DAVA NEWMAN: We want to make Earth as habitable and livable, and since we're accelerating this change, we want to live in balance with Spaceship Earth.

SARAH HANSEN: In today's episode, we're taking another look at our planet from the outside in.

DAVA NEWMAN: Simply we're trying to design a healthy relationship between people, technology, and our Earth systems for sustainability of humanity and all the living things on the planet.

SARAH HANSEN: I'm your host, Sarah Hansen. Today on *Chalk Radio,* we're talking with Apollo Program Professor of Astronautics Dava Newman. Professor Newman is an expert in aerospace engineering, and she's used that knowledge to forge new perspectives on climate change. You can check out Professor Newman's course, 16.423J, Aerospace Biomedical and Life Support Engineering, on OCW as well as her climate-focused resources. In short, Professor Newman has worked on some very cool things, including better spacesuits for astronauts, ones designed for much longer journeys into space in the future.

DAVA NEWMAN: In research-- I specialize in astronaut performance and biomedical engineering as well. I spend a lot of time thinking about humanity becoming interplanetary literally when we'll have humans going back to the moon and Mars, and design of suits, and life support systems, and experiments to keep our astronauts healthy and well during long-duration flight, and about 50% of my research is now in climate.

And I kind of frame that as Earth systems. As an engineer myself looking at complex systems, well, there's no more complex system I submit than Earth systems, and that includes oceans to land to air, all the way to space.

SARAH HANSEN: Because of her background as an aerospace engineer, Professor Newman takes a unique approach to climate change. Many of her teachings draw on this approach and the lessons from her time at NASA.

DAVA NEWMAN: I served as NASA Deputy Administrator, so that's the number two during the Obama administration from 2015 to 2017. And most people think of NASA and think of human spaceflight. That's my research specialty and background, but really, it's all the aeronautics, breakthrough research as well, a huge amount of Earth science research related to climate. We have a hundred science missions flying at any one time, exploring the solar system and beyond, exoplanets.

NASA's always been my agency, but to be able to be a leader at NASA and also join the civil servants-- that was really quite an honor, and it's definitely changed my research. And what we're talking about, climate-- I came back to MIT as the Apollo professor and said, you know, what's the most important thing I can be working on every day? And my answer changed after my NASA experience. Now the answer is climate and Earth systems, secondarily, getting people to Mars.

SARAH HANSEN: Part of her work with Earth systems, or systems that span our globe and connect us as a planet, is helping people understand this more global perspective. Professor Newman has some powerful insights about organizing people around this kind of big-picture thinking. Her time at NASA coordinating international efforts informs her approach to climate action and research.

DAVA NEWMAN: As an aerospace engineer, we have a pretty specific, I think, special perspective. It's called the overview perspective. So anyone who is an aerospace engineer-- we're always looking at data from satellites and from space, first the human experience in space, when the astronaut is in low Earth orbit, looking down on Earth, Spaceship Earth as I call it. And so we're all on this Spaceship Earth together.

Guess what. We're all the crew. We're actually all astronauts because we're orbiting around our sun. And that's how I think we need to think about climate and accelerating positive change is a-- it's a global issue. It's an Earth-wide issue, and I think the overview effect-- you can really look at down on Earth, get into the data, but equally as important is the human spirit and thinking about collaboration. It's not a nation-state issue at all. We want to make Earth as habitable and livable, and since we're accelerating this change, we want to live in balance with the Spaceship Earth.

SARAH HANSEN: Recently, Professor Newman co-founded the non-profit organization called EarthDNA. It's a global platform for climate advocacy and action. EarthDNA works to inform and facilitate climate action by first sharing knowledge about our planet in a way that's available and accessible to everyone. The spirit of teaching openly and collaboratively is one that Professor Newman and her EarthDNA co-founder, Guillermo Trotti, care about deeply.

DAVA NEWMAN: We call EarthDNA our life project. It's open source, and we really envision a platform for climate advocacy and action. It starts with knowledge and education. I've been an educator my whole life, so it starts with the educational piece. Using a lot of artificial intelligence. I call it curating the data, petabytes of data, literally data from our satellites, so we have so much data. That gets overwhelming, even for me as an engineer and scientist but for sure for someone who's busy working, and they just want to know a little bit more about climate.

We have to-- I call it-- you curate that data, use our artificial intelligence, use these wonderful visualizations so people say, ah, I get it. I get temperature change. I get ocean change.

The hard piece, the second piece is changing human behavior. So the point about EarthDNA-- simply we're trying to design a healthy relationship between people, technology, and our Earth systems for sustainability of humanity and all the living things on the planet. We can't waste a second. We can't waste a day. It's so urgent in the next decade to do, I think, whatever all of we can through all of us to really move the bar, to really accelerate positive change for the Earth.

SARAH HANSEN: Part of what makes EarthDNA unique and uniquely accessible is its focus on meeting people where they are, literally.

DAVA NEWMAN: We can talk about the temperature, global temperature, and things like that, but I think we care about our own zip code. We care about our family and friends. So what I care about is what's happening in my backyard here. I have family in Montana and California on the West Coast. We have relatives in Argentina. So I have those five zip codes, and what I care about is, oh, what's happening here? Maybe what can I do in those places?

So the point being that we need to have global information. We need to zoom down to maybe regional, and then we need to care about local. And so maybe you love turtles. Maybe you love things out in the ocean. We're trying to be a network that can connect these things and give you news that might be relevant to you.

What's happening tomorrow, Saturday? Maybe I can go join some friends, and we can do a little bit of a beach cleanup, something like that, just something simple that I enjoy doing, but trying to connect people that are like-minded.

SARAH HANSEN: Professor Newman and her colleagues have developed another powerful strategy for helping people learn and engage around climate issues. They've separated Earth into four different sub-systems.

DAVA NEWMAN: There's no silver bullet for climate. It's really all these complex systems working together, so the oceans first and foremost because the oceans are our largest sub-system and then the land, where most people live, on land, and then from the land, air, and then space. I count space, again, back to my roots. I'm biased. I'm an aerospace engineer.

But that's really where so much of the information is coming from, near space, so our satellites, our eyes on Earth, the information that we can see from space is when we get that global, that holistic view. So that's why I put those four sub-systems there. We need work in all of them, but I think I find it helpful to talk about those four sub-systems because someone might have affinity-- oh, for me it's the oceans. Oh, no, for me it's the land. And that's kind of the fundamental part of the mission. It's to make the world of work for 100% of humanity.

SARAH HANSEN: An important part of climate science is making models that help us predict what's likely to happen in the future. This posed a particularly complex challenge for Professor Newman and the EarthDNA team. How to convey complex climate models that draw on tons of data points and variables to those of us who don't have a background in climate science?

DAVA NEWMAN: We have so much data from our satellites for Earth systems. Maybe just even take ocean data, if you will. Take a look at, well, what's the sea level temperature, what's the sea level rise, coverage of the whole Earth. And then, again, we want to zoom down into something regional. Let's say the North Atlantic. We can look from, say, New England, where we are at MIT, all the way, then, across the Atlantic, taking all that data, going deep into reducing it. And it can generate satellite images from the future.

Imagine I could put that in your hand. Perhaps if we immerse people in these future visions or-- boom, teleport yourself to anywhere you want in the world. And so it's the the storytelling, and the storyline, I think, hopefully also will engage people and get people involved. And hopefully people can ask questions and people can think about, OK, what can I do? And we can serve up a whole bunch of different opportunities, different actions that they could take.

Even though a lot of this is open source, it's really hard to access. It takes a lot of time. It can take an hour of digging, let's say, on a NASA website to find what you might be looking for. Well, wouldn't that be neat if you could just speak to me, and give me a couple of keywords, and say what you'd want, and then, boom, I'd serve it up now. We don't have that capability yet, but that's what we're working on. We want to make it that easy.

SARAH HANSEN: For this episode, we also had the chance to ask Professor Newman some of your questions that you submitted to us. One of the questions was this-- does the Earth have global climate cycles, and is climate change possibly just part of a normal cycle?

DAVA NEWMAN: Earth does have cycles. Earth is 4.5 billion years old, and so we've had weather and climate through those billions and billions of years. So there are cycles, but no, we are not in a normal cycle by any stretch of the imagination. This is an incredibly accelerated response since the Industrial Revolution.

We actually can calculate the percentage of climate that is human-caused human-induced. There's some tools out there, some simulations. You can imagine. Well, what if I use this much energy? What if we emit this much carbon dioxide? Oh, what if we cut down by 50%?

And what we're striving for is, where's that balance? Where's that balance for people having healthy, wonderful, again, economically successful lives but just always trying to keep that in mind, our effects on climate, and how we can change things, and how we can do much better.

SARAH HANSEN: Another one of your questions was this-- how is climate change transforming people's lives and societies at a broad level?

DAVA NEWMAN: Climate change impacts every single one of us, and it's going to get more acute. And it's going to get more intense. Globally, we definitely see it, immigration and people moving. And people don't ever want to leave their house. You want to stay with your family and friends, but if you're forced to, especially by natural disaster, but especially by war-- but I think that we really need to show people the connections between climate and health. So again, that's really important today.

Let's link. We have the climate data. We have health data, but let's link them because they're very, very linked. We can talk about asthma. We can talk about people's changing health issues, and we can look at that and say, there's a climate link there. And that's, I think, an important discussion to have.

SARAH HANSEN: Another question you submitted was, what are one or two of the biggest challenges that governments and concerned citizens of Spaceship Earth should try to solve in order to prevent or mitigate climate change?

DAVA NEWMAN: I love that question, and my answer is really just a discussion with that person. What do you want to do? Because I think it's important that people go with their passion. There's so much to do. There's something that everyone can do, so I'd like to ask it back answer, not to not answer question, but just to know a little bit more about that person and say, what do you like? What's really your passion?

And then if I know that, again, it could be something for the oceans. Maybe it's something for animals, or land, or something like that. Maybe it's pollution and plastics. So good, we love a challenge. Well, what's the plastic in the future? What's a synthetic biological-- what's the biological new material-- not plastic, but new material-- in the future that acts like plastic?

We probably couldn't live without plastic, but let's reinvent it. Let's reinvent it so that is completely sustainable. And there's research going on that right now, but hopefully that's just an example for someone for that question, seeing what they like to do and what they'd like to get involved in.

SARAH HANSEN: And our last question from listeners-- how long do we have before it's too late to do something about climate change?

DAVA NEWMAN: I'd like to rephrase that a little bit and say, now is the time to act. No more excuses, no more pushing this off onto the other generation. Everyone can do something today, and these are little things. These really are not inconvenient things. These are things that I think everyone actually would feel good about, so the time to act is now.

SARAH HANSEN: Thanks for joining us for another episode of *Chalk Radio.* We hope you're feeling inspired and motivated to start taking some steps to mitigate climate change based on your own passions and interests. Don't forget to check out Professor Newman's courses and her EarthDNA resources on our website. You can also visit earthdna.org. Signing off from Spaceship Earth, I'm Sarah Hansen from MIT OpenCourseWare.

Hey, before we go, did that OCW has a birthday coming up? We're turning 20 in April. For two decades we've worked to share MIT course materials with the world. Your support helps us to do so freely and openly and helps make resources like this podcast possible. If you're able to give, please consider donating to OCW at ocw.mit.edu so we can stay open for the next 20 years. Thank you.

AUDIO BUMPER Ma, park the car.