

**Sue Nelson**

Hello, I'm Sue Nelson and welcome to the Create the Future podcast, brought to you by the Queen Elizabeth Prize for Engineering. Celebrating engineering visionaries and inspiring creative minds.

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A degree in engineering can lead to any number of careers and specialisms, or, in Emily Calandrelli's case, two degrees in mechanical engineering and aerospace engineering from MIT, as well as two masters in aeronautics and astronautics engineering, and technology and policy. This background, as well as numerous academic awards has led to her inspiring others into STEM through media and communication. She does this by, among other things, writing children's books, and as a TV host, including the Emmy nominated series Emily's WonderLab for Netflix and Xploration Outer Space, which has been running since 2014. And is syndicated by Fox across the United States. Before we get into the TV presenting and books, Emily, what was it that inspired you to study engineering?

**Emily Calandrelli**

My introduction to engineering was very practical. I have a lot of peers who have beautiful stories of you know, looking up at the night sky when they were kids or having a family member that was a scientist or an engineer. But for me, I was a high school senior. And I wanted to get a good job that made good money. And so, I looked up all of the majors that one could major in, in college, and I looked up their starting salaries. And on the top of those charts was engineering. And so, I kind of reluctantly joined this field thinking, "Oh, it's going to be so hard, it's going to be really boring. But I'm going to end up with a good job in the end and make my family proud". And then once I got there, once I got into university and started studying engineering, I learned a few things, I learned that I was good at it. And I learned that there are so many adventures that one could have, if they studied engineering and science. I was able to travel the world through science and research internships, I was able to live in California and I worked at NASA centres, I was able to do research on board NASA's Vomit Comet and fly weightless like an astronaut, I was able to travel to Mexico through Engineers Without Borders and help solve problems there using the engineering that we learned in the classroom. And so, my story is sort of one of reluctantly joining it, and then enthusiastically becoming obsessed with it along the way.

**Sue Nelson**

That's really interesting, because it's quite a practical approach, which a number of people do! They consider other careers specifically for that reason, it's just that you don't often hear the sort of attractive salary prospects being mentioned as a reason to go into engineering.

**Emily Calandrelli**

Right? I mean, because it does have a lot of the appeal of, you know, working on exciting things. I just wasn't introduced to any of that, as a kid. I didn't know any scientists or engineers, I'm the first person in my family to pursue a degree in STEM. And so for me, that draw that appeal of working on exciting things, wasn't there, because I didn't know of it. And for me, the drop engineering was the salary, which, you know, it's a very good and valid reason to go into it. And it's one of the reasons that I try to promote, especially when I go into areas like my home state of West Virginia, where, you know, there aren't a ton of job opportunities there. And sometimes there are people there who don't really know what to do, and they want to better their family situation. And they're not really sure how to do that. And I try to promote the fact that if you study engineering, that is a sure-fire way to make sure that you're going to have a really good job at the end of it.

**Sue Nelson**

Absolutely. I mean, you've touched on some of the things like the travel and the fact that you enjoyed the subject in itself. What was it about MIT, as well as a sort of place to study, I mean, I have been there and I know it's rather beautiful. Did that sort of add to it or was it just being engrossed in the subject itself?

**Emily Calandrelli**

So, I went to West Virginia University for undergrad and I did very well there in engineering and for me, I just thought, "Okay, well, I learned how to do really well, at the school in my home state. How can I take this further?" And so, I took kind of a shot in the dark and thought "alright, I will apply to the best engineering university in the world and see what happens". And I got accepted. And so it was just it was an opportunity to see what it would be like to go to the best university in the world for engineering. And it was wonderful. I mean, the professor's there are truly miraculous. They are often astronauts They are the top in their field, you're learning from the best. And it's a very wonderful place to be obviously, because it's you're learning from the best, but it's also a very intimidating place to be, because everybody around you is the best of the best. And it certainly makes you, you know, be very introspective and think about your own qualities and whether or not you deserve to be there. And, and I think that it challenges you to the point that, you know, you've never been challenged in such a way before. And for me, that was a really important experience for my growth. And I'm very lucky and thankful that I had the opportunity to go there.

**Sue Nelson**

How many women were on your course?

**Emily Calandrelli**

Actually, at MIT I don't remember women being necessarily a minority in the programme, I'm sure that we didn't make up half of the programme. But we made up a much higher percentage than when I was at where I was at an undergrad, the vast majority of classes in undergrad, I would be one of maybe two or three women and a 50 person class. At MIT I think because you just have so many people applying there, it is much easier to attract the top women in the world to that programme.

**Sue Nelson**

Is that what inspired you, particularly into championing girls and women into science and STEM subjects?

**Emily Calandrelli**

Yeah, definitely, my experience in undergrad definitely inspired me to try to inspire more girls to pursue it. Because I think when you are walking into a room where the vast majority of people do not look like you, you assume that you have walked into the wrong room. And while there are fewer women in engineering classes, there are also fewer girls in robotics classes, there are fewer girls on science teams. And so you need to start at a much earlier age to try to show that representation. Because it's not that women and girls aren't inspired to go into science, there's just so many barriers along the way, starting at a very young age that prevent them from either seeing themselves in those careers. Or once they're there. Once they do decide to join that robotic class, once they do decide to study engineering, once they're there, there's often a lot of challenges that they experience that make them decide to leave at that point. So there are a lot of things to address to help solve that problem, one of which is representation. At a very young age, there's not a lot of girls and women that they can read about in books or watch in movies that are in STEM careers. And so that's part of the work that I want to do that I've been doing through my TV shows, through my books to provide that extra representation for girls in STEM.

**Sue Nelson**

Do you think it's also a class issue as well, because you mentioned you're the first in your family to, you know, study a STEM subject. You can go either way and I say this as someone who was also the first family to go to university, it can either make you feel like you say as like an outsider. Or it can also give you a bit of a chip on your shoulder. And you can actually just think, "Well, I'm here. So, deal with it".

**Emily Calandrelli**

Yeah. I mean, absolutely, because a lot of these programmes, they are much less intimidating if your family had the time and the resources to help teach you coding when you were younger, to send you to those science camps when you were younger, to introduce you to some of these concepts before you get into high school to join the robotics team before you get into college to decide to go into engineering. So absolutely. It's a resource issue. It's a class issue as well, because not everybody has the money to be able to do those sorts of things.

**Sue Nelson**

It was great to hear you say that, you know, you got an internship at NASA?

**Emily Calandrelli**

Yeah, I mean, that was a key part of why I was so successful and undergrad. And the key to being able to get into a place like MIT is that I did internships every single summer I worked. At NASA twice, I worked at a congressman's office in DC who worked on the NASA budget. I lived in China doing a research internship with the National Science Foundation. I worked at Disney learning how to be an Imagineer, like these experiences, were key to figuring out, A, what I wanted to do with my life, and also showcasing that you had the ability to work in this field. The other thing I wanted to say about, you know, not having maybe we could call them a role model and engineering growing up is that yes, it was really intimidating. Because I didn't have a path laid out for me to follow. I didn't know exactly what I needed to do to be successful in this field. But because I didn't have a path for success, I also didn't have like a roadmap for failure either. So I had the ability to be fearless in that way I could try new things, I could try a bunch of challenging things. Because if I failed, who cares? I didn't know anybody who had tried it before. So I didn't know whether or not it was easy to get these things are hard to get these things I was bold enough to apply to MIT because I didn't know anybody who had applied to MIT and gotten in. I didn't have that expectation set for me. And so there are obviously a lot of shortcomings when you don't have family or somebody to look up to in these fields. But there is a silver lining. And that's the ability to be fearless.

**Sue Nelson**

People only remember your successes as well. I've failed at so many things for exactly that reason. Because I had parents who said somebody's got to do it. They might as well you.

**Emily Calandrelli**

Yes, exactly.

**Sue Nelson**

Just give it a go. And if they say no. So what?

**Emily Calandrelli**

Yes, there are so many instances in my life now that I've been in sometimes the other position where I'm offering opportunities and asking students to apply to them. I have seen it the other way where, you know, it seems so intimidating. Nobody thinks that it could be them that would get selected. And then because of that you only have a handful of people who apply. And so you almost guarantee that the person who is applying is the person who is going to get that thing because they were bold enough to apply in the first place. And so you don't you don't want to count yourself out before anybody else can because you're just you're shooting yourself in the foot.

**Sue Nelson**

Now, you mentioned NASA, what did you actually do on that internship?

**Emily Calandrelli**

My first internship was at NASA Glenn, near Cleveland, Ohio. And on that internship, I worked on a specific type of spray propulsion engine for rockets and just kind of looked to see how the spray profile affected the performance of the engine. And then in my second one, I worked at NASA Ames in California, in Mountain View, California. And for that one, I worked on a team project with some other students, where, at the time, the Phoenix lander was on Mars. And the Phoenix lander had the scooping mechanism and the sifting mechanism where it would use it scoop to scoop out Martian soil and put it in the sift and the sift would vibrate. And it would use some chemistry to understand what was in the soil. And primarily, they were really interested to see whether or not there was liquid water on Mars. And the SIFT they were using seemed clogged. And so there was this hypothesis that the Martian soil was muddy because of liquid water in the soil, which would be a really big deal. And so, one of the ways that we tried as students to figure out if that hypothesis could be valid could be true, was we recreated that sift and soil experiment here on Earth, and put it under different temperature conditions, vacuum conditions, salts, conditions, water conditions, and tried to recreate what was happening on Mars. And based on our experiments, we at least provided additional evidence to show that it was possible that in those conditions, the temperature, the pressure, the salt conditions on Mars using Martian simulant that we had here on Earth, and a little bit of liquid water, we showed that it could very well be possible that that soil was muddy. And that was the reason why it was getting clogged.

**Sue Nelson**

It's really interesting. When did you do your first film that explains some of the science and engineering that you had been working on?

**Emily Calandrelli**

Yeah, well it's funny, when I was an undergrad and even some in grad school, I love doing outreach meaning I loved going to schools in the area and talking about the engineering that I was doing in the classroom. A lot of the projects that I worked on, especially if they were NASA related projects funded by NASA, you had to as requirement, do an outreach portion where you went into a local school and talked about the science and the engineering that you were doing with NASA as a way to give back to the community. And that part of the project is something that I always volunteered to be in charge of, because I've always loved talking to young students and kids about science and engineering, I find it to be a really unique challenge to be able to explain things in a way that somebody without the proper background could understand. And so I've always loved doing that. And I've practised that for a really long time. And then when I graduated from MIT, they had seen some of the press that my undergrad did about me because I was one of the only students to major in a couple of different engineering majors and get a 4.0 and win these national scholarships. And so they had done a lot of press on me and a lot of video interviews with me. And so when I was graduating from MIT, I got a call from a production company that had come across some of these articles. And they asked me, Do you want to be the host of our next space show? And that sounded like such an adventure and such a similar skillset as to my outreach days of going back into schools and talking about science and engineering that I without hesitation, I was like, "Yes, that sounds so much fun". And I thought I'd never done anything like that before. I'd never hosted a television programme. I had no idea what I was doing. And but I thought, you know, if this doesn't work out, if this doesn't pan out, I have four degrees in science and policy to fall back on, I think that I'll probably be okay. And that show was now nine years ago, it's been on for almost a decade. That was Xploration Outer Space.

**Sue Nelson**

Like you say, it's a sort of an offer, you can't refuse. A brilliant opportunity. What would you say is one of the most challenging concepts to explain and how did you get around it?

**Emily Calandrelli**

Anything with astrophysics, because as an engineer, I like hands-on things, I like things that I can see and test and stuff that you can get your hands on the astrophysics, stuff that is just mind bogglingly large at scale. That is the stuff that I have a hard time wrapping my mind around. And when I get to those kinds of topics, I usually spend a lot of time on YouTube, watching other people explain it in different ways. And I usually have to find, like five different videos of people explaining it in five different ways for me to be like, "Okay, now I finally have a handle on why this is interesting. Why this is unique, what the context of this is", because if I don't, oh my gosh, that's the kind of stuff that blows my mind. It's hard for me to wrap my mind around.

**Sue Nelson**

People don't realise actually, particularly, you know, when you, your audience is children. They don't realise the amount of work. It's a bit like their proverbial, you know, swan gliding on the top, but actually, the feet are going crazy, is actually how much work you need to do. Probably more work than if you were talking to a roomful of Harvard students or MIT students.

**Emily Calandrelli**

It's definitely a different skill set for sure. Because you have to find analogies, and you have to really employ storytelling. And you have to figure out, "what do I expect my audience to know? And how can I explain this in a way that not only explains what's happening, but explains why it's important", because if somebody is just listening to a TV programme, they want to know why they should care. And so you have to go a bit farther than just explaining the science and the technology, you have to explain why they should care about it, and why it's so unique.

**Sue Nelson**

How did Emily's WonderLab come about then?

**Emily Calandrelli**

Oh, my gosh, yeah. So after I'd been doing Xploration Outer Space, for four or five years, maybe I had met a producer who worked at a company called Bunim/Murray, which is a very famous production company here in the United States. And we created this science idea together this children's science show idea, and we had been pitching it to a few different networks. And we got to the pilot stage with another children's network, a major children's network, but after filming it, they had told us that they thought it was too "sciency" for their audience, which was really disappointing to hear, because I'd already whittled down a lot of the science and it got to the point where it wasn't really a science show. It was just like a craft show where we made big explosions, and I wasn't really excited about it anymore. But then a few years later, somebody at Netflix had heard that we had made this pilot had heard that we had a science show in the works, and they wanted us to pitch it there. And so we went to Netflix and we pitched the show and they loved it. They actually learned that I was pretty pregnant at the time. And, and they called and said that not only did they want my show, but that they were totally fine with me filming it while I was nine months pregnant.

**Sue Nelson**

Which sounds sort of shocking. And it shouldn't be shocking, because I didn't see such a normal thing for 50% of the population. And yet I do you see very few women pregnant on TV unless they are being interviewed.

**Emily Calandrelli**

Exactly. Yeah, I think growing up for me, when I saw pregnant women on TV, it was mostly about them being pregnant, and them preparing the nursery and talking about labour. And it was like, I had this idea in my mind that once you're pregnant, all you do is sing to your belly and paint a nursery. And that's all, you sit and wait for the baby to come. But for the reality for so many people who get pregnant, they continue to work, they work, oftentimes, up until the baby comes, which, you know, we could argue whether or not they should have to do that, but a lot of us do anyways. And so it was really nice to be able to provide that representation for little kids who are watching, I had a lot of families say that they especially their little girls would watch and be like, "she's a mommy and a scientist". Because when you're really little, a lot of times, you know, the role model that you see in your life or your parents, and the first job that you think about having is being a parent and having a baby. And so for a lot of these little kids, the thing that they want to be so badly right now when they're like five years old, and they want to be a mommy. So now this representation, they can watch this and be like, "Oh, I can do both?". And I think that simple idea can be just so transformative.

#### **Sue Nelson**

Now, you know, you as you said you were nine months pregnant, so you gave birth to your first child, just a few weeks after you finished filming effectively. So during the pandemic, you had a young baby. And I saw and rather loved that you did an awful lot of films from your look like your living room? Was that sort of deliberate decision to stop yourself going totally mad? Or did you just know, it's something I love doing it. I'm just gonna keep on?

#### **Emily Calandrelli**

Oh, that was exactly, I mean, part of both of those things, I think, during the pandemic, a lot of my work involves travel, I would travel to film, I would travel to do speeches. And so because of the pandemic, a lot of my work was cancelled. And so I was stuck at home without much to do. And I thought, well, what am I going to do with my time, and I figured I had all of these science ideas for Emily's Wonder Lab, we had figured out just hundreds of science experiments that we kind of narrowed down to the ones that were ultimately in the show. And I thought "well, let me just do some of the other ones". And I often did them with my daughter who was like six months, seven months old at the time. And I just created this library of science experiments on YouTube and now on TikTok that just launched this new part of my career of being you know, a science person on TikTok, which has been really fun. But yeah, the pandemic kind of launched this new aspect of my career for me.

#### **Sue Nelson**

TikTok, I mean, that's something that it feels a generational social media form because it's primarily used by much younger people. Do you have a different style than what you would do on TikTok, which is much shorter as well?

#### **Emily Calandrelli**

Yes, exactly. Everything on TikTok that I do is very fast paced. I love having high energy content. And I think TikTok really allowed me to tap into that part of myself. So the TikTok version of Emily is a little bit different than the YouTube or Instagram version of Emily. And it is much higher energy. And for me, it's just so much fun. I love that style of storytelling, that style of communication. And I mean, I have been building up my followers on there for the last couple years and working my way to almost a million at this point, which is just hard for me to wrap my mind around that number of people following the things that I say. But it all started with science experiments.

#### **Sue Nelson**

It does show your versatility though, because you also did a TED Talk. So your audience range is, is pretty wide. And you also went into you know, another audience avenue and area with your Ada Lace Adventure series,

which is a has an eight-year-old heroine who is an inventor and she loves science and maths, solving mysteries. Now, I know she was named after the English mathematician Ada Lovelace. But she sounds like a younger version of you. What qualities does she share with you and what qualities doesn't she share with you?

**Emily Calandrelli**

Yeah, oh, I love this. So the Ada Lace Adventures. There's currently five books in the series. I'm working on the sixth one right now, we're actually we got picked up for another book. And so we're working on that right now. And Ada is just she's the girl that I wish that I was when I was a kid. Because, like I said, I didn't really have any role models who were in science or engineering. I just wasn't introduced any of that stuff at a young age. But she is and she is not afraid to fail. Growing up, I think I was, especially when I was younger. I wanted to be perfect at everything. And because of that, I didn't want to try things that were hard for fear of failing. And if I failed, what would that tell me about myself, what would that mean? And I've tried to work to get over that as I got older. But Ada doesn't have that fear. Ada is willing to try things where she will fail. She is willing to try new things. She works together with friends to solve problems that are really hard. And it's just this wonderful girl who loves science and technology. And she uses those skills to work with her friends to solve problems around her. So yeah, it's kind of a girl that I wish that I was when I was little.

**Sue Nelson**

I believe the third book in the series has quite an honour.

**Emily Calandrelli**

Yes. Oh my gosh, though, the third book in the series was selected to go to space, it was launched to the International Space Station with the Storytime from Space Programme. And it was the very first chapter book read in full on the International Space Station through this programme. I mean, I went to the launch, I was able to watch something that I wrote, be put on a rocket and launch to space and be read aloud by an astronaut floating in orbit around our planet. I mean, that was, it was such a cool milestone moment for me.

**Sue Nelson**

And you had a book that was released earlier this year in April, called Reach for the Stars. And that's a picture book.

**Emily Calandrelli**

That's right.

**Sue Nelson**

What kind of impact is a picture book have on young children when it shows different subjects and STEM subjects?

**Emily Calandrelli**

So that book reach for the stars, I wrote it right after my daughter was born as a way to just put towards everything that I was feeling. And what I was feeling was I wanted to envision all of the things that she would reach for at different stages of her life and all of the things that I wanted to teach her at every stage of her life. And so the book follows this baby, this little girl from new-born phase all the way to the phase where they're a grown up and they leave home to you know, travel the world go to college, they leave the nest, and every stage in between.

**Sue Nelson**

What about the Ada Lace series, has anyone got in touch with you to say that “I'm now considering a career as an inventor or an engineer or scientist”?

**Emily Calandrelli**

Oh, all the time. I mean, when I have book signings for the Ada series, I'll have kids come up to me dressed as Ada Lace, and they'll have these NASA shirts on and they'll just be, they're so excited to show me that they read the book and they love science, they want to be just like Ada Lace. And I feel like this is just this is the power of representation, being able to read about even just reading about a fake character who looks like you, who's a girl who loves science and engineering. It just makes that field feel more relatable and feel more exciting, perhaps to pursue.

**Sue Nelson**

Now you've had tremendous success with your media, career, and it's ongoing. The one thing that seems to be in the background in terms of your qualifications is the policy side. Do you miss that, or have you got plans?

**Emily Calandrelli**

Yeah, I mean, it's funny because now, the original plan was I was going to go to DC and work, maybe at a place called like the Office of Science and Technology Policy and use my science and technical skills to influence Science and Technology Policy. But now with my TV show, and my social media platform and my ability to story tell things related to science and technology to a general audience, I've gained this platform of you know, 1.6 million followers or so. And now I can use that platform to speak on policy issues that I care about. So it's been a full circle moment. I recently talked about this bad experience I had with TSA and breast milk. TSA stands for the Transportation Security Administration. And they are the agency that when you get to the airport, they're the security there that make you take your shoes off and take your liquids out of your bag and all of that. And on the TSA website, it says very specifically that you are allowed to take as much breast milk through security as you like as you need for your child, you can take cooling equipment to keep it cool. And then they confiscated my cooler packs, they made me check them, which meant that I wasn't able to pump before my flight and keep the milk cool. And so anyways, I tweeted about this experience, I shared it on social media. And I just had this groundswell of support from my followers and other parents who have experienced similar issues. And it was so much attention because of the platform that I have, that the administrator of the TSA himself had to respond in a very public way to my specific situation. And now I am working with multiple Congress members to draft a bill that will hopefully be passed that will help alleviate this problem for people in the future. In addition to the TSA experience, I have been very vocal about reproductive rights as of late because Roe v. Wade got overturned here in the States. And so now I'm using my platform to talk about why reproductive rights are so important for those of us with uteruses, and push for policies and promote candidates that will hopefully help protect those for people in different states.

**Sue Nelson**

Would you like to go into politics at some stage?

**Emily Calandrelli**

It's always a question. It's a maybe, I always said that. If I want if I were, I would want to go back to my home state of West Virginia, because that's where my people are. I grew up there. And I, I feel like I would want to go back there. But I don't have any plans to move back. Right now. But it's always a, it's an open question at the moment.

**Sue Nelson**

And going back to the engineering, I wondered if there's anything within engineering that, because the Queen Elizabeth Prize, you know, gives its award to all sorts of amazing inventions and research, is there anything that you've come across in engineering that you think more people should know about simply because it's so cool?

**Emily Calandrelli**

Oh man, I mean, something that I am finding very fascinating is, is space travel, travelling through space and figuring out a way to do that faster and more effectively. Because with the release of the James Webb Space Telescope images, we have seen just how vast our universe truly is. But the limitation there is that while we can see it, it's so far away that we can't travel to it, at least not with the technology that exists today. And there are some technologies in space that will allow us to go even faster to travel faster than we have before. There are technologies like light sail that is using the pressure from light, like literally just shining a light on a piece of fabric that allows the spacecraft to propel itself forward. I find that technology to be absolutely fascinating.

**Sue Nelson**

And finally, younger children have got a hero in Ada Lace, who would you say your engineering and scientific heroes are?

**Emily Calandrelli**

Oh, wow. I mean, for me, I really value, the ability to combine scientific knowledge with other creative skills. And so anybody who can combine storytelling skills with science is somebody, that's the type of skill set that I truly admire. So people like Carl Sagan and Bill Nye, I think they are just so good. They're just masters of their craft to be able to combine storytelling and even comedy, with their knowledge of science in a way that makes things that may not on the surface seem very appealing and interesting, just seem absolutely breath-taking and interesting. And so those are those are definitely like my top role models for sure.

**Sue Nelson**

And I have great choices there. Carl Sagan no longer with us, of course, but Bill Nye is a former guest on this podcast. So, if anybody wants to hear an interview with him as well just look it up on your usual podcast platform. But in the meantime, Emily Calandrelli thank you so much for joining me on the Create the Future podcast and revealing the breadth of careers that you can go into and especially how successful you can take engineering degrees on to when it comes to the media.

**Emily Calandrelli**

Well, thank you so much for having me.

**Sue Nelson**

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