The Rational Optimist Society

Stephen McBride // The Rational Optimist Society
Halen Mattison // General Galactic

Editor's Note: This transcript was automatically generated. We've included it for your convenience. However, it may contain errors. If anything is unclear or simply seems off, please refer to the recording here.

Stephen McBride: Halen, what's the most important thing that you learned working at SpaceX?

Halen Mattison: Yeah, I really enjoyed my time at SpaceX. I think it was probably one of the most important things I've gotten to do. I feel very fortunate to have contributed to some of the big missions, like the first crewed flight of Dragon, our first flight of Starship, and some of the future planning that'll go to Moon and Mars. I think SpaceX is kind of an enigma to a lot of the outside world, right? Like we sit back and watch these videos of boosters landing on the ground or being caught by towers or, you know, Teslas floating around the Earth. I think the thing that people don't realize is the secret sauce is pretty straightforward.

SpaceX is a combination of extremely talented people and extremely thoughtful planning. I think that is the thing that I've taken away into building General Galactic that I've found to be most valuable in that if you combine people very serious and very competent and very mission driven and you give them the ability to make the right decisions and you take away the roadblocks in terms of development and bureaucracy, amazing things can happen. And that's really what has made SpaceX the dominant player in the space industry is just appropriately combining those capabilities and I think the leadership constantly refocusing on building a strong environment there.

Stephen McBride: Is it a case where, obviously the company is quite large now, is it a case where individual teams still have agency and the ability to change things? When you're there, does it still feel like a startup?

Halen Mattison: Absolutely. I think the I would even go further and say it's not individual teams. It's individual engineers have an extreme sense of urgency there. Something that we try to replicate at General Galactic and I think a lot of folks who do want to build in hard tech should be thinking about is how do I constantly give more agency and more responsibility to my engineers. Engineers fundamentally tend to be very

physics driven, very pragmatic, and that is the engine that you want running your progress. The RE, or responsible engineer, is the CEO of their product, and they have the ultimate authority to see that product through and to make the right decisions along the way. It is extremely common in engineering outside of SpaceX and really just kind of in the broader ecosystem that you hear a story of

We're working on a product, we're working on this new innovation, but we can't do the right thing here because of XYZ. And that XYZ can be, because the funding structure isn't where we want it, because the timeline won't allow for it, because this personality is in the way. I'd say that's probably actually the most common, is like, you know, we don't want to do this because somebody else designed the original system and it would hurt their feelings too much to make the better one.

SpaceX does not operate in that way. We almost always, when we came to a roadblock, would work through a technical trade. And what that meant was looking at the problem in its most basic sense, doing comparative analysis to guide our path forward. And whatever that analysis showed became the future of the company, whether that was what we wanted it to be or not. And so, absolving those kind technical...

challenges from your personality and from the personalities in the room is what allows you to go faster than pretty much anyone else.

Stephen McBride: So most people from the outside would say, you left SpaceX, are you crazy? But you mentioned the startup that your startup General Galactic. Tell us what you're working on. Tell us why it was such a big, a big problem and so lucrative that you left by, by many, in many people's eyes, the best or most innovative company in the world.

Halen Mattison: Yeah, I think I'd still say that I hope General Galactic can one day be mentioned in the same breath. I love my job at SpaceX. I love the people I worked with. I had a great team, great management. I was working on, towards the end, Artemis III, which will be America's return to the moon, ideally within this decade. And so extremely important work. For me personally, part of my journey during SpaceX was getting into the Mars planning and thinking about what SpaceX's ultimate goal, which is in their mission statement of creating a multi-planetary species and going to Mars would look like. And I started to go into this field that we in the space industry called ISRU, which is in situ resource utilization. That title encompasses a niche of technologies that we need to do more sustained space operations. You can think of it as tools that enable you to live off the land, the things that we need to go and build, the resources that mean that we can do bigger, bolder missions. And as I dove into that for SpaceX, I started to kind of go into some technologies that are a little bit outside the mainstream of space. They're often thought of as like chemical engineering or in some cases like energy projects. But I realized that these would be the enablers for the next step of space advancement.

I think SpaceX has kicked down the door of space technology. They have really changed the way people think about space in the 21st century. And I think that they fired the starting gun for all the other cool things that we want to go do as we think about getting more resources in space, building up infrastructure in space, getting infrastructure on the surface of the moon and onto Mars. And so I kind of had this idea that the biggest step that humanity will take in the next few decades will be when we open the first gas station on Mars. And what I mean by that is a permanent facility that allows us to refuel very, very far from Earth. And the technology that you need to make that gas station happen was a little bit outside of SpaceX's wheelhouse. It was outside of everybody's wheelhouse to some degree. And that became like the seed idea behind General Galactic. And that was something that I was spending a lot of nights and weekends

thinking about, doing my own modeling and thinking about all the different applications of the technology. And it got to a point where I was like, I think that it's important for the world and for the things that I care about that I at least try to do this. I have no clue if this is gonna work out, but it's important to me and I'm in a position.

where I can go do this now. I grew up in the South, I was very fortunate just to even go to college, managed to get a scholarship to do that, managed to get a scholarship for grad school, found my way to SpaceX. So like, I still have this mentality of I have pretty much nothing to lose here, because I didn't come from much, it doesn't really matter if I end up with nothing. And so I'm one of the fortunate few people who...

can take a swing like this and can go out and say, yeah, I believe that there is a bigger mission in making this technology real and going and building these things. And so, yeah, I'm going to step away from the most exciting job that I could ever imagine to go and do this startup.

Stephen McBride: Was it harder to graduate Stanford or harder to be employed at SpaceX, which was a harder task?

Halen Mattison: This might get me disinvited from some Stanford alumni events, but the answer is definitely SpaceX.

Stephen McBride: I was recently talking to a dad in Austin who goes to AlphaSkills, the two hour learning skill, and he said some of the high school kids in AlphaSkills high school, they basically went to Stanford once they graduated, like Stanford is slow. And I was like, that's the first time I've ever heard Stanford being described as slow. It's interesting that you had, you you were at SpaceX and you are understanding, you know, the next evolution in space.

needs to happen, what technical breakthroughs do we need to make us a multiplanetary species? I've heard similar stories from Dougher at Radiant Nuclear and Casey at Terraform Industries. Of all the ideas that you explored, is there any other kind of billion dollar ideas hiding in there? Like, hey, here's what we need to do to make life sustainable on Mars.

Halen Mattison: Yeah, well, I think that that's the recipe for a great startup, right? Is having a...

deep understanding of the market and the environment and recognizing that there's a potential huge opportunity just sitting there if you can crack the code. And sometimes that's simply just going after it and being first. And sometimes it's, hey, we need to make the tech work to get there. I think that there is actually quite a bit of opportunity in the space domain and along the way.

I think one thing that I tend to disagree with a lot of people in the space domain about is I don't see inherent value in going to space, but there's also not a lot of inherent value in most things that humans do. Like most of our day and the things we spend money on are very, very hard to justify in a very like utilitarian way. The things that happen along the way and the platforms that we create will be immensely valuable.

more than anything in human history. And I think the things that I think will naturally happen as humanity continues to make progress beyond the moon and to Mars, I think will drive incredible business opportunities and opportunities for people to just kind of build new infrastructure. You know, this kind of whole concept is inspired by what happened during the early...

space race where a lot of the pieces of technology that were being developed to support early human ventures beyond the atmosphere ended up becoming like regular consumer products or you know pieces of technology that are built into every bit of our lives today and I think that that evolution is still very much happening and will continue to happen and there will be I would say trillions of dollars of value generated over the next couple decades from that.

Stephen McBride: You mentioned the starting seed idea for General Galactic. Talk me through that seed idea and then maybe some of the trade offs in different energy sources in space. I think, you know, energy in space is one of those amazing things that just blows your mind. Just talk me through maybe why making methane on Mars was was, you know, an optimal decision. Why not build a nuclear reactor there? Why would solar not work? Talk me through all that.

Halen Mattison: Yeah, I actually, think it's more of an and than an or here. If you want to do methane on Mars, you need nuclear and solar, in my opinion. And I think that you mentioned, you know, Doug and the radiant team, you know, I'm super thrilled by what they're doing.

I think a lot of the progress in the energy space right now is amazing and we need it to do a lot of the cool things that I think will happen during our lifetime. And these are super important as you think about energy and the way that humans interact with it. When we first started the company, we were really, really focused on that methane making opportunity because it's, you know.

to some degree, this mind-blowingly cool concept where you can turn air into fuel anywhere in the solar system practically, or at least anywhere there's a carbon source. Part of the reason that SpaceX chose to design Starship around methane is because of this concept, that one day you could turn the carbon dioxide on the Mars atmosphere into fuel for Starship.

And I still think that, you know, that's very much on our long-term roadmap. But I think the other thing that we started to realize is we are very lucky here on Earth to have very abundant hydrocarbon sources. That's what has enabled the Industrial Revolution and the very energy-rich lives we live today. And the energy cost of this type of synthesis, of doing synthetic fuels, is prohibitively high.

And so as we've learned and grown as a company, we've really refocused around using some of these technologies like the electrolysis tech that enables our propulsion system for space applications where there isn't an abundant alternative that's a lot cheaper and easier to deal with. And it actually unlocks new capabilities. But as far as space power goes, it's an all of the above answer. We are utilizing so little

of the power that we could be both on earth and in space right now that any new power generation I think is a massive net positive.

Stephen McBride: I talk, you said before we press the record button here, you said you were going to break some news. I know you pivoted, I think earlier this year from, you know, air to methane fuel plants to something that that's a cool idea. I think you've pivoted to something even more mind-bending and cool. Tell us what you're working on now.

Halen Mattison: Yeah, I appreciate that. Yeah, I mean, I think in the evolution of the company, you know, we're coming into the second full year here and we have learned basically an incredible amount about the usefulness of our technology and basically where we know it's going to win.

If you saw the very first pitch deck I ever made for General Galactic, it basically had two blocks in the like plans section, which was earth, arrow, space. Meaning like we're going to prove out this technology in these cool earth applications.

we're going to use it to convert carbon and figure out the carbon crisis. And then we're going to use it in space when we're ready. And I think that General Galactic's future has effectively just reversed those things, where we're recognizing that our value proposition is actually much higher in the space domain with this technology than it could be for synthetic fuels. I think synthetic fuels are an incredible concept. They're one of the few ways out there that we can combat

the climate crisis in an economically positive way, but unfortunately the economic story does not close. And we worked in every continent practically on earth, looking at the energy markets, working directly with energy vendors, working with the people who want synthetic fuels, who are excited about the idea of low carbon fuels. And we found no case where the economic story was positive. And that puts you in an interesting position.

both as a founder and a company, because you're like, wow, I've built this really cool technology. But the path and the plan right now doesn't make a lot of sense. And there's really, especially these days, nothing's stopping you from just continuing to raise money and tell the story. But I'm not really in it for that reason. I don't think I started General Galactic just to experience running a startup. I think...

this company is aiming for something bigger. And so, yeah, we basically worked with the team and said, yep, we're skipping to phase two of the plan. Let's look at these space applications. And one of the things that had been on the back burner was using our electrolyzer technology as the core of a spacecraft propulsion system. And what that looks like is basically splitting water to drive your spacecraft propulsion. This is a concept that

NASA has been exploring since the Apollo era. In fact, electrolyzers were practically invented for the Apollo missions.

We have seen as the technology that underlies electrolyzers and really electrochemical cells in general has gone from kind of again a niche field 50 years ago to every single one of us having an electrochemical cell or potentially multiple strapped to you all the time all day. Like that is the modern human experience. This technology has massively massively improved in a very short

time period. And so suddenly it's gone from something that NASA has played around with and has explored some benefits of to being something that

that we think is going to revolutionize how people move things in space. And that is a much more exciting value proposition for a team of incredibly smart people that we're fortunate to have at this company to go and chase. And so it was a very easy jump for us to just kind of say, yep, like this is a great thing for us to go and spend the next few years building towards.

Stephen McBride: So double click on that WTF is water based propulsion. How does it work? Talk me through it. Cause a lot of people listening might think this guy wants to send Starship to space where water does no way. So just talk me through how the technology works from one on one.

Halen Mattison: Yeah, right.

Yeah, for those skilled in the art, you probably have the same reaction that I did, which is, you know, WTF. Water propulsion, that kind of sounds ridiculous. We're all used to propellants that are much more, I'll say, and much more scary. Today, the baseline for high thrust space propulsion, whether it be on a SpaceX system or one of the many communications satellites that are up there, is to use a fuel called hydrazine.

Hydrazine is the legacy spacecraft propulsion system. It's super reliable. However, it's also probably one of the most dangerous chemicals that humans routinely handle. You have to put on what is effectively a space suit to load a hydrazine vehicle. It is an incredibly, incredibly dangerous molecule. It is deeply toxic.

It is also not produced in the US. And so there is a big supply chain challenge that the Defense Logistics Agency has been dealing with there. And on top of that, it's not the most performant thing in the world. It's great for reliability. But as mentioned, I think not just water, but there are many other propellants out there that can do this job better.

Water-based propulsion as a bucket has always kind of been tied to, well, the only thing it does for you is at least you can drink it instead of hydrazine, which kills you if you can see it. But.

When you combine that with electrolysis technology, you actually unlock the really amazing combination of hydrogen and oxygen propellant, which is about as good as it will ever get for chemical propulsion. And suddenly, you're talking about a solution that is safer, cheaper, easier to work with in many ways, but also meaningfully more efficient.

and meaningfully more powerful for the right application. And so that is really the promise of water-based propulsion technology. There have been many water-based architectures tried in the past. Most of those are directly feeding water into their engines. And so what they're effectively doing is building like either a bottle rocket or a superheated bottle rocket, which can work. There's actually quite a few folks that move around just fine in space doing that.

What General Galactic wants to do is to kind of supercharge that. We unlock the chemical energy and the kind of amazing combustion efficiency and amazing properties of hydrogen and oxygen that are contained within the water and use that. And what we're talking about is entering the market with a solution that doesn't just replace all the issues with the legacy systems, but actually meaningfully improves upon them.

Stephen McBride: We're used to seeing those starship cathedrals blast off into space those beautiful skyscraper sized rockets. If your system was on one of a starship rocket, like how would that change the visual of it? Would you see no smoke? Would it be water coming out? Just tell me.

Halen Mattison: Sure, yeah. So I think I should clarify. I think the area that this technology wins is in-space propulsion. So you can think of, once you've blasted off from Starbase and you're in your injection orbit, what we envision is that people use this for what's effectively a third stage. So Starship releases you and then you now have a lot of Delta B capabilities sitting there to go wherever you want and it's a way more efficient way of moving once you're in space. And in my mind, that's going to be a bottleneck without a technology like general galactic in the market, because most of the solutions out there are still based on either legacy chemicals or are actually less performant than the legacy options. And so when we think about

the SpaceX vision of continuing to put more and more mass into orbit and sending more more mass around the solar system, SpaceX will get you off of the earth and into orbit. General Galactic takes you from there.

Stephen McBride: Interesting and is this a case where the technology would be so efficient that a satellite up there for 10 years would only need to refill once or twice? Is it a case where you would make water on Mars and it would dock and refill? Talk me through all that.

Halen Mattison: Yeah, I love talking about the long-term vision. And I'll say that we aren't one of those space companies that needs Starship to be successful. I believe it will be. It's something that I deeply care about. But a lot of people see what's happening with Starship and other heavy-lift launch vehicles, and they go, well, OK, mass doesn't matter anymore. So efficiency no longer matters.

the general galactic system that we're developing.

is still very much something that I think wins in today's marketplace. But what you're getting at is what happens in the longer term? What happens when we can go and get water from the moon? And that's a really, really interesting case because the cost of moving mass from the lunar surface into Earth orbit is anywhere from 20 to 70 times lower than moving it from the Earth surface into Earth orbit.

So once we have that infrastructure in place, and I've got a lot of friends who are working on some cool tech in that domain, so I'm excited for us to get there. Once we're able to procure water from one of the many sources in the solar system, but we'll talk about the moon, then the

technology that General Galactic is developing will not only be dominant over the market, it will be incredibly cheap.

incredibly easy to move things around in space because the cost of refueling and the cost of doing these operations will plummet.

Stephen McBride: Interesting. Just talk me through, obviously it's cold up there in orbit. You'd have to, I guess, heat the water somehow. We talked earlier about those different kind of energy systems in space based on what you saw, based on what your friends are working on. Is there one architecture that you'd kind of bet on right now? Is it solar? Is it nuclear? Is it kind of all of the above?

Halen Mattison: Yeah, I mean, I think it's on the power side, it's mostly all of the above, especially, you know, there's they win in different domains. And now I'm starting to speak a little bit in the way that I SpaceX thinks about trade studies, which is like once you set your bounding conditions and say, OK, I want to do a mission in low Earth orbit, solar probably wins for pretty much any case there in terms of the energy capability per kilogram of dry mass on that vehicle.

you probably go solar, but when you think about on-surface or deep space missions, that's where we really need to be thinking about nuclear. And you said something there that I think I always like to point out to folks, which is space is actually warmer than most people think. I think there have been so many movies where...

The moment someone steps outside a spaceship or even that classic scene in Iron Man where he gets higher into the upper atmosphere and starts to freeze, people think of space as immediately freezingly cold. But actually, especially in low Earth orbit where the vast majority of space operations take place, we tend to normalize most of our thermal models to around 300 Kelvin, which is roughly room temperature.

things actually can get very, very hot in space. It's actually much more of a challenge to reject heat, which means to like cool yourself in space, than it is to stay warm. And so when we think about storability of propellant and longevity of these missions, where we do want to do multi-decade missions or missions where there will be several refueling events over a lifetime, you actually want something that's pretty stable and around those conditions.

It's much more challenging when you have cryogenics. It's much more challenging when you actually need to stay warm, or sorry, stay cold, than to try to reject that heat. But yeah, as we think about power and what scales with this, we're super interested to see.

basically proliferation of every power source we can think of. It pretty much comes down to solar and nuclear. And I'm excited to see nuclear really take off. I think we're seeing a lot of progress there, especially for space applications.

Stephen McBride: What's the other most misunderstood things about space?

Halen Mattison: Oh man, I think Hollywood does us no favors in the space industry most of the time. I think the probably biggest thing that comes to mind, and this is more about the industry than about space itself, is people really, like every time a space movie starts,

There's always this opening scene and they're talking about, you know, this crazy science and usually there's like a bunch of PhDs in the room and they're explaining this like incredibly complicated program and you are the few people on earth that understand it. Most of what happened in the space industry is actually very straightforward and in fact the secret ability of most space companies to scale is to not be super research heavy. When you look at the technology that has enabled SpaceX to be successful

Most of the underlying technology, again, was developed during the first space race. There have been very few massive step changes in the underlying tech since then. And I think that that's something that's misconstrued in the public is you think that we're just living in a different era in the space industry when really a lot of our practices and a lot of our technology is actually very straightforward. And I think it's really just about how we apply it.

I'd say that. And then the other big one for me, at least I think about long term is people, I think will have a very interesting time responding to communications in space one day. Because of the speed of light and the ability of our self to communicate, we are actually living in a very brief window here in 2025 where

I can be instantaneously looking at someone on the other side of the world, just as I'm looking at you now on this podcast, at any point, right? Like, because we have access to Wi-Fi, we have Starlink now, and we can have this instantaneous conversation as if we were in person.

With space travel, as soon as you get meaningfully far away, that's no longer going to be possible. Especially as we think about Mars. There's going to be a several minute delay for every message sent back and forth. And so that will change again how humans communicate, especially as we have more and more people living out that way. And I think we'll actually return to a style of communication that's more akin to the pre-industrial era.

Stephen McBride: Mm.

Halen Mattison: So take advantage of it now that really every human alive today, you could have a in-person like conversation at any point because I think in a couple of decades that probably won't be the case.

Stephen McBride: That is incredible. Letter writing is going to come back in a big way. Well, that's that's fascinating to think through. Does that make you like what does that make you more bullish on in the world and less bullish on in the sense that is that like, oh, hey, when we're all on Mars and you need these long term communications, is that like Max Bullish geo? Just talk me through the way you think about different things there.

Halen Mattison: Yeah, it might be actually more straightforward than that. I would say that we're living in a period right now where instant gratification, instant communication is

redefining a lot of our experience. And I would say I'm bearish on the impacts of that, right? Even in the startup domain, we see this where...

there's a large rush towards getting as much attention as possible in these very quick clips and very reactionary feelings and that's pervasive. That's infected the technical environment, the engineering environment, research, politics, what have you. I think that the fact that nature is going to slow us down due to our inherent desire to go out and explore is somewhat poetic in the sense that

we will probably return to a more balanced approach just due to the nature of communication with each other. So bullish very much on the future of humanity. And I think that these kind of natural desires that we have to go and explore and make progress will somewhat correct for the things that we don't like as much.

Stephen McBride: The Adams Revolution will give us our attention spans back.

Halen Mattison: Ideally.

Stephen McBride: I love it. Listen, tell me more about this spacecraft thruster. I saw you tweeted about a test recently. It looked really cool. Talk us through the key numbers, what that was, why it matters.

Halen Mattison: Yeah, and it's up on our Twitter and our LinkedIn and a couple other places we were finally able to post some photos of the early testing of what we're calling GT25, which is the 25 Newton.

hydrogen-oxygen thruster that we've developed for this system. As mentioned, hydrogen and oxygen are pretty much your best case propellant combo in terms of ISP or specific impulse that you can get in a rocket or a space thruster. And that's all enabled by our water splitting technology. And so those tests were our first hot fires as a company of that engine. One of the really cool things is

Compared to a traditional rocket engine test where you're generating all kinds of pretty gross chemicals that you probably don't want to be around when you test fire, as much as we save for fire and pressure, in terms of the gas that you're actually generating, it's just water vapor.

And so we do a lot of very quick turn testing and that's a really neat part of this architecture is that we can continue to do tests like in those photos very quickly. But that test itself was really just a validation of the fundamental underlying principles of the system. Obviously an opportunity to make some fire and noise and mock diamonds is something that I will always sign up for and it's very fun for the team to get to keep doing. And it allows us to test out different cooling methodologies and some of the

important features of the form factor of that type of thruster. And we're continuing those tests and we will keep test firing and test firing as we mature the design and it allows us again to get some early data back to see where our performance lies.

Stephen McBride: Dumb question, but could you ever see something like this on a commercial airplane or is it completely built for space?

Halen Mattison: It's really useful for space applications. So, you know, anytime you're moving around in space, you're pretty much governed by Newton's third law and the Tchaikovsky rocket equation, which is a derivation of that. And it knocks out the factors of like gravity and drag that we influence movement on Earth and around Earth for. So this is really tuned for space applications.

Stephen McBride: Talk me through to first customers or something like this. Ian Cinnamon of Apex Space is a good friend and he obviously builds the space buses. Is he going to be buying these? Is tearing the hinges off your doors in two years to put all these on his space buses?

Halen Mattison: Yeah, yeah, so I've had the chance to meet with his co-founder and a lot of the other folks in the space industry. I will say it's a very small ecosystem and I'm very fortunate that a lot of us have a great relationship and it's been awesome to see a lot of the progress happening across the board for space and satellite development. For us on the commercial side, we are working with a few of those guys.

under NDA for now, but hopeful to announce some more stuff soon. I think the value prop for them as we think about commercialization and who General Galactic will ultimately be working with is really interesting because of how outdated most of the propulsion supply chain is. You know, I mentioned all these challenges with hydrazine, but that's for chemical prop. I mean, on the electric side, we have an incredible set of issues with the way that

satellite developers procure those systems. They are almost entirely being produced outside the US. The lead times are sometimes in the multiple years. There's a lot to not like in that ecosystem. And I think that having conversations with a lot of these new developers and even a lot of the legacy folks has highlighted just how important it is that the US have propulsion manufacturing capability and even better that it'll be the best one on the market.

Stephen McBride: What timelines are you guys targeting? How fast could we see a general galactic thruster in space?

Halen Mattison: I would love to fly as soon as possible. I think one of the unfortunate realities of so much interest being in the space domain is that launches are getting eaten up very quickly. We are in talks with a couple of groups about getting a demo as soon as next year, and that's our baseline. So we're moving as quickly as we can here for ground testing and qualification, aiming to have the first propulsion system basically flight qualification ready at the end of this year. And then we'll get it on the first flight that we

Yeah.

Stephen McBride: You obviously launched a huge business today in space, coms like Starlink. Broadly speaking, mentioned space in and of itself is not valuable. What are the kind of biggest near-term opportunities you see in space besides those two that I mentioned?

Halen Mattison: I mean, comms, as you mentioned, is huge. I still think that's not even fully tapped. There's a lot to be done there and a lot that you can do with having a platform and a relay in space. I think that that included, there's also of course the defense element, which would be remiss not to talk about. I it's pretty clear at this point that the next kind of major engagement between great powers will...

if not start in, will almost certainly include the space domain. And so space is the ultimate high ground. It is strategically extremely important. It is socially extremely important. And I think a lot of assets in the defense space will benefit from increased mobility in space. And that's a lot of our end user relationships relate to that. And I think it's going to be a huge opportunity for us as a business to go and be able to support them.

There's some other things that I'm pretty excited about. I think space energy solutions, we've mentioned nuclear and kind of what that starts to unlock. I'm excited for continued human presence as well. Seeing that become more commercialized as there's renewed interest in commercial space stations. I think a huge opportunity lies there to make sure that human beings continue to be present in space.

And then longer term, I think that the lunar economy will be deeply meaningful. There's a lot of cool things that can happen there, whether it be just the resource utilization, the comms, the research that we can do. I feel like I need to shout out my co-founder was at Varta Space, who I think has started to open the door on the ability to just make things in zero gravity and some of the really, really neat science that goes behind that and the ways that that can scale. So it's an amazing domain. I'm always shocked when people aren't paying attention to space because I feel like there's some element that you probably care about that is massively going to increase over the next decade.

Stephen McBride: My four year old son is just graduating from his dinosaur phase to his space phase. So I'm going to go downstairs and I'm going to put him to bed in a couple of minutes. What's the over under and when we can visit space together?

Halen Mattison: Oh man, I would say sooner than you think. I think that there's going to be ample opportunity for a lot of people to get to go above the Karman line over the next few decades. Whether that be as purely as a tourist, whether that be as a researcher, whether that be as one of the General Galactic gas station operators. I think that...

A lot more humans will be making their way off of Earth. And I think that we are very fortunate to live in the generation that's going to get to do that.

Stephen McBride: What important truth do you believe about space that the rest of the industry disagrees with you on?

Halen Mattison: Hmm. I think, man, there's a lot of things that I think I have strong opinions on. Probably the thing that I'd be most disagreed with upon is something that I referenced earlier about the inherent value of space.

A lot of folks are still searching for that and make that like it tends to be the biggest gap in a lot of the public funding proposals that we put forward for NASA or DoD where people have this reaction of like, why are we going to space when we have so many problems on earth? And I think that argument misses the point quite a bit because they're looking for some inherent value. They want there to be platinum or some unobtainium material or some very clear, like we have to go out there to get this. I think that there's something bigger than that.

which is kind of the human desire for exploration and using it as a platform to increase connectivity and to change the way that humans live on earth. Like the same folks that often deride more funding going into the space domain are probably using Google Maps to get somewhere or probably squeezing a toothpaste tube to brush their teeth in the morning. And these are all things that don't happen without space development. I think that we should stop trying to search for

these kind of magic answer of like, why go? And recognize that part of the human experience is frontierism and constantly pushing the limits. And we should kind of just accept that and keep building.

Stephen McBride: Let's say we're sitting here in a decade from now, maybe you're on Mars, I'm here on Earth, the communication time between us is three minutes, three minutes either way. General Galactic has changed the world. Tell me what that world looks like. Tell me your vision of the future.

Halen Mattison: Yeah, cheap space transportation, which is enabled by great propulsion, means that we can move things in space without the intense amount of cost and over planning that we do today. So it means that in the near term, our satellites can move quicker, they can operate faster.

But in the longer term, it means that we can move lots of mass back and forth, and we can actually use this technology to get over that kind of painful hump of establishing the first lunar bases and the first Mars bases. It allows us to decrease the upfront pain of cost and planning and time and human risk. And so General Galactic is focused on cracking that code. And so 10 years from now,

with our plans, that means that we're kind of the default mode for moving around once you're outside of Earth. And I think that that means that we've grown quite a bit to be able to support these things. And then we build up this network of energy hubs or gas stations that allows us to kind of be the energy infrastructure and the mobility infrastructure for going beyond Earth.

Stephen McBride: All right, Halen, this has been fascinating. We like to finish the podcast with a lightning round. So what I'm going to do is I have a dozen kind of space based technologies or ideas. I'm inspired by my friend Tyler Cowen. I'm going to ask you to say overrated, properly rated or underrated for each of them. And you can give a brief explanation if you want, but one word is fine with me. Ready to go? Starship.

Halen Mattison: Okay, let's do it. Underrated.

Stephen McBride: Space elevators.

Halen Mattison: Underrated. Needs to happen.

Stephen McBride: Nuclear, nuclear propulsion.

Halen Mattison: Definitely underrated.

Stephen McBride: Reusable upper stages.

Halen Mattison: Absolutely underrated.

Stephen McBride: In Space Manufacturing, shout out to Varta.

Halen Mattison: Yeah, underrated. I might say underrated to all of these.

Stephen McBride: Asteroid mining.

Halen Mattison: Ooh, I would actually maybe go overrated in the near term, underrated in the long term.

Stephen McBride: The Bill Gates quote, the golden dome.

Halen Mattison: Hmm, probably properly rated. It's definitely getting a lot of attention at the moment.

Stephen McBride: Space Hotels.

Halen Mattison: Underrated. I would go to one if I could, absolutely.

Stephen McBride: Permanent lunar bases.

Halen Mattison: I was so underrated that it keeps me up at night. It should be the primary national goal of this country.

Stephen McBride: I love it. I love the conviction. Space solar power.

Halen Mattison: I would actually say overrated. I think, when you really run the numbers behind that, it's useful for certain things, but not for the things that a lot of people think.

Stephen McBride: Geostationary comms satellites.

Halen Mattison: I think the communication layer of space is so invaluable and will continue to just improve so much of human lives. Yeah, very important.

Stephen McBride: And last one, terraforming Mars.

Halen Mattison: Underrated. That's what it's all about.

Stephen McBride: Halen, this has been absolutely fascinating. Is there anything that we didn't cover that you want to mention? Where can people find you? Find out more about what General Galactic does.

Halen Mattison: Yeah, I'm at Halen Mattison with 2Ts on X. You can check us out on LinkedIn. We are doing a lot of hiring right now. And so I'm super excited. Even if you're just interested to learn more about the company, you don't know if there's an amazing fit for you here in El Segundo and in the space industry. I still love to talk to people about what we're doing. So always open to chatting. And if you're looking to...

leave your sleepy role in a big company and come to a very exciting startup and get to own quite a bit of what we think the future of space transportation is going to look like, definitely apply.

Stephen McBride: Fascinating discussion. Thank you so much for your time.

Halen Mattison: Thank you.