to land successfully across the last kilometre. But we've got a huge amount of data for the rest of the descent. So a lot of it was a success and we tested the parachutes. We tested the radar. We know this worked and we can use that data to analyse exactly what went wrong and hopefully correct it in the future.

It is a real shame for the scientists who did have instruments on the lander that were going to take weather measurements at the surface and they won't get anything back and that is a real shame. But it was not a complete loss. We did get a lot of data during the descent.

KAREN FOLEY: Yeah. No, absolutely. These things do happen fairly frequently, in terms of this sort of thing. I guess it's like you say. It's not all necessarily a bad thing.

We have got a lot of data from that but obviously heartbreaking if you put so long into researching some of these things, as well. You're specifically looking at Martian dust storms and likely, you're doing your modelling and you're trying to look at that. So you're going to be getting some of this data back and seeing how that compares with your model.

RHIAN CHAPMAN: Yes.

KAREN FOLEY: So why are dust storms so important?

RHIAN CHAPMAN: Dust storms play a big part in the general circulation of the Martian atmosphere because as Liam was saying, there's not any water really in the Martian atmosphere. Dust is the main constituent of the atmosphere that absorbs solar radiation and heats up. So the heating and the cooling of the atmosphere is really dependent on the amount of dust that's in the atmosphere, which can vary from a very background level of dust to a really thick dust storm that can blanket the whole planet for weeks.

And we can't always predict when those storms are coming so the more we know about the atmosphere as it is, the more measurements we can get at the surface as to winds and temperature through the daily and annual cycles, the better we can predict how it will be in the future. And for landers like Schiaparelli, it was battery powered so it doesn't rely on solar power so dust storms are not such a problem for it.

But if you're sending down a rover or a lander which is solar powered, then having a dust storm obscure the Sun for any extended period of time could affect the performance of that lander on the surface. So knowing a bit more about the storms, how thick they are, how frequently they can come across the surface, can help us plan missions for the future.

KAREN FOLEY: No, very important. Like we were saying before, not every lander has successfully landed and particularly on Mars, as well as other planets. We asked our audience a whole range of things reaching their destination, Mars 1, Mariner 4, Viking 1, Namosi, Mars 96, Insight, and Phoenix. They have said that Phoenix, Mariner 4, and Viking 1 did reach their destinations.

RHIAN CHAPMAN: I believe that is correct, yes.

KAREN FOLEY: Good. Good. Yeah, we haven't written down the answers. It's very difficult, though, when you're amazed by all these lovely stars and planets, et cetera, to remember. Buy I guess the point here you're trying to make is that proportionately, it's not always a success.

RHIAN CHAPMAN: It's not always a success. No, it's very hard. A lot of orbiters that we've sent to Mars in past have missed the planet or we've lost communication before we got there. The ratio is getting better in recent years and Insight hasn't actually made it yet because it's not been launched yet. Insight will be one of the next missions launched.

KAREN FOLEY: A bit of an unfair question, Rhian.

RHIAN CHAPMAN: Yeah, that was a bit of a trick question.

KAREN FOLEY: OK. So the lander then-- so we've got this entry descent and then the landing module phase of the ExoMars programme. As you say, it was a test. Well, to some extent, obviously it is a test, although there were instruments on board. And we've recorded nearly all of the data down to the surface. Some of the instruments there, what were they trying to test? They were trying to take a look at the surface but to a much lesser extent than the rover.

RHIAN CHAPMAN: Yes. We were going to look at the air temperature, the wind speed and direction, look at pressure, humidity, all the weather sensors that you might take on Earth. We were going to look at the electric field, as well, that's near the surface, which has never been attempted before so it's a real shame we won't get that but trying to build up the ability to forecast the weather, if you will.

KAREN FOLEY: But how critical was that to know? We've seen here that there were lots of other instruments

that are arguably able to get different measurements but from the orbit. So how important was that?

RHIAN CHAPMAN: It wasn't critical. In this case, the lander really was to test the landing technology. So the science on surface was a bit of a bonus. It would have been really nice to have but if we don't have that, that does not adversely affect the next mission, necessarily.

KAREN FOLEY: So can all the critical science be done then from the orbiter for the 2020 mission?

RHIAN CHAPMAN: A lot of it can, as well as analysing the data that we did get from Schiaparelli on the landing.

KAREN FOLEY: Yeah. OK. All right. So we've talked a little bit about what happened then during the descent. Can we talk about some of the data that we're hoping to get back and also why that's going to be so important for you?

RHIAN CHAPMAN: Some of it that's not necessarily important to me but I think is really interesting is the data we'll get back from the heat shield, which is this silver side here when it's flipped upside down. We're getting data back from thermal sensors inside that, which we don't have any data from that at all before. So this is how well-protected the craft is as it plummets through the atmosphere and heats up due to friction.

And you want to protect everything that's inside the craft from that massive heat outside so that it doesn't melt so it actually becomes a usable instrument when it reaches the surface. And not even NASA have taken those sort of readings before from something descending to the Martian surface. So we don't really know if our heat protection is too much. Perhaps we're sending too much mass up there.

If we could reduce the layers of insulation that we're putting on a spacecraft, we could put a bit more science there in the future. So I think that one will be really interesting. For me, it's a lot about how the spacecraft behaved as it was travelling down to the surface. So there were inertial measurement units. There were accelerometers in the craft itself as it descended, as it was plunging through the upper atmosphere and then as it was swinging below the parachute in a bit of a pendulum action.

So I can analyse all of that and I can then work out what the wind speeds were like in the upper atmosphere and all the way down to the surface. And I can compare that again to the simulations that I've run on the computer models and see how accurate my models are

compared to what it actually experienced as it was going down. We can use all this information from a lot of different sensors to build up a whole picture overall and that's what I'll be doing with it, hopefully.

KAREN FOLEY: So obviously, you're getting data and you're comparing that with your data but that needs to be interpreted. How difficult is it to then interpret that data?

RHIAN CHAPMAN: Initially, it takes calibration of the raw data. So I'm relying on the scientists who actually created the instruments that I'm getting data back from to take the raw data, run it through their calibration systems, and then provide me with more intelligible data, which I can then analyse and put on graphs, essentially.

KAREN FOLEY: Is it compatible with your data then in that form? Would you need to perform other transformations?

RHIAN CHAPMAN: By the time I get it, it will be a set of numbers which I then have to juggle into a set that I can compare in a nice graph against my numbers. So it's a lot of juggling numbers, messing around, and making some plots that are actually comparable to human eye rather than just computers.

KAREN FOLEY: And how specialist do you have to be to be able to do some of that?

RHIAN CHAPMAN: I would love to say very specialist. It takes practise. It takes practise and time just to get to know how to juggle data and how to present it, as well.

KAREN FOLEY: Because Liam's been talking about this race, I guess, that when you get this data, everyone's going to be set and analysing that. Where do you fit in terms of that research field with other people who are also going to be very interested in getting that? Is there a difference between the way you're going to be interpreting something, say, and somebody somewhere else might look at it?

RHIAN CHAPMAN: I think everyone will be looking for something slightly different in it. I will definitely be looking to compare it to my particular atmospheric model. Other people have different models, which they've got different results already. So I could compare my results to their results and we can both compare our results to what the lander is telling us. So then we can all argue over who had a better match to start off with.

KAREN FOLEY: How will you sort that out?

RHIAN CHAPMAN: That will be through various conference presentations and arguments and suggestions and discussions amongst the scientific community.

KAREN FOLEY: That sounds fun. Right. Let's go to the Hot Desk. Sophie and HJ, I hear you're talking about some sci-fi versus real life.

SOPHIE: Yes.

HJ: And we all know sci-fi is better than real life, don't we?

SOPHIE: HJ's got that worked out more than I have. I'm taking questions.

HJ: Yeah. Well, Lisa does say she really likes your *DS-9* t-shirt. It's really cool. We'll have to get a few of those. But--

KAREN FOLEY: You're not talking about Comic Con again, are you?

HJ: Well, oh, no. Well--

KAREN FOLEY: No, you are, aren't you?

HJ: Me and Amber are talking to the *Star Trek* conventions and how much fun we had at them. So she's just gone to one recently and I remember going to my first one a few years ago, which was really fun.

But Davin's wondering about the technologies in sci-fi shows like *Trek, Star Wars, Babylon 5*-- have influenced all the different technologies that have come about. And we're finding perhaps any we used on the ExoMars mission, which is quite an interesting thought and perhaps Rhian has some thoughts on that. But I know perhaps Sophie can ground us a bit more.

KAREN FOLEY: HJ gets very excited, just the Comic Con and *Star Trek* or *Wars* or whatever it is.

SOPHIE: A lot of these questions are really over my head but David had a good one about, is the effort that we have on Mars and going to Mars, is it something maybe we should sidestep? Should we be concentrating on more lunar missions and lunar bases and things like that and preparing man for life on the Moon? Is that more realistic and move viable maybe than preparing for life on Mars?

KAREN FOLEY: That is a very difficult question. I suppose it depends what the point is, doesn't it?

RHIAN CHAPMAN: I think lunar bases are a great standpoint for moving on to Mars. So I think we really should go back to the Moon. We should definitely send man back to the Moon. And it is a lot easier to get there. It's a much shorter journey time so it's a really good test base. If we can get people living on the Moon, then that would be a really good test for getting people to live on Mars.

KAREN FOLEY: And Mars is the destination. The Moon is just a--

RHIAN CHAPMAN: The Moon is a weigh station and maybe a supply point on the way. Yeah, I think we should definitely start with the Moon but we should always aim for Mars.

KAREN FOLEY: Well, I think David Rothery would disagree with you here. He would say we should always aim for Mercury.

RHIAN CHAPMAN: Well, yes.

KAREN FOLEY: But I guess that's one of the interesting things about this is that there are so many people looking at very similar sorts of technologies, very similar sorts of things that they're measuring but on different planets. In planetary sciences, we've seen you guys are obviously all interested in Mars. But there are lots of other people at the Open University who are doing various, various other things, in particular, the Moon.

And there's this moons MOOC, as well, that's starting again that you might want to join in if you haven't already had a go at that one. But there are so many different things. How does it work then? You say conference presentations and things. You're not all just going to be arguing about Mars, et cetera. How does it work fitting in some of the things that you're finding here in terms of the whole solar system?

RHIAN CHAPMAN: There is a bit of friendly rivalry between the different planets that we research. If you go to a really big conference, you often get a lot of different sessions. So some of us will be talking about Mars but then there'll be a session next door about Pluto, as well. And speaking for myself, I'm always fascinated about the other planets. I love learning about Venus, about the Moon and the moons of Saturn and Jupiter, particularly.

So I am researching Mars at the moment but I find all the planets fascinating. And I think you'll find that amongst a lot of planetary scientists. We all have our favourites but everyone is very interested in the development of technologies which you can use across all the different planets and all the different missions that are out there.

KAREN FOLEY: But is there anything from ExoMars then in terms of the technologies? Like you say, things can feed into research about other areas, other planets. Is there anything from ExoMars that you think is going to be particularly important that other people could employ?

RHIAN CHAPMAN: I think any technology that has proven itself or half proven itself will be considered for future missions. All the space agencies always build on past missions when they're creating future missions. They don't start again from scratch because that would be too expensive and too slow. So any proven technology that exists is always used to feed into the next level of technology.

As we've said, it sometimes takes many years for missions to get to the outer solar system so some of those missions are a bit behind the technology by the time they get there. But we can learn from how they performed on the way, how they are working while they're actually in operation, and we can use that to build the next generation of technology.

KAREN FOLEY: OK. So what are you most looking forward to in terms of some of this data you're getting back? I asked Liam earlier and he seems very excited about lots of different things. But for you, what are you most excited about and what do you think you're going to find out that you maybe didn't know before?

RHIAN CHAPMAN: I am most excited about seeing what it's like during the dust storm season because we haven't had a lot of information about the annual dust storm season from any landers or rovers particularly. So even though Schiaparelli didn't make it all the way to the surface, I can get a lot of information about the atmosphere as it went down in the dust storm season.

And this is an annual season that occurs where more dust is lifted from the surface. You're more likely to see more storms. And again, we can't predict that in advance yet but if I can get data from this year's dust storm season, then maybe I can use it to get a better idea of what next year will be like.

KAREN FOLEY: Yeah. No, it'll be so interesting, I guess, getting all of that back. I'll look forward to seeing how you're doing when you're starting to have your sleepless nights analysing it all.

But a lot of countries-- Jon sat here and said, well, this side is ESA and the side is the Russian side. But lots and lots of different countries have been involved with the Trace Gas Orbiter and Schiaparelli Lander. Most people in our audience think that nine countries were involved.

RHIAN CHAPMAN: Yes, nine would be my answer, as well.

KAREN FOLEY: Yeah. Excellent. That's good. So well done there.

And we're going to end the session so if you haven't already voted on what you think a name for a lander would be-- so maybe you don't like saying "Schiaparelli," which I don't. You might be able to think of a better name. So you let us know and we're going to show the answers to that very soon.

Rhian, that's been really, really interesting talking about this. What's happening for you now then? This is obviously very, very interesting. You're obviously waiting with the hope that if something happens, it's going to happen very soon in terms of getting anything back. What's your next few days look like?

RHIAN CHAPMAN: The next few days, I will actually be going back to different simulations I'm running because although the data is now back from Schiaparelli, it is with the scientists who created the instrument. So I've got to wait for them to calibrate the data and streamline it to then send it on to me. So I'll be preparing my analysis routines in preparation for that.

KAREN FOLEY: Excellent. So it's going to be a busy time.

RHIAN CHAPMAN: Yes, yeah, quite a lot of juggling numbers.

KAREN FOLEY: Wonderful. Well, Rhian Chapman, thank you so much for joining me. That's been really interesting. Good luck with all of that and I hope it goes the way you want it to and that you manage to get everything on track and on time.

RHIAN CHAPMAN: Thank you.

KAREN FOLEY: Thank you for joining us. Right. HJ, have you stopped talking about Comic Con now?

HJ: Nope.

KAREN FOLEY: Well, that didn't work very well, did it?

HJ: No.

KAREN FOLEY: We're trying to have a very sensible conversation here.

HJ: Yeah. Unfortunately, I'm not easily grounded from all these different things.

SOPHIE: It's what I'm here for until we start talking about cake. And then we will have HJ talking about *Star Trek.* I'm talking about cake. It's going to go downhill.

Davin does have a very good question, actually, which might be good for the next session. He says, Would discoveries about Mars's environmental condition help us better protect our environment on Earth? It's actually a really good question. Thank you for asking that, Davin.

HJ: David's got another quick question to grab myself away from all this sci-fi stuff. And David's just wondering how Brexit will affect the UK's role in these missions in the ESA, if at all. And do the experts worry that we could be sidelined? So that's an interesting timely one perhaps for the future prospects of our involvement.

SOPHIE: I would also just like to thank-- actually, there's been really good photos coming in, some really good cloud photos and some selfies and study buddy pictures. We are trying to get those printed as soon as possible.

I would just like to point out that I really am liking Andrew's cloud picture. That is my favourite, a nice little cloud drawing. So please do keep sending those through at studenthub@open.ac.uk. Or you can tweet us at @studenthub or you can use our Twitter handle-- so #StudentHubLive2016.

KAREN FOLEY: Brilliant. We asked what you thought the name of the lander should be. So let's take a look and see what some of those answers were. "Bob," "Starship Enterprise," "Leonard Nimoy," "Docky," "Dora the Explorer," "Rover McRoverface"-- I think that's brilliant. Excellent. "Ziggy Stardust"-- some very, very imaginative answers. "Intrepid," "Starship Enterprise," "Alien Finder"-- well, that's a good one. "Exo 2020," "Fifi"-- brilliant. Excellent.

Thank you for filling those in. Aren't you all imaginative? That's really good work out there. Maybe we should put the Student Hub Live audience in charge of naming the next one.

[MUSIC PLAYING]