

## Space on the Page Podcast

### Mars Future: Humans on the Red Planet

>> David Baron: We have traveled to Mars many times in books and films. Think Total Recall, The Expanse, and of course The Martian. But in real life, sending a crew of astronauts to the red planet remains a dream. When might we really see a human footprint on Mars? What will it take to get there?

[ Music ]

I'm David Baron, and this is Space on the Page from the Kluge Center at the Library of Congress. This podcast explores outer space in literature, science, and the human imagination, and today's episode marks the third and last in my trilogy on Mars. I'm an author, and I spent part of 2021 as the Baruch S. Blumberg NASA Library of Congress Chair in Astrobiology, Exploration, and Scientific Innovation. I'm writing a book about Mars, and I've been speaking with authors of other recent books about that planet. I've examined our society's fascination with Mars in the past and present, and now I turn to the future. My guest this time is David Whitehouse. He has a PhD in astrophysics, he's a former science correspondent for the BBC, and his latest book is called Space 2069: After Apollo: Back to the Moon, to Mars, and Beyond. The book looks at what humans might achieve in space exploration by the 100th anniversary of the first Apollo Moon landing. As you'll hear, when it comes to the human exploration of Mars, David Whitehouse is a booster, but one who comes to the subject with a hefty dose of realism.

>> David Whitehouse: I think that we should go to Mars. I think it's important that we go to Mars, you know. I mean, and it will permeate the whole of society. If we get to Mars, there will be art, which is uniquely Martian. There will be poetry and operas and music which we will not have had had we not got to Mars. There will be books and novels, you know, worldwide best-sellers which will change our view of things we will not have had if we get to Mars. We will not have a whole generation of inspired youngsters solving other problems if we don't get to Mars. So I do hope we will get to Mars, but it's not a foregone conclusion that we will in the near future.

>> David Baron: Well, you've taken on a difficult task in your new book. You are, in essence, prognosticating the future and asking where might we be as a species by the 100th anniversary of the Moon landing. How far will human beings have traveled. Now you don't believe we'll go beyond Mars by the year 2069, but you do, in the book, seem pretty confident that we will get to Mars by then. And so what gives you the confidence that by 2069 at least a handful of people may have gotten there?

>> David Whitehouse: Well, because we're going to the Moon. As you know, we've spent the last 50 years as a species since we last went to the Moon wondering about how we will get back. And there have been a succession of projects which have not lasted very long, which have failed. But at last, there does seem to be an initiative which will take us back to the Moon in the next few years.

>> David Baron: Right. And that is NASA's Artemis program.

>> David Whitehouse: Sure. That's right.

>> David Baron: With the goal of getting what -- the first woman on the Moon...

>> David Whitehouse: Yeah.

>> David Baron: ...first person of color on the Moon as well as starting us on our way to Mars.

>> David Whitehouse: That's right, in the next three years. And of course, with China along and billionaires taking an interest in this, it does seem as though things could start to move in human exploration of deep space that hasn't happened. Things haven't come together quite so well in the past as they are doing now. Although I do notice that there are various studies that have been carried out about how we would get to Mars. And almost all of them suggest that for humans -- well, almost all of them except for perhaps Elon Musk's advisors -- most of them suggest that humans could not make the voyage for at least 15-20 years because there's so much we do not understand. Now we understand a lot about Mars itself. We've got rovers on the surface. We understand the chemistry, the geology. We're looking for life. We understand the atmosphere and the weather, but we do not -- the big thing is that we do not understand the voyage. That, to me, in the book was the big unknown, because the voyage to Mars is unlike anything -- anything -- we will have ever done before.

>> David Baron: Now a voyage to Mars using current technology would take about seven months, I guess.

>> David Whitehouse: Yeah. Seven or eight months, yeah.

>> David Baron: Right, and yet we've had astronauts in space. The astronaut Scott Kelly was up in the space station for almost a year, so why is it that much harder to send someone to Mars for seven months than to have them in Earth orbit?

>> David Whitehouse: There are several aspects to that. Because all Scott Kelly did -- remarkably well when he was on the International Space Station -- but he came back in a dreadful physical condition. And in a mental condition as well. His body was affected greatly by being in zero gravity for that length of time. Various studies which have come out since of the intensive work which was done on him and his twin brother have shown that the effects of microgravity and the space environment on the human body are even more profound and serious than we had imagined. It affects every part of your system -- your digestive system, your skeletal system, your nervous system, your immune system, your endocrine system -- everything is affected severely. And there was a study on cognitive function which showed that as he was going through the mission, he was losing his edge. And he didn't quite -- he said he didn't quite feel on the ball. And so from the physical point of view, we have a great deal to learn, because you don't want to go to Mars and then arrive in a state where you cannot explore, where you are not at your best. So we really have to understand more about what happens to the body and how we would treat the body and design the equipment we need to support the voyage. Now that's the physical side of it. But of course, as you say, it's a seven, eight, nine-month trip to Mars with an isolation and a loneliness and a distance that no human being has ever experienced before.

And the isolation, the pressure, the intensity requires study, requires probably special types of people and groups of people. So the voyage, the physical, the emotional, the mental, the technological solutions to that to me are the big barriers of going to Mars.

>> David Baron: Right. And there have been some attempts already to explore at least the interpersonal dynamics of putting a small group of people together for a long period of time. There was a simulated Mars mission out in the lava beds of Hawaii, people stuck out there pretending they were going to Mars. The Russians had a similar sort of thing where they locked people up in a pretend space capsule.

>> David Whitehouse: And they came to blows! [laughter]

>> David Baron: [laughter] So it's not just what happens as an individual, it's what happens as a group when you're all on a voyage like that. But then there's another very serious physical risk that you mentioned, and that is that you're exposed to the full force of the power of the Sun, that is, the Sun's radiation. The Sun is very dangerous if you don't have the Earth's magnetic field to protect you.

>> David Whitehouse: That's right. There was a solar flare which occurred in between two of the Apollo Moon-walking missions, and had the astronauts been on the surface and exposed to that at the time, they would have been severely injured, if not incapacitated. So Apollo was lucky in the sense that they got away with it. But if you're in space for several years, then you've got to understand what the solar radiation and cosmic ray radiation as well would do to you, would do to your equipment. You've got to at least have some shelter within your spacecraft to hide when radiation gets high. But this is a problem which is not faced on the International Space Station because you are protected. When we get to the Moon and we simulate Mars duration missions in orbit around the Moon, then we'd have a bit more idea about how to deal with these flare events. But even with the Moon, you will be within hours of being able to get down to the surface of the Moon to hide or a couple of days away to get back to the Earth. So even if you get caught by a flare, you can come back very quickly. Get caught by a flare on the interplanetary cruise to Mars, then you're on your own.

>> David Baron: Now once we get there, if the goal is to be on the surface, we need to land, and that poses its own challenges. Although I have to say, I mean, back in February of 2021, the Perseverance rover landed on Mars and sent us back these wonderful videos of the parachute deploying and the sky crane lowering the rover down to the surface, and it all just seemed to go perfectly. So, I mean, are we ready to now send a crew capsule down to the surface and know that it will land?

>> David Whitehouse: Not quite, because the thing about Perseverance and Curiosity and the others before it is that they're fairly light craft. If you send a craft with humans, it's got to be extremely heavy, hundreds of times heavier. So there are some various interesting good designs in spacecraft [inaudible]. They're all big. They're all very large with a lot of fuel on board. And that's part of the reason why it's thought when people land there, there will already be a return spacecraft landed in the vicinity and ready to come back.

>> David Baron: We'll need to send it there first, yeah.

>> David Whitehouse: That's right. And also to -- on Perseverance, there's a nice interesting experimental box called MOXIE which extracts oxygen from the atmosphere, and it's doing very well. We'd have to send a super big MOXIE there and the return craft that's already there near the site where you land. So this is the type -- if you want to land on Mars, you're going to have to start putting stuff at the landing site eight years perhaps before the landing, because you get an opportunity every two years. And you're going to have to start building up and be sure that you have the reserves and the facilities on the surface when people arrive.

>> David Baron: Well, so let's now imagine we figure out how to send people to Mars safely, we figure out how to land them on Mars safely, now we need to sustain them on the surface. And looking at those wonderful pictures that have been sent back from Mars by the rovers, you know, Mars looks very Earthlike. You can really, it's almost like the deserts of the American West or the Middle East. You can imagine a cowboy or a Bedouin riding over the horizon. [laughter] But you write that this is misleading, and let me just quote from your book. You write, "Thinking of Mars as a different type of Earth, possibly an Earth in waiting, is wrong and likely to get one killed."

>> David Whitehouse: Yeah.

>> David Baron: Now explain.

>> David Whitehouse: You're quite right. You look at these pictures of Mars, and they -- it's familiar. It's understandable. But it's Mars. It's not Earth with a twist or Earth with a slightly thinner atmosphere. It is totally different. And therefore, you have to go and engineer -- you have to study how we would live on Mars, where the food would come from, where your heat would come from. Not with any of the grace and favor that the Earth offers you on our planet. Mars -- you know, I have this thing in the book where I talk about the Mars philosophy, the Mars frontier philosophy, of people living on Mars with this constant struggle to survive, knowing that if the water reclamation unit fails, they're dead. If the carbon dioxide scrubbers fail, they're dead. If the heater fails, they're dead. If their supply craft from Earth doesn't get there, they're dead. They're under a pressure, technological and psychological, of every second, you know, they could be -- they might have to react to a life-ending event. And this would give people a different mental outlook, different philosophy. And I had this idea that the Martian settlers could develop in different ways from those on Earth. They might resent Earth. Particularly they might have more of an independent spirit when the first people die on Mars, because everybody who goes to Mars, they're not all going to come back. Some of them might not want to come back or not be able to face the return journey. So Mars is, as you say, is not Earth. This is the, you know, the most difficult environment in which to live we'll have ever -- the Moon's a breeze compared to living on Mars. This is the most difficult environment we'll have ever explored or tried to live in. And it's at the end of such a long supply chain that who knows how the crew and the Earth and the Martians are going to develop once we start doing this.

>> David Baron: And yet despite the hazards, many people dream of going to Mars. An organization called Mars One was founded several years ago with the goal of jump-starting efforts to colonize Mars. And it put out the call for volunteer settlers, people who were

actually willing to raise their hand and say I'll go to Mars, even if it's a one-way trip. And in five months, 200,000 people from 140 countries applied. I mean, the enthusiasm just seems boundless.

>> David Whitehouse: Yes, but that was a bit of a joke, really, because I don't suppose anybody there had really seriously thought about what they were undertaking. I mean, it's fine to record a video about why you would like to live on Mars and fill out a form and talk enthusiastically about exploring another world, but it is very different, the actual reality, and the first people who go there will know this intimately. I imagine actually some of those people at the top of a rocket, and there is the capsule with the door open. And they're brought forward and they say, right, you go in that door -- you go in that capsule and you shut the door and you're never coming back. You're never going to breathe Earth air again. You're never going to feel the warmth of Earth. You are going to Mars and you will never come back and you will probably die on the voyage or you will die on Mars. How many of them would take that step?

>> David Baron: Yet, I've seen, you know, interviews with kids in college today who say, you know, they are determined to go to Mars, and they are prepared that it may be a one-way trip. And whether that's something they really would follow through on or not, the whole history of our view of Mars, looking at the time of Percival Lowell and the canals on Mars or the meteorite from Mars that fell to Antarctica that was thought to have life in it back in the 1990s, we seem to have a history of projecting onto Mars what we hope it is or hope it will be. It's sort of like it says more about us on Earth than about Mars itself, and I wonder if that's true as well with this idea of us colonizing Mars in the next 50 years or 100 years, that whether it's realistic or not, it says something more about us than about Mars.

>> David Whitehouse: Well, in an sense, I think you are quite right, yes. We as a species are exploratory. We have to explore. We explore in all aspects of our society. In science, literature, art -- it's all exploration in one form or another to explore what humans can and cannot do or what we can and cannot imagine. So the idea that we would not go to Mars would seem strange in the long run, although politically it might not happen as soon as many would like. But you're right, it would take us into a new environment, into a direction -- I mean, even though the people who go to Mars will be few initially, their experience there changes -- the fact that humanity occupies somewhere else will not only affect them profoundly, it'll affect everybody. That's why I think it's important to go to the Moon first, because we need a generation of people growing up who take it for granted that there are people living on the Moon, and that you can have lessons from the Moon, you can have interaction with people living on the Moon. When that becomes accepted as a part of what we do, I think it'll be easier to sell the trip to Mars to the politicians.

>> David Baron: Well, predictions about when people will get to Mars have a history of being wildly optimistic.

>> David Whitehouse: Oh yeah, yeah.

>> David Baron: In the early 1970s, the American Vice President Spiro Agnew predicted we'd land people on Mars in 1984. In 1985, Carl Sagan said it was realistic to put a human on Mars by 2010. Today, Elon Musk talks about landing humans on Mars as soon as 2026.

The Chinese are aiming for 2033. What do you think is realistic today? I mean, based on what we know and the politics and the rate of development and the money about when we might see the first human on Mars?

>> David Whitehouse: Well, China is an interesting question, because they clearly want to go for the spectacular. And therefore, they may do things which are far more risky just for the prize of landing a person on Mars in a way that is a spectacular mission that just achieves the landing and gets back and is not part of anything longer than that. Because that's clearly -- they want these things. They want these spectacles. But I would have thought if you want to send people to Mars and you want to continue this, I don't see that happening for another 10 or 15 years at least. So as we have seen in the past 50 years, people wanted to go back to Mars. Spiro Agnew, Carl Sagan, everybody else. The decades can whittle away quite quickly, and particularly if the politicians are not necessarily on board. So I hopefully think that in 20 years' time, we could get to Mars, which means perhaps some of those people who did apply to Mars One. You know, the first person who will walk on Mars is probably at school now, and they may well be at school in China. So it's going to be very interesting times. But if you said to me David, when are you going to land on Mars, I'd say with the China flag up for a quick mission there and back with, you know, a strike at Mars and a strike back, I would say it's 15 years. But you're quite right; China has said 2033. And with such a political drive behind that, they may cut corners and move faster than in the West that we would normally proceed at.

>> David Baron: And then you've got private industry involved.

>> David Whitehouse: Yeah, yeah.

>> David Baron: Now the cost of going to Mars is enormous -- and I don't even know if Elon Musk can finance that -- but is it possible that what will finally get us to Mars is the profit motive?

>> David Whitehouse: It's hard to see how anybody would make a vast amount of money going to Mars, and that's probably why billionaires are interested. Because if you've got -- what's the difference between having 4 billion and 50 billion to a person? It makes no difference. And yet the difference is something you can use to develop space technology. So if billionaires of the flavor we have seen in the last 10 or 15 years have so much money that they could spend as much as governments spend on space and not notice the difference, and therefore the profit motive for them, you know, is not really as serious. It's not really a constraint as somebody who had significantly less money. It's going to be interesting to see how this happens, because clearly Elon Musk is overenthusiastic about Mars, and he's not going to get people to Mars in the next few years. It's just not technologically going to happen. But if he sits down and does the same for Mars that he's done for SpaceX, and if he applied that philosophy to Mars and realized he's not going to get there in five years but he could get there in 10 or 15 years, then you're quite right; it could be Elon Musk's private consortium that puts [laughter] -- gets to Mars.

>> David Baron: Well, you bring a lot of, I would say, cautious optimism to this question about getting to Mars, I mean, the fact that you believe that the first human on Mars may be in school today. But let me flip this on its head. What if we don't get to Mars by 2069? What

if, you know, by the 100th anniversary of the Moon landing, once again, the decades go by, the dreams fade, the plans disintegrate, and human beings remain tethered to this one planet. What will that say about our species and about our future?

>> David Whitehouse: Well, I would feel disappointed. And I would feel the same way when I'm embarrassed to talk to my kids in the sense that I remember as a schoolboy watching Armstrong and Aldrin walk on the Moon, the first footprint. I've never forgotten it. I will never get over it. It changed my life. And I know it changed a lot of people's life, and it's the thing which in many people's mind is one of the biggest things that's ever happened. And I say to my kids -- who are much younger, obviously -- what has happened within your lifetime that is of a similar magnitude that you remember. And frankly, they can't come up with anything.

>> David Baron: Not only memorable, though, but inspiring.

>> David Whitehouse: Yeah.

>> David Baron: I mean, we can remember horrible things that have happened, but [inaudible] inspiring.

>> David Whitehouse: That's right. But -- yeah, that's right. And I regard my generation as having let them down, because we have not given them that. And if my kids or their children had to explain to their offspring that we have let -- that they have let them down again and they have not given them this piece of history, this piece of what humanity is, that will be very sad. That will be -- that will say something about a diminishing of expectations. Because the thing about the space program -- about going to Mars and going to the Moon -- is that it's more than going to Mars and going to the Moon. Because if you know it's possible, if people when they're young want to go into science and technology because we are going to Mars and the Moon, they don't always stay in that subject but they take their enthusiasm, their drive, and their expertise into other areas of society. And it's like building the cathedrals in the Middle Ages. It's a focus for activity. It's a focus for expertise, which benefits everybody. There's a famous phrase that President Bush Senior said 20 years after Apollo 11. [music] He said that the benefits to the American economy of Apollo was the best return on an investment since Leonardo da Vinci bought a sketch pad.

>> David Baron: [laughter] Well, David Whitehouse, I thank you so much for sharing your time and your expertise and helping us imagine our future in space. And I certainly hope I'll have an opportunity to talk again when those first human footprints are put on Mars.

>> David Whitehouse: I hope so.

>> David Baron: David Whitehouse's book is Space 2069: After Apollo: Back to the Moon, to Mars, and Beyond. Well, it's been a pleasure hosting these first three episodes of Space on the Page. I've enjoyed speaking to other authors who share my passion for Mars, and I look forward to my book on the history of Mars joining their books on library shelves in a few years' time. This podcast comes from the Kluge Center at the Library of Congress, where I spent part of 2021 as the Baruch S. Blumberg NASA Library of Congress Chair in Astrobiology, Exploration, and Scientific Innovation. Thanks to everyone at the Kluge

Center and the Library of Congress more broadly for making my stay so productive and memorable. Thanks as well to Andrew Breiner who composed and performed the original music for this podcast. I will now leave this podcast in the hands of my successor as Blumberg Chair. Lucas Mix will be your host for the next few episodes. He'll bring you conversations between scientists and science fiction writers. I'm David Baron. Thanks for listening, and Lucas will see you next time.