NASM AirSpace Season 3 Ep. 2 The Rover Final Transcription

[MUSIC]

Nick Partridge: Hey AirSpace fans! We've got something new headed your way; an AirSpace side hustle of sorts. It's a literary mixtape we're calling, "Voyages to Mars."

[MUSIC]

Matt Shindell: As NASA's Perseverance Rover makes its way towards the red planet, we're diving deep into the past of Mars-related science fiction to bring you excerpts of how humans have imagined Mars.

[MUSIC]

Emily Martin: You'll hear the story where the term, "astronaut" was written down in English for the first time.

[MUSIC]

Matt Shindell: And a story about launching into space via a giant cannon in Florida.

[MUSIC]

Nick Partridge: All over some great soundscapes from DJ Kid Koala.

[MUSIC]

Emily Martin: For ease of listening, "Voyages to Mars" will be right here in the same place you always find AirSpace. Keep an ear out for this new adventure dropping August 18th.

[MUSIC]

Nick Partridge: You guys, let's not bury the lead. Mars helicopters.

Matt Shindell: And mud!

Emily Martin: (Laughs).

Matt Shindell: Don't forget mud.

Emily Martin: (Laughs). There's so much mud.

[MUSIC]

Matt Shindell: Welcome to AirSpace, from the Smithsonian's National Air and Space Museum. I'm Matt.

[MUSIC]

Emily Martin: I'm Emily!

[MUSIC]

Nick Partridge: And I'm Nick. Sometime in the next several weeks, NASA's latest Mars Rover, Perseverance, is going to take off on its way to explore the red planet. If you are a casual student or fan of space history, it may seem like we have been to Mars many times in the past, and truly we have, but today, we're going to remind you that it is always an astounding feat of human ingenuity and technology. And, we're going to break down what makes this particular mission special.

[MUSIC]

Matt Shindell: Perseverance is NASA's fifth Mars Rover. This new mission uses that history and adds some really cool, new science, including a helicopter and a drill that can take geologic samples, seal them, and place them on the surface for future Mars missions to pick up and bring back to Earth.

[MUSIC]

Emily Martin: The Perseverance Rover is expected to land in February of 2021 at a site called, "Jezero Crater" or, "Yezero Crater." The Perseverance Rover is really looking for signs of microbial life that might have existed on Mars, maybe billions of years ago. We're gonna jump into what this mission is and the science it aims to advance today on AirSpace.

[MUSIC]

Nick Partridge: Here's a really fun game. Matt, how briefly…

Matt Shindell: (Laughs).

Nick Partridge: …can you describe the history of Rover exploration on Mars?

Matt Shindell: Well, um, I'm actually writing a musical about it, in the vein of, "Hamilton…"

Emily Martin: (Laughs).

Matt Shindell: …but about Rovers.

Emily Martin: (Laughs).

Nick Partridge: So, not briefly at all?

Emily Martin: (Laughs).

Matt Shindell: Not briefly at all! It's two acts with an intermission. No!

Emily Martin: (Laughs).

Matt Shindell: So, we've sent four Rovers so far. The first Rover was tiny. It was like the size of a microwave. And they've only gotten bigger and better since then. And most recently, you've seen the Curiosity Rover on Mars, taking selfies of itself. That was the fourth Rover. And this fifth Rover is a lot like it, but sort of amped up with a lot of extra super stuff.

Emily Martin: I think though… when I think of the Perseverance Rover, the mission that I spend the most time thinking about impart because of this picture I have in my head of Matt.

Matt Shindell: Hmm.

Emily Martin: I always think of the Viking Lander, when I think about the habitability experiments that all of the Martian spacecraft have been…

Matt Shindell: Yeah, that's a good point! I mean, Viking wasn't a Rover. It was a Lander. We sent two of them. And they had on them some, at the time, you know, 1976, the most advanced sort of micro-versions of, of, um, life-detecting laboratories on board them. And we've learned so much more about microbial life since then, you know. The way that we looked for life in 1976 was very different from how we're gonna look for it now.

Emily Martin: For a long time, the Mars exploration Rovers, Spirit and Opportunity, were on the surface of Mars, still operating, but right now, the only operating Rover on the surface of Mars is the Curiosity Rover.

Matt Shindell: Hmm, mmm.

Emily Martin: And then, we still have the operating Insight Lander, which we've talked about in Season Two. And this is a whole different kind of Rover that's launching this summer. Even though, in a lot of ways, it looks like a lot like the Curiosity Rover.

Nick Partridge: The cartoon version of Perseverance… Let's just call him, "Percy."

Matt Shindell: I want, "Vera." I'm still pushing for, "Vera."

Nick Partridge: Okay. That's fair. So, "Percy" or, "Vera" looks…

Matt Shindell: (Laughs).

Emily Martin: (Laughs).

Nick Partridge: …in silhouette, a lot like Curiosity.

Matt Shindell: Yes.

Nick Partridge: So, what are, what are the differences? What, what sets, "Percy" or, "Vera" apart from Curiosity?

Matt Shindell: Well, there's a few things that set it apart. The main thing, I think, is that this one is actually going to do something that Curiosity didn't do, which is gonna do a little bit of drilling and collecting of rock samples and hopefully sediment samples that then can be cached to be brought back to Earth later. Emily, you're the Geologist. Tell us what caching means in geological terms.

Emily Martin: Yeah, so caching really just means, "collecting, packaging up," sort of making your little package and sort of just leaving it there for somebody else to go find your cache. I mean, you can always think of like, secret treasures that somebody ever, you know, finds on a secret

treasure island or the cache of Shackleton's whiskey. It's a package siting on the surface or sitting below the surface. In the case of Mars, it'll be sitting on the surface, waiting for another mission to come back and collect that sample. There will be multiple caches on the surface. It'll take a sample, cache it, leave it on the surface where it was cached. So, these are going to be pretty small samples. They're going to be about the size of a Tootsie roll. And they're going to be placed into a kind of vacuum-sealed packaging so that the Martian atmosphere and Martian weather won't affect that sample because while NASA is working on what it's going to take to go back and collect the samples, there hasn't been a specific mission set to go do it yet. And so, we don't know how long they're gonna be sitting there on the surface.

Nick Partridge: To use Emily's Treasure Island metaphor, a cache of negotiable, monetary documents would be a, "cach cashe."

Emily Martin: (Laughs).

Nick Partridge: So, we are drilling samples on Mars that will then sit on Mars and wait for us to come and get them at some undetermined point in the future. Right?

Matt Shindell: Right. And probably a couple more missions that will go and pick them up and then bring them back.

Nick Partridge: That reminds me of one of President Kennedy's less often quoted space speeches where he talks about the story of the kids walking across the field and they come to a wall too high to climb. So, they throw their hats over it and then they've got no choice, but to figure it out. That's how he described the American Space Program. You've got to commit to stuff before you know how you're going to do it. So, yeah! There's gonna be a bunch of Mars samples waiting for us on Mars with the rest of the planet, but I guess now, we've got to go! Right?

Emily Martin: Yeah! Now, we gotta go back.

Matt Shindell: We've got to.

Emily Martin: But I think that brings us back to some of the other really interesting, scientific investigations that are kind of the primary goal of the Perseverance mission, which includes preparing for humans to go to Mars. And this is something I didn't know until I was having a conversation last week with some of the people in the Center of Earth and Planetary Studies who are involved in these Mars missions. Some of the experiments on the Perseverance Rover are specifically designed to try and figure out how to sustain humans on the surface of Mars.

Matt Shindell: Humans on Mars obviously, there's a lot of requirements humans have for living anywhere.

Nick Partridge: We're very needy.

Matt Shindell: And Mars, you know, is a place where it seems very inhospitable because of the very thin atmosphere, and the high radiation levels, and, you know, still trying to figure out exactly if and where we can find liquid water on the planet or where we could make liquid water out of frozen water that's there. So, I imagine these experiments are geared towards that.

Emily Martin: Sure! So, some of the experiments have a lot to do with how they might be able to create oxygen for, you know, breathing is cool. And other kinds of things like fuel because we also use… don't we use liquid oxygen in rockets?

Matt Shindell: We do! Yes.

Emily Martin: We do. So, oxygen is cool for a lot of things and there's lots of other oxygen in Mars, but not so much on or in the atmosphere. And so, there's chemistry. I'm not a chemist, but you can do all kinds of cool chemistry. So, the questions are: is there enough oxygen floating around in easily accessible places to be able to create these kinds of resources. You don't have to carry them with you. They do a lot of this on the International Space Station, right? Like, they're constantly trying to conserve water, but they're also creating water through, you know, better life through chemistry, right?

Matt Shindell: Hmm, mmm. (Laughs). Well, Emily there is oxygen bound up into different minerals, right?

Emily Martin: Right! Of course. So, if you find frozen water, even if it's not liquid, you can find frozen water. So, you can separate that oxygen off of those hydrogens. I don't know how hard that is to do, again, not a chemist. But the point being as long as the oxygen is there, there's different kinds of things you can do to try and figure out ways efficiently. That's important. It's not just, "Can you do it?" Can you do it efficiently and in enough quantity to be able to sustain humans? But the other thing I didn't know, and I thought this was really interesting 'cause I never thought about it before, the requirements for the space suits that the Apollo astronauts wore are totally different than the requirements that are needed for a Martian astronaut to survive on the surface of Mars. I mean, they have similarities of course, but they're different. And so, the Perseverance Rover is going to bring along with it samples of some of the materials that are being considered for the kinds of suits that Martian astronauts might be wearing to see how they hold up to the weather on Mars.

Nick Partridge: The focus on evaluating conditions and technology is for possible future human missions. Did that play any part in the selection of Jezero Crater as the landing site for Percy or Vera? Everyone, by the way, remember to comment on our social media whether you prefer the nickname Percy or Vera. And we will immediately call NASA and let them know what you've decided.

Matt Shindell: (Laughs).

Emily Martin: (Laughs).

Matt Shindell: So, you know the NASA motto behind these roving missions for years was, "Follow the water." And the previous Rovers have done that and they've found evidence that there was water active on the surface of Mars. And the orbiters have found additional evidence of active sites where water flowed on the surface. And Jezero Crater is sort of special in that it's a crater that we think held a very large lake and we think that for various different reasons.

Emily Martin: But what's really cool, I think, about Jezero, is not just the question being was there a lake inside that crater. The cool thing about lake sediments is that they are typically pretty thin and because lakes are not rivers, you don't have currents and other kinds of really heavy activity inside the lake. So, they're calm enough that those sediments don't get turned up too much. And so, they're really good at recording these really sort of small scale events in

terms of timing like, they're really gonna do well at capturing seasons and other kinds of environmental changes, which means you've got this really deep record of what might have been going on there, which might have been a really exciting place for baby, little microbes to go and thrive.

[MUSIC]

Emily Martin: So, I want to ask more about the helicopter because I remember hearing about the helicopter and being like, "How do you fly a helicopter on Mars?"

Matt Shindell: Oh, yeah.

Emily Martin: But Matt, you had a chance to actually see the helicopter?

Matt Shindell: I saw the sort of twin of the helicopter when I was at JPL back in the fall and it looks really cool. And like, the type of engineering that they had to do to come up with a rotor design that would work on Mars, where the atmosphere is so much thinner. I mean, they had all kinds of problems trying to control the first version of the helicopter that they designed 'cause they tried to use the same type of rotors they would use on an Earth helicopter. Right? But the thing was almost impossible to control because there's so much less resistance in the atmosphere there. So, they had to kind of design a very special type or rotor for Mars and they had to test it inside of a vacuum chamber to make sure that it would work. And so, watching those videos and seeing that twin of the helicopter, I just kept thinking, "God! I want to bring that helicopter back to the museum and put it on display."

Emily Martin: (Laughs). Every time you go to JPL, do you just have like a secret shopping list?

Matt Shindell: I do, I have a shopping list. (Laughs). Yeah. (Laughs).

Emily Martin: I got to call this person for this robot.

Matt Shindell: (Laughs). I put a little post-it note on it and say, you know…

Emily Martin: (Laughs).

Matt Shindell: It just says, "Shindell."

Emily Martin: (Laughs). Call Shindell!

Matt Shindell: Shindell!

Emily Martin: So, when I think of the Curiosity Rover, I think about the size of maybe a golf cart. How big is this helicopter?

Matt Shindell: Um…

Emily Martin: Like, does it fit in a Happy Meal or like?

Matt Shindell: No. Its bigger than that and it straps on to the bottom of the Rover in a weird sort of pop-out hatch that kind of releases it when it's ready to go.

Emily Martin: Like, its little marsupial pouch where it keeps its little marsupial helicopter?

Matt Shindell: Yeah, yeah. It's totally like it's the momma kangaroo. Perseverance is the mama kangaroo and the little joey is gonna be that helicopter that pops out.

[MUSIC]

Matt Shindell: I was at JPL when one of the Rovers landed. It wasn't Curiosity. It was the Mars Exploration Rovers and if you remember, those Rovers actually bounced on the surface with big airbags before they finally came to rest, and then started roving. At least with Curiosity, it had a more gentle landing, thanks to the sky crane system. They're using a new version of that for this Rover, which is even better and even smarter than the original version.

Emily Martin: And its smarter because it's got the ability to not just gently lower the Perseverance Rover on to the surface of Mars, but it also has the ability to sort of survey what's going on, on the ground. And the spacecraft can actually decide to sort of like shift itself a little bit and put the Rover down on the surface and kind of do all of that without any guidance from humans back on Earth.

Nick Partridge: Perseverance is launching towards the red planet soon, in a matter of weeks from now. And how long is going to take to get to Mars?

Matt Shindell: It's about a seven-month trip.

Emily Martin: Yeah. Getting to Mars doesn't take nearly as long as it does a lot of other planets. Just part of why we love sending Rovers there, and part of why we communicate so well with those Rovers; and in part, why they have been so successful. The Perseverance Rover is expected to land on the surface of Mars, February 18th of 2021.

[MUSIC]

Emily Martin: AirSpace is from the Smithsonian's National Air and Space Museum.

[MUSIC]

Emily Martin: You can follow us on Twitter and Instagram at @AirSpacePod.

[MUSIC]

Nick Partridge: AirSpace is produced by Katie Moyer and Jennifer Weingart, mix by Tarek Fouda, special thanks to Andrew Fletcher, distributed by PRX.

[MUSIC]

Nick Partridge: New cameras, headin' down to the lake. It's like NASA's planning out a summer vacation.

Emily Martin: (Laughs).

Nick Partridge: They're gonna dredge out the bottom of Jezero Crater Lake…

Emily Martin: (Laughs).

Matt Shindell: Yeah.

Nick Partridge: …for microbial life, and try and find microbial PBR cans…

Matt Shindell: (Laughs).

Nick Partridge: …and microbial boom boxes and…

Matt Shindell: (Laughs).

Nick Partridge: …old microbial…

Matt Shindell: Sunglasses!

Nick Partridge: …rope swings from, from…

Matt Shindell: Yeah.

Nick Partridge: …summers gone by where the microbes spent their time, down by the lake.

Matt Shindell: (Laughs).

[MUSIC]