EPISODE 758

[INTRODUCTION]

[00:00:00] JM: Mars is a cold, inhospitable planet far from Earth. It represents one of the most complex challenges faced by engineers. How can we create a new world? To create a new world, first we have to get there. We can build new rockets with improved propulsion systems. We can build ships that allow us to survive the long grueling trip from Earth to Mars. We can build robots that will help us construct our new home, and this is just the beginning. Mars could be warmed and it could develop a hydrologic cycle like the ones with systems of clouds and oceans on earth. Mars could be a place for new ideas and new cultures, unfettered by the conventions of Earth.

Mike Solana is the host of Anatomy of Next, a podcast about technologies and philosophies of the future. He's also a vice president at Founders Fund, a venture capital firm that makes ambitious investments in companies that are building the future. In a previous episode, Mike joined the show to talk about artificial intelligence, genetics, and robotics. Today, we discuss Mars.

The latest season of Anatomy of Next explores the science that is bringing us closer to exploring other planets. On his podcast, Mike speaks with engineers, researchers and entrepreneurs about the state-of-the-art of space technology as well as the challenges that remained unsolved. Mike returns to the show to discuss this dream of a new world. Why should we go to Mars and why should the software engineers listen to this podcast even care about Mars? Why is this relevant?

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can always send me an email, jeff@softwareengineeringdaily.com, or send me feedback on anything else.

Let's get on with the episode.

[SPONSOR MESSAGE]

[00:02:48] JM: DigitalOcean is a reliable, easy to use cloud provider. I've used DigitalOcean for years whenever I want to get an application off the ground quickly, and I've always loved the focus on user experience, the great documentation and the simple user interface. More and more people are finding out about DigitalOcean and realizing that DigitalOcean is perfect for their application workloads.

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The prices on standard instances have gone down too. You can check out all their new deals by going to do.co/sedaily, and as a bonus to our listeners, you will get $100 in credit to use over 60 days. That's a lot of money to experiment with. You can make a hundred dollars go pretty far on DigitalOcean. You can use the credit for hosting, or infrastructure, and that includes load balancers, object storage. DigitalOcean Spaces is a great new product that provides object storage, of course, computation.

Get your free $100 credit at do.co/sedaily, and thanks to DigitalOcean for being a sponsor. The cofounder of DigitalOcean, Moisey Uretsky, was one of the first people I interviewed, and his interview was really inspirational for me. So I've always thought of DigitalOcean as a pretty inspirational company. So thank you, DigitalOcean.

[INTERVIEW]

[00:04:55] JM: Mike Solana, you are a VP of Founders Fund. Welcome back to Software Engineering Daily .

[00:04:59] MS: Thanks, man! It's great to be back.

[00:05:00] JM: Yes. So your latest season of Anatomy of Next is about how to reach Mars and how to turn Mars into a hospitable planet. Why is this an important topic?

[00:05:13] MS: All right, huge question. So this is actually a question I've asked a lot of the guests on the show. It's something that to a lot of people seems self-evident, like we just have to go to Mars, but it's not often that you sit down and really drill into that question. It's a question that I tried to answer in the first couple episodes of the show.

I think what it comes down to is basically this; human beings to the best of our knowledge are the only species capable of thinking and moving throughout the universe. Unless you think that the universe is just teeming with intelligent alien life, which is another question that we tried to tackle at the top of this season. I am not convinced. I don't think there's any evidence for that, and if that's the case, if we're the only intelligent life form in the universe, then that means that we are the only things capable of preserving life.

So far as you think that life is important, humans are the most important things in the universe, and expanding into the universe is a way to ensure both our survival and the survival of this, I think, phenomenal thing that is life. Life to me is important for a handful of reasons. It's weird, I get pushback sometimes from people about this, which is insane. I mean, there are people who genuinely are like, "Why is life important? Why does any of this matter?" and then it's like, "Why I think that life is anti-entropic?" which means that it's the only thing that actually it applies order to the world. Everything else naturally disorders. Life organizes the natural world.

So looking forward, this is a topic that we really kind of work up towards in the last episode of this season. I talked to an astrophysicist about just the shape of reality and the future of the universe itself. The universe is expanding into nothingness, and so my big – I think the high-level thought here is that if you care about existence, you should care about life. I think life is the antidote to entropy, and I think preserving the universe –

[00:07:10] JM: I think extropy is actually a word.

[00:07:13] MS: What is it?

[00:07:14] JM: The opposite of entropy.

[00:07:16] MS: Right. I didn't know that.

[00:07:17] JM: Yeah.

[00:07:19] MS: Yeah, that makes sense, then maybe that's that. I believe in extropy, and I think that the human is the single thing we know of that can actually preserve life, preserve the universe, and then also it's just I think maybe people don't need all of that background. I think for a lot of people, it really just comes down to this spirit of adventure and you look up into the stars at night and you imagine yourself on different worlds, and that is just something that is baked into many, many, many, many of us.

[00:07:53] JM: Totally.

[00:07:54] MS: In fact, when I started working on Anatomy of Next, the first season was all about the way that we talk about the future, and we tackled all of these different technologies that people are terrified of, things like nuclear power, and genetic engineering, robots. What I found was there was a horror story for every one of these technologies that people were obsessed with and was really hard to challenge that way of thinking in people.

The one exception to that throughout my investigation in the first season was space. When it came to space and space exploration, colonization, Mars, the average person just naturally want it to go and I think that's a reason enough to follow that calling. But yeah, then if you want to break it down philosophically, you have to take it to a weird sort of abstract philosophical place, and that comes down to life, and I do think that – I do think it's important in that dimension.

[00:08:51] JM: Definitely. I want to revisit the broader philosophical subject. But before we get to the broader philosophy, let's talk about specifically for engineers. So a lot of engineers are listening to this show, mostly software engineers, and they might be thinking, "Okay, Mars. That's kind of cool. But why should I care? I'm a software engineer. Maybe I'm working at a tech company. Maybe it's a big tech company. Maybe it's a startup. Maybe it's a big legacy insurance company, and I'm just a software engineer. Why should I care anything about Mars?"

[00:09:27] MS: Well, I think that it depends on just really what you want to be working on every day. Not everybody in the world has to – Feels this sense that they have to be working on something that their work has to be incredibly meaningful in some way. My dad never felt that way. For example, my dad likes to go fishing. He was a teacher. He was in construction, then he was a teacher and kind of went back and forth between the two throughout his life, and he worked to make money to live, and that's I think perfectly fine, and there are many engineers who want to do that. If that's the case, we have plenty of companies that in our portfolio even, I think it's all over here in Silicon Valley, San Francisco. It's like there are companies everywhere that are good companies with hard problems that are least not boring to you to work on and you're going to make a good salary, and that's fine.

If you want to – If you're this other kind of person, which is more like my mom, who the actual work that she's doing is incredibly key to her sense of fulfillment. Like she needs to know that what she's working on matters in some other dimension in like her own – She's making money. Cool, whatever. Then you have to start looking – As an engineer, you have to start looking at problems that are important for the world, and Mars is important to the world for many reasons. The first is the sort of – I laid the sort of philosophical groundwork down, but I mean let's just take a step back and talk about technology.

Mars is a series of incredibly challenging engineering problems. Not even science. Most of the science is there. There are some stuff that would be great if we discovered along the way, but like we kind of know what – We know what to expect on Mars. We know roughly what sort of challenges we'll be facing. There are some that we can't know until were on the ground, but it's always what – What has to be done is we have the build things that solve these problems now.

The cool thing about that is like everything that you develop on Mars has this tremendous benefit back home. We're talking about one of the big things that I talk about, I've already talked about the first half of the second season, is terraforming. The idea of turning an alien world into a more hospitable planet, a more earth-like or terra-like planet. That means building atmospheres, building oceans, growing crops on Mars, genetically engineering the crops to do certain things they don't do here to survive in an environment they couldn't naturally survive on, and all of those things. Everything in terraforming Mars actually has an immediate impact on earth if we have not even just the technology to do these things, but I guess the experience with them.

So in the context of the atmosphere, right? I mean, everything in a subject of altering the content of your atmosphere to have a different effect on the planet's temperature is directly applicable to global warming on earth. In a way, we're actually doing the opposite. On Mars, we want to warm it up. But along the way, we're going to be releasing chemicals into the atmosphere, basically experimenting on this planet to reshape it in a more earth-like way.

I think that a better understanding there directly impacts all 7 billion of us on earth. If we have a technology in one place, we can start geo-engineering terraforming earth. People talk all the time about Bernie Sanders was just tweeting about how global warming is akin to like a world war or something, right? Maybe you believe that. Maybe he believes that. That's great. If you believe that – I mean, someone else said that global warming is big of a threat as Nazi Germany, and I think that seems – That's a very bold statement. I think it's probably a big problem. If you believe that it's that big of a problem, then I don't think that sitting around trying to sort of regulate or only trying to regulate carbon emissions is the approach. I think what you want to do is develop technology that draws some of the carbon out of our atmosphere.

If you have too much carbon in the atmosphere, then we should be building things that remove it. That's what you would do if you actually believe that this was – I mean, I happen to believe that that's what you would do if you actually believed it was a problem on the scale of Nazi Germany. But I think it's also what maybe we should just be doing. I think that the conversation should be leaning in that direction. Geo-engineering. How do we – This is that big of a threat, and how do we solve it without hoping, just praying, that China stops burning coal? Because that's never happening. So yeah, and I think Mars is where that story really could begin.

[00:13:46] JM: So you're giving a few ways of looking at why this would be important to engineers. So one is there are plenty of engineers who their personal moonshot is to raise a family, be good to the people around them and be responsible, just be a good citizen, and I think that is a kind of moonshot. If you can be personally responsible, if you're a good person that people rely on, that is something to aspire to.

There are other kinds of engineers who aspire to build something that is unique, that changes the world, that is an invention, that contributes to exploration, and that's perhaps another kind of aspiration, and these things are not actually mutually exclusive. You can be a very good person to the people around you while also building something and inventing or explorational. But really, the show, Anatomy of Next, or at least Anatomy of Next new world this season is more around the appealing to the second sensibility, the sensibility of exploration and where that takes you as an individual, whether you're an engineer or not.

I think there are all these sub-problems that emerge from the idea of we're going to do something incredible, like going to Mars. As you were saying, whether or not Mars itself is something that we should be aspiring to, the fact that it is this really difficult problem with all of these complex sub problems beneath it puts really difficult constraints on engineers trying to build solutions that get us to Mars.

So it's almost like this really difficult game to play that it makes you think of, "Okay. Well, how did we even get the internet?" Well, the internet was the result of having protection for our communications in the event of a nuclear bomb. So this constraint of how do we communicate after a nuclear bomb destroys part of our infrastructure led to the internet. So whether or not you think Mars is a practical idea, the difficulty of it alone presents an opportunity to give birth to new technologies.

[00:16:02] MS: Yeah, I think that's exactly correct. It's a frontier, and it's like we do not know exactly what our lives would look like in the context of a multi-planetary human civilization. What we know for sure is that on every single technological frontier in human history, we have developed things that dramatically improve the lives of humans across the planet. This is not just a jaunt to Mars for the hell of it. This is the natural march forward of the human being. This

is like the next place where we should be building. Yeah, and along that path, yeah, you develop things that you use in other contexts of course.

[00:16:48] JM: So there are a number of different applications that you explore in this season of anatomy of next that engineers might be interested in. So one is robotics, for example. What role does robotics play in Mars exploration?

[00:17:04] MS: There are two different schools of thought here. Well, there are probably a million, but there are two that I've seen a lot of or that the most of the arguments I've seen come from two different camps. On the first hand, you have people who believe that robots are going to be this essential tool that we're going to be using on Mars. There'll be robots, semi-autonomous robots, hopefully helping us build our habitats, tend to our crops, certainly analyze all the chemicals. If there's a huge perchlorate problems of sort of toxic chemical that covers Mars needs to be washed out basically and gathered.

-Fortunately, it can be used for fuel. But we need to get rid of it if you want to grow crops and things. We need robots to help us with this. It's a huge problem. Robots are going to helping us terraform all these kind of stuff. That's actually the – This is the conservative view. This is the kind of like tempered, pragmatic – Not even pragmatic I would say, just the conservative view on robots.

The more extreme version is that Mars is going to be populated entirely by robots for the foreseeable future, like does it make more sense to just only send robots ahead of us? They do not just some of the jobs. They're not just our tools on Mars. They do everything. For the next 50 years, robots are both exploring and terraforming. There are some people who apply this to the universe. Like should robots just be exploring the universe? Humans are hard to move around. Why should we bother?

Certainly they're going to be a part of the – Oh! This is fun. I mean, there's a tweet. Someone tweeted this about a month ago. She said, "Crazy to think that there is a planet in our solar system entirely inhabited by robots," and that Mars. It's a robot planet right now. It already is completely inhabited by robots. It's a population of what I think like five or six, but they're robots,

and that could balloons to 5,000 or 6,000 doing tasks for us. Yeah, and an actual extension of that would be to sort of send them into the universe.

[00:18:58] JM: The people you talk to who are familiar with the subject on the show, they give me the impression that robotics are advancing pretty quickly. I mean, it's hard for the average consumer or even I think the average engineer to really have a perspective on how fast robots are advancing. I mean, we know robots are in Amazon warehouses, and maybe they're being used for some security purposes, or some like drone things. But it's hard for us to know how fast robots are advancing. Do you have a sense for how far are we from a place where we could have a bunch of humanoid robots or whatever kinds of shapes of robots we need to do actual work on Mars?

[00:19:43] MS: Yeah. Well, so this is the big – A colleague of mine, [inaudible 00:19:46], wrote a piece about the way robots look in science-fiction and whatnot. They tend to look humanoid, and we have these companies – I'm not going to name names, that spent a lot of time developing robots that look like people and try and maybe perform tasks the way people perform tasks currently. So imagine like a construction worker robot that looks like a construction worker, or maybe like a big scary version of a construction worker, but still like four limbs and a head. That's very silly.

I mean, robots aren't going to look like people. They're not going to act like people. They're going to be – It's like you have to develop things. Probably what's going to happen is people are going to develop things to solve very specific problems, and yeah, they're going to look totally different.

I mean, I talked to a guy who – He's out of the Future of Humanity Institute at Oxford, and he studies Burmese paradox, and aliens, and one of the ways he gets at this is he talks about like mega structural engineering. So that means like the Dyson structure, Dyson swarm. Imagine just like trillions of little self- replicating robots surrounding the sun and gathering all of the energy. That's a very different kind of – I don't know what that robot looks like. I mean, that's going to be a very – That will be very specific to the problem.

In terms of how far along are we, I mean, we already have robots. For example, one of our companies at Founders Fund, called Emerald, they have an entire robotic laboratory. Things have moved along very quick. Self-driving cars are right around the corner. There are a lot of advances here. I think we're advancing in dimensions where people just expected things to look more human than they are. So it'd be very advanced robots that just don't – They don't look like people. It's not I, Robot. So we don't –

[00:21:28] JM: If you wanted to build a bricklayer robot for Mars, maybe would have like a 3D printer thing that would be like gathering material off the surface of Mars and then turning it into bricks, and then maybe you have another robot that looks like a drone and that's laying the bricks, and it's like there's no humanoid thing involved there.

[00:21:45] MS: Right. You have to have someone who just – I think that we actually roughly have the technology to do this kind of stuff now. There's not the will. Right now on earth, it's just so much easier to send a person in there to do that job. But it's way harder on Mars. Who are going to be sending it first? Probably scientists They're not bricklayers.

So if we want to build structures and things like this, they're going to need help. And so as they need help, we'll develop robots to help us create the bricks, then lay the bricks. Then as we develop those things on Mars, people are going to find use for them back on earth.

[00:22:17] JM: So if we could just have robots go and build Mars, terraform Mars for us, that will be great. But probably there's going to be at least some time where we're sending humans to Mars to maybe scope out the land or –

[00:22:31] MS: I mean, I hope that's the case. I want that to be the case. I think there's something important about us –

[00:22:37] JM: Humans going to Mars.

[00:22:38] MS: Moving forward into the universe, and I think right now there's a practical thing about that. So it probably will be that, yeah. I mean, among the people who care about Mars, I

think most really want to see people on Mars. So that insofar as Mars is going to happen, I think people will be on Mars. But whether or not Mars happens is –

[00:22:59] JM: So as far as what we need to get to Mars as humans, we obviously need to build a rocket. We can talk about the rocket technologies, but can humans withstand the radiation and the other stresses that are involved in flying to Mars assuming we have the rocketry?

[00:23:21] MS: Yeah. So Mars is almost too perfect. It's like eerily perfect for us to be traveling to. It's definitely lethal to be on that planet right now without protection, but it's not like Venus, right? It's not this planet where we don't actually have the technology to withstand the surface of Venus right now. We can't even send robots that aren't destroyed almost immediately when they arrive.

Mars is a lot like Earth. It's like a desert version. It's just a dead Earth with a lower gravity. So if you can go there – Yeah, the radiation is high, because there's no magnetosphere protecting you and there's no atmosphere. But we have protection from radiation, a bit of it. There is a slight risk for people on the planet, but as Robert Zubrin talks about – I interviewed Robert Zubrin, this guy who wrote this book called *The Case for Mars*, which radicalized me on to the subject when I was in high school. He talks about the risks, the radiation risk, for example, for a Martian traveler, and it's basically – I think it's roughly equivalent or a little bit less of a risk than living near a petrochemical plant on planet Earth.

There is a risk. A slight uptick in cancer risk, but that just – I mean, that's a risk that you take if you care about adventure and living on the frontier and expanding the bounds of human knowledge, which people have taken throughout history, and everyone has to take it, but some people want to take it. So those people I think should be allowed to take it.

On the journey over, yes, light radiation risk for sure, but nothing insane. Way less, for example, than smoking. Then once you're there, it's a matter of living in a habit first. The very first problem is how do we warm this planet? That's a terraforming question. How do we warm this planet, which will release the frozen carbon dioxide in the southern polarized cap and start to thicken up an atmosphere. You can also artificially thicken up the atmosphere with a handful of different

chemicals that we talk about in the series. As you do that, the atmosphere protects you from radiation. It also increases the atmosphere pressure obviously. So people can start walking around. They can't breathe yet. The atmosphere will be – The air will be toxic, or I guess not really toxic. The air will just not have what we need, which is oxygen. You can bring around a little oxygen tank with you wherever you go, and it could in probably a sweatshirt and jeans hopefully. I mean, that's I think like 100 years out, 150 years out.

[00:25:37] JM: 150 years from now.

[00:25:39] MS: There's a wide range here. I mean, we just haven't done it. So I don't think I know — I mean, some people say with advances in technology and different chemical approach, it could be 100 years. Some people say 200 years. 200 is the first number that I encountered like 20 years ago when I first thought that this was – As a kid and I was looking into all these stuff. 20-year terraforming thing is sort of I think that's like the conservative estimate, and it's depending on what happens between now and then. We could do it a lot a lot faster. I mean, we're warming this planet pretty quick and we're trying not to. So imagine if we're really putting our mind to it.

[00:26:12] JM: So some of these concepts, like building an atmosphere, or I think you also talk about building an ocean on Mars.

[00:26:19] MS: Yeah.

[00:26:20] JM: Do these require any scientific breakthroughs?

[00:26:23] MS: No. None.

[00:26:24] JM: No. Okay.

[00:26:24] MS: None. No. The science is there. The technology, I think it's –

[00:26:29] JM: But we haven't engineered a hydrologic cycle, right? In mean, earth came –

[00:26:33] MS: You don't have to engineer a – So the thing about building an ocean, I use the phrase building an ocean. But I mean that's sort of – That's a little bit of I guess a clickbaity headline. I mean, what we're actually doing is warming the planet, and the planet engineers, the hydrologic cycle. There already was a hydrologic cycle on Mars. That's why there are – We see evidence for water everywhere. The entire northern half of the planet was an ocean. We, I think, have proven that at this point. You see signs of rivers and you see signs of lakes. You obviously – Like I said, you see a sign of this massive ocean. There's frozen water everywhere. I think some of it was lost space when the atmosphere ended, but there's frozen water just like everywhere you look.

Once you warm up the planet, that ice begins to melt. Once the ice begins to melt, you have to water. It starts creating more streams. The hydrologic cycle begins, you have rain, and then the face of the planet changes. Yeah, it's sort of Mars slowly comes back to life in a way.

[00:27:31] JM: Okay, interesting.

[00:27:32] MS: Yeah, the main thing we're doing is warming the planet up, and in terms of terraforming. That's the big challenge.

[SPONSOR MESSAGE]

[00:27:46] JM: If you are looking to your dream job, check out Vettery. With Vettery, companies hiring for tech roles reach out directly to you and request interviews. Vettery is an online hiring marketplace that connects highly qualified job seekers with inspiring companies. Once you're accepted to Vettery, companies reach out directly to you. Their matching algorithm shows off your profile to hiring managers looking for someone with your skills with your experience and your preferences.

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[INTERVIEW CONTINUED]

[00:29:21] JM: We're covering different aspects of going to Mars and re-creating it, terraforming it. Let's touch on rocketry. In the episode, I think it was called Strange Rocket, you talk about not just taking conventional rockets like with jet fuel or whatever kinds of fuel go into rocket today, rocket fuel, I guess. There're I guess positron engines and other kinds of advanced physics.

[00:29:49] JM: Yeah. I mean, there are a lot of different types of thrust. I mean, the Holy Grail would be something like a warp drive, which there is no thrust. So the way that rockets work is they propel fuel out of the back and that pushes the rocket up. But a warp drive doesn't need that, right? That's an abstract, like crazy science fiction type thing that some people say it's possible and some people say, "It will never happen." That's certainly a science – That's like science leap that we've not yet made, and would be awesome if we do and would change obviously everything.

But in terms of things that already exist or that are very likely to exist, you have a handful of different things. Three that I covered, one was nuclear rocketry. Pretty cool. It doesn't change the game quite in the same way as the next two, which would be ion thrust, and then antimatter thrust. antimatter, of the three, is the most like volatile. We haven't been able to create enough stable, I think, antimatter to actually change the way that we move.

[00:30:54] JM: But there are companies that are actually working on this. This is not just like in the lab.

[00:30:58] MS: No. Yes. I should just say that this is true of everything that I'm talking about right now. I'm not an expert in any of it. I just am interested in all of it, and I bring in guys and women who are experts in this stuff.

So, for example, in strange rockets we have Mark Massie of Transatomic doing nuclear. We have Natalya Brikner of Positron talking about ion thrust; and then Ryan weed, who talks a lot about antimatter, and his company is working on this stuff. So, yeah. I mean, there are people working on all three of these things. I would say that Mark was working more on nuclear power and just had an enthusiasm for nuclear rockets, and Natalya is actually working and ion thrust, and it is marketable and you can use it right now.

The antimatter admittedly is there are still science things that need to be figured out, but if it does work out, yeah, it changes the landscape of not just getting to Mars. Actually, in fact, going to Mars is not the really exciting thing about antimatter. Antimatter becomes really useful overmuch greater distances. So it's something that would unlock something like interstellar travel. You can go to Alpha Centauri in a human lifetime, which would be really cool. It's definitely a little bit of a wildcard technology. We don't have it yet, but I don't think it's insane.

[00:32:12] JM: You explore genetic engineering in this series I think both for some advances that we could have that would help us, but also ones that could potentially hurt us, the idea of pandemic that could really impact the size of the human civilization, or perhaps destroy the human civilization entirely, and this will be one of the more practical motivations for expanding to another planet is if somebody were to develop a version of the flu that wipes out humanity, then we could have a backup.

[00:32:45] MS: Yeah. Just pause really quick there and say that – I mean, that could happen without genetic engineering, right? I mean, that's really – Nature is really the scariest bioterrorist of all. So, sorry. Continue.

[00:32:56] JM: Yeah. Well, why is genetic engineering relevant to this season of Anatomy of Next?

[00:33:01] MS: Yeah. So I think that there's almost no version of Mars that isn’t employing some kind of genetic engineering, because the problems we’re facing on Mars are so unique, that much of the planet life on Earth is just not at all suited to it and neither are we to a certain extent. So what you're going to want to be doing is designing crops that are capable of surviving in a much harsher environment with less nitrogen. That's one of the big constraints on Mars.

So far, the best of our knowledge, there is a lot less nitrogen on that planet than there is on earth. On earth, it's like everywhere. It's in the atmosphere. Most plants can't do anything with a nitrogen in the atmosphere. So they fix it mostly through symbiotic relationship between bacteria and the soil that draws the nitrogen into the soil near the roots of the plants. The plants absorb it through the roots.

On Mars, we don't have any nitrogen in the atmosphere. What you do have is nitrates in the soil. So you want to be designing crops that are able to either fix it themselves or designing bacteria to help them fix it, or figuring out a way to just do more with – And I guess I should say figure out a way to do a lot more with a lot less. This might seem like a deus sex mocking, like, "Oh well, I'll just use some magic science to fix the problem," but in fact we're already working on this on Earth, because there's a tremendous market for plants that use less nitrogen so they have to use less fertilizer, which is how we feed the planet right now, is basically we're eating fertilizer. Yeah, there are all sorts of biotech firms working on plants and crops that just use a lot less of it, and that's just basic genetic engineering stuff that we've been working on for years.

That's getting better and better, especially with things like CRISPRs. We have much better cutting tools now. I think the future of Martian farming is one of the coolest aspects of the whole endeavor, because that's the one that does just have the most impact that I can see. I'm sure there are things that I can't even think that are going to have a tremendous impact. But the ones – In terms of the things that we really see coming, that's the one that all the genetic engineering stuff that we do on Mars, either improve our plants or gene therapies to help us resist things like radiation, or deal with this perchlorate problem. That's going to have an impact on people back on earth.

[00:35:23] JM: Is CRISPR being successfully applied to improve crops on earth today?

[00:35:28] MS: Not that I know of. You have three companies that are working with CRISPR, three publicly traded companies that work with CRISPR on different gene therapies. I think that we're still in sort of early stages of using CRISPR and all these different dimensions. But CRISPR is just one tool for cutting. There are all different tools for cutting genes, and those kinds of things companies are experimenting with cutting. So it's a matter of time.

[00:35:53] JM: To come back to Robert Zubrin, this is an author who is a key character in the whole season. So he wrote the Case for Mars. This was way back in 1996, more than 20 years ago. Back in the 90s, mars was not taken very seriously as a destination for humans, I don't think. I think you also spoke to Zubrin about this humanism versus anti-humanism set of ideas. How would you describe Robert Zubrin as a philosopher?

[00:36:29] MS: You should interview him, because he's awesome.

[00:36:31] JM: Okay.

[00:36:31] MS: He is – I think we're similar. Where we are certainly the same is I think we're both very pro-human, which sounds funny to say out loud, but I think there is all of these anti-human philosophy out there, certainly people like Malthus. Anyone who's talking about how to we reduce the human population? How do we curb our energy use and things like this? That comes from maybe a well-meaning place, but when you apply these things to their sort of logical conclusions, they always end – Historically, have always ended in just like mass death. You see Malthusian practices at work in the Indian famines, for example, in the Irish famine.

I think — well, and more. I mean, you could talk about Germany and living space, needing living space. The belief that people had to expand because they needed more resources. Without those resources, their society would collapse. In fact, it's just not true. Sort of throughout time, what we found is that with more people come more technological innovations that improve our ability to make either use of new resources that we never even knew how to use before, or to do more with less, or to recycle better.

I mean, I've been so afraid of peak oil for so long. I always thought this was like this one unavoidable problem. Talking with Dr. Zubrin, I heard and did not believe, and then had to research. The fact that – I mean, we're actually further away from it than ever before. Like there's no end in sight. We've just got much better drilling deeper.

I mean, obviously yes. It's a finite resource. Oil is a finite resource, but we're also like along the way developing new ways of just like using it much more efficiently, new fuel sources. I mean,

we're going to be fine. What we need is not less people. We need more people to help us think of solutions to these kinds of problems.

Robert at his core is someone who just believes in people. He believes that we're good. He believes that we're worth saving, and he believes that the way to enrich and preserve our lives is to encourage technological innovation. That's his first thing. I think his second thing is I think he really loves America. I think definitely he believes in the sort of innate – Not innate. He believes in I think the goodness of American-style government and a culture of innovation and entrepreneurship that was incredibly powerful for the last couple of centuries in America, and he's a sort of defender of that broadly I would say.

[00:38:55] JM: Can you go a little bit deeper on the Malthusian ideas, the anti-humanism idea? Because – Do you have an entire episode dedicated to this in the show?

[00:39:09] MS: Yeah, and it's a hard argument, because it's a counterintuitive argument. So I really encourage people to just check it out. This is the only episode that I ever got a scathing criticism for. It was one comment on iTunes, and I get it. I mean, I don't agree with the comment. I think this person is wrong. Malthus is wrong. Malthus has been wrong for working over a hundred years –

[00:39:30] JM: What did Malthus say? I don't everybody knows who Malthus is.

[00:39:33] MS: So Malthus is a philosopher, was a philosopher, and probably most famous for his ideas about population, which sound very reasonable when you hear them out loud. The idea that eventually as the human population grows, we're going to have less and less resources. With less and less resources come famine, poverty, just a bleak future for the whole world. Malthus was speaking at a time when our population was fraction of what it is today. So I think it was a billion or less than a billion. Certainly, I think it was less than a billion humans in the world when Malthus was writing.

What was interesting about Malthus is not only is he wrong. So since Malthus made his predictions about the future of humans and resources, poverty has plummeted, hunger has plummeted and our population has exploded. We're maybe 10 times as big as we were when

he was writing and everything is better, and everything keeps getting better across the world. People want to talk about maybe wage stagnation and the wealth gap and things like this, and that's perfectly reasonable. We can have those conversations. I think they're somewhat more political conversations, because what Malthus was talking about was just straight up dystopian. He's talking about a world where there is mass starvation, because there are too many people, and he was predicting that to be right around the corner and everyone believed him, and that fueled a lot of 19th and then 20th century politics. This real fear of population of not having enough, of our population not having enough, and so we need to take from this other population, our neighbors or whatever.

The Malthusian worldview pits people against people, and maybe it sounds a little Pollyannaish to be like, "But I think people are great, and we should all work together," even though I think those things, but also just the data supports this. The data supports that with more people, actually things have gotten better. With more people come more ideas. With more ideas on how to solve these problems come greater use of the resources we have, an expansion of the resources we have and just an overall improvement in the quality of life.

The really crazy thing about Malthus is that not only have his predictions been wrong. I think other than Marx, there's no one whose ideas have been applied more vigorously despite all evidence that says the ideas don't work. For so long, I mean, we've seen just failure after failure after failure of the Malthusian ideas. Never have any of his predictions come to pass, but he's not just been wrong for the past century or two. He was counterfactually wrong.

So if you were Malthus just writing at the time of his birth, 1766 – He's born 1766. He's probably writing most of his work in the early 19th century, early 1800s. If you just look backwards, he could've seen that things were far bleaker a hundred years before with a smaller population. Wealth was down. So global GDP was down, global food production was down, not just in general. Obviously, there're more of us. We're doing more. But like per capita, these things were down. We were all ready. As the population was growing, we were producing more. Hunger was going down. Wealth was going up. People were living better lives.

So he was making just incredibly insane predictions that he just sound – They just sound reasonable, but they're wrong. They were wrong when he was writing and they're wrong today.

They've been wrong for 200 years, and people still teach Malthus in college as if he's the second coming. Well, he was wrong for two centuries, but maybe now he'll be right. Maybe now when things are better than they've ever been before, suddenly the predictions come to pass it. I just don't think it's true, and it's hard to accept that just because it makes sense in some gut way. This is our animal instinct, is to not want people in our territory or something. You don't want more people, but we're – Yeah, we're animals, but we're thinking animals, and that means that our potential is much greater than a roaming mountain lion or something where you have too many mountain lions, there aren't enough deer. The mountain lion population crashes. That's not what we are. We're a race that's capable of creating food. That's never existed before. So that needs to be factored into the equation.

[00:43:48] JM: Yeah. Well, this exemplifies one thing I really like about Anatomy of Next, which is it is a philosophical respite from cynicism or from apathy. Your podcast is a place where ideas are explored with a sense of optimism or at least open-mindedness, or at least scientific curiosity, which is that's something I try to do with my podcast as well maybe on a less – I guess on a more microcosmic scale, because we try to just look at particular software tools and how can you use these software tools to build stuff, because I think the idea of building things, building new things is inherently optimistic or at least it makes me happier when I think about it. When I wake up in the morning, I think about all the cool tools that are coming out and the things that I could build with those tools. It makes me optimistic, and I think that there is a need for positive philosophies, and I think there are a lot of people out there who are looking who have a hunger for positive philosophies and for antidotes to that kind of Malthusian, I guess, negativity.

I know in that episode you talked to some of your coworkers about – Your Founders Fund coworkers about the idea of do we need to sort of pull back as humanity in order to make human civilization more sustainable, versus the idea of hurtling forward with the confidence that we're going to be able to innovate our way out of this human expansion. I think that tension, that tension ran through the first season of Anatomy of Next because you are talking about the philosophical ramifications of that on a cultural level. How does culture respond to a world where there are cynical pressures and pop culture pushes you towards cynical areas, because advertising might be able to pluck your heartstrings more effectively if you're in a pessimistic mode because you need to buy something to cure that pessimism than if you're in an optimistic

mode and you don't need to buy as much. Maybe you're in the mood to just build things and be creative. So the philosophical side of the podcast is really appealing to me.

To totally change the subject, to what extent is – I mean, we're sitting in Founders Fund. So this is a place that business flows through this building. To what extent is the private space industry booming?

[00:46:23] MS: Well, I mean it's huge right now. It's a huge deal. Right now, I think the bread-and-butter of private space is satellite. It's the satellite industry I guess you would call it. That's where all the money is coming from, and that's not going to stop anytime soon. We're more connected in that way than we've ever been in the history of the world, and it's only increasing. But in terms of the stuff that gets me super excited, this is like space exploration, we don't have a government that's involved in this anymore. Maybe they're writing checks, and that's great, but they're not writing checks – It's like NASA is not developing a plan.

The only chance that we have at this point would be the private industry, and I'm someone who I love private enterprise, but that does not make me – I mean, I miss having a NASA that did stuff, and NASA did a lot of stuff. I should say that NASA does stuff. NASA does a ton of stuff, but what they're not doing is developing a plan to go to Mars and to colonize that world. They are doing just like a million different research projects on robotics, and like space mining, and a lot of think tank type stuff in there, and they're blogging, and they're tweeting, and they have a great Instagram account.

They're like a marketing arm of the U.S. government and they're really optimistic to follow, and they are really excited about space. But that's not what we need from the people in charge of getting us there. We don't need a fan. We need someone who is almost like a general, who's like, "This is the objective. To execute, we have to do this, this, this, this and this. How do we get to Mars? How do we build a sustainable branch of human civilization on Mars?" These are the goals, and I don't believe that there is anyone at NASA working towards these goals. They say they are, but you dig into the planning and you see that it's just – I mean, it's all BS. There's no money. There's no timetable. No one is really actually working on the plan to go to Mars.

On the government side of things, China says they are, but China says a lot of stuff, because it's a crazy government that lies all the time. Sometimes they don't. I don't know, like I have no idea. No one can really be sure what China is actually going to do. I think that the private industry in the West is – I mean, I think it's our only shot. Yeah, any movement towards Mars is pretty much in the hands of companies like SpaceX.

[00:48:54] JM: And Elon Musk has been pretty influential in pushing us philosophically in that direction to thinking about Mars, or at least popularizing the idea of Mars.

[00:49:07] MS: I mean, listen. I love Elon Musk. I think that what he's done for the world has been amazing. I think not even just the Mars stuff. The idea that we can solve enormous problems, right? Like that's what he saying, and it's hard, and he might fail. I mean, he's doing a lot. This guy is doing a lot right now, and people love to attack him. But he is out there every day trying to solve enormous problems and to really do something positive for the entire human race, for all of human history. We have a few people like this in every generation who are this prolific.

But I am reluctant to say that he's gotten people excited about Mars, because I think that people are always excited about Mars. I mean, my whole life, people have been saying, “Were going to go to Mars. In 20 years, we’ll be on Mars.” The truth is we’ve had the technology to go to Mars since – What? The 1970s? And we’re not there. People aren’t doing it. The government has not put resources towards it.

What’s cool about Elon is not that is getting people excited about Mars, but to me it's that he actually controls the strings at SpaceX and he wants to go himself. I believe that. So those two things, that’s somewhat new. You have someone in charge of all of the power and resources of a company and also the will. So if anyone's going to do it, I think it's him. Yeah, in terms of enthusiasm, I think it's roughly been the same forever.

Wernher von Braun was the guy who pretty much created NASA way back in the day. We took him from Germany during World War II. He’s a rocket scientist, and his original plan was not to go to the moon. I mean, that's eventually what NASA did with his early work. But his original plan was to go to Mars. That was the vision. That was the vision like almost a century ago.

People wanted to go to Mars. We don't think that. We have this idea that like we're getting closer and closer, and I want to believe that's true. You just to described me as an optimist. I, mean I would love to believe that that's true. It's just not true. We're not getting any closer. Things that Elon has done are definitely like going to help us by – I mean, I can't even begin to explain how important it is to have reusable rockets. So if you can just make it so much cheaper to go, that improves our odds of getting there. But yeah, I still don't see a plan. No one has a plan.

[00:51:21] JM: Are you surprised by kind of the paucity of the number of engineers in Silicon Valley that are working on space travel or things that are related to space, or do you think it's understandable? Maybe it's a little bit too early for the average engineer to be thinking about space?

[00:51:40] MS: No. I think that SpaceX has done a great job of finding the people who want to work on those things and employing them, and I'm grateful for that. But the truth is – I mean, there aren't that many places working on this stuff, and there are plenty of things that engineers I think can be working on to help with things that will get us there. Anything that makes, first of all, combustion more efficient. So any kind of mechanical engineering or physics type work that would make just the cost of moving through space less expensive would be both lucrative on earth, obviously, and also really important to getting us there. Like those are the kinds of problems that you could be working on.

I think maybe that's the main problem really is energy. That's the main problem. That is the problem of all problems. Everything comes down to energy. How do we get more of it? How do we use more of it? How do we make the acquisition of it more efficient and the burning of it more efficient? Yeah, everything – We eat energy. We move on energy. Our whole society exists because of energy, and we don't want to use less. We want to use more. We want to use 100 times more. So how do we do that and keep the environment healthy and our resources not totally depleted? That's an engineering problem. That's the biggest problem of all.

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[INTERVIEW CONTINUED]

[00:54:58] JM: How is the progress in the energy sciences advancing? I know there are companies that Founders Fund is invested in related to nuclear energy, for example. But is that stuff at all on the cusp of having an impact on the actual market for energy?

[00:55:15] MS: Yeah. Well, I mean nuclear has an impact in other countries, like France and increasingly Canada. We don't do enough with it here for it to make a huge impact unfortunately.

[00:55:26] JM: That a policy issue?

[00:55:28] MS: Yeah, and it's not even – It's weird, because I mean there's a lot of support for nuclear. So like even among politicians, there's support for nuclear energy. People aren't scared of it as they used to be despite things like Fukushima, which is great, because nuclear is important. Nuclear is – If you care about global warming, nuclear is the thing that you should really be working towards. But I think there's like this other cultural problem that's not even to do with energy or nuclear power, which is people just don't have an appetite for enormous projects anymore. You talk about high-speed rail, or building tunnels across the country, or – Yeah, like a new network of nuclear power plants. Maybe a new kind of nuclear power plant. We'd have to deal with waste and it's like, "How you do that?" It's like this whole like nested series of problems that seems big and the average person just does not believe that we're capable of doing big things.

You talk to someone about this stuff and they don't believe you. They don't believe that there's going to be a tunnel from Los Angeles to New York City. They don't believe it's ever going to happen. They don't believe it can happen, and that – That's new. That's like the last 50 years in America That is seeped into our way of thinking about the world, and it's like borrowed from Peter Thiel, a colleague of mine. That would be a sort of I think indeterminate pessimism creeping into the American consciousness.

[00:56:57] JM: Yeah.

[00:56:57] MS: The idea that things are going to get worse. We don't exactly know how, but they're just going to kind of keep getting worse. Like good things can't happen anymore, and we certainly can't build them. We used to be more of an indeterminate optimistic culture, which was also bad, and that was like a few decades ago, where we just believe things were going to get better and better. We had no idea how or why right, but we're not even optimistic anymore. So yeah, that's not an engineering problem. I don't know what that is. That's –

[00:57:23] JM: Cultural, societal. I mean, before the indeterminate optimism, what was the full –

[00:57:29] MS: Determinate optimism. That was the 40s and 50s, and Manhattan Project, and the Apollo Program and Americans –

[00:57:35] JM: But before that. Before that.

[00:57:37] MS: In America? I think America from its inception was pretty determinate and optimist. You believe that you're just going to build a new country. That's insane. Who was doing that? That's wild. The Americans were doing it, and everything that Americans did had to be built from nothing. There was no legacy infrastructure. They had to build every single piece of it. They didn't inherit anything. So generation to generation, you're expanding along the frontier. On every new geographical frontier, new things have to be built. There's new technology to build them. So things kind of change as you move across the country.

Now our frontier is gun, and we're all just inheriting infrastructure that already exists. We don't know how it was built. So we're sort of living in the museum of a civilization that used to exist, and I think there's something kind of naturally demotivating about that. It's one of the reasons I think – It's another reason I think Mars is so important reopening a frontier, an actual geographical frontier, or I guess it wouldn't be geographical. It's not on earth, right? So maybe another spatial frontier. Sorry, what was that?

[00:58:42] JM: Well, we're wrapping up again on a philosophical note of why this is important to talk about, because the inciting – A cultural shift back towards a determinate optimism is important, and I think speaking to the audience, I think engineers are as well-equipped as anybody to contribute to on the front of actually building stuff as well as on the evangelical front, or just if people are feeling personally indeterminately pessimistic, then maybe they can listen to Anatomy of Next for some remedy.

So let's close on talking about podcasting a little bit. You're exploring a lot of different formats in your podcast. I guess two mainly. So the main two formats are this transitory splicing together different interviews with different people interspersed with your own narration. Then the other format, which you've had in the recent episodes is just longer form interviews with some of these people, standalone interviews. I think we talked about this a little bit on the last interview we did, but how are you feeling about the basic interview format versus the well-produced stitching together? I guess more generally about podcast formats in general, what is the best podcast format?

[01:00:06] JM: I mean, this is like really subjective, right? I mean, this is like the question of what is the best kind of television or something. It's whatever people want to listen to would be the best podcast I would say for them. For me, I like the longer form storytelling type stuff. I think it's more gripping and engaging and I think you learn more, you take more time with it. But also there's a huge market for just talk radio, and I grew up listening to talk radio. So I love that too, and I think people love that too.

I try and do a little bit of both, because I mean the longer form story I think is better. I think the main narrative this season, New World, and you can see if you check it. You check my podcast out on iTunes, you'll see that it's pretty clearly marked. It's like there are episodes called New World, and there are side chats, or they say in conversation or side chat, and those are just like the sort of longer form just interviews of people. I think one of the reasons I introduced that.

One, I like talk radio. I like this format, what we're doing right, a lot. That's essentially what it is that I added in. It's also a way to just do more faster. It takes so much time to produce the longer form stuff with multiple interviews and narration. It's all scripted, the soundtrack. That's just harder to do, and I have a lot of cool stuff that I want to share that didn't fit into the main season. So it's like, "Well, this is interesting. We should at least share it," and there are people who want to listen to it. So [inaudible 01:01:26] there is the best.

The cool thing about podcasting is its sort of a frontier right now. It's a media frontier. People are doing – And I think people have been saying this for years, but it's no less true now. People are really experimenting with the medium still and doing really interesting things. I have a few new thoughts on it myself. Not quite ready to share them. They're not totally baked, but I definitely want to keep experimenting and just telling stories in new and interesting ways.

[01:01:51] JM: Now, one thing I've realized over the years of being a podcast power consumer is that my retention of specific facts from podcasts is not great, and it's made me continually revisit why am I listening to podcasts and what am I getting out of it, and there are a few things that I know that I get out of it. One is that you hear examples of how people are conversing in productive fashion or in an enjoyable fashion at least. So sometimes it can set an example for your own conversations. That's one thing that's useful.

Another is I was listening to your interview with the guy from MythBusters, I think Jamie –

[01:02:35] MS: Yeah. That was Jamie Heinemann.

[01:02:36] JM: Jamie Heinemann.

[01:02:37] MS: That was a good interview. He's so cool.

[01:02:39] JM: He was really cool, and one thing he said was that in your early career, one thing you're doing is you're gathering ideas into this heap and you're just like throwing ideas into this heap, and then later on you are able to take advantage of that heap that you've built up over time, and sometimes you don't even know where these ideas have come from. But the bigger they heap has gotten, the more you're able to ideate, the more you are able to build new things, the more you're able to draw on past random experiences where you don't really know where this idea came from. I think podcasts really help to just like throwing stuff on the heap and maybe you can't retain it from a fact-based Wikipedia type retention, but there's something there. You are getting something that you're able to draw on in the future.

[01:03:26] MS: Yeah, I think that's certainly – I've never thought about the modeling for conversational styles, and certainly with a podcast like Sam Harris or something, I think that's maybe where that is really useful especially in this like super volatile crazy world that we live in now where people can't talk to each other without yelling. Yeah, that's great. I love that.

Yeah, for me, when I listen to a podcast – When I listen to something like that NPR does, it's well produce. I'm also hearing their production and I'm like, "Oh! That's cool. I need to do more of that."

[01:03:56] JM: Oh, yeah! Totally! Totally!

[01:03:57] MS: I need to add in that element or this or, "Wow! Their sound is like so low and it's this kind of sound for their soundtrack or whatever, the music." I mean, I'm thinking mechanically like how can I make my podcast better. But if it's just a cool subjects or a contentious subject, especially if I don't agree with it or I agree, but have other thoughts. My brain is like firing off now

and I have 10 new ideas. There's kind of is a dialogue between yourself and radio in a way there's maybe less of in like a blog post or something. It's like it's a voice. You hear a voice and your natural response as a human is to like speak back.

So even if you're not in a real dialogue, I think that your brain is almost – You're producing something in that way, I think. I don't know. I don't think there's enough –

[01:04:43] JM: So like when somebody is saying something that you vociferously disagree with in the podcast, you're like, "No!"

[01:04:47] MS: Yeah. Usually, I'm like probably shaking my head. I won't be singing it out loud if I'm on a train or something, but like I'll be shaking my head. Sometimes I'll make notes. I'll have an idea for a blog post or something. I'll have an idea for my own – We have a couple of new shows coming. We have one for our next season. It's going to be a little more controversial I might say. So I have a whole like Google Sheets and I'm like just keeping track of different stuff I want to weave in there. But yeah. I mean, I'm definitely like an active podcast listener, if that's a thing.

[01:05:14] JM: Yeah. Well, it's cool, because people email me. Like when I explore something that is weird in a show, I will get email from people and they'll be like, "I really like that idea," or "I at least heard that idea. I totally disagree with you, but it's an interesting idea or you're a total narcissistic and your idea is really stupid." But in any case, like, "Hey! You listened and you –"

[01:05:39] MS: Yeah, I love it too. When people reach out to me, I respond to I think everyone, because I used to do that, but not for podcast like 10 years ago when I started my career. I was reaching out to bloggers who said stuff that I liked or didn't, and I was respectful if I disagreed. But like I would always have – And I think that writers and now podcasters, I do think that people appreciate, that conversation, you're a professional conversationalist to a certain extent. You like talking about, especially the stuff you're podcasting about. I mean, these are things that we're interested in.

Yeah, I love when I get people who – On Twitter, a lot of people DM me, and most have this or that to say about whatever episode and maybe they'll pushback, maybe they will just love it and

want to talk more about it. I had a lot of people who want to help work with me on it, which is cool. I don't really need much help right now. It's like I can do a lot of it myself and I enjoy it, but like one day, as I expand. Who knows?

But I love hearing from people and I reach out to people myself all the time who I hear now or, again, read stuff from. It's cool. Yeah, cold emails, or DMs. I think that everyone should do that when they're interested in something.

[01:06:45] JM: Yeah. Okay, Mike. I love your show is really great.

[01:06:48] MS: Thank you so much. I love your show.

[01:06:46] JM: Yeah. Okay, Mike. I love your show. It's really great.

[01:06:48] MS: Thank you so much. I love your show.

[01:06:50] JM: Thank you. What's next for Anatomy of Next?

[01:06:53] MS: Next up is season three. Not going to talk too much about it. I'm not quite ready yet. There're a lot of research I'm still working on with colleagues of mine at Founders Fund. But roughly I'll say I started the show, season one was super abstract. It was like the way that we talk about the future. Basically, season two was still pretty abstract, but a little more concrete and then it was like, "Well, what about this very specific thing in the future?" which is building a new world on Mars.

Season three, I want to be much more concrete, and it's going to be focused on things that already exist, aren't working to very sort of, I would say, in some cases, catastrophic ways, and then how do we fix them? So how do we fix some of the things that aren't working right now? It's kind of ambiguous what I'm saying right now, because I don't want to like blow it. But yeah, it'll probably be a little more –

[01:07:49] JM: You told me before the show, and I can just say it's going to be good. [inaudible 01:07:52].

[01:07:53] MS: Thanks a lot. Thank you.

[01:07:55] JM: Okay, cool. Thanks, Mike.

[01:07:56] MS: Thank you.

[END OF INTERVIEW]

[01:08:01] JM: If I were to interview for a software engineering job right now, I would fail that interview. The skills that you need to do well in a software engineering interview are not the same skills that you build in your job. This is a weird paradox within the world of software engineering, but it's a reality, and we have to cope with it.

Software engineering interviews challenge you and show many areas, algorithms and data structures, databases, systems architecture, the ability to talk to people. There's a time limit. There's whiteboarding. It's completely different than working as an engineer, which is why so many people study intensely for their interviews. If you are starting to look for a new engineering job, consider the App Academy Engineering Interview Prep Course.

App Academy is deeply familiar with the software engineering interview process and their curriculum is curated from over 30,000 engineering interviews. The engineering interview prep course is an online class that will get you up to speed on everything you need to know to get a better engineering job than your current one.

Go to softwareengineeringdaily.com/interviewprep and get $100 off the online course. Software interviews can be stressful and hard to prepare for. App Academy's engineering interview prep course will help you build your skills and build the confidence that you need to do the sorting algorithms, the binary tree questions, all the material that you've forgotten since your last interview. Go to softwareengineeringdailya.com/interviewprep to get $100 off the online course and put yourself in a position to get a job that you are more satisfied with, and a higher salary.

I am so glad that I don't have to do software engineering interviews right now, because I'm a podcaster. But if I were going to go back into the field and I had to do all those crazy whiteboard questions, the App Academy Engineering Interview Prep Course would be quite useful. So you can go to softwareengineeringdaily.com/interviewprep to find out more.

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[END]