AirSpace Season 2, Episode 14

Survivor

Matt:

Water bears, moss piglets.

Nick:

Tardigrades.

Matt:

That's their boring name.

Nick:

From the Italian tardigrada, slow steppers.

Emily:

I don't think I've ever seen a video of a tardigrade moving. Welcome to AirSpace. I'm Emily.

Nick:

I'm Nick.

Matt:

And, I'm Matt.

Nick:

Today on the show, we're going to talk about tardigrades.

Emily:

These creatures, look something straight out of a science fiction movie. They're kind of a cross between a gummy bear and a caterpillar, but a lot smaller.

Matt:

And, they like living in damp places, hence they're sometimes called water bears.

Nick:

Get ready for tiny water bears and planetary protection. That's coming up next on this episode of AirSpace, from the Smithsonian's National Air and Space Museum, distributed by PRX.

Emily:

So, what do tardigrades have to do with this episode of AirSpace?

Matt:

Well, we know now that tardigrades have gone where no tardigrade has gone before.

Emily:

Tardigrades crashed on the moon.

Nick:

Tardigrades are famously indestructible

Matt:

Mm-hmm (affirmative).

Nick:

Not physically immortal, but they're tough. They're tough little things, and it has been previously established that they can survive in the vacuum of space.

Matt:

Yeah. They can dry out their bodies and condense themselves into little microscopic balls. And, these have been shown to be able to survive even in the hard vacuum of space. So, if these tardigrades ever get rehydrated under some kind of ideal conditions, they could even go on to live normal tardigrade lives.

Nick:

Go to tardigrade college, have tardigrade kids.

Matt:

Retire and play with the tardigrade grandkids.

Nick:

Buy a tardigrade ranch house in the suburbs.

Matt:

Or, maybe, a tardigrade RV and see the country.

Nick:

A tardigrade chicken in every pot.

Matt:

Yeah. It's a nice idyllic American dream of the tardigrade.

Emily:

So, why are we talking about tardigrades right now?

Matt:

Right. So, earlier this year in April, a private Israeli space mission to the moon crashed. The mission had planned to do some astrobiological research, so they were carrying, among other things, human DNA and tardigrades. Since that crash, there've been all sorts of questions about what may have been destroyed, lost, or even released.

Emily:

And, that crash was a real disappointment for the entire space community.

Nick:

There was history to be made. This was going to be the first private organization that had landed on the moon. This was a group that was formed specifically to pursue the Google Lunar XPRIZE.

Matt:

Which really had an incredible number of international companies that were competing.

Nick:

And, going after cash prizes for unprecedented aerospace achievement goes back a long way. That's how and why Charles Lindbergh crossed the Atlantic.

Matt:

Mm-hmm (affirmative).

Nick:

I mean, this is how aerospace history is made sometimes.

Emily:

When it didn't land successfully, everybody was really bummed out.

Nick:

Yeah. And, space is obviously still very competitive, but the global space community really wants to see everyone succeed when they try to do something new. This was a big emotional deal.

Emily:

And so, the question is now, what survived the crash?

Matt:

Yeah. Because, we've tried to be good in the past, especially with landing on things where we were trying to look for life. When we landed the Viking Lander on Mars, we... I say, "We," I wasn't there. But, NASA wiped it down with alcohol and other disinfectants. They baked all of the components at 400 degrees in an oven. They really went to great lengths to try to make sure nothing survived on that spacecraft, even though they knew there was no way that they could kill absolutely everything on it.

Nick:

So, the tardigrades were not intended to get out of their enclosure. But, when a spacecraft crashes, something may have happened to the enclosure. They may be on the surface of the moon now. Why is that bad? Why do we go to such lengths to keep earth bugs on earth?

Matt:

The main reason we do it is so that if we discover bugs on another planet, we know that we didn't put them there.

Emily:

This is a big issue that came up during the Mars 2020 site selection. There are a lot of places that we have landed stuff, or not landed on purpose stuff, on the surface of Mars. The things that land there over the decades, as Matt was talking about, we've started cooking and wiping and doing all the things we can do to clean these spacecraft. Our ability to do that has improved through time, which means those first few things we've put there aren't as clean as we would have liked them to be. So, sending Mars 2020, which is the super cool robot, that's going to rove all over the surface... They did a lot of different things during site selection. One, making sure to pick a location that we haven't gotten too close to and probably contaminated already. And two, picking a place that wasn't likely to be wet and goopy, in case we didn't clean the spacecraft as well, nowadays, as we would have wanted it to have been cleaned 50 years from now.

Nick:

So, that we have every possible confidence that if we find something, we've found something.

Matt:

Yeah.

Nick:

Instead of noticing that we brought it with us.

Matt:

It's saving Mars for future science, same way that... In this case, the challenge is that tardigrades on the moon may mean that that spot on the moon really can't be studied by scientists in the future.

Emily:

Well, and we've made a little bit of a mess. I mean, we talked about space junk a while back, in terms of what we've put into low earth orbit. Apollo astronauts, getting all that stuff on the surface of the moon, loading up their spaceships full of rocks to bring home, that weighs a bunch of stuff too. So, you leave a bunch of stuff on the surface of the moon. And, the missions got progressively longer. You're not going to pay to fly home your trash from all your weird squeezy tubes of food, right? I mean, you're not taking that home with you. You're taking home moon rocks.

Nick:

So, this isn't the first time that we've potentially contaminated places on other worlds.

Matt:

Not by a long shot.

Nick:
Not by a long shot, but the first time that we've done it with cute little moss piglets.

Matt:
Yes.

Emily:
Well, that we know of.

Nick:
That we know of.

Emily:
I mean, there could have been some tardigrade hitchhikers, right?

Matt:
Right. Yeah. Who knows?

Emily:
What camera is it that they brought home from the moon?

Matt:
We have the camera that was brought back by Apollo 12, that they-

Emily:
Has that been swabbed-

Matt:
... cut off from Surveyor 3-

Emily:
... for water bears?

Matt:
Well, not for water bears, that I know of, but they did check it for microbes.

Emily:
And?

Matt:
Well, there's a little bit of a complicated story there, because, at first-

Nick:

Ooh, good.

Matt:

... they thought that they had found some bacteria living on the camera, but then it wasn't clear later if that bacteria hadn't been introduced in the laboratory when the camera got brought back. So, just like sending something to the moon complicates the question of whether or not you can find life on the moon-

Emily:

Yeah, right.

Matt:

... when you bring something back to earth, you always have to question whether or not you contaminated it when it came back.

Emily:

Yeah. So, planetary protection is super important for our current and future interests in space science. And, it's a topic that has been addressed in something called the Outer Space Treaty.

Matt:

Right.

Nick:

That's the outer space treaty of 1967, which says, in part, that you don't own the moon or other celestial bodies and that you won't do certain things to exploit them, or that you will do certain things in order to protect them.

Emily:

And, this is critically important when it comes to ocean worlds, which are my favorite, like the icy moons that I study around Saturn or Jupiter. So, for example, the Cassini spacecraft that crashed, actually very recently, two years ago, into Saturn, did so, because it became really clear that there were moons around Saturn that were astrobiologically interesting. And, we needed to make sure that the Cassini spacecraft didn't contaminate those moons by accident, by crashing into those moons. So, we crashed it into Saturn instead.

Matt:

So, they crashed Cassini to preserve the research integrity of the moons for future missions.

Emily:

Right. In the case of the Israeli mission, they carried things like tardigrades on purpose. But, what NASA is more concerned with is what might be unintentionally hitchhiking on a spacecraft. I mean, there's a whole division within NASA that is thinking about the threshold for spacecraft cleanliness.

Matt:

Yes. Totally.

Emily:

And, NASA does a really good job of sharing these plans once they're put in place and implemented, so that other institutions can go ahead and utilize some of those protocols.

Matt:

Right.

Nick:

So, when it comes to the moon, there's one area surrounding this recent crash where we're probably not going to go searching for microbes anytime soon, because we know there might be some there, they came from earth.

Matt:

Yeah. And, there's plenty of other places on the moon to explore, so it's not like we've run out of places to look. I mean, there's a lot of moon. It's a big moon that we can go and explore.

Emily:

And, there's lots of other moons to explore too.

Nick:

So, we know that your heart lies in the outer solar system, in the icy moons around Saturn. If we find life on one of Saturn's moons and it turns out to be a tardigrade, are you crestfallen? Are you excited?

Emily:

Oh, it depends on which moon.

Nick:

Are you suspicious?

Emily:

Always suspicious, if it looks exactly like something we have here on earth. That's not impossible. There's a word for that called panspermia, where you actually transfer life between planetary bodies, usually through some kind of meteorite impact. So, it's not impossible to think that life from earth maybe got out to Saturn, although physically that's really hard to make happen.

Matt:

Usually it's easier to make things go the other direction.

Emily:

Yeah, exactly. However, extraordinary claims require extraordinary evidence. So, right now, our contamination of, let's say Enceladus, one of my near and dear... It would be really hard to envision

how, outside of panspermia, Enceladus would have been touched by a tardigrade. I would be suspicious, because any news story that's going to come out saying that we found life, you should be suspicious of. But, we're scientists, so we're naturally suspicious.

Matt:

I've got a great idea for a TV show, called touched by tardigrade.

Nick:

So, what you were saying, outside of natural panspermia... Because, panspermia is usually understood to be meteorites impacting with microbes.

Emily:

Sure.

Nick:

That's kind of what we just did to the moon.

Emily:

Exactly. So, yeah. I have to imagine that we can expand the definition of panspermia to include these robotic spacecraft.

Nick:

Spacecraft with Sweet'n Low packets full of cute, adorable microbes?

Emily:

I really hope it was Sweet'n Low, because then there's little pink packets all over the moon.

Matt:

Aw. That's it for this episode of AirSpace. AirSpace is produced by Katie Moyer, Jocelyn Frank and Michelle Harvin. Mixed by Tarek Fouda.

Emily:

Special thanks to Jason Orfanon, Genevieve Sponsler and John Barth. You can follow us on Instagram @airspacepodcast.

Nick:

This is the last episode of Season 2, so if you haven't already, go back and catch up on Season 1. Until we meet again.

Emily:

Dig through that archive, like a good geologist.

Matt:

There's some really great moments in there. Moments that make you laugh, cry.

Emily:
Cry, really?

Matt:
I cried, I think, during one episode, or I at least sang. I sang. Will my-

Nick:
We all cried. He sang, we cried.

Matt:
My singing will induce tears

Nick:
Hear Matt sing, while we all weep bitter tears.

Matt:
Bitter, bitter tears.

Emily:
Are they really bitter?

Matt:
Bitter sweet.

Speaker 4:
From PRX.